

LABOR PRODUCTIVITY AND WAGES IN THE REPUBLIC OF MACEDONIA

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Abstract: The relationship between wage and labor productivity is very frequent and receives a special treatment in economic theory and practice. The purpose of this paper is to explore the relationship and interdependence between net-wage and labor productivity in the Republic of Macedonia during the period 1995-2007. The objects of analysis are the relations between the two variables on aggregate level of the Macedonian economy, as well as for certain economic sectors separately (industry, mining and water management; agriculture, fishing and forestry; construction; transport and communications; trade and financial services). Based on the results from the performed analysis, the paper reveals how and to what extent changes in real net-wage influence the changes in labor productivity in Macedonia, on aggregate level and in the observed sectors.

JEL classification: J24, J39

Key words: real wage, GDP per worker, labor productivity, OLS regression, correlation.

1. Introduction

Relation between wages and labor productivity is subject of continual observation by economists. Numerous papers with different approaches and research aspects are dealing with the abovementioned issue. Researches commence with establishing simple models for determining the correlation between wages and labor productivity and go to development of models for determining their interdependence. In recent times the models which examine labor productivity's dependence on wages are considered increasingly important. Researches made by Gordon in the 1980s showed that “..the reaction of the labor productivity on the changes of real wages and cyclical fluctuations in the output are almost identical in USA, Japan and Europe” (Gordon 1988, p. 1). Efficiency wages models (Yellen 1984, Akerlof, Yellen 1986 and Katz 1986) can be included in more advanced models. They point out that higher wages increase productivity of workers. (Trpeski 2005, pg.72-84). According to efficiency wages theory, companies can work more efficiently if they maintain wages on a level higher than the level at which clearance of the labor market is enabled. Therefore, companies can be more attractive if they maintain wages on a higher level, even if labor supply exists on the labor market. The essence of this theory is that higher wages increase workers productivity. This theory puts workers' productivity and their wages in a direct relation. If higher wage level is followed by increased productivity, then

higher wages can provide increased profit for the companies. Companies have a lot of reasons to pay workers higher wages: *first*, wages for efficiency improve workers health, *second*, wages for efficiency increase labor force quality, *third*, wages for efficiency stimulate workers to increase their efforts and *fourth*, wages for efficiency decrease the rotation rate of the working force (more details in Mankiw 1998, p. 295-307 and Stiglitz 1994, p. 717-727).

In the scope of the efficiency wages theory several models are developed as follows: shirking model, models of working force rotation, adverse selection models and sociology models. Except in the efficiency wages models, interdependence between labor productivity and wage can be noticed in models for implicit contracts, as well as “insiders-outsiders” models.

2. Characteristics of the labor market in the Republic of Macedonia

The labor market in the Republic of Macedonia in the transition period can be qualified as imbalanced. For observed period the supply of the working force drastically exceeded the demand, which resulted in high unemployment rates that prevailed on a high level in a long period of time.

The economic performances of the Macedonian economy can be realized from following table:

Table no. 1

	Active		Inactive		Unemployment		Employment		Real GDP	
	Total	%	Total	%	Total	%	Total	%	Mil \$	%
2000	811.557	52,9	722.699	47,1	261.711	32,2	549.846	35,8	3.588	4,5
2001	862.504	55,5	691.916	44,5	263.196	30,5	599.308	38,6	3.437	-4,5
2002	824.824	52,6	742.129	47,4	263.483	31,9	561.341	35,8	3.769	0,9
2003	860.976	54,5	718.474	45,5	315.868	36,7	545.108	34,5	4.631	2,8
2004	832.281	52,2	762.276	47,8	309.286	37,2	522.995	32,8	5.368	4,1
2005	869.187	54,1	738.810	45,9	323.934	37,3	545.253	33,9	5.815	4,1
2006	891.679	55,1	726.810	44,9	321.274	36,0	570.404	35,2	6.345	4,0
2007	907.138	55,7	721.496	44,3	316.905	34,9	590.234	36,2	7.583	5,8

Source: Statistical Yearbook, Bulletin of the Ministry of Finances of Republic of Macedonia, 05-06.2008, pg. 50.

The high rate of unemployment can be considered to be imported from the period before transition. The Republic of Macedonia has inherited an unemployment rate of 22,6% at the end of the 1990s. This unemployment rate continually increased in the transition period and reached 37,3% in 2005. In the last decade, the rate of GDP growth was stable, but was lower than the growth rates of other countries which aspire to EU or became EU members in the mentioned period. An exception from this is 2001, when the growth rate was -4,5%, but it was understandable because of the internal conflict that occurred in the same year.

The rates of employment in the Republic of Macedonia are drastically lower than the rates in EU. In the period between 2000 – 2007, the average employment rate was 35,35%, which is far below the Lisbon goal which envisions employment in EU to reach 70% until 2010. Employment in EU-27 rose from an average 64,5% in 2006 to 65,4% in 2007, and in EU-15 it is higher and amounts 66,9% in 2007. However, employment rates in EU countries have not reached the Lisbon goal (rate of employment of 70%) established in Lisbon strategy in 2000 (Employment in Europe 2008, p. 28-29). The average employment rate in EU-27 is 4,6 percentage points below

the Lisbon goal of 70%. In EU-15 it is 3,1 percentage points below the goal. In the Republic of Macedonia, the rate of employment in 2007 is 33,8 percentage points lower than the Lisbon goal.

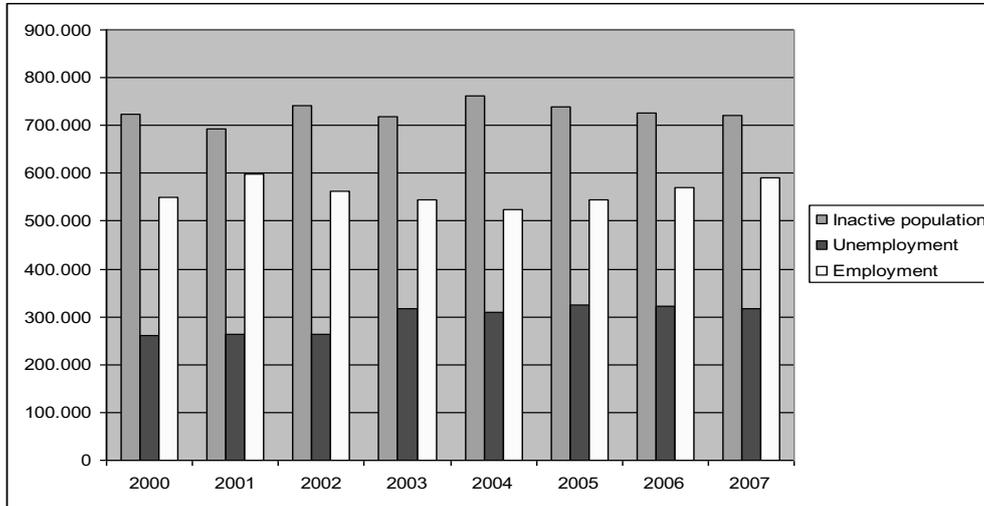


Figure no. 1 Employment, unemployment and inactive population in the Republic of Macedonia

Table 2 presents the average growth rates of the real annual net-wage and real GDP per worker in the period 1995-2007, where rg_w stands for average net-wage growth rate and $rg_{gdp\ per\ worker}$ stands of average growth rate of GDP per worker.^{§§}

It can be noticed that, in almost all sectors of the macedonian economy productivity grew with a faster average rate than the net-wage in the corresponding sector. An exception is the financial services sector, which is one of the faster growing and expanding sectors in Macedonia, and also a sector with high average wages compared to other sectors. The average growth rate of the real net-wage is 10,04 percentage points higher than the average growth rate of the productivity in this sector. This contributes for almost equal average growth rate of the two variables on the aggregate level.

As can be noticed from table 2, on aggregate economy level, GDP per worker in the period 1995-2007 grew with an average annual rate of 4,76%. This is not only due to the increase of real GDP, which in the same period rose by only 2,59%, but it is also due to the decrease in employment. The employment in Macedonia in the referred period decreased with an average rate of 0, 27%.

Table no. 2

$$^{\S\S} \quad rg_{GDP} = \left(\sqrt[n]{\frac{Y_n}{Y_1}} - 1 \right) * 100 \quad \text{and} \quad rg_w = \left(\sqrt[n]{\frac{W_n}{W_1}} - 1 \right) * 100 \cdot Y_n - \text{GDP per worker in the last year;}$$

Y_1 – GDP per worker in the first year; W_n – real average net-wage in the last year; w_1 - real average net-wage in the first year.

Sector	rg _w	rg _{GDP per worker}
Industry, mining and water management	5,54	7,91
Agriculture, fishing and forestry	3,39	12,27
Construction	4,14	9,48
Transport and communication	5,11	6,65
Trade	3,72	5,28
Financial services	10,50	0,46
Total economy	4,37	4,76

*Authors' calculations according to data from the table in the annex.

3. Data and methodology

The purpose of this paper is to investigate the relationship between labor productivity and wages in the Republic of Macedonia during the period 1995-2007. Therefore, we performed analysis of this relationship on the level of the total economy, as well as for certain economic sectors separately. In this context, we used annual data for real GDP, average number of employees and annual average net-wage, for the determined period. The labor productivity is expressed through real GDP per worker (per employee), separately for each sector. Workers in the context of this paper are considered to be anyone officially employed by business subject, regardless of whether the position is for an indefinite or definite period, and regardless of whether the individual is employed full or part-time.***

A few constrains need to be taken into account when interpreting the results:

- High levels of GDP growth per worker appear not only due to the GDP growth in the sector, but also to the decrease in the number of employees.
- The 2001 interethnic conflict has an influence on the final results.
- The analyzed period for which estimations are made is relatively short. The regression and correlation analysis give more accurate results when the time series are longer and thus the number of statistical data is larger.
- The estimations are made based on real values. For this purpose, a conversion of the nominal values of GDP and net-wage into their real values was made, using appropriate price indexes i.e. deflators. In calculating real GDP we used GDP deflator, while in calculating real net-wage we used the CPI, which is used to determine the level of inflation in Macedonia. Due to the use of different price deflators for the GDP and the net-wages, some gap might occur in the dynamics of growth of the two variables.
- Economies in transition are usually characterized by a high informal economy, which is not reflected in the official data.

The first step taken in analyzing the data was drawing scatter charts, in order to see whether the two variables are correlated, i.e. whether the dynamics of their growth is related to each other. After that, we estimated the influence of net-wages that the employees receive for their work, on their productivity. The main goal is to examine the relevance of the claim that higher wages stimulate workers, and hence induce higher labor productivity.

The estimation is based on a regression analysis, using the ordinary least square method (OLS). The relationship between labor productivity and net-wages can be presented with the following model:

$$Y_i = b_0 + b_1 x_i + e_i$$

*** Definition from the State Statistical Office of the Republic of Macedonia.

where Y_i presents real GDP per worker, and x - real average annual net-wage. The net-wage is the explanatory variable, while GDP per worker is the dependent variable. The coefficient b_0 is the intercept term, while the b_1 coefficient shows the slope of the regression line, and e indicates the standard error. We are mostly interested in the b_1 coefficient, because it illustrates the extent of change in labor productivity as a result of a change in real net-wage of 1 denar.^{†††} A positive value of b_1 shows a direct relationship between the two variables, while a negative b_1 value shows an inverse relationship between the analyzed indicators.

Also, as complementary to the regression, the coefficient of single linear correlation was estimated. What do the correlation coefficients mean and how to interpret them? They show the level of linear accordance of net-wage and real GDP per worker. Their interpretation, considering that all estimated coefficients have a positive sign, can be based on the following intervals:

MR	Interpretation
0 – 0,70	There is no significant direct relation
0,71 – 0,80	There is a significant direct relation
0,81 – 0,90	There is a strong direct relation
0,91 – 1,00	There is a very strong direct relation

4. Empirical results

In this section we present the results from the performed empirical analysis. Table 3 shows the results from the calculated regressions according to the model given in the previous section. It contains the coefficient of correlation between the two analyzed variables (MR), the coefficients calculated in the regression (b_0 – intercept term and b_1 – regression coefficient) and the determination coefficient (R^2). While the correlation coefficient expresses the intensity of the relationship between productivity and real net-wage, the determination coefficient shows how ell the total variation in the dependent variable is explained by the variation of the explanatory variable. The scatter charts that show how productivity, expressed as real GDP per worker varies as real annual net-wage changes, are presented in Appendix 1. If we analyze the charts, we can conclude that none of the sectors exhibit a very strong direct relationship between productivity and net-wage.

The OLS regression on aggregate level is statistically significant at 95% significance level. However, the relationship between GDP per worker and net-wage is not strong. The correlation coefficient is only 0,57 and the determination coefficient is 0,32, indicating that the changes in labor productivity are far more determined by other factors than by changes in real net-wage. A one denar increase in real annual net-wage influences is related to an increase in real GDP per worker of 3,25 denars.

The correlation between the two variables is the strongest in the following sectors: construction (0,88), agriculture, forestry and fishing (0,84), and industry, mining and water management (0,82). They all have a strong direct connection between productivity and net-wage. This can be seen both from the scatter charts, as well as from table 3.

^{†††} Denar is the national currency of the Republic of Macedonia. All data used in this research are expressed in national currency.

The construction sector has the highest determination coefficient (0,78), which means that 78% of the variations in the labor productivity can be explained with variations in the net-wage that the workers receive. The OLS regression is statistically significant at 99% and the b_1 coefficient shows that when annual real net-wage increases by 1 denar, the real GDP per worker increases by 7,09 denars. In the agriculture, forestry and fishing sector, 75% of the variations in the labor productivity can be explained with variations in the net-wage that the workers receive, and the b_1 coefficient is 35,58.

In the industry, mining and water management sector, where 68% of the variations in productivity can be explained with variations in net-wage, the b_1 coefficient is 2,16, indicating that a one denar change in real annual net-wage induces a 2,16 denars change in GDP per worker. In the agriculture, fishing and forestry sectors 71% of the variations in productivity is due to changes in net-wage, while the rest 29% are due to other factors. A one denar change in annual net-wage causes a 35, 58 denars change in GDP per worker. This is the highest coefficient compared to other sectors.

The OLS regression for the sector transport and communications is statistically significant, but there is a weak direct relationship between the two variables. The variations in net-wage only explain one third of the variations in productivity, while the other two thirds are a result of the influence of other factors. The regressions for the finance services and trade sectors are not statistically significant. This just confirms what can be seen from the scatter charts, that there is no significant direct relationship between productivity and net-wage in these sectors. They even show a slight inverse relationship, which does not confirm the hypothesis that higher net-wages increase labor productivity. The number of employees in the trade sector exhibits a tremendous increase in 2004 of 440%, while the GDP only increased by 27%, thus resulting in a decline in GDP per worker of 76%.

Table no. 3 Regression results

	Coefficients		MR	R ²
	b_0	b_1		
Total economy	260,10	3,25*	0,57	0,32
Industry, mining and water management	110,40	2,16**	0,82	0,68
Agriculture, fishing and forestry	-2149,00	35,58**	0,84	0,71
Construction	-208,13	7,09**	0,88	0,78
Transport and communications	236,91	3,91*	0,57	0,33
Trade	2145,29	-7,80	0,27	0,07
Financial services	1680,00	-1,36	-0,40	0,02

Note: * significant at 95%, ** significant at 99%

5. Conclusion

Based on the performed analysis of the economy and labor market in the Republic of Macedonia for the period 1995-2007, and considering the indicated constrains in section 3, different results have been reached for the relationship and interdependence between real wage and labor productivity in different sectors analyzed in the paper.

On an aggregate level, there is no strong direct correlation between real wage and labor productivity i.e. changes in real net-wage explain only 32% of the changes in

labor productivity. The labor productivity is far more determined by other factors than real net-wage. But in some sectors there is a strong direct relationship between labor productivity and net-wage and the variations in real net-wage explain to a great extent the variations in labor productivity.

The results show that there is a strongest relationship between productivity and net-wage in Construction and in Agriculture, fishing and forestry, and also in Industry, mining and water management. This is due to two reasons: first, wages in these sectors are maintained on very low level and second, these are sectors where the labor greatly participates in forming GDP. Considering this, current employers can expect that by increasing the wages of workers, they will achieve an above-proportional growth in labor productivity. The same can be expected by investors, domestic and foreign, that wish to invest in these sectors. This is correct taking into consideration the given level of wages. At higher wage level, it should be expected that this relationship would become weaker.

There is a completely different situation in the sectors where wages are on a higher level, and where the participation of labor in forming the output is lower. A typical example is the financial services sector, where the relationship between the two variables is not statistically significant.

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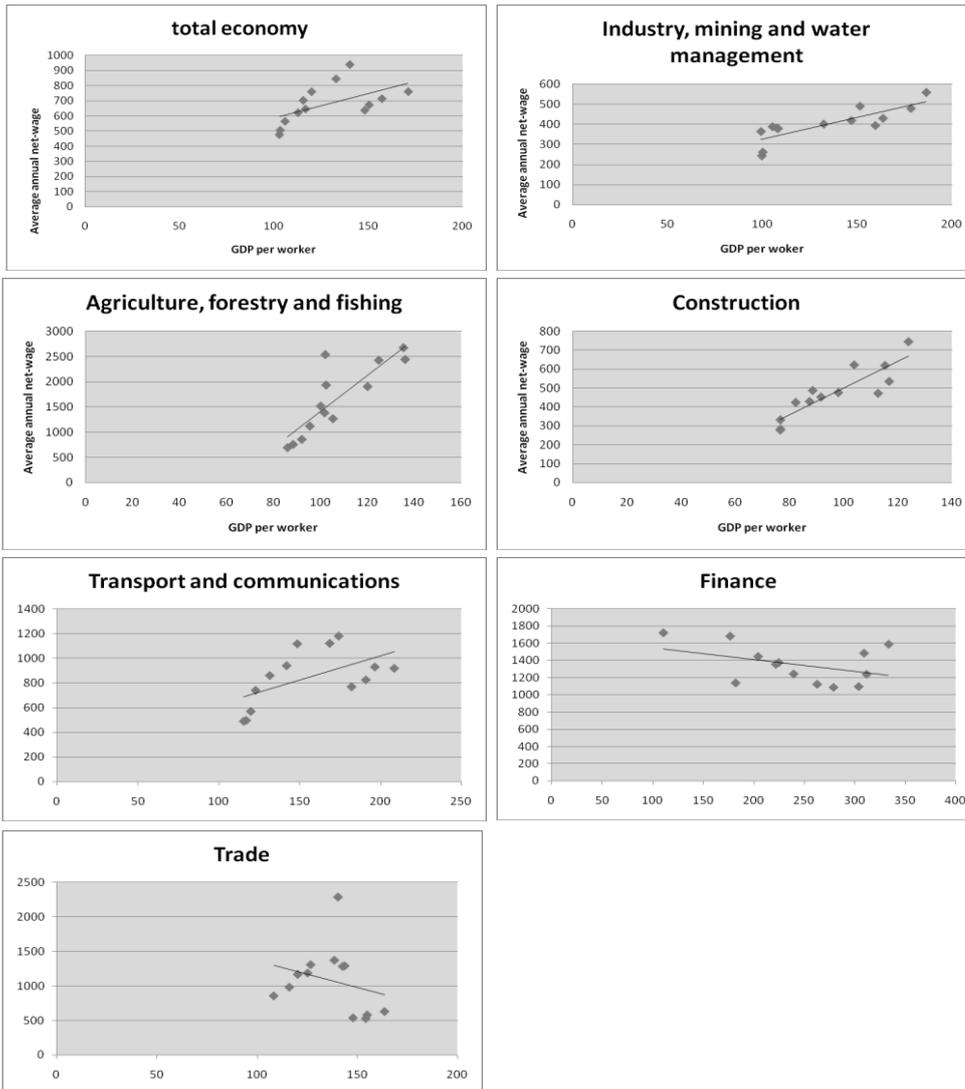
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Appendix 1: Scatter charts of the relationship between labour productivity and net-wage



Appendix 2: Average annual net-wage and GDP per worker – real values

Year	Total economy		Industry, mining and water management		Agriculture, fishing and forestry		Construction		Transport and communications		Trade		Financial services	
	Annual net-wage	GDP per worker	Annual net-wage	GDP per worker	Annual net-wage	GDP per worker	Annual net-wage	GDP per worker	Annual net-wage	GDP per worker	Annual net-wage	GDP per worker	Annual net-wage	GDP per worker
1995	102,97	475,36	99,62	244,47	5704,30	694,64	76,66	283,39	8335,72	491,02	3400,62	852,27	110,60	1718,92
1996	103,43	504,59	100,09	262,34	6055,06	756,86	76,59	278,61	9082,27	498,14	3343,26	978,80	176,62	1680,56
1997	106,00	563,15	99,20	364,77	6757,85	858,00	76,63	332,64	10295,97	571,09	3991,73	1183,72	182,12	1137,82
1998	112,84	619,85	105,22	388,32	7438,26	1121,87	82,29	424,10	13462,43	741,69	5089,21	1281,29	204,27	1444,33
1999	116,79	644,46	108,21	379,37	7733,51	1269,46	87,40	429,57	15233,49	861,70	5154,80	1289,16	224,71	1374,38
2000	115,61	700,88	107,46	381,56	8410,51	1385,16	88,56	487,18	16621,87	941,26	5846,10	1370,11	221,91	1354,68
2001	120,02	757,99	132,28	401,25	9095,92	1519,42	91,63	452,56	18233,08	1118,54	5430,72	1164,63	239,44	1242,14
2002	132,95	843,11	146,81	418,77	10117,32	1936,52	98,05	476,31	23238,27	1122,12	5715,72	1305,51	262,64	1122,31
2003	140,21	937,16	151,41	489,72	11245,94	2542,71	103,87	621,70	30512,57	1181,38	7460,41	2288,01	278,83	1086,64
2004	148,11	635,99	159,53	394,16	7631,92	1907,53	112,69	472,38	22890,30	770,43	5668,54	533,41	303,72	1095,88
2005	150,41	671,79	163,53	429,86	8061,47	2446,18	116,80	534,96	29354,16	826,11	6419,52	523,15	311,58	1238,03
2006	157,17	712,14	178,28	478,56	8545,68	2679,30	115,26	619,06	32151,56	931,11	7428,74	576,84	309,01	1482,39
2007	171,07	758,94	186,42	557,77	9107,24	2430,25	123,92	744,15	29163,04	919,81	8929,80	625,73	333,36	1586,80

