Regional economic and labour market performance and inter-regional labour market balance – the case of Poland

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The paper analyses the directions of inter-regional migration in Poland in the years 1995-2002 and points out some major factors that cause the migration. The analyses indicate the voivodships with the largest net migration flows (Mazowieckie, Pomorskie) are characterized by high relative GDP per capita, high labour productivity and high relative wages. In contrast, the voivodships with the smallest net migration flows (Warminsko-Mazurskie, Lubelskie, Swietokrzyskie) are typified by large shares of the employed in agriculture, low labour productivity and wages and low GDP per capita. The size of migration inflows is negatively related to regional unemployment rates. Moreover, the highest propensity for inter-regional migration exhibit young people, aged 21-35, as well as people with tertiary education.

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1 Introduction

Internal migration means people moving between various places, which leads to permanent or long-lasting changes in their places of residence (see Holzer 1994: p. 282). A significant element of internal migration is inter-regional migration (i.e. between regions), which consists in people moving from one region to another. One important aspect of migration is labour force migration for occupational reasons. People aim at getting better access to the labour market, higher wages or better conditions for starting up their own businesses compared with their previous regions of residence.

Inter-regional migration is an important form of spatial mobility of the labour force. Such mobility plays a crucial role in shaping the regional variation of unemployment, including structural unemployment in the economy. In a dynamic transition economy there follow structural changes in labour demand, including the regional layout, which imply regional variation of unemployment. The inter-regional mobility of the labour force might contribute to narrowing the gap between various regions concerning their labour markets.

One of the features of the Polish economy is its strong regional variation in economic performance with respect to sectoral structure, GDP per capita, the unemployment rate and wages. It is worth noting that this variation is relatively stable over time. The question arises as to whether the regional variation causes a reaction in the field of inter-regional labour migration and whether the directions of the migration are in line with the theoretical hypotheses.

The purpose of the analyses undertaken in this paper is to determine the directions of inter-regional (i.e. inter-voivodship) migration in Poland in the years 1995-2002, and to point out some major factors that cause the migration. The investigation is restricted to the period 1995-2002 alone as the data for earlier years is not consistent with that of the new administrative division of Poland.

The paper (section 2) starts with a presentation of the regional economic variation of voivodships, with an emphasis on the socio-economic conditions that strongly affect migration. Sections 3 shows inter-regional migration between the voivodships and identifies the regions with the highest and the lowest net migration. Section 4 is devoted to recording, by means of statistical analyses, the influence of some major factors that determine migration processes (wages, labour productivity, unemployment rates, per capita GDP and other variables in-

cluding socio-demographic characteristics of individuals).

2 Regional variation of economic and labour market performance

Poland's regions differ considerably as regards their economies. The variation refers, among other things, to their economic structures, levels of development, living standards as well as their labour markets. One may state that there are weighty prerequisites for the development of strong inter-regional migration in Poland. We look into this variation, making use of statistical data on Polish voivodships, covering the years 1995-2002.[1]

The economic structure of the regions varies significantly. This is manifested in the three-sector structure of the economy (agriculture – industry and construction – services), which can be defined on the basis of the sectors' shares of total employment and of total value added by region (see table 1). All the Polish regions are typified by relatively large shares of agriculture in employment, but – at the same time – by relatively small shares of this sector in their total value added. Still, though the share of the services sector in the total employment of individual regions is relatively small, it is worth noting that for all the regions together its share of the total value added is much larger than that of overall employment. This results from the fact that, although labour productivity in agriculture (measured by value added per employee) is well below average in certain regions, labour productivity in the service sector is well above average.

The following voivodships can be regarded as typically agricultural ones (with the largest shares of agriculture): Lubelskie, Podlaskie, Podkarpackie and Świętokrzyskie (see Chart 1). These regions, located in eastern Poland, are characterized by a dispersed agrarian structure (relatively small farms) and a predominance of private farms, which emerged in the previous economic system. During the transition period these farms acted as a "container" absorbing excess labour, thus easing social tensions on the labour market. Some voivodships located in central Poland (Kujawsko-Pomorskie, Wielkopolskie, Opolskie, Łódzkie, Warmińsko-Mazurskie, and to some extent even Mazowieckie – see Chart 1) also have relatively large shares of agriculture.

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[1] Due to the fact that the new administrative division of Poland has been in force since 1999, the statistical data for the previous years have been adjusted so as to be coherent with the new voivodship layout.

Table 1

Employment (E) and value added (VA) structure by sectors in voivodships in the years 1995–2001* (period average, in %)
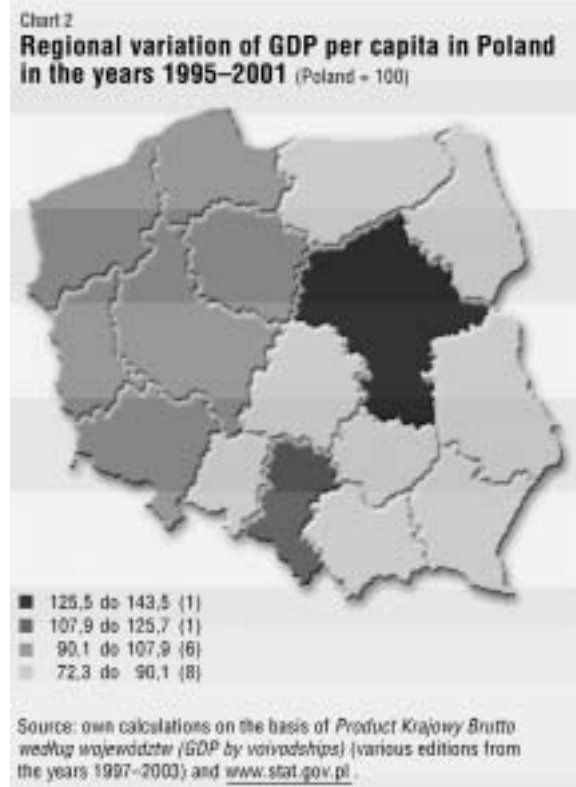
Voivodship		Agriculture	Industry and construction	Services
Dolnośląskie	E	11.4	34.8	53.8
	VA	4.4	39.1	56.5
Kujawsko-pomorskie	E	21.0	31.0	48.0
	VA	6.0	36.8	57.2
Lubelskie	E	41.1	19.4	39.5
	VA	9.8	29.5	60.7
Lubuskie	E	12.4	34.8	52.8
	VA	5.3	31.9	62.8
Łódzkie	E	21.0	32.8	46.2
	VA	5.6	35.5	58.9
Małopolskie	E	27.5	29.8	42.7
	VA	4.0	36.5	59.5
Mazowieckie	E	21.4	25.0	53.6
	VA	4.8	29.6	65.6
Opolskie	E	18.2	37.7	44.1
	VA	8.0	39.6	52.4
Podkarpackie	E	33.2	28.0	38.8
	VA	6.0	38.5	55.5
Podlaskie	E	39.4	21.7	38.9
	VA	10.5	27.9	61.6
Pomorskie	E	11.5	30.5	57.0
	VA	3.8	35.4	60.8
Śląskie	E	6.7	46.4	46.9
	VA	1.8	45.5	52.7
Świętokrzyskie	E	34.8	28.1	37.1
	VA	8.1	35.0	56.9
Warmińsko-mazurskie	E	20.0	29.0	51.0
	VA	9.5	31.9	58.6
Wielkopolskie	E	19.3	34.5	46.2
	VA	8.5	37.3	54.2
Zachodniopomorskie	E	8.7	30.2	61.1
	VA	5.8	30.7	63.4

* - value added in the years 1995–2000.

Source: own calculations on the basis of statistical data by GUS (Central Statistical Office), www.stat.gov.pl.

The transition period was accompanied by the weakening and even collapse of some branches of industry. However, the relative role of industry is still large in some regions, first of all in the Śląskie and Dolnośląskie voivodships but also in such voivodships as: Opolskie, Lubuskie, Wielkopolskie, Łódzkie and Kujawsko-Pomorskie. The high level of industrialization of the Śląskie voivodship results from mining and the metal industries, which, however, are faced with the need for deeper restructuring.

Chart 1
Administrative division of Poland (since January 1st, 1999)

Chart 2
Regional variation of GDP per capita in Poland in the years 1995–2001 (Poland = 100)

- 125,5 do 143,5 (1)
- 107,9 do 125,7 (1)
- 90,1 do 107,9 (6)
- 72,3 do 90,1 (8)

Source: own calculations on the basis of *Produkt Krajowy Brutto według województw (GDP by voivodships)* (various editions from the years 1997–2003) and www.stat.gov.pl .

A relatively modern economic structure, manifested by comparatively large shares of the services sector in both employment and value added, can be found in northern and western Poland as well as in the Mazowieckie voivodship. The large role of the services sector in the northern voivodships (Zachodniopomorskie, Pomorskie, Warmińsko-Mazurskie) is associated first and foremost with tourism.
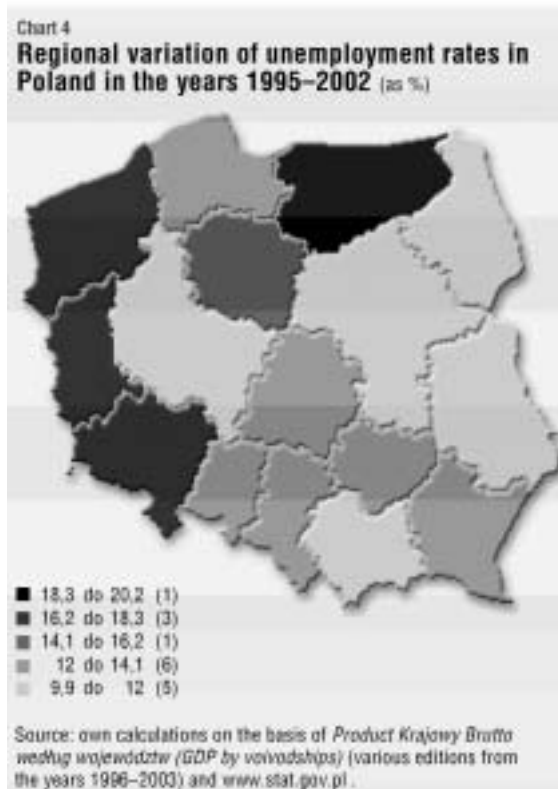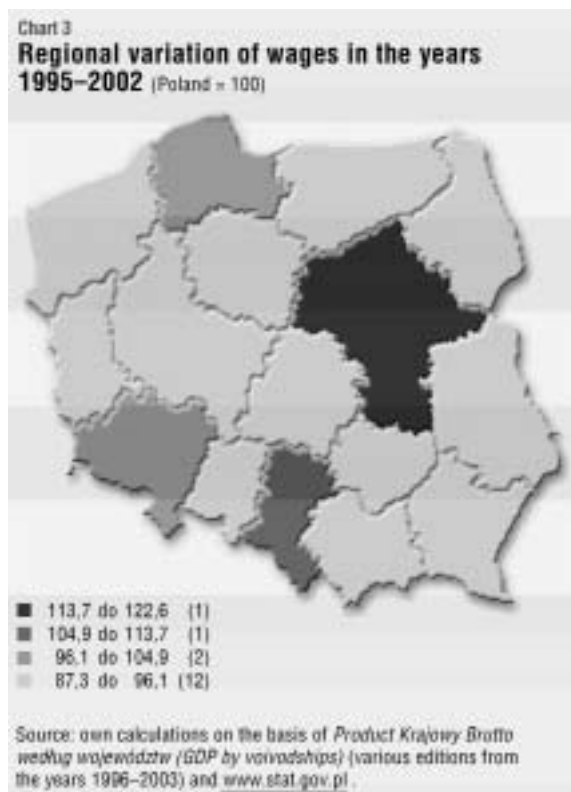
The regions differ considerably with respect to their GDP per capita. The Mazowieckie voivodship has the definitely highest value, with its capital city being Warsaw; the second place is occupied by the Śląskie voivodship, it being Poland's most industrialized region (see Chart 2). The lowest values are found in eastern voivodships (Lubelskie, Podkarpackie, Podlaskie) as well as in the following voivodships: Warmińsko-Mazurskie, Świętokrzyskie, Opolskie, Małopolskie and Łódzkie. Interestingly, the sets of voivodships with the highest and the lowest GDP per capita did not change during the transition period. Moreover, there even followed a further widening of the gaps between the regions in this respect. In 1995 GDP per capita in the Mazowieckie voivodship was 64% higher than the lowest regional GDP, whereas in the year 2002 that difference reached 98%.

The regional variation regarding per capita GDP is closely related to the regional differences in labour productivity (GDP per employee). The latter, measured by means of the coefficient of variation, is slightly higher than the regional diversification with respect to per capita GDP. The Mazowieckie and Śląskie voivodships show the highest levels of labour

productivity; relatively high levels of labour productivity also occur in western voivodships, whereas the lowest are in eastern, agricultural voivodships (Lubelskie, Podkarpackie, Podlaskie) as well as in the Świętokrzyskie and Łódzkie voivodships.

The regional variation of wages is considerably lower than that of labour productivity (in the case of wages the coefficient of variation for the years 1995-2001 is less than half of that of labour productivity). The highest wages are earned by the inhabitants of the Mazowieckie voivodship (which results from the high incomes of those employed in the agglomeration of Warsaw and of those in the Płock "Orlen"); the second place is occupied by the employees of the Śląskie voivodship. During the transition period the rank of these two voivodships has changed: as recently as 1995 it was the Śląskie voivodship that had the highest wages, with the Mazowieckie voivodship coming second. The Pomorskie and Dolnośląskie voivodships also have comparatively high wages (see Chart 3). In the remaining voivodships, the regional variation of wages is negligible, although one should state that the lowest wages are found in the eastern voivodships.

Chart 4 shows the regional variation of the unemployment rates. It follows from the chart that the most difficult labour market situation is found in the

Chart 3
Regional variation of wages in the years
1995–2002 (Poland = 100)

■ 113,7 do 122,6 (1)
■ 104,9 do 113,7 (1)
■ 96,1 do 104,9 (2)
□ 87,3 do 96,1 (12)

Source: own calculations on the basis of *Product Krajowy Brutto
według województw (GDP by voivodships)* (various editions from
the years 1996–2003) and www.stat.gov.pl .

Chart 4
Regional variation of unemployment rates in
Poland in the years 1995–2002 (as %)

■ 18,3 do 20,2 (1)
■ 16,2 do 18,3 (3)
■ 14,1 do 16,2 (1)
■ 12 do 14,1 (6)
□ 9,9 do 12 (5)

Source: own calculations on the basis of *Product Krajowy Brutto
według województw (GDP by voivodships)* (various editions from
the years 1996–2003) and www.stat.gov.pl .

following voivodships: Warmińsko-Mazurskie, Za-
chodniopomorskie, Lubuskie and Dolnośląskie, as
well as in Kujawsko-Pomorskie. On the other hand,
the relatively best situations are in the Mazowieckie,
Małopolskie, Lubelskie, Podlaskie and Wielkopol-
skie voivodships. It is worth emphasising that the sets
of voivodships with the highest and the lowest unem-
ployment rates has not changed during the transition
period. This might reflect the influence of perma-
nent, structural factors on unemployment in individ-
ual regions.

During the first years of the transition period, the
transformation shock resulted in the largest increase
in unemployment in two groups of regions. Firstly, in
the regions with large shares of state agriculture,
which was an inheritance of the centrally planned
economy. The state farms were liquidated at the be-
ginning of the transition period, which led to the
emergence of high actual unemployment. No central
restructuring initiatives were undertaken. No protec-
tive, governmental programmes were established
with respect to the state farm workers, no special
schemes of occupational activation for those dis-
missed from work were implemented. As a result,
there followed a considerable drop in labour demand
and a consequent increase in unemployment in such
voivodships as: Warmińsko-Mazurskie, Zachodnio-
Pomorskie, Lubuskie, Pomorskie and Kujawsko-Po-

morskie. Secondly, the transformation shock resulted
in a strong drop in labour demand in the regions dom-
inated by some traditional industries, especially by
the light industry. This industry, well developed in
the Łódzkie, Dolnośląskie and Lubuskie voivod-
ships, had focused for years on the markets of the for-
mer CMEA countries. The collapse of these markets
after the political breakdown as well as the opening
of the Polish economy to foreign competition, includ-
ing countries in the Far East, were an adverse de-
mand shock, which affected the labour markets in the
regions that were strongly dependent on the light in-
dustry. What was also of great importance were fac-
tors resulting from the relatively weak position of
trade unions in this industry, as well as from the lack
of the state-run, special protective or restructuring
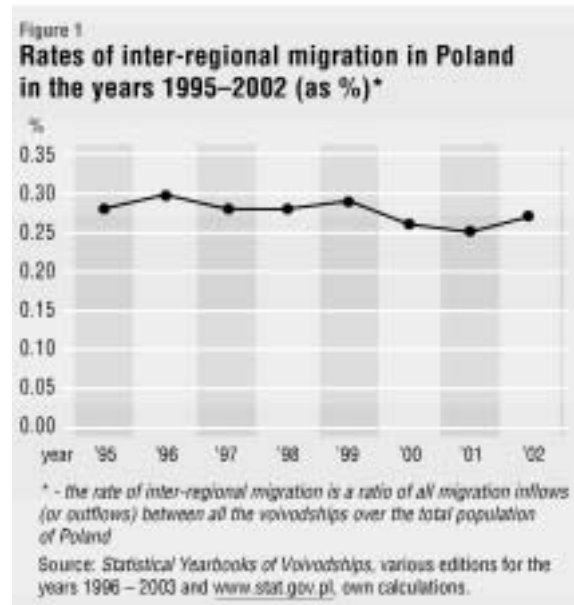programmes in the light industry.

The transformation shock entailed a relatively small
decrease in labour demand in three regional groups.
Firstly, in the regions with a comparatively modern
economic structure, typified by relatively high shares
of services and quite modern industry (the Ma-
zowieckie, Małopolskie, and Wielkopolskie voivod-
ships). The economies of these regions managed to
adapt fairly quickly to the requirements of the market
economy, benefiting from their advantages, amongst
others, from the agglomeration effect (favourable in-
fluence of Warsaw, Kraków and Poznań). Secondly, a

relatively small decline in labour demand occurred in regions with large shares of traditional industries (coal mining, the metals industry), which, due to strong pressure from their trade unions managed to gain special treatment from the state. This treatment consisted of implementing protective programmes, elaborating favourable restructuring schemes as well as permitting "soft" budget constraints in some state enterprises. Consequently, the fall in labour demand and the increase in unemployment were comparatively mild (especially in the Śląskie voivodship but partly also in the Świętokrzyskie and Opolskie voivodships), but the economic problems of these industries still remained unsolved. Thirdly, a relatively small drop in labour demand, accompanied by a not too considerable increase in unemployment, followed in the regions with high shares of private agriculture (the Lubelskie, Podkarpackie, Podlaskie voivodships). Agriculture started acting as an absorber of pressure on the labour market, absorbing excess labour. The tendencies to increase hidden unemployment in these regions became even more intense because of the functions played by private agriculture.

The regional variation of unemployment is subject to strong inertia. Some symptoms of hysteresis can be observed, too. Diversified elasticities of employment with respect to overall economic activity play a role in shaping the mechanisms of hysteresis in regional unemployment. It follows from research carried out for the Polish economy (see Kwiatkowski/Kucharski/Tokarski 2002) that the elasticity of employment with respect to value added is much lower in agriculture than in industry or services. This means that any drop in economic activity leads to quite a strong decline of employment in industry and services, but only a slight decrease of employment in agriculture (the function of agriculture as an absorber of excess labour is of great importance here). This also means that any recovery in economic activity should lead to a considerable growth of employment in industry and services, but to only a slight increase of employment in agriculture.
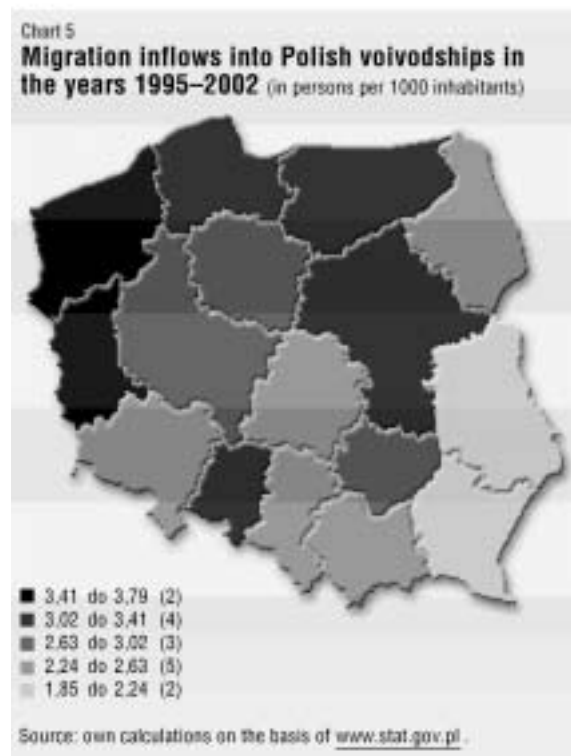
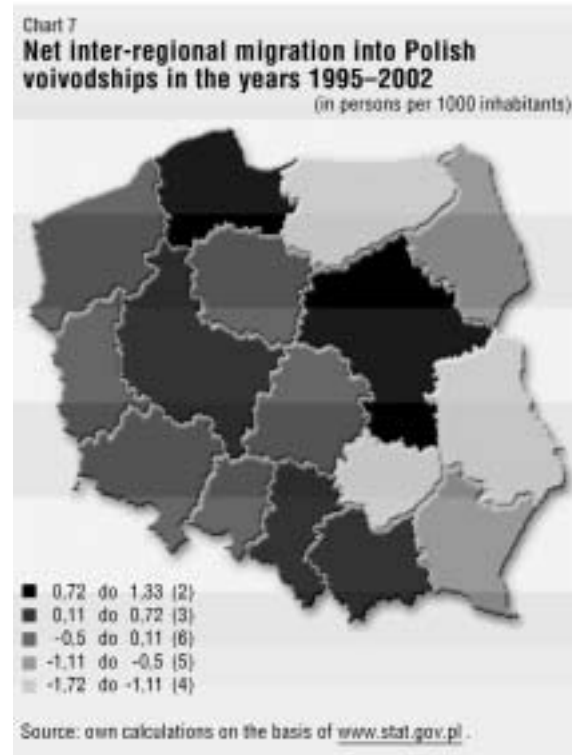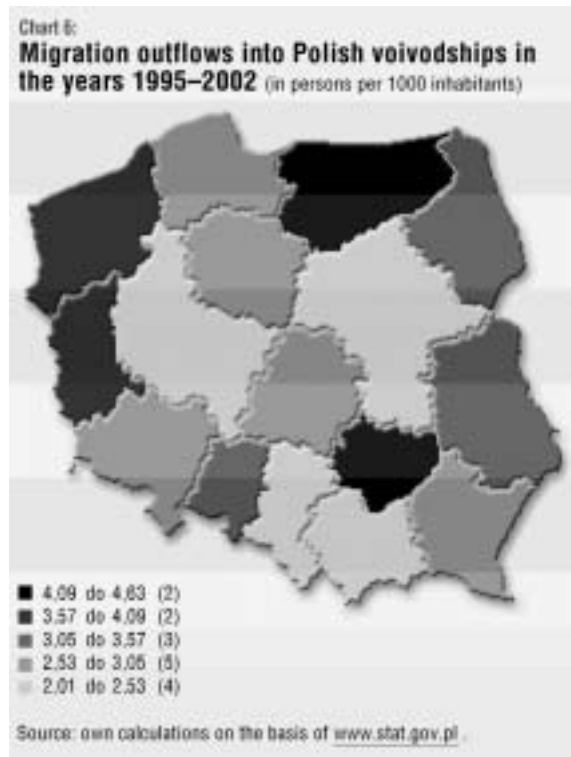## 3 Inter-regional migration of population

Let us look into the tendencies regarding inter-voivodship migration in Poland in the years 1995-2002. It follows from Figure 1 that in the period under consideration the scale of inter-regional migration was relatively low compared with earlier periods. The rates of flows of inter-voivodship migration amounted to 0.24%-0.3% of the total population of Poland.

Figure 1
Rates of inter-regional migration in Poland in the years 1995–2002 (as %)*

* - the rate of inter-regional migration is a ratio of all migration inflows (or outflows) between all the voivodships over the total population of Poland

Source: Statistical Yearbooks of Voivodships, various editions for the years 1996 – 2003 and www.stat.gov.pl, own calculations.

Let us proceed to inter-regional migration in Poland. Chart 5 depicts data on migration inflows during the years 1995-2002. One can draw the following conclusions based on the chart:

• The highest levels of migration inflows were shown by the following voivodships: Lubuskie and Zachodniopomorskie. High levels of migration inflows also typified the Mazowieckie, Pomorskie, Warmińsko-Mazurskie and Opolskie voivodships. It

Chart 5
Migration inflows into Polish voivodships in the years 1995–2002 (in persons per 1000 inhabitants)

■ 3.41 do 3.79 (2)
■ 3.02 do 3.41 (4)
■ 2.63 do 3.02 (3)
■ 2.24 do 2.63 (5)
▫ 1.85 do 2.24 (2)

Source: own calculations on the basis of www.stat.gov.pl

Chart 6:
Migration outflows into Polish voivodships in the years 1995–2002 (in persons per 1000 inhabitants)

■ 4.09 do 4.63 (2)
■ 3.57 do 4.09 (2)
■ 3.05 do 3.57 (3)
■ 2.53 do 3.05 (5)
□ 2.01 do 2.53 (4)

Source: own calculations on the basis of www.stat.gov.pl .

Chart 7
Net inter-regional migration into Polish voivodships in the years 1995–2002

(in persons per 1000 inhabitants)

■ 0.72 do 1.33 (2)
■ 0.11 do 0.72 (3)
■ -0.5 do 0.11 (6)
■ -1.11 do -0.5 (5)
□ -1.72 do -1.11 (4)

Source: own calculations on the basis of www.stat.gov.pl .

is worth emphasizing that the Mazowieckie voivodship is characterized by the highest levels of per capita GDP, labour productivity and relative wages. What matters in the case of the Mazowieckie, Pomorskie and Zachodniopomorskie voivodships is the fact that their capitals are big cities. Moreover, the Mazowieckie, Zachodniopomorskie and Pomorskie voivodships have modern employment structures, with quite large shares of services.

• The lowest levels of migration inflows are exhibited by the Lubelskie and Podkarpackie voivodships. These are voivodships with large shares of people employed in agriculture and with the lowest per capita GDP and labour productivity (of all the voivodships). Rural areas are not attractive for potential migrants as such areas ensure neither better working conditions nor higher wages.

Chart 6 depicts data on inter-regional outflows. It follows from the chart that the Warmińsko-Mazurskie and Świętokrzyskie voivodships had the highest levels of outflows in the period under investigation. These are voivodships with relatively low levels of per capita GDP, labour productivity and wages. Throughout the entire transformation period, the Warmińsko-Mazurskie voivodship had the highest unemployment rates. The Świętokrzyskie voivodship is a typical agricultural region. Also the Lubuskie and Zachodniopomorskie voivodships were typified by high inter-regional outflows.

The following voivodships had the lowest levels of migration outflows: Mazowieckie, Wielkopolskie, Śląskie and Małopolskie. This might result from the fact that these regions are the best developed in economic terms and are characterized by modern economic structures.

Chart 7 depicts data on net inter-regional migration in the years 1995-2002. Net migration is defined as the difference between migration inflows and migration outflows. One can draw the following conclusions on the basis of Chart 7:

• The Mazowieckie and Pomorskie voivodships had the highest net migration. These voivodships are typified by large shares of employment in services. Their capitals are large cities, which are socio-economic centres of areas far beyond the voivodships' administrative borders. They also distinguish themselves by high levels of socio-economic development and by low unemployment rates. Moreover, the Mazowieckie voivodship has the highest relative wages.

• The voivodships with the lowest net migration were as follows: Warmińsko-Mazurskie, Lubelskie and Świętokrzyskie. The Świętokrzyskie and Lubelskie voivodships had relatively low shares of the employed in services but very high shares of employment in agriculture. Besides, these two voivodships are typified by low socio-economic development and low relative wages. The Warmińsko-Mazurskie

voivodship is the region with the highest unemployment rates.

4 Determinants of inter-regional migration – the model and its econometric verification

4.1 Macroeconomic analyses

While analysing the determinants of inter-regional migration in Poland in the years 1995-2001 we focus mainly on strictly economic determinants. The subject of the investigation is the influence of economic factors on migration flows. We take into consideration such macroeconomic variables as: relative gross wages, relative labour productivity, relative per capita GDP and regional unemployment rates. Moreover we include in the analysis the number of teachers per 1000 inhabitants and the length of roads per 1 km^2.

The influence of relative gross wages, labour productivity and per capita GDP on inter-regional migration can be justified in such a way that (as a rule) migrants move from poorer regions to richer ones, in search of better living conditions. The variation of regional unemployment rates can affect inter-regional migration in a similar way (although in the opposite direction) as wages, labour productivity or GDP per capita. This is so because some migration might be dependent upon the situation on the labour market. Thus, in the regions whose unemployment rates are high, the migration outflows should also be comparatively high. This happens because, after losing hope of finding a job in their resident region, some more mobile jobseekers start to look for a job in other voivodships, which should translate itself into streams of inter-regional migration.

We decided to include the number of teachers per 1000 inhabitants as a determinant of migration because one of the factors determining migration – as the literature indicates (Kowaleski 2000: p. 74) – is a will to improve the level of educational attainment. We also included the length of roads per 1 km^2 because this variable is of some importance for regional infrastructure, a factor closely connected with the level of economic development of regions.

One of the important determinants of migration is the differences in flat conditions (Kowaleski 2000, p. 74). Unfortunately we are not able to investigate this factor due to the lack of regional data.

Based on the above-mentioned assumptions, the authors of the investigation have estimated the parameters of the following equations:

$$mi_{it} = \alpha_0 + \alpha_1 \frac{y_{it}}{\bar{y}_t} - \alpha_2 (u_{it} - \bar{u}_t) + \xi_{it}^{mi} \qquad (1.a)$$

$$mo_{it} = \beta_0 - \beta_1 \frac{y_{it}}{\bar{y}_t} + \beta_2 (u_{it} - \bar{u}_t) + \xi_{it}^{mo} \qquad (1.b)$$

$$mn_{it} = \gamma_0 + \gamma_1 \frac{y_{it}}{\bar{y}_t} - \gamma_2 (u_{it} - \bar{u}_t) + \xi_{it}^{mn} \qquad (1.c)$$

where:

mi_{it} – gross migration inflow into voivodship i (i=1,2,...,16) in year t (t=1995, 1996, 2001) per 1000 inhabitants of voivodship i (source: www.stat.gov.pl);
mo_{it} – migration outflow from voivodship i in year t per 1000 inhabitants of voivodship i (source: www.stat.gov.pl);

$mn_{it} \equiv mi_{it}$-mo_{it}, net migration inflow into voivodship i in year t;

$\frac{y_{it}}{\bar{y}_t}$ – ratio of variable y in voivodship i in year t over the average value of variable y in year t in Poland. Variable y was respectively: gross wages, labour productivity (GDP per employee by BAEL) and GDP per capita. This means that ratios $\frac{y_{it}}{\bar{y}_t}$ in consecutive versions of equations (1.a-1.c) are relative gross wages, labour productivity and GDP per capita [source: *Statistical Yearbooks of Voivodships,* various editions for the years 1996–2003 and www.stat.gov.pl].

$u_{it} - \bar{u}_t$ – difference between the unemployment rate of the i-th voivodship and the average unemployment rate of Poland in year t;

α_j, β_j oraz γ_j (j=0,1,2) structural parameters of equations (1.a-1.c);

ξ^{mi}_{it}, ξ^{mo}_{it}, ξ^{mn}_{it}-error terms, assumed to be white noise.

Structural parameters α_j, β_j and γ_j can be interpreted in economic terms as follows:

• α_0, β_j i γ_0 are intercepts devoid of direct economic interpretation.

• Parameters α_1 i γ_1 are, respectively, ratios of increments in gross (Δmi_{it}) and net (Δmn_{it}) migration over a relative growth of variable y $\left[\Delta \left(\frac{y_{it}}{y_t} \right) \right]$.

Parameter β_1 measures the relation of a decline in migration outflows against a relative growth of variable

y. This means that the higher the estimates of parameters α_1, β_1 and γ_1 are, the stronger is the influence of relative gross wages, labour productivity and GDP per capita on migration outflows.

• α_2 and γ_2 measure the relations of decreases in gross (Δmi_{it}) and net (Δmn_{it}) migration inflows with respect to an increase in the difference between the unemployment rate in a given region and the national average unemployment rate, $[\Delta(u_{it} - \bar{u}_t)]$. Parameter β_2 is a relation of an increase in migration outflows to a rise in the difference between the unemployment rate in a given region and the national average unemployment rate. This means that the higher the estimates of parameters α_2, β_2 and γ_2 are, the stronger the reaction of migration flows is to changes in the unemployment rate.

Equations (1.a-1.c) were modified by means of the fixed-effect procedure (see Pindyck/Rubinfeld 1991: pp. 223-226). Equations (1.a-1.c) can then be written as follows:

$$mi_{it} = \alpha_0 + \sum_j \alpha_0^j d_j + \alpha_1 \frac{y_{it}}{\bar{y}_t} - \alpha_2 (u_{it} - \bar{u}_t) + \xi_{it}^{mi} \quad (2.a)$$

$$mo_{it} = \beta_0 + \sum_j \beta_0^j d_j - \beta_1 \frac{y_{it}}{\bar{y}_t} + \beta_2 (u_{it} - \bar{u}_t) + \xi_{it}^{mo} \quad (2.b)$$

$$mn_{it} = \gamma_0 + \sum_j \gamma_0^j d_j + \gamma_1 \frac{y_{it}}{\bar{y}_t} - \gamma_2 (u_{it} - \bar{u}_t) + \xi_{it}^{mn} \quad (2.c)$$

where:

d_j (for j=2,3,..,16) are dummies for consecutive non-base voivodships (for the purpose of the investigation the Mazowieckie voivodship was made the base voivodship);

α_j^0, β_j^0, γ_j^0 are constant adjustments in consecutive non-base voivodships. This means that their estimates will measure the differences between migration flows per 1000 inhabitants in voivodship j and the Mazowieckie voivodship, the differences stemming from regional differences in the explanatory variables in equations (2.a-2.c).

The estimates of equations (2.a-2c) are reported in Tables 2-4. One can draw the following conclusions on the basis of the estimates reported in Tables 2-4:

• While analysing the influence of relative wages, relative labour productivity and relative GDP per capita on inter-regional gross migration, it emerges that each of these variables affects migration in a statistically significant way. Judging by t-statistics at proper estimates of equation (2a.) as well as by the values of

Akaike's or Schwarz' criteria, one can conclude that, of the three above-mentioned macro-variables, it was the regional variation of GDP per capita that was of crucial importance, followed by gross wages, with labour productivity being the least important.

• When considering the influence of regional variation in unemployment rates on inter-regional migration, it emerges that in each variant of equation (2.a), the difference between the unemployment rate in a given voivodship and the national average affected in a statistically significant way the scale of inter-regional migration inflows. Moreover, when comparing proper values of t-Student statistics, it emerges that the influence of inter-regional differences in unemployment rates on migration was much lower than that of both GDP per capita and gross wages, and it was only slightly higher than the influence of labour productivity differentials.

• It follows from the estimates of dummies in equation (2.a), D96, D99, D00 and D01, that in the years 1996 and 1999 the migration inflows were *ceteris paribus* higher, but in the years 2000-2001 they were lower than in the remaining years of the period under investigation.[2]

• It follows from the estimates of equation (2.b) that the regional differences in migration outflows were statistically significantly determined by the regional diversity in GDP per capita as well as by the regional variation of unemployment rates. Besides, the regional variation of GDP per capita affected the outflows more strongly than the variation of unemployment rates (see proper t-Student statistics). The impact of the regional diversity of relative wages and labour productivity on regional differences in migration outflows is statistically nearly significant (at the significance level of 13.6% and 16.8%, respectively).

• Moreover, just like in the case of gross migration inflows, migration outflows were also *(ceteris paribus)* higher in the years 1996 and 1999, but lower in the years 2000-2001.

• On the basis of Table 4 one may conclude that the net migration inflows were statistically determined to a significantly positive degree by relative gross wages, relative labour productivity and relative GDP per capita. Just as in the case of the equation of gross

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[2] Dummies for the remaining years proved statistically insignificant, and that is why so they were eliminated from equation (1.a). The situation with the estimates of equation (2.b) was similar. As for the equation of net migration outflows, dummies for the years 1996, 1999, 2000 and 2001 also proved statistically insignificant and were eliminated from that equation.

Table 2

Estimates of equations (2.a)

Explanatory variable	Explained variable: gross migration inflow / 1000 persons		
Intercept	-1.397 (-1.900)	1.756 (3.881)	-0.828 (-1.360)
Dolnośląskie	0.403 (2.370)	-0.114 (-0.738)	0.659 (3.414)
Kujawsko-pomorskie	0.761 (3.646)	0.0710 (0.392)	0.995 (4.338)
Lubelskie	-0.0888 (-0.419)	-0.595 (-2.514)	0.698 (2.245)
Lubuskie	2.013 (9.204)	1.233 (6.971)	2.201 (9.464)
Łódzkie	0.350 (1.711)	-0.185 (-0.869)	0.676 (2.839)
Małopolskie	0.327 (1.702)	-0.239 (-1.297)	0.780 (3.243)
Opolskie	1.142 (6.031)	0.587 (3.243)	1.603 (6.630)
Podkarpackie	-0.0273 (-0.124)	-0.633 (-2.815)	0.621 (2.076)
Podlaskie	0.391 (1.853)	-0.193 (-0.903)	1.077 (3.648)
Pomorskie	1.114 (6.526)	0.441 (3.447)	1.427 (7.044)
Śląskie	-0.199 (-1.757)	-0.559 (-5.264)	0.163 (1.112)
Świętokrzyskie	0.855 (4.133)	0.387 (1.651)	1.511 (5.284)
Warmińsko-mazurskie	1.638 (7.157)	1.131 (4.565)	2.265 (7.635)
Wielkopolskie	0.457 (2.466)	-0.234 (-1.631)	0.532 (2.861)
Zachodniopomorskie	1.398 (7.330)	0.804 (4.700)	1.608 (7.762)
D96	0.165 (3.389)	0.192 (3.489)	0.195 (4.087)
D99	0.161 (3.220)	0.106 (1.905)	0.118 (2.460)
D00	-0.215 (-4.317)	-0.274 (-4.967)	-0.246 (-5.128)
D01	-0.326 (-6.405)	-0.402 (-7.246)	-0.373 (-7.736)
Gross relative wages	3.808 (6.324)	–	–
Relative labour productivity	–	1.098 (3.315)	–
Relative GDP per capita	–	–	2.856 (6.714)
$u - \bar{u}$	-2.516 (-2.011)	-5.447 (-3.739)	-2.705 (-2.216)
R^2	0.938	0.921	0.941
Adjusted R^2	0.924	0.902	0.927
DW	1.960	1.943	2.006
AIC	-3.390	-3.137	-3.428
S.C.	-2.856	-2.603	-2.894
Sample	1995-2001		
Number of observations	112		

Notes:
Dolnośląskie, Kujawsko-Pomorskie etc. are dummies for individual voivodships, whereas D96, D99 etc. are dummies for respective years. In the parentheses under the estimates are T-Student statistics; DW- Durbin-Watson statistic; AIC (S.C.)- Akaike's information criterion (Schwarz); R^2 (adjusted R^2) is a coefficient of determination (adjusted coefficient of determination).

Table 3

Estimates of equations (2.b)

Explanatory variable	Explained variable: gross migration inflow / 1000 persons		
Intercept	2.996 (5.403)	2.579 (8.563)	3.424 (7.537)
Dolnośląskie	0.423 (3.299)	0.487 (4.727)	0.239 (1.656)
Kujawsko-pomorskie	0.569 (3.617)	0.647 (5.369)	0.347 (2.027)
Lubelskie	0.905 (5.658)	0.925 (5.866)	0.502 (2.164)
Lubuskie	1.608 (9.754)	1.707 (14.499)	1.394 (6.030)
Łódzkie	0.462 (2.997)	0.496 (3.495)	0.211 (1.186)
Małopolskie	-0.216 (-1.491)	-0.165 (-1.350)	-0.503 (-2.730)
Opolskie	0.952 (6.669)	1.003 (8.328)	0.674 (3.733)
Podkarpackie	0.181 (1.091)	0.224 (1.494)	-0.185 (-0.828)
Podlaskie	0.843 (5.304)	0.886 (6.231)	0.473 (2.148)
Pomorskie	0.348 (2.702)	0.447 (5.251)	0.135 (0.891)
Śląskie	0.191 (2.241)	0.251 (3.546)	0.0257 (0.235)
Świętokrzyskie	2.173 (13.940)	2.188 (14.002)	1.819 (8.517)
Warmińsko-mazurskie	2.148 (12.447)	2.177 (13.201)	1.807 (8.159)
Wielkopolskie	-0.0823 (-0.590)	0.00816 (0.0855)	-0.239 (-1.723)
Zachodniopomorskie	1.193 (8.301)	1.268 (11.133)	1.009 (6.522)
D96	0.209 (5.681)	0.205 (5.580)	0.204 (5.738)
D99	0.0983 (2.605)	0.106 (2.882)	0.102 (2.851)
D00	-0.233 (-6.210)	-0.224 (-6.068)	-0.233 (-6.494)
D01	-0.331 (-8.632)	-0.320 (-8.664)	-0.330 (-9.152)
Gross relative wages	-0.682 (-1.502)	–	–
Relative labour productivity	–	-0.306 (-1.390)	–
Relative GDP per capita	–	–	-0.885 (-2.786)
$u - \bar{u}$	1.811 (1.920)	2.477 (2.554)	1.671 (1.834)
R^2	0.980	0.980	0.981
Adjusted R^2	0.975	0.972	0.977
DW	2.151	2.216	2.233
AIC	-3.955	-3.951	-4.013
S.C.	-3.542	-3.417	-3.479
Sample Number of observations	1995–2001 112		

Table 4

Estimates of equations (2.c)

Explanatory variable	Explained variable: gross migration inflow / 1000 persons		
Intercept	-4.036 (-5.130)	-0.916 (-1.770)	-4.327 (-6.591)
Dolnośląskie	-0.0866 (-0.454)	-0.588 (-3.284)	0.436 (2.075)
Kujawsko-pomorskie	0.101 (0.539)	-0.554 (-2.652)	0.669 (2.686)
Lubelskie	-1.085 (-4.667)	-1.484 (-5.435)	0.230 (0.681)
Lubuskie	0.309 (1.284)	-0.455 (-2.226)	0.828 (3.276)
Łódzkie	-0.201 (-0.897)	-0.652 (-2.649)	0.489 (1.892)
Małopolskie	0.463 (2.188)	-0.0476 (-0.224)	1.329 (4.960)
Opolskie	0.109 (0.522)	-0.393 (-1.879)	0.954 (3.632)
Podkarpackie	-0.306 (-1.269)	-0.825 (-3.179)	0.838 (2.581)
Podlaskie	-0.545 (-2.356)	-1.048 (-4.254)	0.636 (1.983)
Pomorskie	0.696 (3.677)	0.00367 (0.0247)	1.311 (5.952)
Śląskie	-0.423 (-3.260)	-0.808 (-6.538)	0.149 (0.936)
Świętokrzyskie	-1.409 (-6.201)	-1.767 (-6.529)	-0.278 (-0.894)
Warmińsko-mazurskie	-0.604 (-2.367)	-1.018 (-3.561)	0.484 (1.502)
Wielkopolskie	0.461 (2.258)	-0.226 (-1.360)	0.790 (3.902)
Zachodniopomorskie	0.128 (0.603)	-0.500 (-2.272)	0.616 (2.728)
Gross relative wages	4.201 (6.481)	–	–
Relative labour productivity	–	1.459 (3.830)	–
Relative GDP per capita	–	–	3.790 (8.222)
$u - \bar{u}$	-4.343 (-2.950)	-7.963 (-4.714)	-4.310 (-3.204)
R^2 Adjusted R^2	0.945 0.935	0.931 0.918	0.954 0.945
DW	1.957	2.033	2.178
AIC S.C.	-3.086 -2.649	-2.861 -2.424	-3.258 -2.821
Sample Number of observations	1995-2001 112		

Table 5

Estimates of the extended equation (2.c)

Explanatory variable	Explained variable: net migration inflow / 1000 persons		
Stała	-7.962 (-7.442)	-2.672 (-3.036)	-6.062 (-7.080)
Dolnośląskie	0.224 (1.153)	-0.556 (-2.952)	0.464 (2.209)
Kujawsko-pomorskie	0.444 (1.653)	-0.644 (-2.444)	0.597 (2.181)
Lubelskie	-0.546 (-2.254)	-1.386 (-4.945)	0.334 (1.011)
Lubuskie	1.494 (4.316)	0.0101 (0.0313)	1.288 (4.059)
Łódzkie	0.235 (0.996)	-0.627 (-2.414)	0.537 (2.074)
Małopolskie	-0.414 (-1.546)	-0.809 (-2.332)	0.590 (1.732)
Opolskie	0.642 (2.351)	-0.375 (-1.324)	0.988 (3.321)
Podkarpackie	0.715 (2.087)	-0.544 (-1.523)	1.133 (3.053)
Podlaskie	0.582 (1.869)	-0.575 (-1.801)	1.099 (3.136)
Pomorskie	1.309 (6.138)	0.258 (1.432)	1.534 (6.748)
Śląskie	-1.678 (-4.700)	-1.877 (-4.283)	-0.893 (-2.348)
Świętokrzyskie	-0.894 (-3.123)	-1.801 (-5.374)	-0.281 (-0.829)
Warmińsko-mazurskie	0.536 (1.546)	-0.602 (-1.614)	0.907 (2.456)
Wielkopolskie	0.829 (3.910)	-0.185 (-1.036)	0.829 (4.067)
Zachodniopomorskie	1.352 (4.377)	0.192 (0.615)	1.233 (4.223)
Gross relative wages	4.793 (7.828)	–	–
Relative labour productivity	–	1.297 (3.402)	–
Relative GDP per capita	–	–	3.654 (8.200)
$u - \bar{u}$	-4.349 (-3.290)	-7.706 (-4.601)	-4.350 (-3.357)
Number of teachers per 1000 inhabitants	0.141 (1.536)	-0.0107 (-0.0993)	0.00200 (0.0231)
Length of roads in km/km²	2.176 (4.764)	1.531 (2.729)	1.472 (3.281)
R^2 Adjusted R^2	0.957 0.948	0.936 0.923	0.958 0.950
DW	1.959	2.094	2.198
AIC S.C.	-3.296 -2.810	-2.904 -2.418	-3.334 -2.848
Sample Number of observations		1995-2001 112	

inflows, the most important factor proved to be the influence of GDP per capita, followed by relative gross wages, and with labour productivities being the least important.

• The impact of regional differences in unemployment rates was statistically significant this time, too. The regions with lower unemployment rates had larger net inflows. The influence of differences in unemployment rates upon net migration inflows is (just as in the case of the equation of gross inflows) lower than the impact of relative per capita GDP and relative real wages but higher than the influence of relative productivity.

Equation (2c) was then extended by introducing some variables explaining the number of teachers per 1000 inhabitants and the length (in km) of roads per 1 km^2. The estimates of the extended equation are reported in Table 5. One can conclude the following on the basis of the estimates of equation (2c). Firstly, the impact of relative gross wages, relative GDP per employee, relative GDP per capita, and of the difference between the unemployment rate in a given voivodship and the national average, was similar to the one before the extension of equation (2c). Secondly, the influence of the number of teachers proved to be statistically insignificant. Thirdly, the length of roads affected migration in a statistically significant way: the denser the network of roads, the higher the level of net migration.

4.2 Socio-demographic features of individuals and propensity for inter-regional migration

In this section we look into the propensity for inter-voivodship migration subject to such socio-demographic features as age, education and gender. To determine the probability of inter-voivodship migration using these features we make use of a logit model. To this end we have split the whole population into two categories: persons who resided in a different voivodship a year before the analysed period (assigned a value of 1) and those who did not change their place of residence (being a value of 0). Let us consider the probability of the event that a person with feature x_i will move from one voivodship to another. Such a probability can be expressed by equation (3) (see G.C. Chow 1995: p. 310):

$$P_1(x_i) = P_{1i} = \frac{e^{\beta'x_i}}{e^{\beta'x_i} + 1} \tag{3}$$

where:

P_{1i} – probability that the i-th person with feature x_i will move from one voivodship to another,

x_i – is a column vector of features,

ß – is a column vector of parameters of the logit function.

By transforming equation (3) we obtain:

$$1_n \frac{P_{1i}}{1 - P_{1i}} = \beta'x_i \tag{4}$$

In order to form the sample likelihood we introduce a dummy: $f_{1i} = 1$, when the i-th person changed their place of residence, and a value of 0 when they did not. The likelihood function, (L) n, for an n-element sample is described by formula (5):

$$L = \prod_{i=1}^{n} P_{1i}^{f_{1i}} (1 - P)^{1-f_{1i}} \tag{5}$$

The unknown structural parameters (ß) of the logit model are estimated by means of the maximum likelihood method (MLM).

Odds ratio greater than 1 means that a given group has a higher probability of changing their place of residence compared with the base category. For instance, the estimate for people in the age group up to 20 (column 2 in Table 6), equalling 2,656, means that people of that age had a 165.5% greater probability of changing their resident voivodships compared with those in the base category.

Table 6 contains the estimates of probabilities of inter-regional flows in Poland subject to socio-demographic characteristics. The following conclusions can be drawn from Table 6. Firstly, the greatest propensity for inter-voivodship migration is shown by young people aged 21-35. People from age groups 21-25 and 26-35 exhibited greater probabilities of changing their resident voivodships than those in the base category (which was people aged 36-45). Secondly, people below the age of 20 were also more inclined to move between voivodships than those in the base category. Thirdly, the greatest propensity for inter-regional migration is found in persons with higher education. Better-educated people are professionally more mobile. They are spatially more mobile, too. Fourthly, females exhibit a lower propensity for inter-voivodship migration than males. Migration flows depend not only on economic factors but also on family aspects.

Table 6

Estimates of probabilities of inter-voivodship flows

Entry	Odds ratio	t-Student
Age (base age: people in the 36-45 age group)		
Up to 20	2.656	1.94
21-25	8.529	5.75
26- 35	3.747	3.52
46-55	0.535	-1.12
Over 55	0.519	-1.23
Education (base education: people with basic vocational education)		
Tertiary	5.029	6.04
Post-secondary	0.946	-0.07
General secondary	1.281	0.67
Vocational secondary	1.086	0.27
Primary and incomplete primary	0.643	-1.13
Gender (base gender: males)		
Females	0.423	-4.06

Number of observations: 47.805
Log likelihood: -664.38

Source: own calculation on the basis of LFS, quarter IV, 2002.

5   Conclusions

The following conclusions can be drawn from the presented analyses:

• During the whole period under investigation inter-regional migration was relatively stable but very low (inter-voivodship rates of flows amounted to 0.2-0.3%).

• The Lubuskie and Zachodniopomorskie voivodships exhibited the largest migration inflows. Also the Mazowieckie, Pomorskie, Warmińsko-Mazurskie and Opolskie voivodships had large migration inflows. The Mazowieckie, Zachodniopomorskie and Pomorskie voivodships are characterized by high relative GDP per capita, high labour productivity and high relative wages. In contrast, the Lubelskie and Podkarpackie voivodships had the smallest migration inflows. These voivodships are typified by very large shares of the employed in agriculture. They also have very low labour productivity and wages.

• The Warmińsko-Mazurskie and Świętokrzyskie voivodships exhibited the largest migration outflows in the period under investigation. In contrast, the Mazowieckie, Wielkopolskie, Śląskie and Małopolskie voivodships had the smallest migration outflows. Low outflows from the Mazowieckie, Śląskie and Wielkopolskie voivodships result from the fact that these are Poland's best developed regions in economic terms.

• The Mazowieckie and Pomorskie voivodships exhibited the highest level of net migration, whereas the Warmińsko-Mazurskie, Lubelskie and Świętokrzyskie voivodships had the lowest level of net migration.

• It follows from the econometric analyses that migration inflows were positively correlated with regionally differentiated GDP per capita, labour productivity and gross wages. The greatest impact on migration inflows in the period under consideration was exerted by GDP per capita, followed by gross wages, with labour productivity being the least influential. The difference between the unemployment rate in a given voivodship and the national average negatively affected the size of migration inflows.

• Regional differences in inter-regional outflows depend on regional variation in per capita GDP as well as on regional variation of unemployment rates. The impact of regional relative wages and labour productivity upon inter-regional migration outflows is statistically hardly significant. One should note that regional variation in GDP affected migration outflows more strongly than the regional variation of unemployment rates.

• Net migration inflows are positively correlated with gross relative wages, relative labour productivity as well as with relative GDP per capita. The strongest impact upon net migration inflows in the analysed period was exerted by the regional variation of GDP per capita. Moreover, net migration inflows are positively correlated with the length of roads (in km/km^2).

• Young people, aged 21-35, as well as people with tertiary education exhibit the highest propensity for inter-regional migration. Young, well-educated people are more mobile on the labour market. It also follows from the econometric analyses that females are less inclined to undertake inter-voivodship migration compared with males.

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