THE CONNECTION BETWEEN LABOUR PRODUCTIVITY AND WAGE IN ROMANIA. TERRITORIAL AND SECTORAL APPROACHES

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Abstract Labour productivity and wages are both essential economic factors and the way they interrelate is a constant concern for the economists, as well as for employers and policy-makers. The target of this paper to estimate to which extent is the variation of productivity consistent with the distribution of wages, employing two patterns of comparison: by region and by economic branch. For this purpose, we developed a revised form of the coefficient of structural changes, in order to determine the regional/ sectoral dissimilarities between productivity and wage.

Key words: labour productivity, wage, disparities, Romania

Introduction

This paper explores the inter-region and inter-sector labour productivity and wage variation employing transversal data sets for 2000 and 2005. The main idea is to determine the dissimilarities between labour productivity and wage, both by regions and by main economic branches. For this purpose, we developed a modified form of the coefficient of structural changes (Kazineț, 1955, Tövissi, 1979), in order to enable comparisons between qualitative variables such as labour productivity and wage.

This paper is structured as follows. Section 2 outlines the two major economic lines of thought that provide explanations for the relations between labour productivity and wages. Section 3 briefly describes the methodology used to work on our spatial and sectoral data. Sections 4 and 5 focus on the results of the regional and sectoral analysis of productivity - wage dissimilarities. Section 6 provides some concluding remarks on the topic.

Theoretical background

The labour economics literature displays two main approaches to the connection between labour productivity and wages. In neo-classical theory the level of wages is supposed to be determined by the marginal productivity of labour. Firms are activating on a competitive market and the level of wages is established exogenously on the labour market, like other prices in the economy.

From the standpoint of the profit maximizing goal, the decision to hire an additional unit of labour is entirely based upon its effect on the profits. Considering the wage as the cost of hiring one more worker and the revenue as the marginal productivity of the unit of labour, in order to maximize profit, the firm demands each factor of production until the marginal productivity falls equal to the real price of that factor (Mankiw 2003, p. 46-48).

This judgement establishes a clear link between wage and the average productivity of labour: the economic sector with bigger labour productivity would also have higher wages. Increases in labour productivity in one economic sector would magnify the demand for labour, thus producing an increase in wages, at least on the short run. In the long run, this wage surplus is difficult to maintain, since more workers will be attracted by the sector offering higher wages, thus increasing the supply of labour and exercising upon the wages a downward pressure that can bring them back to the average wage. Considering the supply of labour is mobile, from a theoretical point of view the long run effect will be the convergence of wages between sectors, together with an increase in employment in the higher productivity sector, owing to migration of workers.

There is empirical evidence to support this theory derived from the standard neo-classical model. A research for Sweden and Finland, over 1950-2000 period, found that the dispersion (by economic sector) of labour productivity and wages develops in the same direction for the most of the period (Svanlund, 2007), Finland better fitting the neo-classical theory.

Some authors consider this neo-classical theory about the relationship between labour productivity and wage is wrong (Bruce, 2002, Huizinga, 2004). First, they say there isn't necessary a correspondence between output per worker and revenue per worker because, if decline in the demand for the output of a certain sector occurs, market prices will have to reduce too, thus causing a decrease in the revenue per worker, despite any presumable productivity gains. A higher labour productivity may produce a price reduction because it determines the increase of the total output of the sector and, by the laws of supply and demand, when supply rise, the price fall. This decline in prices furthermore produces a reduction in revenue per worker. The agricultural sector of the developed countries represents such an example, the farm incomes being under permanent downward pressure despite constant productivity improvements.

Second, even if revenue per worker actually increase in the higher productivity sector, the consequent higher level of wages may not be sustainable on the long run because the increasing labour supply generated by the workers migrating from lower wage sectors puts a downward pressure on wages.

To sum up, there may be only partial, time-limited connection between labor productivity and wages from the sectoral point of view. Empirical evidence supports these assertions. An example is a research employing statistical data covering 1961-1995 period for Canada, that discovered that regardless of an industry's growth in relative multifactor productivity, relative wages remained unchanged Bruce (2002). Another made in Nederland's showed that a wage push only temporary raises labour productivity in the short run, but it is inefficient in the long run (Huizinga, 2004). Therefore, the author concludes that it is probably best not to use wage policy at all as a tool to influence productivity, but it is very effective as a tool against unemployment.

Methodology

The aim of this paper is to measure the dissimilarities between labour productivity and wage variations from the standpoint of their regional and sectoral values, as compared with the national average. We started from the coefficient of structural changes (Kazineţ, 1955, Tövissi, 1979) that measures the average variation in the structure of a population over a period of time using the quadratic mean of the absolute differences between the present (t) and the previous (o) shares owned by the elements (i) of this population:

$$CS = \sqrt{\frac{\sum_{i=1}^{n}\left(\frac{x_i^t}{\sum_{i=1}^{n} x_i^t} - \frac{x_i^0}{\sum_{i=1}^{n} x_i^0}\right)^2}{n}} \qquad (1)$$

We developed the formula for a coefficient of dissimilarities (CD) that enables comparisons between the structures of two different variables. For qualitative variables, such as wage and labour productivity,

instead of the share of each unit i ($\dfrac{x_i^t}{\sum\limits_{i=1}^{n} x_i^t}$) we employ the ratio between the value of the variable for unit i

and the arithmetic mean, as in the formula below:

$$CD = \sqrt{\dfrac{\sum\limits_{i=1}^{n}\left(\dfrac{P_i}{P_m} - \dfrac{W_i}{W_m}\right)^2}{n}} \qquad (2)$$

where:

$\dfrac{P_i}{P_m}$ is the ratio between region/sector "i" productivity and the national average;

$\dfrac{W_i}{W_m}$ is the ratio between the average monthly wage in region/sector "i" and the

national average monthly wage;

n – number of regions/sectors.

This indicator measures the overall dissimilarities between the spatial/sectoral distributions of wages and labour productivity and its values lays between 0 and $\sqrt{2n}$. For example, when territorial inequalities of labour productivity perfectly mirror the ones of wages, that is for each region i the position it holds against productivity national average is exactly the same as for the wage, there is no discrepancy between the two distributions and the coefficient of dissimilarities is zero. On the opposite, when the regional labour productivity hierarchy is totally different from the one of wages (e.g., the region with the highest wage has the smaller labour productivity) the dissimilarities reach their maximum level: $CD = \sqrt{2n}$, where n stands for the number of regions. Romania has eight development regions, so the regional CD may vary between 0 and 4. Taking into account that we employed 12 main branches for our sectoral analysis, in this case CD may vary between 0 and 4.9.

Regional productivity-wage dissimilarities

In this paper we first investigate the relationship between wage dispersion and labour productivity dispersion in the Romanian development regions. Absolute values of labour productivity and wage presented in the table 1 show little regional variation. In 2000, the territorial coefficient of variation for wages was 13.35% against the 16.31% variation of labour productivity. In 2005 the coefficient of variation for labour productivity recorded a sharp reduction, falling to 3.96%, but the wages variation slightly increased to 14.06%.

Table 1. Regional productivity-wage dissimilarities

Regions (i)	2000				2005			
	Labour productivity (GDP/person in thou RON	Wage (RON /person current	$\dfrac{P_i}{P_m}$	$\dfrac{W_i}{W_m}$	Labour productivity (GDP/person in thou RON	Wage (RON/ person, current	$\dfrac{P_i}{P_m}$	$\dfrac{W_i}{W_m}$

	current prices)	prices)			current prices)	prices)		
0	1	2	3	4	5	6	7	8
North-East	15.2208	185	0.8754	0.864	60.6997	663	0.9606	0.889
South-East	16.4368	217	0.9454	1.014	62.4436	702	0.9883	0.941
South	15.8948	208	0.9142	0.972	64.9609	716	1.0282	0.960
South-West	17.4566	226	1.0040	1.056	65.3714	734	1.0347	0.984
West	15.9466	204	0.9172	0.953	61.1393	718	0.9677	0.962
North-West	16.4948	191	0.9487	0.892	61.0493	679	0.9663	0.910
Center	16.2320	197	0.9336	0.921	61.1211	661	0.9674	0.886
Bucharest	23.9761	275	1.3790	1.285	67.1918	977	1.0635	1.310

Source: Romanian Statistical Yearbook 2006, Labour cost survey and authors' calculations

These divergent evolutions of labour productivity and wages explain the increase in the dissimilarities between the territorial distribution of their values since 2000:

$$CD_{2000} = 0.0551 \text{ or } 5.51\%$$

$$CD_{2005} = 0.1031 \text{ or } 10.31\%.$$

The level of this indicator is near the lower limit of its variation range, proving that the regional distributions of wages and labour productivity are highly connected.

The ratio between the maximum and the minimum wage by regions was 1.49 in 2000 and 1.47 in 2005. For labour productivity, these ratios were 1.58 and 1.10 respectively.

The evolution of the coefficient of dissimilarities shows a big increase in productivity-wage regional differentials in 2000-2005 period. Although it almost doubled, the regional productivity-wage dissimilarities are still very low, especially if compared with the ones by economic sectors.
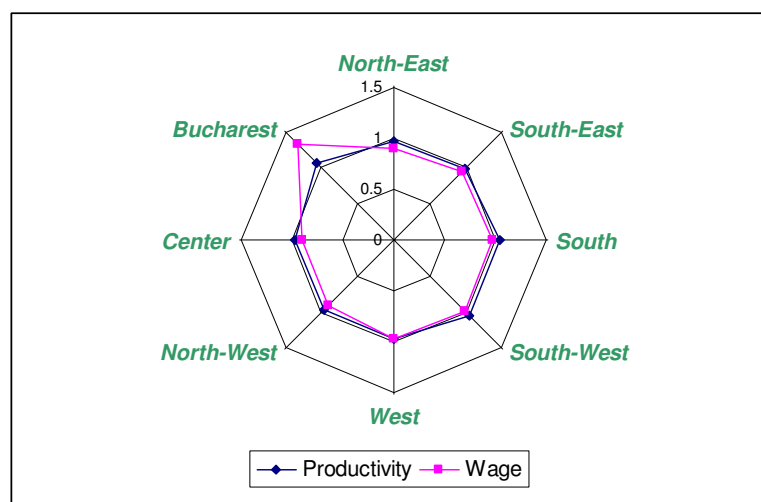
Figure 1. Regional productivity-wage dissimilarities in 2005

Productivity-wage dissimilarities by main branches of economy

In the second part of our empirical study we are testing whether differential levels of labour productivity across economic sectors are reflected in their relative wages. Starting from the wage and labour productivity levels of 12 main branches of the economy in 2000 and 2005 (table 2) we measure the overall dissimilitude between the distribution of these two indicators by using relation (1), where $\dfrac{P_i}{P_m}$ is the ratio between the productivity of branch "i" and the national average and $\dfrac{W_i}{W_m}$ represents the ratio between the monthly average wage in branch "i" and the national monthly average wage.

Firstly we measure labour productivity as gross value added /employee, by dividing the gross value added in each branch by its number of employees (table 2). Fundamental problems of labour productivity measurement by this formula arise in agriculture, hunting and sylviculture, where the employees are only a small part of the employed population. These leads to an unrealistic high value of labour productivity, as the gross value added is created by all the population employed in agriculture and the employees hold a smaller share of the employed population, as compared to other sectors of the economy. When labour productivity is measured as gross value added per person employed (table 3), the value of labour productivity in agriculture sharply decreases.

The overall differences between labour productivity and wage distributions of values by branches are far bigger than the regional ones. The coefficient of dissimilarities is:

$$CD_{2000} = 1.1370 \text{ or } 113.70\%$$
$$CD_{2005} = 0.9240 \text{ or } 92.40\%.$$

Although the differences between sectoral distribution of wages and labour productivity are significant, considering the full range of variation of this indicator (from 0 to 4.9), there is still considerable productivity-wage connection.

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Table 2. Dissimilarities between labour productivity (gross value added/employee) and wage by main economic branches

Branches (i)	2000				2005			
	Labour productivity (Gross value added/person in thou RON current prices)	Wage (RON/person, current prices)	$\dfrac{P_i}{P_m}$	$\dfrac{W_i}{W_m}$	Labour productivity (Gross value added/person in thou RON current prices)	Wage (RON/person, current prices)	$\dfrac{P_i}{P_m}$	$\dfrac{W_i}{W_m}$
0	1	2	3	4	5	6	7	8
Agriculture, hunting and sylviculture	45.40[*]	164	2.8844	0.7664	169.25[*]	438	2.9533	0.7312
Fishing and pisciculture	1.00	135	0.0635	0.6308	5.23	361	0.0913	0.6027
Industry	11.72	223	0.7445	1.0421	41.48	658	0.7237	1.0985
Construction	12.43	186	0.7899	0.8692	52.56	558	0.9171	0.9316
Trade	14.50	150	0.9213	0.7009	42.88	458	0.7482	0.7646
Hotels and restaurants	22.67	138	1.4402	0.6449	67.75	425	1.1821	0.7095
Transport, storage and communications	21.72	284	1.3797	1.3271	92.74	795	1.6182	1.3272
Financial intermediations	17.41	526	1.1064	2.4579	81.51	842	1.4222	1.4057
Real estate and other services	58.97	216	3.7466	1.0093	150.76	461	2.6305	0.7696
Public administration and defense	23.38	304	1.4853	1.4206	105.93	550	1.8483	0.9182
Education	5.71	205	0.3631	0.9579	26.06	515	0.4548	0.8598
Health and social assistance	5.17	177	0.3284	0.8271	23.59	443	0.4117	0.7396

Source: Romanian Statistical Yearbook 2006, Labour cost survey and authors' calculations

[*] *This unusually high value is due to the low share of employees in the total population employed in agriculture.*

If agriculture, hunting and sylviculture and real estate are excluded because of their extreme values which distort the results, the level of the coefficient of dissimilarities decreases to 54.27% for 2000, respectively 39.24% for 2005.

Better results are obtained by measuring labour productivity as gross value added per person employed (table 3).

Table 3. Dissimilarities between labour productivity (gross value added/person employed) and wage by main economic branches

| Branches (i)	2000				2005			
	Labour productivity (Gross value added/person in thou RON current prices)	Wage (RON/ person, current prices)	$\dfrac{P_i}{P_m}$	$\dfrac{W_i}{W_m}$	Labour productivity (Gross value added/person in thou RON current prices)	Wage (RON/ person, current prices)	$\dfrac{P_i}{P_m}$	$\dfrac{W_i}{W_m}$
0	1	2	3	4	5	6	7	8
Agriculture, hunting and sylviculture	2.49	164	0.3025	0.7664	9.115	438	0.3006	0.7312
Fishing and pisciculture	0.6	135	0.0728	0.6308	3.925	361	0.1295	0.6027
Industry	10.95	223	1.3287	1.0421	35.15	658	1.1593	1.0985
Construction	11.13	186	1.3502	0.8692	39.5	558	1.3029	0.9316
Trade	10.61	150	1.2876	0.7009	27.97	458	0.9223	0.7646
Hotels and restaurants	20.48	138	2.484	0.6449	45.84	425	1.512	0.7095
Transport, storage and communications	19.18	284	2.3265	1.3271	70.78	795	2.3343	1.3272
Financial intermediations	16.71	526	2.0269	2.4579	69.73	842	2.2999	1.4057
Real estate and other services	38.52	216	4.6726	1.0093	93.73	461	3.0915	0.7696
Public administration and defense	23.54	304	2.8554	1.4206	102.3	550	3.3725	0.9182
Education	5.53	205	0.6703	0.9579	23.09	515	0.7617	0.8598
Health and social assistance	4.62	177	0.5609	0.8271	20.47	443	0.6751	0.7396
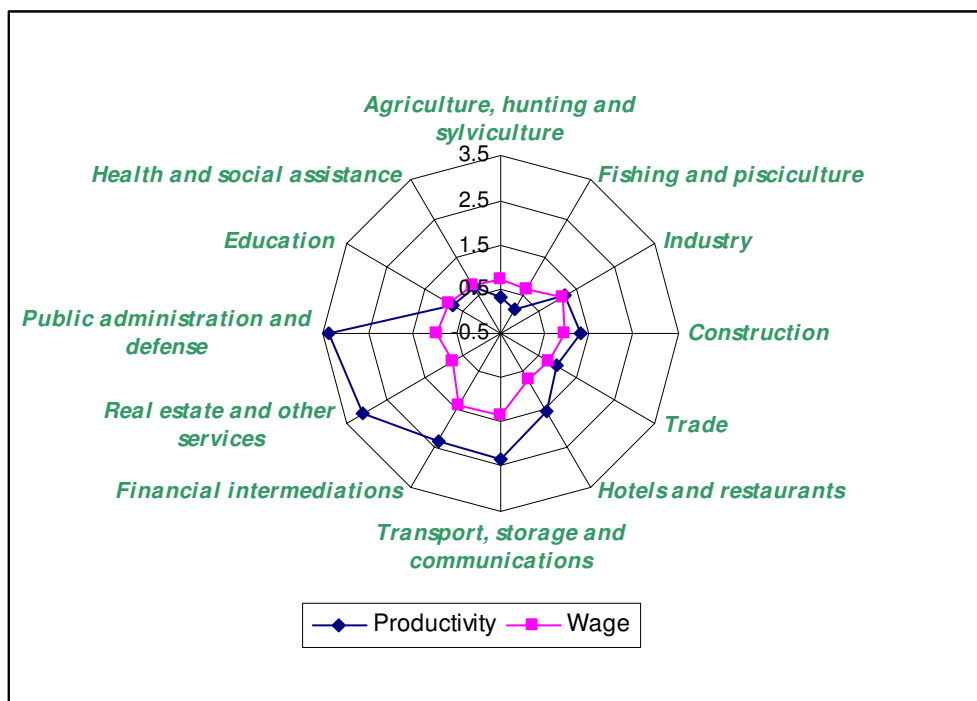
Figure 2. Sectoral productivity-wage dissimilarities in 2005

The ratio between the maximum and the minimum wage by branch was 3.90 in 2000 and decreased to 2.33 in 2005. For labour productivity, these ratios were 64.20 and 26.06 respectively. Based on this reduction of the distances between the extreme values of the distributions, the overall dissimilitude coefficient also decreased in 2000-2005 period:

$$CD_{2000} = 1.3349$$
$$CD_{2005} = 1.0978.$$

The values of the coefficient of dissimilarities are relatively low, showing a significant connection between labour productivity and wages from the sectoral point of view.

Final remarks

The relation between labour productivity and wages is an issue of great interest for economists. Against the neo-classical theoretical belief upon the strong connection between labour productivity and wages, empirical evidence reveals important differences in their variation.

In this paper we investigated the cross-section relation between the dispersion of wages and productivity in Romania, both by regions and by economic activity. We found insignificant differences between the territorial variations of those two variables. However, the distribution of labour productivity across economic branches is in a much bigger dissonance with the sectoral distribution of wages. There is a tendency favoring the reduction of these differences in time, mainly due to a faster increase of labour productivity in the less favored branches of the economy, thus reducing the gap.

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