The Wage Curve in Poland in 1995-2005

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1. Introduction

The motivation of the paper is to check the functioning of regional labour markets in Poland during last ten years of transition period. A brief look at the statistical data shows high and persistent differences in unemployment rates among Polish regions. They are on one hand the consequence of the existence of centrally planned economy for decades, on the other, the result of changes which took place during the process of transformation to the fully market economy. According to Blanchflower and Oswald (1994) there exists a non-linear and downward-sloping relationship between the situation on the regional labour market and the level of pay. Regions with lower unemployment rate tend to characterize by higher level of wages. They named their concept 'The Wage Curve''.

Blanchflower and Oswald brought a wide empirical evidence from UK, USA and other developed economies supporting not only the negative unemployment elasticity of wages but confirming that in most of the countries it varies around -0.1 (see Blanchflower, Oswald, 2005). Moreover, after the publication of their book in 1994, a large number of researches checking the existence of wage curve not only in developed but also in transition economies appeared. In case of Poland we should mention among others a Duffy and Walsh (2001), Iara and Traistaru (2004) and Gora, Sztanderska (1998) papers.

F. Duffy and P. Walsh analysed the relationship between the level of pay and unemployment rate in 49 Polish regions in 1994-1997 basing on data from Polish Labour Force Survey (PLFS) and received the unemployment elasticity around –0.1. The paper of A. Iara and I. Traistaru analyses the wage curve for Poland, Bulgaria and Romania. In case of Poland the analysed period was 1992-1998. They confirm that the relationship between wages and unemployment rate was significant and in case of Poland it varied around –0.05. M. Gora and U. Sztanderska verified the wage curve in 1995 taking into account 49 Polish regions and found the unemployment elasticity of wages around –0,1.

The presented paper continues the research of other authors mentioned above taking into account the new administrative division of Poland (divided in 16 main regions). As data is concerned, we should underline that data on wages from PLFS were not fully representative on regional level. Moreover, LFS data on wages are in some extent biased, fistly because only a part of respondents anwer the question about their salaries. Secondly, it is underlined that repondents tend to lower their wages, and that the bias increases with the level of wages. The

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[1] The authoress would like to thank to Prof. Tomasz Tokarski from Jagiellonian University and dr Robert Kelm from University of Lodz for their comments and suggestions.

analyses conducted in paper are based on data from Regional Statistical Yearbook of Poland and take into account gross montly salaries directly from employers.

The main aim of the paper is to show the existing regional differences both in unemployment rates and wages and their changes in analyzed period. Moreover, to check if wages in Poland adjust to the situation on local labour market. The empirical analyses conducted in the paper tackle the problems of unobserved heterogeneity by using fixed effects and the problem of adjustments of wages to unemployment changes allowing for lags in regression.

The analyses conducted in the paper shows that the confirmation of wage curve in Poland is not so obvious, firstly because of the existance of some atypical regions. Secondly, it turns out that the elasticity of wages was not constant over time. In particular, the reaction of wages is different with respect to fall, and different with respect to rise in unemployment on local labour market.

The structure of the paper is as follows. In the next section we present the theoretical framework of the wage curve. In section 3 we briefly describe the data. In section 4 we show the existing disparities in unemployment and wages on regional labour markets in Poland in 1995-2005. Section 5 presents other factors, which can shift the wage curve at a given unemployment level. Section 6 contains the empirical results of the model. Section 6 concludes.

2. Theoretical framework

One of the first analyses of relation between wages and unemployment is the Phillips curve (1958) which show the inverse relation between the situation on labour market and growth rate of wages on macroeconomic level. Regional concept of relation between these two variables were proposed by John Harris and Michael Todaro (1970). They argued that to take a job in region with high unemployment rate the worker has to be paid well. Here the wages in a given region are then a positive function of local unemployment rate.

According to the theoretical concept of Blanchflower and Oswald (1990, 1994) there exist a downward-sloping logarithmic curve linking the level of pay with the unemployment rate in the local area. The justification of the negative slope comes from the non-competitive labour markets theories for example of efficiency wages and bargaining ones.

In the efficiency wage models it is assumed that effort (productivity) of employees depends on the wage level. The relation between the wage level and labour productivity is widely known since A. Marshall times who claimed that „highly paid labour is, in general, efficient and, as a consequence, not expensive" (see Marshall, 1928, p. 7). However, a direct inspiration for economists dealing with the efficiency wage theory was the capture of the relationship between wage and labour productivity put forward by R. Solow (1979). He thought that the rigidity of wage lies in the interests of employers, as a decline in wage would decrease the productivity and increase the labour costs.

In the efficiency wages model the wage-setting firm behaves in the way to maximize its profit function. According to the assumptions of the shirking model the firm cannot control all the workers so it pays more to discourage them from shirking. Below the simple efficiency wage model is presented (see among others Solow, 1979, Summers, 1988 and Blanchflower and Oswald, 2005), which was the starting point for the empirical analyses conducted in the paper.

According to Solow, 1979 model we assume that there are *n* identical firms in the economy. The typical firm on the regional labour market maximizes its profit function given as:

$$\pi_{it}(w_{it}, L_{it}) = F(\varepsilon[w_{it}]L_{it}) - w_{it}L_{it} \qquad (1)$$

where:

$\tilde{L}_{it} = \varepsilon[w_{it}]L_{it}$ - the effective labour (total number of workers (L_{it}) weighted by the efficiency of the typical worker ($\varepsilon[w_{it}]$));

w_{it} – the level of wages on the regional labour market;

$\varepsilon[w_{it}]$ – the efficiency (effort) of the worker ($d\varepsilon/dw_{it} > 0$);

$F(\tilde{L}_{it})$ - neoclassical production function ($dF/d\tilde{L} > 0$ and $d^2F/d\tilde{L}^2 < 0$).

The profit function (1) is the function of two decisive variables: wages (w_{it}) and employment (L_{it}). The first order conditions for maximizing the profit function are then:

$$\left.\begin{array}{l} \dfrac{\partial \pi}{\partial w_{it}} = \dfrac{dF}{d\tilde{L}_{it}} L_{it} \dfrac{d\varepsilon}{dw_{it}} - L_{it} = 0 \\[3mm] \dfrac{\partial \pi}{\partial L_{it}} = \dfrac{dF}{d\tilde{L}_{it}} \varepsilon[w_{it}] - w_{it} = 0 \end{array}\right\} \qquad (2)$$

After some transformations we get so called Solow condition:

$$\frac{d\varepsilon}{dw_{it}} \frac{w_{it}}{\varepsilon} = 1 \qquad (3)$$

which means that the typical firm on the regional labour market maximize the profit function if and only if the elasticity of an effort with respect to wages equals one.

The extension of Solow model is Summers model (1988) where it is assumed that the effort of the worker depends not only on the level of wages on local labour market but rather on the difference between the level of average wage on the regional labour market and his reservation wage:

$$\varepsilon(w_{it}) = \left(\frac{w_{it} - x_{it}}{x_{it}}\right)^{\beta} \qquad (4)$$

and the reservation wage is the negative function of the situation on regional labour market and positive fuction of average wage in a given economy:

$x_{it} = (1 - bu_{it})\overline{w}_t$ where (β, b>0),

where:

w_{it} - the level of wages on the regional labour market;

$\varepsilon(w_{it})$ - the efficiency (effort) of a worker, $\dfrac{d\varepsilon}{dw_{it}} > 0$;

x_{it} - the average reservation wage on local labour market;

$\overline{w}_t$ - the level of average wage in economy;

u_{it} – the unemployment rate in the regional labour market.

All the workers are risk-neutral. They maximize their total utility coming from the income (w) and disutility from the effort (e). The total utility (TU) of the worker is then simply the difference between their income and effort: TU=w-e.

The worker can choose between working fair and face an effort (e) or shirking and facing the probability of being caught and dismissed. But if undetected, the worker can earn the wage w with zero effort. If detected, the worker is fired and has to find the job elsewhere. The expected utility of a fired worker ($\overline{U}$) will be given as:

$$\overline{U} = (w - e)f(u) + b(1 - f(u)) \qquad (5)$$

where the function *f(u)* measures the probability of finding another job and in the model it is the function of the local unemployment rate. The probability of finding job is by some assumptions a convex function of unemployment rate u.

The employers then have to pay a wage that is sufficiently high to induce employees not to shirk. As the unemployment rate on the local labour market rises, the firm realizes that the workers are more frightened of loosing the job and can pay less while maintaining the same level of worker's effort.

As all the firms are identical and they maximize their profit function, the level of wages on the local labour market in a given economy will be a function of the observed local unemployment. Basing on these assumptions, the standard wage curve which shows the relationship between the level of pay and local unemployment rate can be shown as:

$$w_{it} = f(u_{it}, X_{it}) \qquad (6)$$

where:

w_{it} – the level of wages in region i at time t;

u_{it} – the unemployment rate in region i at time t;

X_{it} – the vector of wage-pushing factors, shifting the wage curve (at a given unemployment level). According to Layard, Nickell, Jackman (2005, p. 212-213) the wage pushing factors can be divided in two groups: the internal (for a given firm) factors: labour productivity, union power, production costs (import prices etc) and the external (for a given firm) factors: the situation on the labour market, the duration and level of unemployment benefits, share of long term unemployed, the mismatch on the labour market and market competitiveness.

3. Data

A number of existing studies in the subject base on micro data, which allows for control variables such as gender, age, education etc. Alternative approach takes into account the regional data. It is also the case of the paper. We base on aggregate data from the Central Statistical Office for the 16 Polish regions. The analysed period (1995-2005) is due to the availability of statistical data[2].

Analyzing the unemployment rates in Poland we have to mention two problems that have impact on official data: a presence of a high hidden unemployment (especially in typical rural areas of eastern Poland) on one side and on the other a large share of labour force employed in the underground economy. Therefore, as it is underlined in Polish literature, the official statistics from the Labour Offices are somehow biased and do not reflect the actual situation on local labour markets (see Gora, 2005). That is the reason that in the paper we use data from

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[2] Since 1999 there is a new administrative division in Poland. The country is divided into 16 regions (called voivodeships) that are further separated into 45 sub-regions and 379 poviats. The Central Statistical Office has re-estimated the main macroeconomic data since 1995, so earlier data are not available. Moreover most of the regional data are published with considerable delay.

Polish Labour Force Survey. As a measure of situation on local labour market we took the average unemployment rate in a given region in a given year.
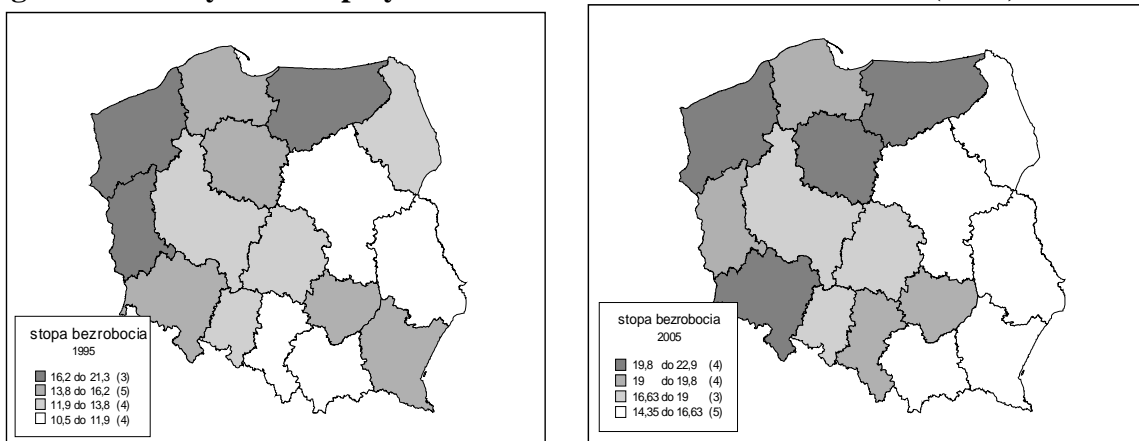
When wages are concerned we have to taken into account the fact that the official data on wages concern mainly industry, construction and services. Most of the workers in agriculture are self-employed. That is why the data on wages in the paper have been reestimated and we took average, weighed by number of employees, level of wages in the three above sectors, without agriculture one. Nominal wages were deflated by GDP deflator.

4. Situation on regional labour markets and wages in Poland in 1995-2005

The observed unemployment rates on regional labour market in Poland show high degree of persistence. Regions with high unemployment rates at the beginning of analysed period tend to characterize by high unemployment also after ten years. To explain the existing differences we should look more carefully at the changes on the beginning of transformation period. The main reason of high unemployment rates in northern and western part of Poland was the liquidation in 1991 the state-owned agricultural farms (in zachodniopomorskie, pomorskie, lubuskie, kujawsko-pomorskie and warminsko-mazurskie regions[3]). As the share of employment in agriculture in those regions was more than 20% of total employment, the shutdown of the farms caused rapid growth of unemployment. Another example is lodzkie region where at the beginning of 90's there was the bankruptcy or liquidation of almost the whole textile industry. As the majority of workers were those with low level of education (and with rather weak chances to find another job at the beginning of transition period), they remained unemployed for a long time (see Gora, Sztanderska, 1998, p. 7). Therefore the differences that occurred in 1991 remained almost unchanged until 1995.

Map 1
Regional diversity of unemployment rates in Poland in 1995 and 2005 (in %)

stopa bezrobocia
1995

- 16,2 do 21,3 (3)
- 13,8 do 16,2 (5)
- 11,9 do 13,8 (4)
- 10,5 do 11,9 (4)

stopa bezrobocia
2005

- 19,8 do 22,9   (4)
- 19   do 19,8   (4)
- 16,63 do 19   (3)
- 14,35 do 16,63 (5)

Source: own calculations based on Labour Force Survey, 1996 and 2006

After the initial period of restructuring as well as the liquidation of many state enterprises (in 1991-1994) the unemployment rate in 1995 in all regions was at a considerable high level (varying from around 10 to 21% of regional labour force; see map 1). Looking at the changes during the following years (1995-2005) one can see that the analysed period was very heterogeneous.

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[3] The administrative map of Poland is in Appendix.

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Table 1
Changes in regional unemployment rate in Poland in 1995-2005 (in percentage points)

	1995-1998	1998-2002	2003-2005	1995-2005
POLAND	-2,8	9,4	-2,2	4,5
Dolnoslaskie	-2,5	12,4	-3,2	6,7
Kujawsko-pomorskie	-4,3	9,6	-1,7	3,7
Lubelskie	-2,8	8,7	-2,2	3,7
Lubuskie	-4,8	14,0	-7,1	2,2
Lodzkie	-2,6	9,6	-3,0	4,0
Malopolskie	-2,4	8,0	-0,9	4,8
Mazowieckie	-2,6	8,1	-2,3	3,2
Opolskie	-1,9	9,1	-2,7	4,5
Podkarpackie	-3,6	7,9	-1,6	2,7
Podlaskie	-1,6	6,6	-2,5	2,5
Pomorskie	-4,7	10,3	-2,6	3,1
Slaskie	-1,2	10,4	-1,1	8,1
Swietokrzyskie	-1,1	6,1	0,2	5,2
Warminsko-mazurskie	-5,0	9,7	-5,6	-0,9
Wielkopolskie	-4,5	10,1	-1,1	4,6
Zachodniopomorskie	-1,0	10,2	-3,4	5,8

Source: own calculations based on Labour Force Survey, various editions from 1995-2006.

In 1995-1998 we could observe a decrease in unemployment rates in all regional labour markets (see table 1), which was mainly due to quick economic growth (the average GDP growth rate was above 5%). The largest changes (of about 4 pp.) took place in western and northern regions (kujawsko-pomorskie, lubuskie, pomorskie, warminsko-mazurskie and wielkopolskie). In 1999-2002 the reduction in GDP growth rate caused negative changes in Polish labour market. In 2002 the unemployment rates went up to 26% in some of the regions. Considerable changes took place especially in western regions and dolnoslaskie and slaskie regions (unemployment rates increased of more than 10 pp). In the latest at the end of 90's the process of restructuring in mining industry was initiated. In 2003 the positive changes, connected with the accelerating in the GDP growth rate, appeared and the unemployment rate in all the regions again decreased. As before the largest changes were noticed in western part of Poland. Looking at the total changes during the whole analysed period we can see that with respect to 1995 the unemployment rates in all regions increased. The biggest changes took place in dolnoslaskie and slaskie regions where unemployment rates increased of respectively 7 and 8 pp. Looking at the persistence of unemployment rates (see figure 1A in appendix) we can see that the western and northern regions of Poland were characterized in general by higher than average unemployment rates during the whole analysed period while in eastern regions the unemployment rates were below the average. In the regions located in central part of Poland the unemployment rate was about the average. Comparing the differences in regional unemployment rates at the beginning and the end of analysed period (see table 2) we can see they slightly decreased. In 1995 the ratio of minimum to maximum value equalled 0,50, in 2005 – 0,63.

Table 2
Unemployment and wages characteristics in Poland in 1995-2005

	Unemployment rates						Wages					
	Min	Max	All regions		Without capital region		Min	Max	All regions		Without capital region	
			CV	MM	CV	MM			CV	MM	CV	MM
1995	10,6	21,3	0,21	0,50	0,21	0,50	1179	1690	0,10	0,70	0,09	0,70
1996	9,5	21,0	0,23	0,45	0,23	0,45	1256	1781	0,10	0,70	0,09	0,71
1997	8,9	19,4	0,23	0,46	0,23	0,46	1385	1967	0,10	0,70	0,08	0,75
1998	7,8	16,3	0,23	0,48	0,23	0,48	1401	2159	0,12	0,65	0,08	0,73
1999	11,5	22,0	0,20	0,52	0,20	0,53	1499	2394	0,13	0,63	0,07	0,77
2000	11,7	23,6	0,19	0,49	0,18	0,49	1603	2524	0,12	0,63	0,06	0,82
2001	13,1	24,3	0,18	0,54	0,17	0,54	1615	2604	0,13	0,62	0,07	0,79
2002	16,2	26,3	0,18	0,62	0,18	0,62	1564	2664	0,14	0,59	0,08	0,77
2003	16,0	26,1	0,16	0,62	0,16	0,62	1662	2741	0,14	0,61	0,07	0,78
2004	14,6	25,0	0,16	0,58	0,15	0,62	1604	2704	0,14	0,59	0,08	0,75
2005	14,4	22,9	0,15	0,63	0,14	0,63	1477	2747	0,16	0,54	0,10	0,69

CV – the coefficient of variation, MM – the minimum/maximum ratio
Source: own calculations based on Regional Statistical Yearbook and Labour Force Surveys, various editions from 1995-2006.

Turning to wages we have to underline that the existing regional differences in wages in Polish economy are to some extend the result of the existence of the centrally planned system for several decades. Deformations in the sectoral diversity of wages within the previous system resulted to a large extent from the primacy of industry production over services. Wages in the strategic industries (for instance in coal-mining) were above average in order to stimulate the development of selected branches or industries (see Welfe, 1997, p. 460-461). The average wage in the mining industry was about 2 times higher than the average wage in Poland.

Looking at the regional differences in wages in 1995 (see map 2) we can see that in Slaskie region (with considerable share of working in mining industry) wages were much above the average (about 117% the average wage in Poland). However, it is worth stressing than in the recent years the differences became much smaller. Apart from very specific Slaskie region, another untypical area taking wages into account is the Mazowieckie (capital) region, where wages were also high (about 114% of average wage). Only in these two regions wages were above the average. The remaining 14 regions were characterized by lower, then the average, wages.

Map 2
Regional diversity of wages in Poland in 1995 and 2005 (nominal prices deflated with the GDP deflator, PLN, constant 2000 prices)
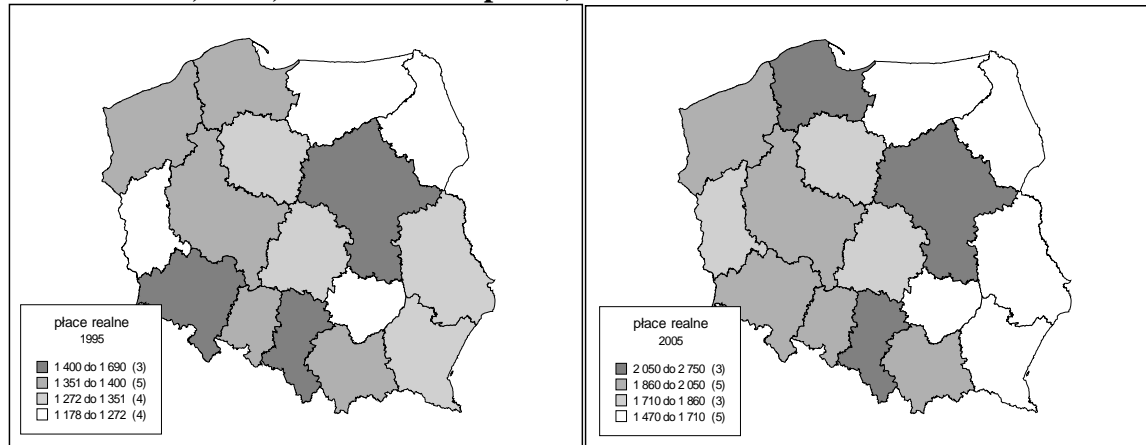
Source: own calculations based on Regional Statistical Yearbook, Warsaw, 1996 and 2006.
Looking at the changes during the analysed period we could see that (see table 3) the average growth rate of wages in 1995-1998 was much higher than in the next sub-periods. In 1995-1998 it varied around 7% while in the 1999-2001 it decreased to about 4,8 and even to less then 1% in 2002-2005. The reduction in the wage growth rate after 1999 was due to the economic recession. The reduction in GDP growth rate and growth of unemployment negatively influenced the wage pressure on all regional markets.

Table 3
Dynamics of real wages on regional labour markets in Poland in 1995-2005

	Average rate of growth				Total growth
	1996-1998	1999-2001	2002-2005	1996-2005	1996-2005
POLAND	106,9	104,8	100,7	103,8	144,8
Dolnoslaskie	105,5	104,5	101,7	103,7	143,0
Kujawsko-pomorskie	106,2	104,0	100,5	103,3	137,5
Lubelskie	105,3	104,0	99,3	102,5	127,0
Lubuskie	107,1	104,1	100,3	103,5	139,6
Lodzkie	104,6	103,9	100,6	102,8	131,3
Malopolskie	105,4	104,1	101,1	103,3	138,3
Mazowieckie	109,6	106,5	101,4	105,4	167,3
Opolskie	105,9	104,4	100,6	103,3	138,2
Podkarpackie	105,0	103,5	99,9	102,5	126,9
Podlaskie	107,5	103,5	99,4	103,0	133,4
Pomorskie	105,9	105,4	101,5	104,0	147,1
Slaskie	104,4	101,9	101,3	102,4	126,9
Swietokrzyskie	103,6	106,1	97,1	101,8	117,2
Warminsko-mazurskie	104,6	106,2	99,7	103,1	135,1
Wielkopolskie	106,9	104,3	100,5	103,6	141,4
Zachodniopomorskie	105,0	104,5	100,3	103,0	133,8

Source: own calculations based on Regional Statistical Yearbook, various editions from 1995-2005.

Looking at the regional diversity of wages (see table 2) one can see that they were much smaller than in case of unemployment rates, but they grew up in the analysed period. The ratio of minimum to maximum value decreased from 0,7 in 1995 to 0,54 in 2005. It was the result of more and more dominant position of Mazowieckie (capital) region, where relative wages increased from about 115 in 1995 to 132% (of average wage in Poland) in 2005.

The regional dispersion of both wages and unemployment rates shows that (see figure 2A in appendix and table 2) the regional dispersion of unemployment rates is much bigger than the one in case of wages. Moreover when we ignore the very specific Mazowieckie and Slaskie regions, both the coefficient of variation and the relation of minimum to maximum in case of wages decreases, which suggests that these regions are responsible for significant part of variation in the analysed sample. The local unemployment rates tend to be characterized by much more variation than the wages. And in this case, exclusion of these two regions does not change much the values of the analysed coefficients.

5. Other factors determing wage pressure in Poland

As it was mentioned in the theoretical part of the paper, while analysing the relation between wages and unemployment we should take into account other, wage-pushing variables, that can shift the wage curve at a given unemployment rate. In the further analyses, we will try to identify other factors, apart from the situation on the local labour market, which could have a significant impact on the wage diversity across regions in Poland. Taking into account both the suggestions from literature (see Layard, Nickell, Jackman, 2005, p. 173) as well as the availability of statistical data, we concentrated on four factors:
- Labour productivity level (as an average in the region);
- Unemployment structure (share of long term unemployed)
- Union power (measured by share of employed in industry[4])
- Market competitiveness (measured by employment in services).

Looking at the regional differences in labour productivity in Poland in 1995-2004[5] (value added per employee; see map 3), we can confirm positive and significant relationship between the level of wages and the level of labour productivity. The regions with higher labour productivity were characterized by higher then the average level of wages (for further analyses see also: Rogut, Tokarski, 2001 or Rogut, Tokarski, 2005). On the other hand, the eastern part of Poland, they are the regions with high share of employment in agriculture, low capital/labour ratio, low labour productivity and also low level of real wages.

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[4] Unfortunately, there is no regional data on unionization, so we put a strong hypothesis, that it can be approximated by share of employment in industry (where, especially in mining, the unions are very strong). Another good measure in case of Polish economy could be the number of big employers (with more than 200 workers) if there were good data available across regions.

[5] The regional data on GDP are published by Central Statistical Office with delay. The latest available data concern 2004.

Map 3
Regional differences in labour productivity in Poland in 1995 and 2004 (thousands of PLN, constant 2000 prices)
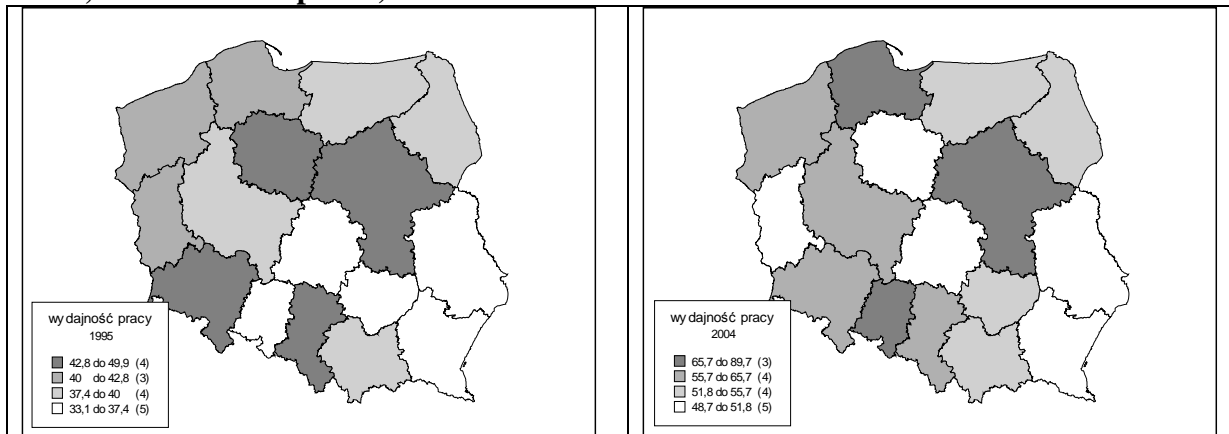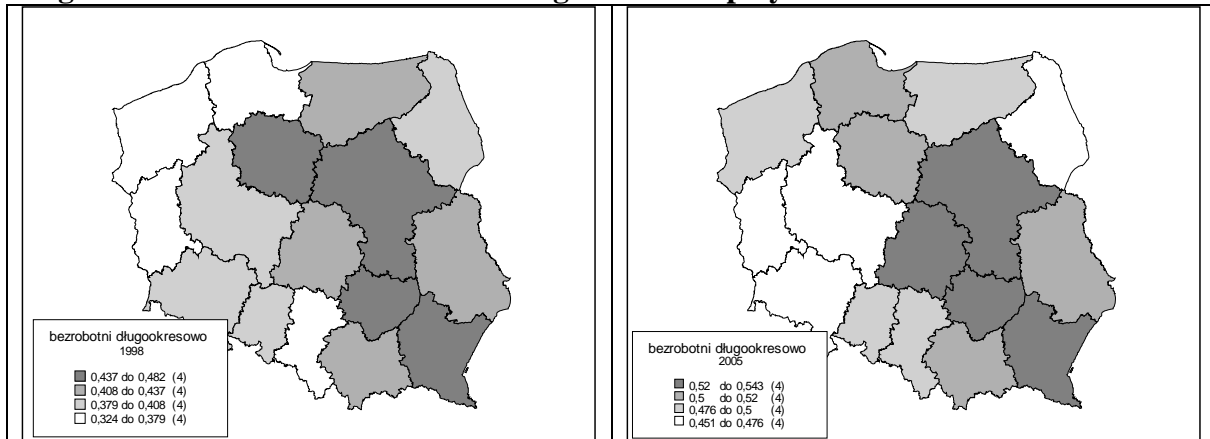

Source: own calculations based on Regional Statistical Yearbook, various editions from 1995-2005.

 Looking at the regional differences in the share of long term unemployed in Poland in 1998-2005[6] (shown at the map 4) we can notice that they are significant. The highest long-term unemployment is observed in the Eastern and Southeastern part of Poland. They are the regions with high share of employment in agricultural sector and low inflows and outflows from unemployment (see also Rogut, Tokarski, 2002). It means that the probability of leaving unemployment there is quite low. The western part of Poland they are the regions with high unemployment, but also with high dynamics (relatively high rates of both outflows and inflows) and relatively low share of long-term unemployed. Looking at the changes in long term unemployment we can see that in 1998-2003 the average share increased from 39 to 52% of total unemployed. It means that more than the half of all unemployed in 2003 were looking for a job for more than 12 months. Since 2004 the positive changes on labour market resulted also in decrease of long-term unemployed. Moreover analysing the differences between regions in the observed period we can see that they have decreased (the coefficient of variation changed from 0,11 to 0,05).

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[6] Earlier data are not available.

Map 4
Regional differences in the share of long term unemployed in Poland in 1998 and 2005

bezrobotni długookresowo
1998

☐ 0,437 do 0,482 (4)
☐ 0,408 do 0,437 (4)
☐ 0,379 do 0,408 (4)
☐ 0,324 do 0,379 (4)

bezrobotni długookresowo
2005

☐ 0,52 do 0,543 (4)
☐ 0,5   do 0,52 (4)
☐ 0,476 do 0,5   (4)
☐ 0,451 do 0,476 (4)

Source: own calculations based on Regional Statistical Yearbook, various editions from 1999-2006.

As it was mentioned above, one of the factors which can explain the existing differences in wages between regions is employment structure. We assumed that share of working in industry sector can be some approximation of regional diversity of union power. Looking at the table 4 we can see that the highest share of employment in industry is noted in the Slaskie region. This is the region with considerable share of working in the mining industry, where the unions are very strong. Moreover, the share of working in industry in general is higher in the western regions of Poland.

Table 4

Regional diversity of employment structure in Poland in 1995-2005 (in % of total employment)

|	Share of employment in:		
	Agriculture	Industry and construction	Services
POLAND	0,19	0,31	0,50
Dolnoslaskie	0,10	0,34	0,56
Kujawsko-pomorskie	0,20	0,31	0,49
Lubelskie	0,40	0,19	0,41
Lubuskie	0,11	0,34	0,56
Lodzkie	0,20	0,32	0,48
Malopolskie	0,24	0,30	0,46
Mazowieckie	0,19	0,24	0,57
Opolskie	0,18	0,35	0,47
Podkarpackie	0,30	0,29	0,41
Podlaskie	0,36	0,21	0,43
Pomorskie	0,11	0,31	0,58
Slaskie	0,05	0,44	0,51
Swietokrzyskie	0,34	0,26	0,40
Warminsko-mazurskie	0,18	0,29	0,53
Wielkopolskie	0,19	0,34	0,47
Zachodniopomorskie	0,09	0,30	0,61

Source: own calculations based on Labour Force Survey, various editions from 1995-2006.

Another factor, which can have an impact on wages, is the level of market competitiveness. As the market competitiveness measure we took the share of working in services in the analysed region. In general we can see that the eastern areas they are the regions with very 'archaic' employment structure (high share of working in agriculture and low share of services in total employment; see map 6). The highest share is observed in Mazowieckie (capital) regions and in the western part of Poland. The latter is due to their location close to German border (more on sectoral diveristy on wages see: Tokarski 2005; Rogut, Lipowski 2005).

6. Empirical verification of wage curve in Poland

The focus in the paper is placed on the flexibility issues, especially on the ability of local labour markets to adjust to specific shocks. The question put in the analyses of the wage curves is how variations in wages are related to variations in unemployment on local labour market. To study more closely the relationship between wages and unemployment in Poland we plot the first differences in wages and unemployment (see figure 1) at the regional labour markets. Looking at the cloud of the points we can see very weak negative relationship between unemployment and wages.

Figure 1
Unemployment and wages dynamics at the regional level in Poland in 1995-2005
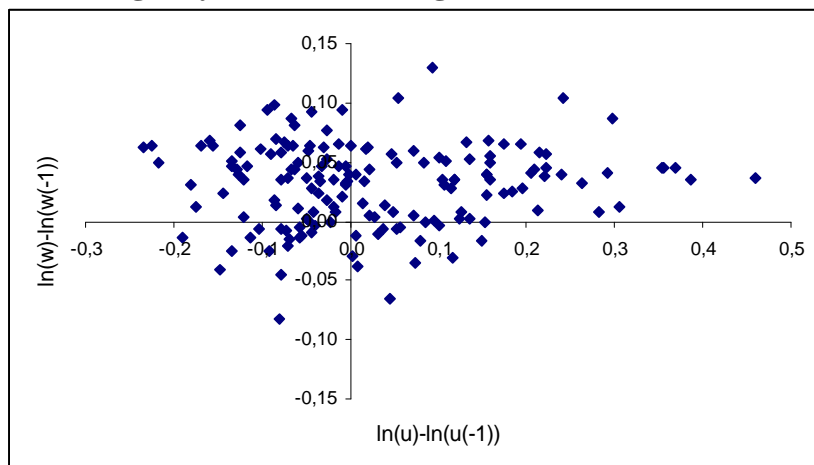
Source: own calculations based on Regional Statistical Yearbook and Labour Force Survey, various editions from 1995-2006.

To look more carefully on the relationship we plot the unemployment rates and wage levels on the regional labour markets separately for each of the analyzed year (see figure 3A in appendix). Again, we can confirm a negative relationship between the level of wages and unemployment rates however this relationship is quite weak.

To answer the question if there is a relation between level of pay and unemployment rate on the regional labour markets, it means if regions with high/low unemployment rate tend to be characterised by low/high level of pay the ranking of Polish regions was constructed (see Sibley, Walsh, 2002, s. 4). We put a mark for each region in each year taking into account both unemployment rate as well as level of wage. There was a separate ranking for each variable. The method of ranking was very simple: we put one point if the regions had the lowest unemployment rate in a given year and 16 points for the region with the highest unemployment rate. The rank was constructed for each of the eleven analyzed years, so the minimum number of points was 11 (it would mean that the region had the lowest unemployment rate during the whole analyzed period). The maximum was 176 (in the case when the unemployment rate was at the highest level all the time). The same ranking was constructed in the case of wages but we put one when the region had the highest level of wage and 16 in the case of the lowest. The results of both rankings are presented in table 5. If the concept of wage curve were fully fulfilled in the Polish economy we would have the same configuration in the column with unemployment rates and wages. This would mean that regions with lowest/highest unemployment rate were characterized by highest/lowest wages. Looking at the data in table 5 we can see that this was not the case and that we can separate few groups of regions:

1. Regions with relatively low unemployment rate and high wages (mazowieckie, slaskie, wielkopolskie, malopolskie);
2. Regions with medium level both of wages and unemployment rates (lodzkie, opolskie);
3. Regions with high unemployment rates and low level of wages (warminsko-mazurskie, lubuskie, kujawsko-pomorskie)

and

4. Regions with low unemployment rates and low wages (lubelskie, podlaskie, podkarpackie and swietokrzyskie);
5. Regions with high unemployment rates and high wages (dolnoslaskie, pomorskie and zachodniopomorskie).

Table 5
The ranking of Polish regions with respect to unemployment rates and level of wages in 1995-2005

Region	No. of points in unemployment rate ranking	No. of group	Region	No. of points in wages ranking	No. of group
lubelskie	25	4	mazowieckie	12	1
mazowieckie	29	1	slaskie	21	1
malopolskie	33	1	dolnoslaskie	39	5
podlaskie	45	4	pomorskie	39	5
wielkopolskie	51	1	wielkopolskie	57	1
opolskie	78	2	malopolskie	69	1
podkarpackie	81	1	zachodniopomorskie	78	5
slaskie	84	1	opolskie	81	2
lodzkie	94	2	kujawsko-pomorskie	106	3
swietokrzyskie	99	4	lodzkie	113	4
pomorskie	113	5	lubelskie	116	2
kujawsko-pomorskie	132	3	warminsko-mazurskie	136	3
lubuskie	152	3	lubuskie	144	3
Dolnoslaskie	158	5	podkarpackie	154	4
zachodniopomorskie	159	5	podlaskie	164	4
warminsko-mazurskie	163	3	swietokrzyskie	167	4

Source: own calculations.

We can see that for the first three groups we could confirm the negative relation between level of pay and situation on the local labour market, but the regions in the last two groups are in that sense atypical. The fourth group includes the rural eastern and south-eastern regions of Poland with low official unemployment rate, but high hidden unemployment. The actual unemployment in these regions is then higher and can be the reason of low wages.

In the last group we have western and northern regions of Poland with high registered unemployment, but the actual rate of unemployment in these regions can be lower because many people officially registered in labour offices as unemployed work in black market in services close to Polish-German border. In dolnoslaskie region high wages are the result of high share of employment in mining industry where wages are much higher than in other branches.

To study the relationship between local unemployment rate and the level of pay the parameters of static wage curve were estimated, where we do allow for unobserved heterogeneity across regions and time effects:

$$\ln(wr_{it}) = \eta_i + \beta_1 \ln(u_{it}) + \chi_k X_{kit} + \mu_t + \xi_{it} \qquad (8)$$

wr_{it} - the level of real wages in region i (i=1, 2, …, 16) at time t (t=1995, 1996, …, 2005);

_____

u_{it} - the unemployment rate in region i (i=1, 2, …, 16) at time t (t=1995, 1996, …, 2005);

X_k - vector of other wage-pushing variables: labour productivity (yl), share of long-term unemployed (ltu), share of employment in industry (lp) and share of employment in services (lu);

χ_k - elasticity of wages with respect to wage-pushing variables.

β_1 - lon-term elasticity of wages with respect to unemployment rate;

η_i - specyfic region effects;

μ_t - specyfic period effects ;

ξ_{it} - error term;

Looking at the estimated parameters of equation (8) we can confirm the negative relation between level of wages and unemployment rate on regional labour markets in Poland (see table 6). The elasticity of wages in respect to unemployment rates is about –0,07-0,1 which confirms the results of other authors. Moreover both the level of labour productivity as well as employment structure have positive and significant impact on level of wages. The results of Hausman test indicate that we can not reject the null that the unobserved specyfic region effects are not correlated with explanatory variables. But we have to reject the hypothesis of no correlation between time effects and independent variables.

Table 6
Estimated parameters of static wage curve in Poland (OLS)

log(u)	-0,0738***	-0,0779***	-0,0940***	-0,0413	-0,102***
log(yl)	0,162***	0,185***	0,167***	0,0977***	0,188***
log(lp)		0,590**			0,0741**
log(lu)			0,127***		0,146***
log(ltu)				0,0486*	
Adj. R^2	0,928	0,927	0,929	0,852	0,929
Region effects	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes
OLS	Yes	Yes	Yes	Yes	Yes

Taking into account the endogeneity of unemployment rates we estimated the parameters of static wage curve with 2SLS taking as an instrument the lag of unemployment rates. The results indicate that after controlling for endogeneity the elasticity of wages with respect to unemployment rates slightly increased (about –0,1-0,13; see table 7).

Table 7
Estimated parameters of static wage curve in Poland (2SLS)

log(u)	-0,131*	-0,109*	-0,139**	-0,0604
log(yl)	0,183**	0,218**	0,159**	0,0656
log(lp)		0,579**		
log(lu)			0,0616	
log(ltu)				0,0822
Adj. R^2	0,963	0,962	0,964	0,978
Region effects	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes
2SLS	Yes	Yes	Yes	Yes

In the next step we took into account the dynamics of labour market, both the fact that employers need some time to react to changes in unemployment on local labour market as well as observed inertia in adjustment processess. As the analysed period is quite short (1995-2005, which gives us 11 observation over time) we allowed for one lag in both depended and independed variables. The analysed dynamic wage curve was than as follows:

$$\ln(wr_{it}) = \eta_i + \alpha \ln(w_{it-1}) + \beta_1 \ln(u_{it}) + \beta_2 \ln(u_{it-1}) + \chi_k X_{kit} + \mu_t + \xi_{it} \qquad (9)$$

where:

α - measures the stickiness of wages to variation of the local unemployment rate: the closer α is to unity in absolute value the faster is the adjustment process;

β_1 and β_2 - are short term elasticities of wages with respect to unemployment rates; the long

run elasticity is $\dfrac{\beta_1 + \beta_2}{1 - \alpha}$.

Taking into account the dynamic nature of processess on labour markets we can say that wages response to changes in the situation on local labour market with one year delay (see table 8). Moreover the previous statistical analyses show that while analysing the relation between wages and unemployment rate in Poland in 1995-2004 we have to take into account the heterogeneity of the analysed period (in 1995-1998 and 2003-2004 the unemployment rate was decreasing, in 1999-2002 – decreasing). That is why in equation (9) we put a dummy (d9902) with value 1 in 1999-2001 and 0 in other periods.

Table 8
Estimated parameters of dynamic wage curve for Poland

log(wr(-1))	0,828***	0,769***
log(u)	-0,0372	
log(u(-1))		-0,0768**
log(yl)	0,0325	0,152*
Adj. R^2	0,961	0,956

Table 9
Estimated parameters of wage curve with dummy variable

log(wr(-1))	0,957***	0,809***
log(u)	-0,0537***	-0,0495***
log(u)*d9901	0,0449**	0,0387**
log(yl)		0,123***
Adj. R^2	0,952	0,96
2SLS	Yes	Yes

d9901 – dummy variable with value 1 in 1999-2001 and 0 in other periods.

The results of estimated wage curve with a dummy (see table 9) show that the elasticity of wages with respect to unemployment was different in different periods. In 1995-1998 and 2002-2005 the short-term elasticity of wages with respect to unemployment rate was equal to –0,05. In 1999-2001 the relation between wages and unemployment rate was much weeker. The short-term elasticity was about –0,01, which shows that the changes in unemployment rates in this period had almost no impact on changes in wages.

The results indicate that wages in Poland react differently in different situation on local labour market. The positive changes on labour market connected with the fall of unemployment rate lead to significant changes in wages. Wages adjust to changes in unemployment rates with yearly delay. But the negative changes on labour markets related to increase in unemployment rates have almost no impact on wages. This can mean that wages in Poland are downward rigid.

7. Conclusions

Looking at the Polish labour market we can notice huge regional heterogeneity. In 1995 the unemployment rate varied across 16 Polish regions from 10,6 to 21,3%. The highest unemployment rates were observed in western and northern regions, and the lowest – in southern and eastern part of Poland.

The changes that took place in analysed period had different impact on particular local labour markets, but in general the unemployment rates in all regions increased. The biggest changes were noted in dolnoslaskie and slaskie, were there was an increase in unemployment rates of about 8 pp. Moreover, the differences between regions remained significant for the next ten years.

In case of wages, the regional differences were much weaker. Apart from Mazowieckie (capital) region and Slaskie (with mining industry) regions the regional dispersion of wages was small. The regional differences in wages were much lower that it could result from the differences in regional unemployment rates. The changes that took place in analysed period were mostly concerned with rapid growth of wages in mazowieckie region and the difference in wages therefore increased.

Comparing the regional diversity of wages and unemployment rates we can divide Polish regions into five groups: regions with relatively low unemployment rate and high wages (mazowieckie, slaskie, wielkopolskie, malopolskie), regions with medium level both of wages

and unemployment rates (lodzkie, opolskie), regions with high unemployment rates and low level of wages (warminsko-mazurskie, lubuskie, kujawsko-pomorskie), regions with low unemployment rates and low wages (lubelskie, podlaskie, podkarpackie and swietokrzyskie) and regions with high unemployment rates and high wages (dolnoslaskie, pomorskie i zachodniopomorskie). The last two groups are those in which we can not confirm the negative relation between level of wage and situation on the local labour market.

The empirical analyses of the wage curve provided in the paper for the whole analysed period show that we can notice negative relation between wages and unemployment rate. The long-run elasticity of wages with respect to unemployment varies around –0,1 which is in line with existing literature. When we take into account the heterogeneity of the analysed period, we can confirm the negative and statistically significant relation between wages and unemployment in periods with decreasing unemployment (1995-1998 and 2002-2005). In 1999-2001 when the unemployment rates in all regions were increasing this relation was almost insignificant, which confirms that wages are downward rigid.

The analyses undertaken in the paper should be treated as a very starting point to the further research on wage dynamics and its regional diversity in Poland. However we can confirm some negative relation between wages and unemployment in some periods, the unemployment rate was not the factor, which explains the variation in wages in a significant way. To understand differences in wages we should look more carefully then on other, than unemployment rate factors, concerned more with sectoral structure of employment and with regional diversity of both human and physical capital that is the factors determining differences in labour productivity. The problems will be taken into account in further analyses.

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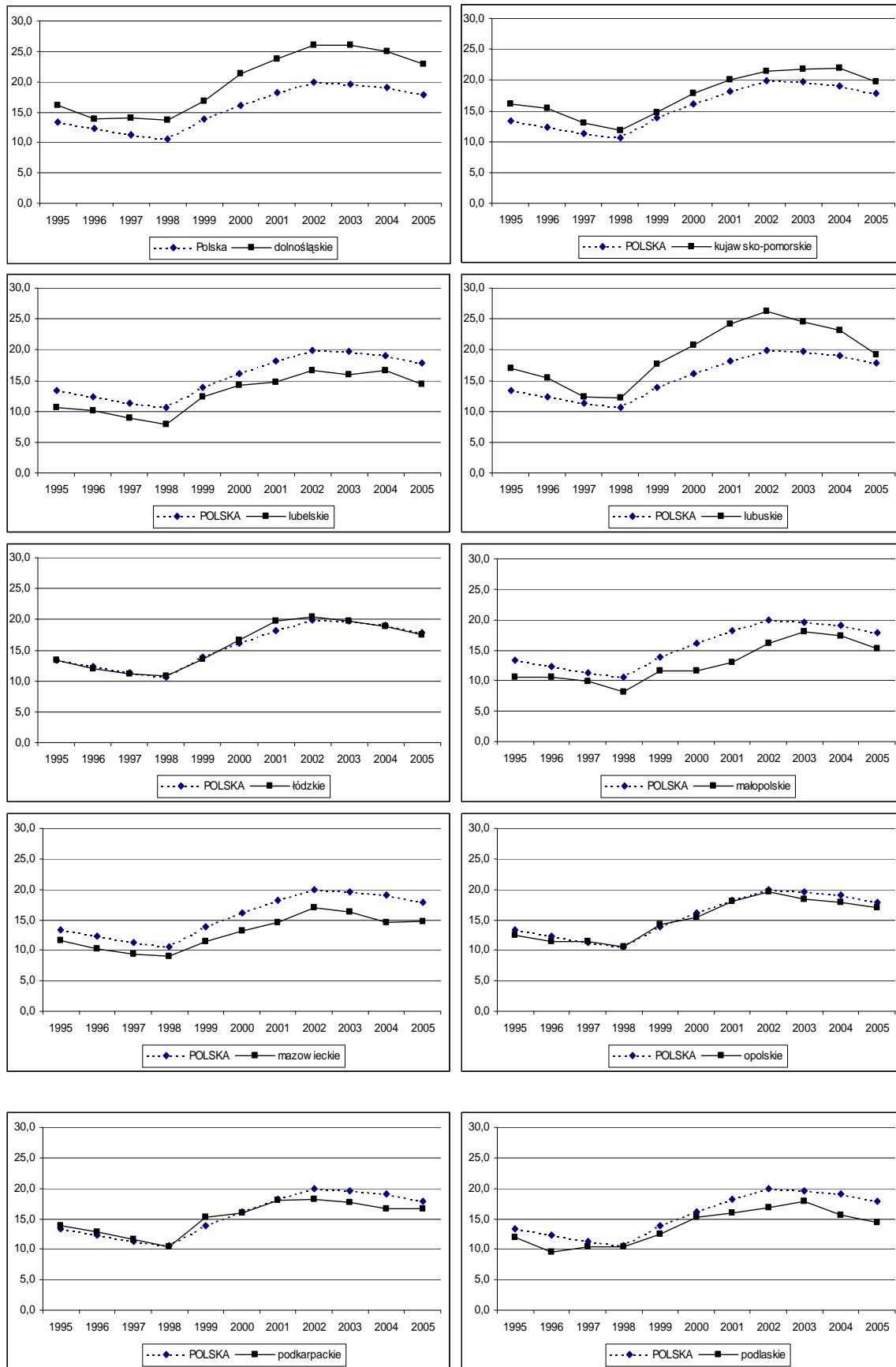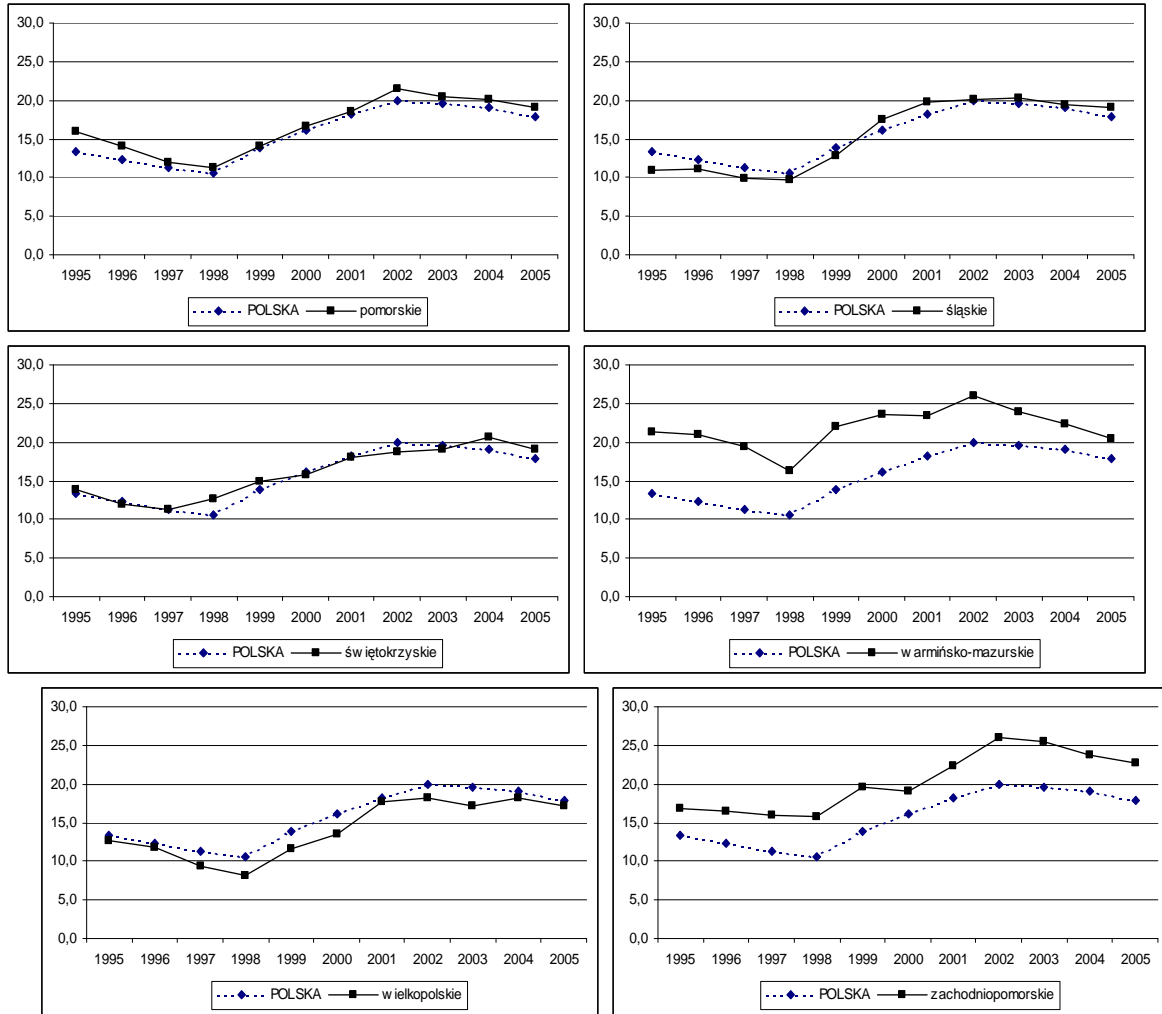
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Appendix

Map 1A
Administrative division of Poland (16 main regions)

Figure 1A

**Evolution of regional and national unemployment rates in Poland in 1995-2005**

Technical University of Košice, Faculty of Economics
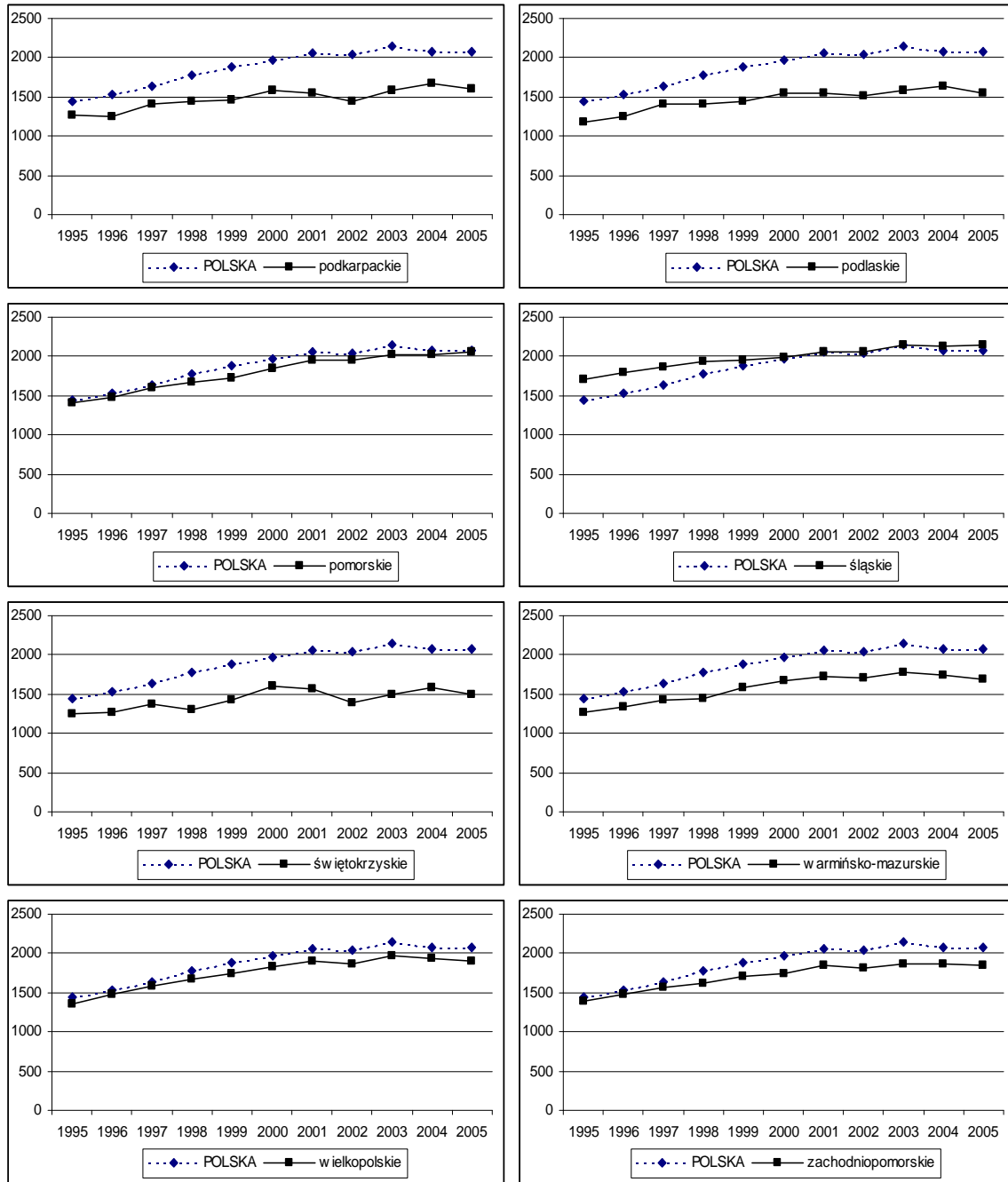2nd Central European Conference in Regional Science – CERS, 2007

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Source: own calculations based on Labour Force Survey, various editions from 1995-2006.

Figure 2A

Evolution of regional and national wage level in Poland in 1995-2004 (nominal prices deflated with the GDP deflator; PLN, constant 2000 prices)
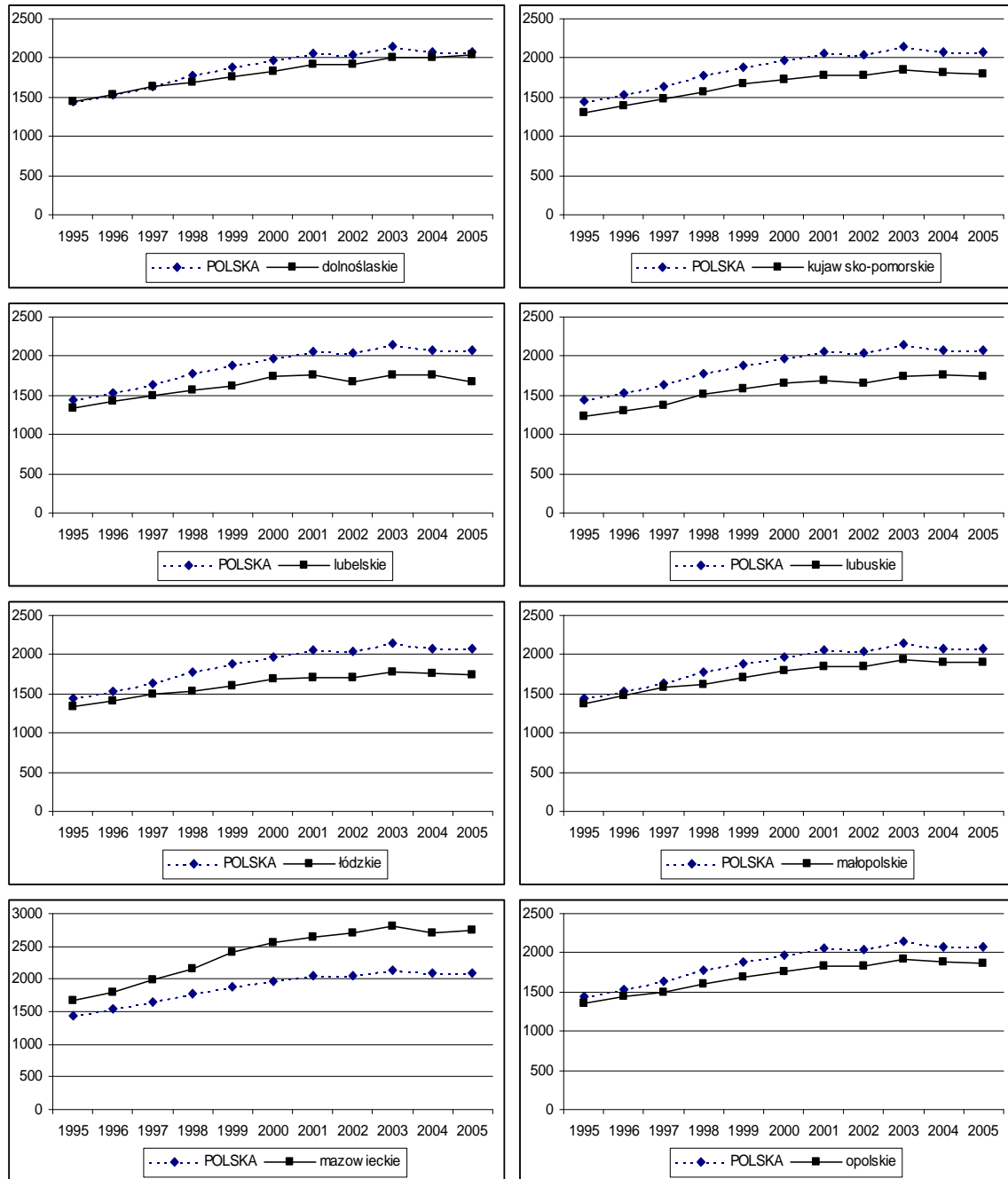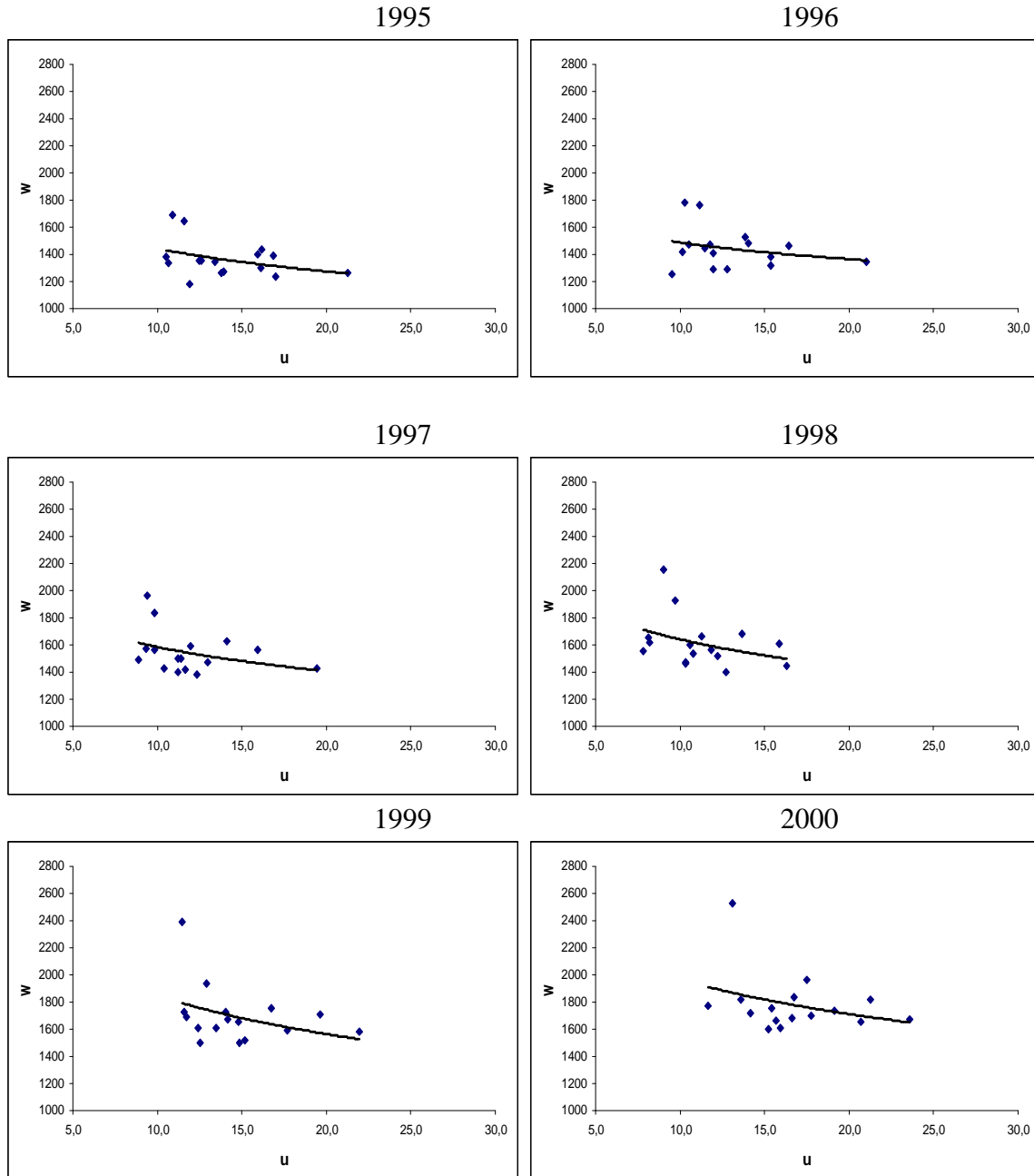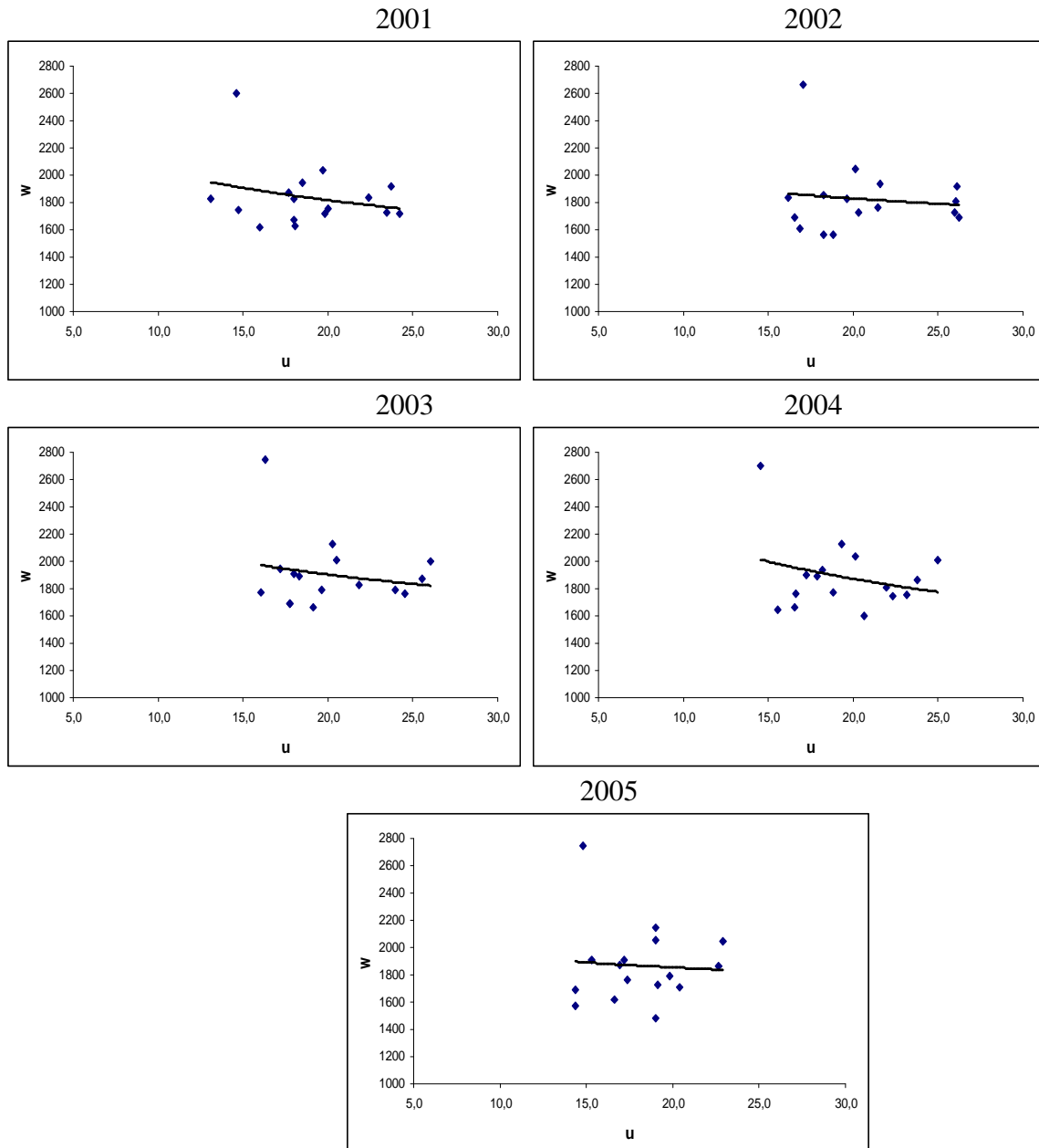
Source: own calculations based on Regional Statistical Yearbook, various editions from 1995-2006.

Figure 4A
Real wages (W; nominal wages deflated with GDP deflator, PLN, constant 2000 prices)
and the local unemployment rate in Poland in 1995-2004 (U; %)

2001

2002

2003

2004

2005

Source: own calculations based on Regional Statistical Yearbook, various editions from 1995-2005.