THE ANALYSIS OF MACROECONOMIC CORRELATIONS USING MODEL "PRICE SPIRAL"

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Abstract:
In this paper an analysis of the correlation between the evolution of consumer prices, average earnings from wages and labour productivity in Romania in the period 1991 – 2007 is presented. The econometric pattern which it is proposed describes dependencies and interdependencies between prices and earnings.
This is consistent with the economic theory, in fact with a model/pattern with multiple equations called "spiral of prices".
The study is based upon the official data published by the National Statistics Institute, with the specification that, in order to be expressed in a mutual measure unit, they have been converted in dollars, using the method used by the international financial organisms.

Key words**:** *inflation, Gross Domestic Product of Romania, correlation coefficient*

JEL classification*:* E 37

Romania's economy is increasingly feeling the need for such a correlation between wages and productivity, since we witnessing to a continuous increase of wages, in report to decrease of production's indicators.

The practice of developed countries knows two methods of indexing wages to the index increase in labour productivity:

- through addition to the wage rate - a method widely used in the U.S. and Japan, consisting of establish by the collective contract of calculation method and the link between the wages and the works productivity (percentage increase, absolute growth and evolution of the report between absolute levels of the two indicators), the addition is granted, usually at intervals of one year ;
- through the payment of collective awards for achievement of "efficiency programs" - a method more widely spread in west countries - Europe and is characterized by delaying the grant awards on a greater time, which may be even five years.

May be used also the indexing in report to national income, with the entire mass of wages, other income and mixed forms.

By 1998, labour wage in Romania was heavily social taxed. Such,a global social tax rate was 59.9 % closer to the countries of the European Union such as France (62.1%) and Hungary (59.7). Instead, Hungary taxed social worker with only 11.5% and 24.3% in France, while Romania was a taxation rate of 16%. Instead, there were obvious discrepancies in terms of PNB(Gross National Product) / capita in the three countries, so :

- in France, 1998: 24210 USD/ capita;
- in Hungary , 1998: 4510 USD/ capita;
- in Romania, 1998: 1360 USD/capita.

The fiscallity pressure on excessive remuneration of labour payment from Romania is leaving still more in evidence when compare the rates of contributions to the social security system both in this country and in the new EU member states. If the romanian employee pays 47.5% of salary for social contributions, In Europe an employee pay out of pocket only 35.6%, while the average for social contributions paid by citizens of new member states is 34.5%.

The effects of this over-taxation has consequences on the standard of living and the index of real wage earnings.

As regards to the decrease of Gross Domestic Product of Romania during 1991-1999, the main factor was the working factor , more precisely, how it has been made the redistribution of labour force on sectors. Romania began the transition period with a private sector which in 1989 produced 12.8% of GDP and employed 5.9% of the workforce. At the end of decade, the share of private sector in the GDP reached 65.5%, and commit to the year 1989 an increase of 75% in total employment work force.

The main cause of the slow lowering rythm of inflation is the surpass of increasing the labour productivity by the wages.

Nominal wage growth is determined also by the expansion of services industry. Prices in this sector have tended to grow faster, non-food products prices impacting the growth of consumer prices, as the labour productivity in the service sector grows more slowly than in other sectors of the economy

In Romania, the inflationary process, started after 1990 consisted in a substantial increase in the average nominal earnings from wages. Thus, compared with 1990, the winning average net monthly salary in 2000 was approximately 630 times greater (Table 1). The main factors of this fast developments were: negotiated annual wage increases; compensations-indexation with effect of manifestation in the spiral of inflation, relatively low impact of the policies of moderation of wages growth.

The index of average nominal wage earnings and net index of consumer prices in 2000 was 88.7% compared with 1999 and 56.8% compared to 1990, highlighting the downward curve of the purchasing power of employees, most have no resources necessary to ensure a decent living.

The surpass of dynamics average net salaries by the dynamic of pricing consists also in lowering the standard of living level, especially the disadvantaged categories (young people, pensioners, unemployed).

Average earnings net monthly wage and the evolution of real average wage earnings in the period 1990-2007

Table no. 1

	Earning from net average wage (lei monthly)	***Earning from net average wage % (1990=100)***	***Earing from real average wage (1990=100)***	***Index of consumption prices% (1990=100)***
1990	3381	100.0	100.0	-
1991	7460	1.3..6	81.5	170.2
1992	20140	595.7	70.8	738.8
1993	59717	1766.3	58.9	2887.0
1994	141951	4198.5	59.1	6971.9
1995	211373	6251.8	66.5	9253.4
1996	31.2.87	9523.4	73.9	12883.4
1997	632086	18695.2	56.2	32976.9
1998	1042274	30826.0	58.4	52524.2
1999	1522878	45042.2	57.0	76628.0
2000	2139138	63269.4	59.4	111667.1
2001	3019424	89305.6	62.4	150190.7
2002	3789202	112073.4	63.9	184162.1
2003	4839648	143152.9	70.8	212291.0
2004	5986386	177166.5	78.3	237504.5

	Earning from net average wage (lei monthly)	*Earning from net average wage % (1990=100)*	*Earing from real average wage (1990=100)*	*Index of consumption prices% (1990=100)*
2005*	746	1.3.644.8	88.5	258912.1
2006*	866	256137.2	92.8	275900.4
2007*	948**	280390.4	96.9	289245.5

Source: *National Institute of Statistics*
** Provisional dates*

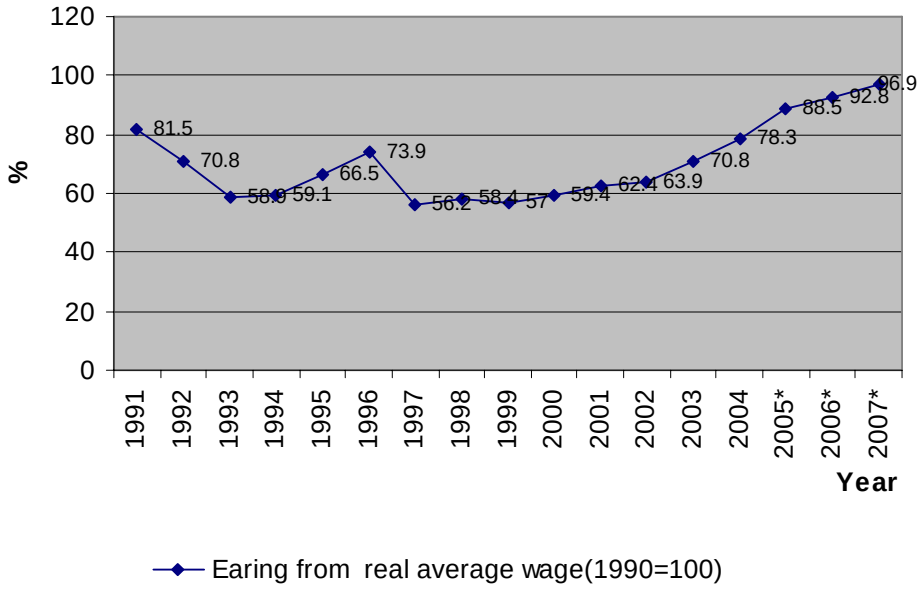

Figure no. 1

The index of real salary earning is calculated as the ratio between the index of nominal net wages and the consumer price index

In the period 1991 - 2007 real wage earnings know an oscillator progress , influenced largely by random factors.

According to the press release no. 155 of August 5 2008 the National Institute of Statistics, in June 2008 winning average nominal net realized was 1273 lei. Compared with October 1990, real wage index gain was 122.3% with 2.0 percentage points higher over that recorded in May 2008. This increase was due mainly as a result of the granting of premiums (premium holiday for civil servants and bonuses for staff stability of contractual public health units) and the achievement of high yields in certain activities, such as post and telecommunications, electricity, gas and water, public administration, etc.. Compared to the same period a year earlier the index gain real wage increased by 14.5%

As a result of inflation, the purchasing power of income from direct employment of the population has fallen heavily

Under the impact of developments in consumer prices, nominal gains from production increased gradually until the year 1993 (year in which inflation has registered the highest level) afterwards to record a moderate trend of normalization.

Evolution of wage earnings and work productivity on the employee during 1991-2007

Table no. 2

The year before = 100

Years	The consumer price index (IPC_{t-1})	Real wage earnings index (IS_t)	Labour productivity index (IW_t)
1991	270,2	81,7	87,7
1992	310,4	87,3	92,9
1993	356,1	83,2	105,1
1994	236,7	100,1	106,2
1995	132,3	111,9	110,4
1996	138,8	109,4	107,3
1997	254,8	77,4	97,6
1998	159,1	103,5	102,1
1999	145,8	96,2	81,8
2000	145,7	104,6	102,2
2001	134,5	105,0	106,3
2002	122,5	102,4	121,7
2003	115,3	110,8	105,0
2004	119,9	110,5	105,2
2005	109,0	114,3	107,3
2006	106,6	115,1	108,1
2007	104,8	115,6	111,2

Source: *National Institute of Statistics*

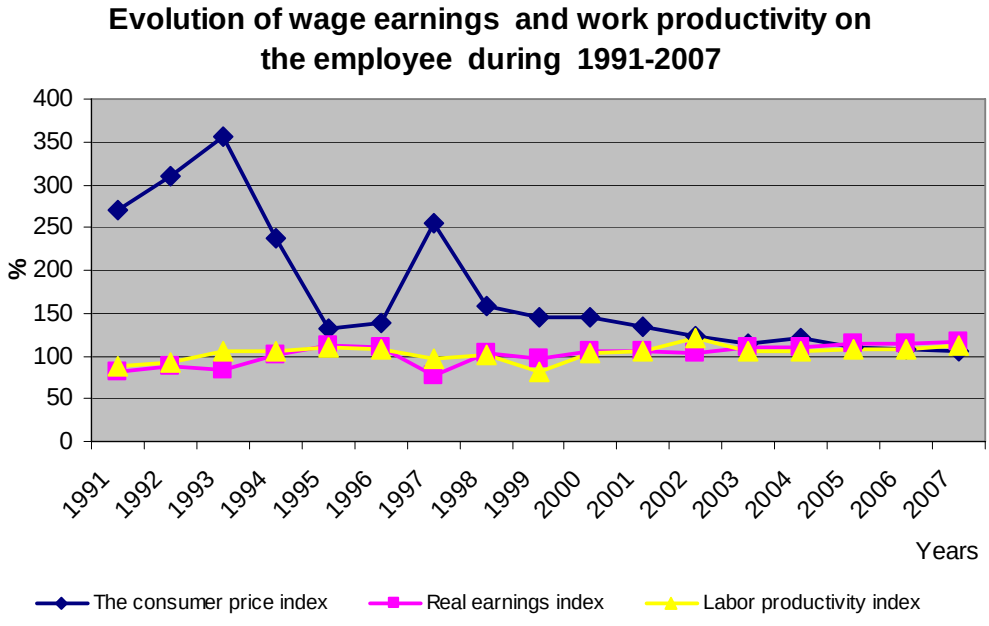

Figure no. 2

It notes that in 1993, labour productivity index surpass for the first time since 1990, the index of real earnings from wages . In the period 1993-1996 is recorded the same trend of surpass the index of real earnings by labour productivity index.

We'll build an econometric pattern which we can describe dependencies and interdependencies between prices and earnings. In economic theory there is a

model/pattern with multiple equations model called "spiral of prices", which as the structural form , is as follows:

$$\begin{cases} IS_t = a_0 + a_1 IPC_t + a_2 IW_t + u_{1t} & (1.1.) \\ IPC_t = b_0 + b_1 IS_t + u_{2t} & (1.2.) \end{cases}$$

This model contains two endogenous variables (IS, CPI) and one exogenous variable (IW), a total amount of three variables.

The equation (1.1.) of the model is non-identified because contains all the variables (0 < 2 - 1) while the equation 1.2. is correctly identified because the number of missing variables (IW) is equal to the number of endogenous variables minus one (1 = 2-1) . In other words, the model is non-identified, the parameters of the model may not be identified.

To be turned into a model correctly both in terms of statistical and econometric we start from the following premises:
- in principle, social pressures on wages are not increased simultaneously with price increases, but they occur after a certain time;
- this fact allows that in equation of the model 1.1., the price index to appear with the deferred value, IPCt-1;
- economic development of a phenomenon presents a certain inertia (selfregressive phenomenon), so in equation 1.2. is introduced a new exogenous variable IPC_{t-1}

Taking into account these premises, the initial model is transformed into a model with multiple equations, as follows:

$$M_1 \begin{cases} IS_t = a_0 + a_1 IPC_{t-1} + a_2 IW_t + u_{1t} & (1.3.) \\ IPC_t = b_0 + b_1 IS_t + b_2 IPC_{t-1} + u_{2t} & (1.4.) \end{cases}$$

This model is considered fair because:
- contains four variables, of which two are endogenous (IST IPCt) and two are exogenous (IPCt-1, IWt);
- in the first equation number of missing variables (IPCt-1) is equal to the number of endogenous variables minus one (1 = 2-1), shows that the first equation is correctly identified;
- the second equation is correctly identified as the missing variables (IWt) is equal to the number of endogenous variables minus one (1 = 2-1)

In this case, the model is correctly identified and its parameters can be estimated, either using the indirect regressive method applied to each of the model equations in reduced form, either using the method of the smallest squares.

Reduced form of the model M1 – regress of endogenous variables only in the light/function of exogenous variables – is obtained achieving the following calculations:

- equation (1.4.) will be made to reduced form by replacing endogenous variable IS_t with it's expression from the first equation:
  $IPC_t = b_0 + a_0 b_1 + (a_1 b_1 + b_2) IPC_{t-1} + a_2 b_1 IW_t + b_1 u_{1t} + u_{2t}$
  In order to make easier the calculation, we will make the following notices:
  $\beta_0 = b_0 + a_0 b_1$
  $\beta_1 = a_1 b_1 + b_2$
  $\beta_2 = a_2 b_1$
  $z_t = b_1 u_{1t} + u_{2t}$
  Thus, the equation 1.4. becomes:
  $IPC_t = \beta_0 + \beta_1 IPC_{t-1} + \beta_2 IW_t + z_t$
  And the reduced form of model is presented thus :

$$M_2\begin{cases} IS_t = a_0 + a_1 IPC_{t-1} + a_2 IW_t + u_{1t} & (1.5.) \\ IPC_t = \beta_0 + \beta_1 IPC_{t-1} + \beta_2 IW_t + z_t & (1.6.) \end{cases}$$

To estimate the parameters of this model it applies the method of the smallest squares in the equation for each hand

By using the program SPSS we have obtained the following results in the first equations of the model as reduced form :

$$IS_t = 89.70 - 0.12 \cdot IPC_{t-1} + 0.32 \cdot IW_t \ ; \qquad (1.7.)$$

$$R = 0{,}82 \ ;$$

The model is not significant, the estimate of the model parameters is insignificant, except the term free.

For equation no. 1.5. under reduced form were obtained the following results:

$IPC_t = 689{,}12 - 6{,}07\ IS_t + 0.99\ IW_t$ (1.8.)

$R = 0{,}79$

The model is considered significant for a significance threshold of 5%.

Finally, the model with multiple equations under structural form is such a form :

$$M_2\begin{cases} IS_t = 89.70 - 0.12 IPC_{t-1} + 0.32 IW_t \\ IPC_t = 689.12 - 6{,}07 IS_t + 0{,}99\ IW_t \end{cases} \qquad (1.9.)$$

Dynamics of real wages has been positively affected by increased labour productivity and deferred price index with a period during the period under review, 1991 - 2007, and the dynamics of prices was negatively influenced by the dynamics of real wage gain.

Therefore, in Romania inflation has been determined mainly by higher increase of wages in conditions of low productivity.

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