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SPECIALIZATIONS AND COMPETITIVE ADVANTAGES OF POLISH REGIONS. ANALYSIS IN YEARS 2005–2012

Abstract: Since 1999, when the new administrative (and statistical) regions in Poland were introduced, a significant change in programming regional development can be observed. Regional self-government has become important player on the national scene with the huge budget, and therefore, impact on the economy. Nevertheless, designing public policy is a great challenge, at least of programming nature. Despite long tradition, experience and achievements in regional analysis in Poland, several elaborations (Czarnecki, Woźniak, 2012, Kudłacz, 2013, Dziemianowicz *et al.,* 2014) indicate on many methodological shortcomings in projecting intervention on the regional level. The presented article is strongly empirical. The aim of the paper is to analyse branch structure of the regional economies, looking for specialization fields and sources of relative competitiveness. Two main techniques: location quotient and modern modification of shift-share method (Artige, van Neuss, 2014) are used to explore regional economies.

Key words: regional policy, regional analysis, Polish regions, shift-share technique, location quotient

JEL codes: R11, R12

1. Introduction

Since 1999, when the new administrative (and statistical) regions in Poland were introduced, a significant change in programming regional development can be observed. Regional self-government has become important player on the national and European scene with the huge budget (supported strongly by European Union funds), and therefore, impact on the economy.

Designing public policy is a great challenge, at least of programming nature. Despite long tradition, experience and achievements in regional analysis in Poland,

several elaborations (Czarnecki, Woźniak, 2012, Kudłacz, 2013, Dziemianowicz *et al.,* 2014) indicate on many methodological shortcomings in projecting intervention on the regional level, especially in diagnostic part.

Designing policy intervention in EU is under strong influence of smart specialization approach. According to Foray *et al.* (2011), the idea of smart specialisation has two facets. First, it is important to focus on certain domains in order to realise the potential for scale, scope and knowledge spillovers and use, as these are important drivers of productivity in the domain of R&D and other innovation-related activities. Second, it is important to focus on certain domains in order to develop distinctive and original areas of specialisation for the future. Together with similar concepts (i.e. constructing regional advantage) they account for differential growth potentials of regions, as regions have their own specific industrial and institutional past, and that local stakeholders should become part of the design and implementation of regional policy (Boschma, 2011). Key feature of modern concept is that knowledge and innovation are considered to be main drivers of regional development, and public policy should support these factors (see Sokołowska-Woźniak, 2013, Sokołowska-Woźniak and Woźniak, 2014 for empirical analysis of regional policy in this dimension).

Although, these modern concepts focus on future possibilities (they require foresight type studies, see Klasik and Kuźnik, 2013 and forecasts based on macroeconomic models, see: Mogiła *et al.,* 2013), the traditional approach and techniques of analysing regional economy should still be treated as basic tools, which identify current specialization areas (in the sense of importance for the region) and competitive advantages areas in the region. Specialization measures how specialized is the economy of the specific region (Franceschi *et al.,* 2009), by measuring how given sector is important for the economy of that region (here in relative terms, comparing to the reference area). Given industry in the region can be regional competitive advantage if it performs better than the same industries in other regions (Porter 2003).

The aim of the paper is to analyse branch structure of the regional economies, looking for specialization fields and sources of relative competitiveness in the case of Polish NUTS 2 regions. Two main techniques presented in the next section are used to explore regional economies: location quotient and modern modification of shift – share analysis (Artige, van Neuss, 2012). Then, the results for years 2005–2012 are discussed. Finally, in the last section, conclusions are presented.

2. Method and data

To identify the regional specialization, which, in the article reflects the importance of the given sectors in the regional economy, the location quotient (LQ) is employed. This popular tool is often used in the exploratory stage of research (Isard *et al.* 1998, Miller *et al.*, 1991). It helps to assess the extent to which each sector is under- or over-represented in the region compared to national economy (reference area in general). Variables like employment and gross value added are the most commonly used in calculating LQ.

Taking into account employment variable we can construct the ratio:

$$\overline{LQ}_E = \frac{E_i^r / E^r}{E_i^n / E^n}$$

where:
i – sector,
r – region,
n – reference area,
E – employment.

In the analysis of LQ, also the changes over the time was considered. To assess the changes coefficient of variation (CV) was introduced:

$$CV = \frac{\sqrt{\sum_t \frac{1}{T} (LQ_t - \overline{LQ})^2}}{\overline{LQ}}$$

where:
t – given year,
T – the number of years,
$\overline{LQ}$ – average (arithmetic mean) value of LQ.

In the competitive advantages analysis, the more advanced, but still accounting based technique is employed. Shift-share technique, also called components of change analysis, is one of the most popular methods to describe reasons for change in economic growth (using *e.g.* employment variable). Its origins date from 1940's when professor H. J. Jones used the technique in Barlow Commission on the Distribution of Industrial Population (Armstrong, Taylor, 1978 cited in Ray, 1990) and the economists for U.S. Bureau of Labor and Statistics developed the concept of "location shift" used to measure the growth trends differences between the nation and the states (Creamer, 1942 cited in Selting, Loveridge, 1992). The most popular, three components approach comes from Dunn (1960):

$$TG = NS + IM + RS$$

This model is mathematical identity, where observed regional change in employment in given sector (TG) between two periods is decomposed into three components: national share effect (NS), industry mix (IM, also called structural, proportional or industrial effect) and regional (also differential or competitive) effect (RS).

The NS reflects the employment change which would have occurred in a region if total base year employment in that region had grown in the same rate as the total employment in the nation as whole. This effects provides a useful comparison to the actual change in the employment in a region. The difference between actual employment growth in a region and that expected on the basis of national share is

called total shift or net shift (denoted TS). The total shift may be expressed as the sum of industry mix and regional effect. IM effect shows the employment change expected from the national growth rate of that sector after allowing for the overall growth rate. It measures the portion of regional growth resulting from an abundance of either quick or slow growing sectors. RS is a component calculated as a difference between the actual and expected change in employment (sum of NS and IM). A positive regional effect for a sector in a given region may be interpreted as indicating positive interaction between a sector and a region, although the source of such a competitive advantage is not known.

Although the shift-share is generally accepted, the shortcomings of the method should be stressed. Four main area of criticism of the traditional model can be distinguished (Selting, Loveridge, 1992):
- lack of theoretical base,
- disaggregation and the shift-share components,
- base or terminal year weights use,
- interdependence of industrial mix and regional effect.

The criticism results in further developments of the model proposed by Dunn. The main extensions of the classic model are made by (among others): Esteban-Marquillas (1972), Arcelus (1984), Barff and Knight (1988), Rigby and Anderson (1993), Haynes and Dinc (1997), Nazara and Hewings (2004), and Artidge and van Neuss (2014). Except the traditional model the probabilistic forms of shift-share (ANOVA-based and information-theoretic models) are developed (Knudsen, 2000).

The shift-share technique is known but rarely used in Poland, also in research (*e.g.* Woźniak, 2010, Mogiła, Woźniak 2013) as well as in practical use (*Konkurencyjność...*, 2011).

The method applied in the article is modern variation of the classic model made by Artidge and van Neuss (2014). Their approach enables us to calculate two effects influencing aggregate growth rate of voivodeships' economies: the growth effect of the economic structure (IM) and the competitive effect (RS) and omit the problem of interdependence of these two effects. According to their findings the shift-share decomposition is as follows:

$$g^{j}_{t+1} - g^{n}_{t+1} = \left[\sum_{i=1}^{I}\left(\omega^{j}_{i,t} - \frac{1}{I}\right)g^{j}_{t+1} - \sum_{i=1}^{I}\left(\omega^{n}_{i,t} - \frac{1}{I}\right)g^{n}_{t+1}\right] + \sum_{i=1}^{I}\frac{1}{I}\left(g^{j}_{t+1} - g^{n}_{t+1}\right)$$

where:
I – the number of sectors,
g^{j}_{t+1} – aggregate (all sectors) growth rate (between time t and t+1) in region j
g^{n}_{t+1} – aggregate (all sectors) growth rate (between time t and t+1) in reference area
ω^{j}_{t+1} – the weight (share) of sector i in the region j economy at the time t
ω^{n}_{t+1} – the weight (share) of sector i in reference area n economy at the time t

The observed difference between the regional and national growth rates is a sum of industry mix effect and regional (competitive) effect.

The analysis takes into consideration sections (this term is used in the article interchangeably with the term sectors) according to Polish Classification of Activities (2007) and years 2005–2012. PKD 2007 is fully methodologically, conceptually, in the scope and coding system (up to fourth digit) coherent and comparable with the classification NACE Revision 2. The territorial dimension is a voivodeship (this term is used in the text interchangeably with the terms province and region). Data is provided by Central Statistical Office database, Local Data Bank[1]. Two variables are used in calculations: employment (Average paid employment by sections, NUTS-2, 2005–2014) and gross value added (Gross value added by PKD 2007, NACE Rev. 2 sections, NUTS-2, 2000–2014). For the employment variable it is necessary to stress, that the data for sections B, D and E (separately) in years 2011 and 2012 are not available. The data for production (GVA) are in current prices. This variable should be used in real dimension when considering time range, but it should be underlined, that in LQ calculations relative values are computed (shares) and the dispersion of price level among voivodeships in the investigated time interval was slight (CV vary from 0.2% in year 2005 to 0.35% in year 2009).

3. Empirical results and discussion

For each sector (PKD section) an average LQ for employment and gross value added was calculated ($\overline{LQ}_E$ $\overline{LQ}_{GVA}$). Additionally, dispersion in years 2005–2012, using coefficient of variation is shown (CV_{LQE} CV_{LQGVA}). The values of LQ higher than 1.25 are considered as a indicator of specialization. In the case of CV, the values higher than 0,2 are regarded as important. In Table 1 computations for LQ are presented.

In section A (Agriculture, forestry and fishing), we can observe that 8 of 16 voivodeships are specialized in this activity. It is worth noticing, that the results differ, when computations based on employment and production are considered (there are 10 provinces with the value of LQ greater than 1.25 in production or employment). We can conclude quite big differences in productivity among regions in this section (positive for Łódzkie, Lubelskie, Podlaskie, Świętokrzyskie voivodeship). Important changes over the analysed period are not observed. Section B (Mining and quaring) is important for Śląskie, Dolnośląskie and Lubuskie voivodeship (in this case only in production). This sector experienced strong changes over this period. Wielkopolskie and Lubuskie voivodeship (the latter in employment only) showed slight specialization in the most significant for Polish economy section C (Manufacturing). No important changes in voivodeships in years 2005–2012 were noticed in this sector. In section D (Electricity, gas, steam and air conditioning supply) differences in productivity among regions are revealed. For 6 regions this sector is relatively more important than for the national economy (4 taken into account employment and 2 production). The importance of this sector was changing strongly in the period of analysis. 5 provinces showed slight specialization, based on employment (only one of them – Zachodniopomoskie voivodeship – in production

[1] Data was downloaded on the 24 and 25 of April, 2015.

Table 1. Location quotients for sections and voivodeships

Sections*	Measures	Voivodeships															
		Łódzkie (LD)	Mazowieckie (MZ)	Małopolskie (MP)	Śląskie (SL)	Lubelskie (LL)	Podkarpackie (PK)	Podlaskie (PL)	Świętokrzyskie (SW)	Lubuskie (LB)	Wielkopolskie (WP)	Zachodnio-pomorskie (ZP)	Dolnośląskie (DL)	Opolskie (OP)	Kujawsko--pomorskie (KP)	Pomorskie (PM)	Warmińsko--mazurskie (WM)
A	$\overline{LQ}_E$	0.88	0.55	0.52	0.36	1.47	0.80	1.32	1.03	1.89	1.68	1.94	0.91	1.54	1.61	1.19	2.40
	CV_{LQ_E}	0.94%	5.89%	6.24%	3.49%	1.73%	3.81%	4.29%	4.60%	9.98%	3.12%	6.20%	3.82%	2.49%	3.76%	4.07%	6.54%
	$\overline{LQ}_{GVA}$	1.37	0.89	0.62	0.26	1.86	0.71	2.68	1.43	1.10	1.53	1.06	0.52	1.29	1.47	0.70	2.03
	$CV_{LQ_{GVA}}$	8.05%	4.01%	10.66%	6.82%	8.80%	10.71%	4.66%	3.55%	10.46%	6.82%	7.34%	5.22%	6.93%	3.06%	10.54%	8.18%
B**	$\overline{LQ}_E$	0.67	0.05	0.27	5.21	0.55	0.19	0.17	0.52	0.18	0.45	0.10	1.86	0.26	0.07	0.09	0.12
	CV_{LQ_E}	36.76%	19.68%	14.05%	2.73%	14.19%	18.93%	24.65%	9.68%	10.74%	4.79%	10.08%	3.12%	6.14%	10.74%	10.38%	5.82%
	$\overline{LQ}_{GVA}$	0.79	0.03	0.56	4.41	0.85	0.37	0.13	0.66	1.80	0.37	0.09	1.87	0.24	0.07	0.27	0.11
	$CV_{LQ_{GVA}}$	5.55%	22.83%	12.10%	3.25%	20.61%	13.70%	36.05%	28.94%	11.40%	11.54%	12.40%	6.92%	13.14%	20.45%	20.66%	35.86%
C	$\overline{LQ}_E$	1.18	0.64	0.92	1.07	0.82	1.21	0.94	1.08	1.27	1.29	1.01	1.03	1.22	1.21	1.07	1.19
	CV_{LQ_E}	1.68%	3.93%	0.48%	4.06%	2.22%	0.37%	1.62%	1.57%	2.66%	0.91%	1.92%	2.32%	1.65%	1.66%	2.08%	3.32%
	$\overline{LQ}_{GVA}$	1.08	0.62	0.98	1.11	0.78	1.21	0.86	1.06	1.22	1.24	0.77	1.37	1.22	1.16	1.08	1.07
	$CV_{LQ_{GVA}}$	2.45%	4.10%	3.45%	1.59%	3.39%	2.53%	2.52%	6.29%	3.10%	2.36%	2.34%	6.68%	4.99%	1.37%	2.17%	2.90%
D**	$\overline{LQ}_E$	1.50	0.92	1.33	1.03	1.26	0.83	0.91	1.02	0.38	0.82	0.67	1.12	0.82	0.49	1.59	0.50
	CV_{LQ_E}	31.07%	14.53%	6.81%	6.33%	36.73%	14.50%	20.49%	25.66%	17.26%	4.35%	24.59%	9.65%	4.73%	11.74%	5.33%	3.17%
	$\overline{LQ}_{GVA}$	1.64	1.18	0.75	1.05	0.72	0.83	0.71	1.18	0.65	0.82	1.06	0.97	1.80	0.72	0.69	0.63
	$CV_{LQ_{GVA}}$	21.29%	8.03%	7.20%	6.56%	9.55%	6.80%	7.36%	20.65%	3.92%	9.71%	6.75%	4.78%	15.80%	14.48%	5.56%	4.15%
E**	$\overline{LQ}_E$	1.00	0.64	1.03	1.24	1.07	1.07	0.96	1.28	1.35	0.80	1.38	1.08	1.27	1.22	0.96	1.28
	CV_{LQ_E}	3.11%	2.41%	3.86%	0.74%	1.54%	3.07%	5.10%	3.00%	2.81%	3.42%	1.75%	1.32%	1.53%	3.80%	1.87%	2.96%
	$\overline{LQ}_{GVA}$	1.05	0.62	1.13	1.22	1.05	1.21	0.87	1.10	1.23	0.91	1.18	1.06	1.20	1.15	1.05	1.34
	$CV_{LQ_{GVA}}$	2.20%	4.57%	4.30%	1.54%	3.67%	3.00%	5.31%	8.27%	2.76%	2.64%	3.06%	3.43%	3.95%	2.45%	2.59%	1.83%

F	$\overline{LQ}_E$	0.82	0.92	1.20	1.08	0.97	0.96	0.94	1.13	0.82	1.01	1.01	0.92	1.14	1.04	1.12	1.06
	CV_{LQ_E}	1.42%	9.11%	3.74%	2.96%	5.76%	3.91%	6.14%	7.20%	4.41%	2.51%	3.60%	3.36%	3.60%	3.76%	6.59%	3.97%
	$\overline{LQ}_{GVA}$	0.93	0.82	1.26	0.99	0.99	1.00	0.98	1.22	0.95	1.04	1.23	0.97	1.04	1.05	1.11	1.05
	$CV_{LQ_{GVA}}$	6.93%	5.77%	2.32%	1.57%	3.16%	4.77%	2.99%	2.08%	5.22%	2.73%	1.10%	4.57%	2.60%	2.68%	3.04%	3.74%
G	$\overline{LQ}_E$	0.91	1.13	1.19	0.80	0.97	1.00	1.02	1.01	0.84	1.21	0.88	0.90	0.78	1.01	0.91	0.80
	CV_{LQ_E}	0.52%	2.86%	0.96%	1.82%	3.14%	1.83%	1.34%	1.94%	4.92%	5.28%	1.69%	1.72%	2.68%	1.18%	1.90%	4.21%
	$\overline{LQ}_{GVA}$	1.02	0.99	1.03	0.98	1.02	1.06	1.00	1.06	0.95	1.08	1.07	0.86	0.94	1.08	1.00	0.90
	$CV_{LQ_{GVA}}$	2.07%	1.43%	1.80%	1.77%	1.36%	1.81%	3.28%	2.61%	2.14%	1.20%	2.30%	3.20%	2.41%	1.01%	2.92%	1.78%
H	$\overline{LQ}_E$	0.65	2.05	0.62	0.74	0.78	0.57	0.71	0.67	0.85	0.76	0.93	0.61	0.70	0.66	0.93	0.58
	CV_{LQ_E}	7.30%	8.42%	8.59%	8.88%	14.45%	12.09%	14.23%	14.07%	3.94%	4.94%	11.02%	13.20%	3.87%	9.56%	7.84%	17.96%
	$\overline{LQ}_{GVA}$	0.86	1.11	0.93	0.89	1.13	0.98	1.05	1.01	1.15	0.94	1.21	0.84	0.99	0.94	1.20	0.93
	$CV_{LQ_{GVA}}$	2.13%	1.23%	2.90%	1.54%	2.66%	4.15%	1.74%	3.66%	4.07%	4.44%	3.01%	4.64%	2.70%	1.62%	2.62%	2.17%
I	$\overline{LQ}_E$	0.76	1.16	1.38	0.79	0.71	0.70	0.85	0.76	0.92	0.72	1.73	1.26	0.80	0.73	1.13	1.14
	CV_{LQ_E}	9.09%	5.56%	1.98%	2.17%	2.15%	6.57%	1.91%	8.25%	5.91%	3.83%	2.78%	7.26%	2.62%	3.37%	2.81%	8.84%
	$\overline{LQ}_{GVA}$	0.97	0.87	1.39	0.98	0.96	0.93	0.95	1.01	1.03	0.92	1.48	0.95	0.85	0.92	1.07	1.16
	$CV_{LQ_{GVA}}$	3.44%	1.24%	3.11%	2.13%	2.95%	4.62%	2.00%	2.24%	7.32%	1.83%	4.35%	3.46%	3.43%	2.85%	3.59%	2.76%
J	$\overline{LQ}_E$	0.48	2.55	1.05	0.59	0.32	0.55	0.40	0.28	0.34	0.66	0.53	0.60	0.25	0.31	0.78	0.46
	CV_{LQ_E}	7.04%	5.15%	6.08%	13.64%	10.41%	34.37%	21.70%	15.41%	11.44%	18.41%	13.34%	12.13%	25.67%	12.64%	14.53%	72.93%
	$\overline{LQ}_{GVA}$	0.46	2.43	0.88	0.56	0.51	0.62	0.44	0.43	0.48	0.69	0.55	0.59	0.35	0.43	0.93	0.46
	$CV_{LQ_{GVA}}$	2.66%	3.40%	6.99%	3.36%	4.88%	20.43%	4.72%	6.40%	4.72%	7.73%	3.62%	8.29%	10.97%	7.71%	4.51%	6.87%
K	$\overline{LQ}_E$	0.76	1.85	0.82	0.68	1.00	0.48	0.73	0.49	0.54	0.62	0.73	1.18	0.61	0.66	1.17	0.56
	CV_{LQ_E}	7.03%	5.42%	7.99%	3.30%	13.96%	11.18%	12.85%	10.33%	8.10%	9.56%	13.03%	7.20%	11.37%	6.39%	7.27%	12.64%
	$\overline{LQ}_{GVA}$	0.76	2.09	0.71	0.66	0.77	0.55	0.59	0.45	0.53	0.70	0.62	0.86	0.49	0.62	0.91	0.62
	$CV_{LQ_{GVA}}$	10.86%	5.83%	7.86%	3.79%	7.58%	9.91%	7.03%	13.14%	6.92%	7.85%	12.19%	6.88%	16.66%	8.01%	21.62%	8.97%
L	$\overline{LQ}_E$	1.11	1.08	0.79	1.18	1.01	0.74	1.04	0.87	1.06	0.76	1.29	0.95	0.84	0.82	1.22	0.92
	CV_{LQ_E}	2.11%	4.26%	3.23%	2.39%	4.88%	6.20%	1.13%	4.10%	3.79%	2.20%	6.09%	7.64%	2.54%	3.12%	10.24%	5.11%
	$\overline{LQ}_{GVA}$	1.10	0.88	0.88	1.16	1.10	0.93	1.15	0.89	1.03	0.81	1.27	0.95	1.00	1.05	1.12	1.21
	$CV_{LQ_{GVA}}$	3.34%	4.46%	10.27%	7.60%	9.18%	12.20%	5.27%	12.71%	4.01%	5.26%	2.61%	3.03%	8.01%	1.94%	2.93%	1.90%

Sections*	Measures	Voivodeships															
		Łódzkie (LD)	Mazowieckie (MZ)	Małopolskie (MP)	Śląskie (SL)	Lubelskie (LL)	Podkarpackie (PK)	Podlaskie (PL)	Świętokrzyskie (SW)	Lubuskie (LB)	Wielkopolskie (WP)	Zachodnio-pomorskie (ZP)	Dolnośląskie (DL)	Opolskie (OP)	Kujawsko--pomorskie (KP)	Pomorskie (PM)	Warmińsko--mazurskie (WM)
M	$\overline{LQ}_E$	0.71	1.80	1.05	0.89	0.65	0.56	0.53	0.67	0.61	0.80	0.68	0.90	0.68	0.66	0.85	0.59
	CV_{LQ_E}	2.84%	5.10%	6.59%	4.30%	4.39%	3.77%	4.63%	12.36%	3.49%	1.41%	5.10%	8.35%	4.10%	3.86%	4.75%	2.47%
	$\overline{LQ}_{GVA}$	0.76	1.56	1.23	0.84	0.66	0.61	0.62	0.63	0.72	0.88	0.98	0.94	0.70	0.70	0.90	0.67
	$CV_{LQ_{GVA}}$	5.14%	1.49%	3.53%	2.38%	1.16%	3.97%	3.45%	2.35%	7.74%	3.38%	3.07%	2.95%	5.00%	2.83%	1.76%	1.70%
N	$\overline{LQ}_E$	1.37	1.34	0.83	0.93	0.27	0.76	0.53	0.40	1.07	0.70	0.75	1.89	0.84	0.84	0.76	0.56
	CV_{LQ_E}	6.40%	2.38%	2.05%	4.52%	11.77%	7.10%	18.33%	7.10%	25.73%	4.55%	6.88%	6.61%	11.86%	3.73%	5.66%	13.34%
	$\overline{LQ}_{GVA}$	1.08	1.34	0.90	0.95	0.52	0.60	0.62	0.62	0.71	0.90	0.90	1.32	0.99	0.81	0.95	0.68
	$CV_{LQ_{GVA}}$	7.99%	2.40%	5.49%	3.08%	7.49%	4.32%	10.34%	5.58%	5.83%	7.88%	4.25%	6.11%	11.64%	3.68%	4.56%	7.21%
O	$\overline{LQ}_E$	1.05	0.95	0.88	0.77	1.30	1.13	1.45	1.21	1.25	0.78	1.33	0.96	1.23	1.10	1.02	1.36
	CV_{LQ_E}	1.96%	1.20%	2.78%	0.97%	1.01%	1.27%	2.46%	2.36%	1.02%	2.02%	2.27%	1.73%	3.47%	0.78%	1.39%	3.90%
	$\overline{LQ}_{GVA}$	0.99	0.90	1.01	0.81	1.34	1.28	1.38	1.17	1.19	0.86	1.24	0.94	1.16	1.02	1.01	1.32
	$CV_{LQ_{GVA}}$	1.44%	3.17%	1.54%	2.02%	2.29%	2.40%	2.38%	2.85%	4.57%	0.82%	0.89%	4.72%	3.15%	3.60%	1.31%	2.78%
P	$\overline{LQ}_E$	1.06	0.68	1.17	0.91	1.52	1.23	1.42	1.18	1.07	0.92	1.14	0.95	1.20	1.13	1.08	1.25
	CV_{LQ_E}	1.48%	1.65%	1.17%	0.73%	1.65%	1.10%	2.87%	1.91%	0.64%	0.83%	2.78%	1.86%	2.17%	1.00%	2.01%	2.76%
	$\overline{LQ}_{GVA}$	1.02	0.76	1.30	0.83	1.48	1.31	1.31	1.09	0.97	0.97	1.11	0.93	1.07	1.08	1.08	1.23
	$CV_{LQ_{GVA}}$	0.49%	2.20%	1.49%	0.88%	1.65%	1.78%	1.52%	2.54%	1.38%	1.21%	2.13%	3.84%	2.16%	2.00%	1.67%	1.86%
Q	$\overline{LQ}_E$	1.15	0.68	1.08	1.01	1.49	1.32	1.34	1.49	1.03	0.77	1.09	1.08	1.15	1.09	0.96	1.13
	CV_{LQ_E}	1.14%	1.43%	1.26%	1.19%	2.16%	2.12%	2.25%	1.63%	4.41%	1.36%	1.30%	2.13%	4.47%	1.19%	1.87%	2.93%
	$\overline{LQ}_{GVA}$	1.11	0.73	1.12	0.98	1.37	1.25	1.22	1.33	1.02	0.87	1.19	1.00	1.08	1.12	1.02	1.13
	$CV_{LQ_{GVA}}$	1.64%	2.18%	1.00%	1.60%	4.22%	2.20%	1.65%	1.59%	2.52%	2.05%	2.47%	3.91%	3.99%	2.28%	2.02%	2.10%

R	$\overline{LQ}_E$	0.93	1.02	1.19	1.09	1.02	1.01	1.16	0.99	0.96	0.73	1.06	0.99	1.12	0.90	0.94	1.01
	CV_{LQ_E}	1.68%	4.77%	1.36%	3.73%	1.57%	4.33%	5.17%	7.27%	1.94%	4.10%	3.00%	2.36%	4.47%	3.06%	2.60%	4.23%
	$\overline{LQ}_{GVA}$	0.98	1.02	1.19	0.92	0.94	0.99	1.06	0.87	1.00	0.87	1.17	0.97	1.24	0.98	0.97	1.12
	$CV_{LQ_{GVA}}$	5.45%	3.75%	3.30%	1.36%	3.09%	5.17%	7.14%	10.04%	2.11%	1.57%	2.06%	3.32%	6.04%	3.78%	2.25%	7.66%
S	$\overline{LQ}_E$	0.79	1.36	0.97	0.90	0.93	0.68	0.94	0.70	1.01	0.91	1.05	0.87	0.81	1.03	1.00	0.86
	CV_{LQ_E}	2.97%	3.30%	1.78%	2.75%	1.24%	6.48%	2.20%	3.92%	2.90%	6.66%	2.91%	2.99%	3.39%	2.54%	3.86%	4.33%
	$\overline{LQ}_{GVA}$	0.69	1.41	0.97	0.83	0.86	0.96	0.90	0.69	0.89	0.76	1.12	0.93	0.75	1.13	0.95	0.92
	$CV_{LQ_{GVA}}$	13.43%	13.15%	4.39%	3.55%	9.78%	5.77%	9.65%	15.44%	7.16%	11.84%	10.49%	2.20%	13.32%	2.37%	2.72%	12.70%

*A – Agriculture, forestry and fishing, B – Mining and quarrying, C – Manufacturing, D – Electricity, gas, steam and air conditioning supply, E – Water supply, sewerage, waste management and remediation activities, F – Construction, G – Wholesale and retail trade; repair of motor vehicles and motorcycles, H – Transportation and storage, I – Accommodation and food service activities, J – Information and communication, K – Financial and insurance activities, L – Real estate activities, M – Professional, scientific and technical activities, N – Administrative and support service activities, O – Public administration and defence; compulsory social security, P – Education, Q – Human health and social work activities, R – Arts, entertainment and recreation, S – Other service activities.

** Employment data for years 2005–2010.

terms), in section E (Water supply, sewerage, waste management and remediation activities). No significant changes over time occurred.

Regions generally are not specializing in sections F (Construction) and G (Wholesale and retail trade; repair of motor vehicles and motorcycles). The observed exception is Małopolskie voivodeship, but only considering LQ based on GVA in F section (the value is 1.26). No important changes were identified in the analysed time interval. Similar situation occurred in the case of section H (Transportation and storage). Mazowieckie voivodeship showed specialization in terms of employment, but also the significant (and negative) difference between LQ based on GVA and employment should be noticed (low productivity in this sector is possible). For Małopolskie, Zachodniopomorskie and Dolnośląskie (only in employment in this case) voivodeships section I (Accommodation and food service activities) is important. No significant changes in this sector over the time were observed. In J section (Information and communication), strong specialization of Mazowieckie voivodeship is revealed. In case of 4 voivodeships important changes (increase) in employment can be noticed (and in the one them, Podkarpackie, also in GVA). Financial sector (K Financial and insurance activities) is important for Mazowieckie voivodeship (both in employment and production). Important changes (in production) were observed only in Zachodniopomorskie.

Slight specialization of Zachodniopomorskie in section L (Real estate activities) is revealed. No significant changes were observed. In section M (Professional, scientific and technical activities) the similar situation occurred, Mazowieckie revealed specialization in this sector and no important changes are observed. Mazowieckie, Dolnośląskie and Łódzkie (only in employment in this case) voivodeships specialize in N section (Administrative and support service activities). The significant change in the importance of this sector is observed in Lubuskie. Section O (Public administration and defence; compulsory social security) is significant for poor regions. The LQ exceeded the value of 1.25 in Lubelskie, Podlaskie, Podkarpackie (only in production), Zachodniopomorskie (only in employment) and Warmińsko-Mazurskie voivodeship. No meaningful changes in this sector (and others, P, Q, R and S) were observed. In Lubelskie, Podlaskie, Małopolskie (only in production in this case) and Podkarpackie (only in production in this case), specialization in section P (Education) was observed. Lubelskie, Podkarpackie, Podlaskie (only in employment in this case) and Świętokrzyskie specialised in section Q (Human health and social work activities). No specializations were revealed in section R (Arts, entertainment and recreation). In section S (Other service activities) LQ exceeds the value of 1,25 only in Mazowieckie voivodeship.

The IM and RS components of shift-share technique are presented in Table 2 (for each voivodeship and section of PKD 2007) and in Figure 1 (for the whole voivodeships' economies). The results are presented in the relative terms (%).

The results should be interpreted as follows. In section K (Financial and insurance activities), in which Mazowieckie voivodship is specializing (LQ calculations), the value of IM is 0.11% and the value of competitive effect is 1.54%. The first component reflects the growth effect of the economic structure and the second is a result of sectoral efficiency. In this section only Dolnośląskie voivodeship revealed

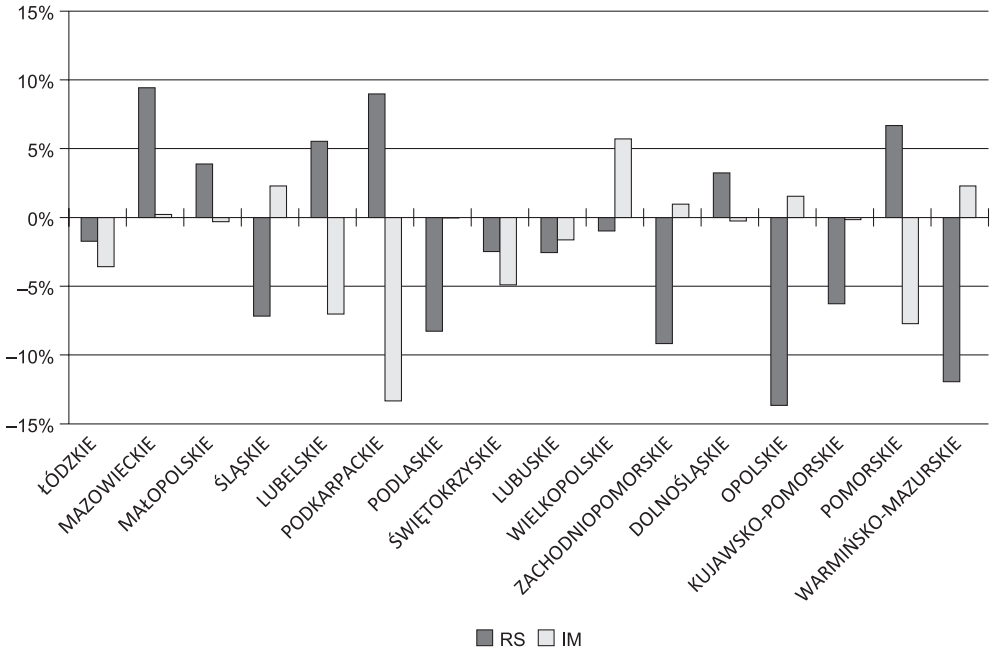

Fig. 1. Aggregate IM and RS components for voivodeships

the positive competitive effect (though Dolnośląskie is not, according to LQ, specializing in section K).

The IM and RS for aggregate growth rate are presented in Figure 1. The sum of both components is equal to the difference between regional and nation employment growth rate. Mazowieckie, Śląskie, Wielkopolskie, Zachodniopomorskie, Opolskie and Warmińsko-Mazurskie are regions with positive IM (provinces are specializing, on average, in fast growing sectors). The competititve effect is positive in Mazowieckie, Małopolskie, Lubelskie, Podkarpackie, Dolnośląskie and Pomorskie.

In Table 3 relationship between regional specialization (LQ based on employment and GVA values over 1.25 were taken into account) and regional competitive advantage (competitive effect values over 1%) was shown. Voivodeships' names are presented in two digit code mode (see Table 1 and 2). Only in few cases regions, which specialize in given branches (LQ>1.25) are also assed as competitive in the same branch (Lubuskie in section A and B, Łódzkie and Lubelskie in section D, Mazowieckie in section H, Dolnośląskie in section I, Mazowieckie in section K).

Table 2. IM and RS for sections and voivodeships (in %)

Sections	Measures	Voivodeships															
		Łódzkie (LD)	Mazowieckie (MZ)	Małopolskie (MP)	Śląskie (SL)	Lubelskie (LL)	Podkarpackie (PK)	Podlaskie (PL)	Świętokrzyskie (SW)	Lubuskie (LB)	Wielkopolskie (WP)	Zachodniopomorskie (ZP)	Dolnośląskie (DL)	Opolskie (OP)	Kujawsko-pomorskie (KP)	Pomorskie (PM)	Warmińsko-mazurskie (WM)
A	IM	0.04	0.21	0.57	0.04	–0.08	–0.28	0.33	0.18	–0.55	–0.26	–0.31	0.22	0.17	0.15	0.25	–0.25
	RS	–0.04	–0.21	–0.63	0.04	0.06	0.41	–0.65	–0.28	1.07	0.41	0.52	–0.31	–0.48	–0.47	–0.47	0.40
B	IM	2.76	–4.00	0.15	–0.49	–1.72	–3.23	–3.40	–1.01	–1.27	0.15	–0.89	–0.07	–0.20	–1.40	–1.51	1.05
	RS	–4.14	4.22	–0.04	0.18	2.25	3.59	3.71	1.34	1.51	–0.08	1.08	–0.31	0.36	1.60	1.72	–0.94
C	IM	–1.86	0.11	0.34	1.43	–1.17	–0.88	–0.81	–1.27	0.89	0.30	–0.16	1.60	–2.97	–1.25	–0.43	–0.48
	RS	–0.42	0.09	0.11	0.38	–0.38	–0.20	–0.24	–0.32	0.18	0.04	–0.04	0.44	–0.65	–0.28	–0.11	–0.12
D	IM	–2.14	–1.26	0.47	0.70	–4.30	1.33	1.93	2.18	2.14	0.45	2.57	0.85	0.60	1.36	0.31	0.43
	RS	4.11	1.68	–0.82	–1.08	6.56	–1.92	–2.82	–3.43	–2.55	–0.64	–3.48	–1.39	–0.85	–1.69	–0.57	–0.56
E	IM	–0.33	–0.91	0.45	0.14	0.22	–0.09	–0.29	0.00	0.47	–0.33	0.21	–0.06	0.45	0.65	0.17	0.18
	RS	0.42	0.98	–0.59	–0.13	–0.28	0.14	0.36	0.08	–0.60	0.36	–0.21	0.11	–0.58	–0.86	–0.22	–0.19
F	IM	–0.15	–0.06	0.37	0.00	–0.14	–0.05	–0.17	0.08	–0.18	–0.01	–0.06	–0.12	0.16	0.01	0.13	–0.06
	RS	–0.36	–0.64	0.74	–0.48	1.08	0.62	0.80	0.40	–0.18	0.04	–0.32	0.17	0.39	0.28	1.03	–0.43
G	IM	–0.61	0.66	0.86	–1.12	0.52	–0.68	–1.18	–1.10	–1.98	3.99	–1.45	0.37	–1.77	–0.80	–1.33	–2.08
	RS	–0.27	0.15	0.22	–0.57	0.35	–0.33	–0.59	–0.55	–1.06	1.60	–0.76	0.37	–1.03	–0.40	–0.68	–1.18
H	IM	–0.33	1.96	–0.18	–0.09	–0.07	0.13	0.02	–0.05	–0.08	–0.50	–0.18	–0.01	–0.01	–0.07	–0.06	0.24
	RS	0.08	1.03	–0.42	–0.73	–1.18	–1.57	–1.74	–0.92	–0.05	1.16	–1.51	–1.11	–1.17	–0.84	–0.62	–2.31
I	IM	–1.04	0.23	–0.28	–0.07	–0.01	–0.19	0.09	–1.14	0.81	0.35	0.35	–0.65	0.64	–0.08	0.11	0.93
	RS	1.22	–0.28	0.63	0.01	–0.09	0.13	–0.18	1.35	–1.18	–0.54	–0.38	1.09	–0.93	0.00	–0.11	–1.41

J	IM	–0.82	0.90	–0.73	0.83	0.33	–7.06	2.34	2.05	1.50	0.87	–0.88	–2.37	2.94	1.79	–2.23	3.53
	RS	0.61	0.08	1.09	–1.33	–0.81	7.60	–3.21	–2.77	–2.14	–1.36	0.76	2.62	–3.81	–2.48	2.70	–4.84
K	IM	0.35	0.11	0.26	0.01	0.91	1.04	0.60	1.05	0.96	0.63	1.02	–0.30	1.25	0.14	0.20	1.48
	RS	–0.74	1.54	–0.56	–0.21	–2.14	–1.76	–1.21	–1.76	–1.66	–1.20	–1.98	0.72	–2.18	–0.41	–0.35	–2.51
L	IM	0.26	0.15	–0.26	0.24	–0.01	–0.42	0.31	0.38	0.30	–0.01	0.21	–0.69	–0.13	–0.31	–0.74	0.05
	RS	–0.37	–0.22	0.32	–0.35	0.00	0.51	–0.45	–0.52	–0.43	0.00	–0.30	0.94	0.15	0.38	1.07	–0.08
M	IM	–0.43	0.83	–0.98	–0.15	–0.07	0.51	–0.24	1.00	0.19	–0.27	–0.04	0.43	0.44	–0.05	–0.63	0.36
	RS	0.22	0.12	1.97	0.00	–0.43	–1.34	–0.31	–2.19	–0.83	0.15	–0.47	–0.98	–1.20	–0.43	0.80	–1.12
N	IM	0.45	0.36	–0.08	0.62	–1.54	–0.03	1.48	–1.81	–4.68	–0.23	–0.15	1.13	1.07	–0.55	–0.99	–0.99
	RS	–0.43	0.25	–0.24	–1.46	0.79	–0.32	–3.06	1.33	7.31	–0.11	–0.37	0.53	–2.44	0.59	1.12	0.69
O	IM	–0.06	0.03	–0.09	–0.19	0.26	0.06	0.25	0.14	0.01	–0.15	0.16	–0.05	0.11	0.00	0.00	0.25
	RS	–0.43	0.72	–0.23	–0.12	0.04	–0.10	–0.11	–0.03	–0.40	–0.21	–0.16	–0.23	–0.07	–0.24	–0.09	0.01
P	IM	0.01	0.21	0.05	–0.24	–0.39	–0.41	–0.02	–0.26	–0.23	0.11	–0.07	–0.10	–0.41	–0.19	0.25	–0.07
	RS	0.01	0.46	0.02	–0.23	–0.19	–0.26	–0.03	–0.17	–0.18	0.12	–0.06	–0.08	–0.27	–0.14	0.18	–0.06
Q	IM	–0.16	–0.17	0.29	–0.07	0.21	0.24	0.02	0.06	–0.34	–0.11	–0.18	0.08	0.10	–0.07	–0.05	0.04
	RS	–0.42	0.34	0.50	–0.20	–0.02	0.15	–0.16	–0.17	–0.80	0.23	–0.48	0.09	0.16	–0.24	–0.14	0.00
R	IM	0.57	–0.06	0.07	0.09	0.05	–0.33	–0.36	–0.88	0.13	0.18	0.17	–0.21	0.15	0.22	–0.17	–0.30
	RS	–0.75	0.09	–0.08	–0.12	–0.07	0.43	0.50	1.12	–0.17	–0.24	–0.23	0.27	–0.20	–0.29	0.21	0.39
S	IM	–0.08	0.93	–1.56	0.59	–0.02	–2.98	–0.93	–4.51	0.30	0.55	0.64	–0.32	–1.06	0.30	–1.01	–2.02
	RS	–0.02	–1.01	1.89	–0.78	–0.02	3.19	1.12	5.02	–0.39	–0.70	–0.77	0.30	1.14	–0.37	1.23	2.31

*A – Agriculture, forestry and fishing, B – Mining and quarrying, C – Manufacturing, D – Electricity, gas, steam and air conditioning supply, E – Water supply, sewerage, waste management and remediation activities, F – Construction, G – Wholesale and retail trade; repair of motor vehicles and motorcycles, H – Transportation and storage, I – Accommodation and food service activities, J – Information and communication, K – Financial and insurance activities, L – Real estate activities, M – Professional, scientific and technical activities, N – Administrative and support service activities, O – Public administration and defence; compulsory social security, P – Education, Q – Human health and social work activities, R – Arts, entertainment and recreation, S – Other service activities

**Employment data for years 2005–2010

Table 3. Sections of specialization and of competitive advantage for Polish regions

Sections	LQ	Specialization	Competitive advantage
A	E	LL, PD, LB, WP, ZP, OP, KP, WM	LB
	GVA	LL, PD, SW, WP, OP, KP, WM	
B	E	SL, DL	MZ, LL, PK, PD, SW, LB, ZP, KP, PM
	GVA	SL, LB, DL	
C	E	LB, WP	–
	GVA	DL	
D	E	LD, MP, LL, PM	LD, MZ, LL
	GVA	LL, OP	
E	E	SW, LB, ZP, OP, WM	–
	GVA	WM	
F	E	–	LL, PM
	GVA	MP	
G	E	–	WP
	GVA	–	
H	E	MZ	MZ, WP
	GVA	–	
I	E	MP, ZP, DL	LD, SW, DL
	GVA	MP, ZP	
J	E	MZ	MP, PK, DL, PM
	GVA	MZ	
K	E	MZ	MZ
	GVA	MZ	
L	E	–	PM
	GVA	ZP	
M	E	MZ	MP
	GVA	MZ	
N	E	LD, MZ, DL	SW, LB, PM
	GVA	MZ, DL	
O	E	LL, PD, ZP, WM	–
	GVA	LL, PK, PD, WM	
P	E	LL, PD	–
	GVA	MP, LL, PK, PD	
Q	E	LL, PK, PD, SW	–
	GVA	LL, SW	
R	E	–	SW
	GVA	–	
S	E	MZ	MP, PK, PD, SW, OP, PM, WM
	GVA	MZ	

4. Conclusions

The aim of the paper was to analyse branch structure of the regional economies, revealing specialization fields and sources of relative competitiveness. Specialization is here understood as important branch for region, in relation to the national economy, and measured by location quotient. Such "specialization", however, does not mean, that the region reveals the competitive advantage in the branch (section). To identify the competitive (strong) sides of regional economy shift – share analysis was used. In the article, the results in years 2005–2012 for section of PKD 2007 were presented.

Beside identification which sections of PKD are specialization areas for voivodeships and which of them can be considered as competitive, interdependences between those fields are shown. Only in 7 cases regional specialization areas (sections of PKD) were assessed as competitive. These results can be used by policy makers. They enable the disclosure of public policy expenditures (do we support competitive advantages of the region or just important areas of the regional economy). For the practical (i.e. policy) purposes, however, more detailed division of PKD should be used.

These basic techniques, are, in the Author's opinion, the background for implementing other analytical techniques, like foresight studies or macroeconomic modelling to recognize the regional structure correctly and design proper regional policy.

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