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III. APPLICATION OF STATISTICAL METHODS

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ON UNEMPLOYMENT INVESTIGATION IN SMALL AREAS

Abstract. The paper presents methods of small area statistics which can be applied to investigate the phenomenon of unemployment in given subpopulations depending on sampling and additional information about population. Some methods selected from this group are shown on the example of analysis of unemployment among men, women and all inhabitants in the Łódź Macroprovince. The analysis is conducted on the basis of data collected in November 1996 in investigation of economic activity of population (Badanie Aktywności Ekonomicznej Ludności – BAEL-investigation).

1. INTRODUCTION

The phenomenon of unemployment can be a serious problem for each country's economy both on the scale of the entire country and on the scale of a region. The ratio of job – seekers and economically active persons is one of characteristics of labour market and allows to assess the state of economy. Different methods of investigating unemployment and its causes are developed. Small area statistics methods can be used for this purpose, too. They enable to analyse the problem of unemployment on a regional scale on the basis of data gathered for the whole population whose part is the distinguished area or subpopulation determined in a way different than territorial assignment (e.g. a subpopulation of women in a given population).

In this paper we consider some estimators of total value, which are used in small area statistics. They can be applied in unemployment investigations. Then we determine the estimates of different quantities characterizing unemployment (e.g. unemployment rate) in the whole Łódź Macroprovince

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and in particular administrative provinces separately for men, women and for all inhabitants.

2. SELECTED METHODS OF SMALL AREA STATISTICS

Small area statistics deals with methods of using data gathered in investigation representative for a given population (registers, current registration and other additional information) in statistical analysis of subpopulations of a given population. Generally, an assumption is made that relations occurring between parameters characteristic of the entire population are also kept for the distinguished subpopulation. In the course of our considerations we assume that the population is divided into H disjoint subpopulations (small areas) and G disjoint stratas.

It is assumed that a population is investigated with respect to variable Y on the basis of random sample, and that sometimes information on auxiliary variable X is available. Moreover, the following denotations for $h = 1, ..., H$ and $g = 1, ..., G$ are introduced:

- N – number of population elements,
- $N_{h.}$ – number of population elements belonging to h-th small area,
- $N_{.g}$ – number of population elements belonging to g-th stratum,
- N_{hg} – number of population elements belonging to h-th small area and g-th stratum,
- Λ – set of indexes:$\{1, ..., N\}$,
- $\Lambda_{h.}$ – set of indexes of values of Y or X observed in population elements belonging to h-th small area,
- Λ_{g} – set of indexes of values of Y or X observed in population elements belonging to g-th stratum,
- Λ_{hg} – set of indexes of values of Y or X observed in population elements belonging to h-th small area and g-th stratum,
- n – number of sample elements from the whole population,
- $n_{h.}$ – number of sample elements from the whole population belonging to h-th small area,
- $n_{.g}$ – number of sample elements from the whole population belonging to g-th stratum,
- n_{hg} – number of sample elements from the whole population belonging to h-th small area and g-th stratum,
- λ – set of indexes of values of Y or X drawn for the sample from the whole population,
- $\lambda_{h.}$ – set of indexes of values of Y or X in population elements belonging to h-th small area and which were found in the sample drawn from the whole population,

$\lambda_{.g}$ – set of indexes of values of Y or X in population elements belonging to g-th stratum which were found in the sample drawn from the whole population,

λ_{hg} – set of indexes of values of Y or X in population elements belonging to h-th small area and g-th stratum which were found in the sample drawn from the whole population,

y_i – value of Y in i-th population element,

x_i – value of X in i-th population element,

T – total value for Y in the population i.e.

$$T = \sum_{i \in \Lambda} y_i \tag{1}$$

$T_{h.}$ – total value for Y in h-th small area i.e.

$$T_{h.} = \sum_{i \in \Lambda_{h.}} y_i = \sum_{g=1}^{G} \sum_{i \in \Lambda_{hg}} y_i \tag{2}$$

$T_{.g}$ – total value for Y in g-th stratum i.e.

$$T_{.g} = \sum_{i \in \Lambda_{.g}} y_i = \sum_{h=1}^{H} \sum_{i \in \Lambda_{hg}} y_i \tag{3}$$

T_{hg} – total value for Y in h-th small area and g-th stratum i.e.

$$T_{hg} = \sum_{i \in \Lambda_{hg}} y_i \tag{4}$$

X, $X_{h.}$, $X_{.g}$, X_{hg} – total values for X in the population, in the h-th small area, in the g-th stratum, also in the h-th small area and in the g-th stratum, respectively (formulas for these values are analogous to formulas (1)–(4)),

$\overline{Y}$, $\overline{X}$ – mean for Y and X, respectively, in the population,

$\overline{Y}_{h.}$, $\overline{X}_{h.}$ – mean for Y and X, respectively, in h-th small area,

$\overline{Y}_{.g}$, $\overline{X}_{.g}$ – mean for Y and X, respectively, in g-th stratum,

$\overline{Y}_{hg}$, $\overline{X}_{hg}$ – mean for Y and X, respectively, in h-th small area and g-th stratum,

$\hat{T}$, $\hat{T}_{h.}$, $\hat{T}_{.g}$, $\hat{T}_{hg}$ – estimates for total values T, $T_{h.}$, $T_{.g}$, T_{hg} respectively,

$\overline{y}$, $\overline{y}_{h.}$, $\overline{y}_{.g}$, $\overline{y}_{hg}$ – estimates for means $\overline{Y}$, $\overline{Y}_{h.}$, $\overline{Y}_{.g}$, $\overline{Y}_{hg}$ respectively,

$\overline{x}$, $\overline{x}_{h.}$, $\overline{x}_{.g}$, $\overline{x}_{hg}$ – estimates for means $\overline{X}$, $\overline{X}_{h.}$, $\overline{X}_{.g}$, $\overline{X}_{hg}$ respectively.

The simplest method of estimation of parameters of variable distribution for the small area is taking as a random sample for the small area elements of the sample drawn from the population which belong to this area, and estimation of selected parameters on this basis.

Estimators constructed in this way are called direct estimators[1]. They could be characterized by large variance when sizes of n_{hg}, $n_{.h}$, $n_{.g}$ turned out to be small in a given investigation. In order to obtain more effective estimators, some additional information on population and strata is used to construct them. In this case indirect estimators are obtained.

We will now present selected estimators of total value of Y defined for a sample obtained by one-stage stratum sampling (see. D o l 1991, p. 19–24).

The direct estimators include the following:

– Hortvitz-Thompson estimator

$$\hat{T}_{h.}(HT) = \sum_{i \in \lambda_{h.}} y_i/\pi_i = \sum_{g=1}^{G} \sum_{i \in \lambda_{hg}} y_i/\pi_i \tag{5}$$

– ratio estimator

$$\hat{T}_{h.}(Rat) = \frac{\sum_{i \in \Lambda_{h.}} x_i}{\sum_{i \in \lambda_{h.}} x_i/\pi_i} \cdot \sum_{i \in \lambda_{h.}} y_i/\pi_i \tag{6}$$

– count ratio estimator

$$\hat{T}_{h.}(CRat) = \frac{N_{h.}}{\sum_{i \in \lambda_{h.}} \frac{1}{\pi_i}} = \sum_{i \in \lambda_{h.}} y_i/\pi_i \tag{7}$$

(this is ratio estimator in which $x_i = 1$ or auxiliary variable is constant and takes value 1),

– post-stratification estimator

$$\hat{T}_{h.}(Post) = \sum_{g=1}^{G} \left(\frac{\sum_{i \in \Lambda_{hg}} x_i}{\sum_{i \in \lambda_{hg}} x_i/\pi_i} \cdot \sum_{i \in \lambda_{hg}} y_i/\pi_i \right) \tag{8}$$

– count post-stratification estimator

$$\hat{T}_{h.}(CPost) = \sum_{g=1}^{G} \left(\frac{N_{hg}}{n_{hg}} \cdot \sum_{i \in \lambda_{.hg}} y_i \right) \tag{9}$$

(this is estimator (8) for which $x_i = 1$).

[1] S c h a i b l e writes (1993): "an indirect estimator uses values of the variable of interest from a domain and/or time period other then the domain and time period of interest".

In formulas (5)–(7) π denotes probability that i-th population element will be drawn from a sample (often $\pi_i = n_{.g}/N_{.g}$ when $i \in \Lambda_{.g}$).

Estimating of variance for the presented direct estimators is not a simple task. It is estimated on the basis of a sample and it enables to compare the quality of estimators. Mean square error defined by

$$MSE = E(\hat{T}_* - T_*)^2 \tag{10}$$

is also used for this purpose, where "*" denotes the whole population or this part of population which is examined in the investigation (e.g. small area). Both estimator variance and MSE can be estimated using different methods.

Synthetic estimators belong to the group of indirect estimators[2]. They are constructed with the assumption that relations between T_{hg} and X_{hg} are the same in all parts of small areas which belong to the same stratum, and the same as in a given stratum i.e.

$$\frac{T_{.g}}{X_{.g}} = \frac{T_{hg}}{X_{hg}} = \beta_g \tag{11}$$

for $g = 1, \ldots, G$ and $h = 1, \ldots, H$.

With the above assumption the total value for Y in h-th small area ($h = 1, \ldots, H$) can be presented by the following formula:

$$T_{h.} = \sum_{i \in \Lambda_{h.}} y_i = \sum_{g=1}^{G} T_{gh} = \sum_{g=1}^{G} X_{hg} \frac{T_{.g}}{X_g} = \sum_{g=1}^{G} \beta_g \cdot X_{gh} \tag{12}$$

The statistic of the following form:

$$\hat{T}_{h.} = \sum_{g=1}^{G} \hat{\beta}_g \cdot X_{gh} \tag{13}$$

where $\hat{\beta}_g$ is the estimator of parameter β_g, can be accepted as the estimator of the total value $T_{h.}$.

The synthetic approach allows to modify direct estimates (5)–(7).

If in formula (13) we put $\hat{\beta}_g$ in place of β_g, where

$$\hat{\beta}_g = \frac{1}{X_{.g}} \cdot \sum_{i \in \lambda_{.g}} y_i/\pi_i \tag{14}$$

[2] Schaible writes (1993): "an indirect estimator uses values of the variable of interest from a domain and/or time period other then the domain and time period of interest".

then we will get the formula of Horvitz-Thompson estimator which is of the form

$$\hat{T}_{h.}(HT-Syn) = \sum_{g=1}^{G} \frac{X_{hg}}{X_{.g}} \left(\sum_{i \in \lambda_{.g}} y_i/\pi_i \right) \tag{15}$$

This results from the fact that in synthetic method we assume

$$\frac{\sum_{i \in \lambda_{hg}} y_i/\pi_i}{X_{hg}} = \frac{\sum_{i \in \lambda_{.g}} y_i/\pi_i}{X_{.g}} \tag{16}$$

We modify estimators (6), (7) in a similar way and we get

– synthetic ratio estimator

$$\hat{T}_{h.}(Rat-Syn) = \sum_{g=1}^{G} X_{hg} \cdot \frac{\sum_{i \in \lambda_{.g}} y_i/\pi_i}{\sum_{i \in \lambda_{.g}} x_i/\pi_i} \tag{17}$$

– synthetic count ratio estimator

$$\hat{T}_{h.}(CRat-Syn) = \sum_{g=1}^{G} \frac{\hat{T}_{.g}}{N_{.g}} N_{hg} = \sum_{g=1}^{G} \overline{y}_{.g} \cdot N_{hg} \tag{18}$$

The final form of $\hat{T}_h$ estimator results from the assumption that mean value of variable Y in stratum g i.e. $\overline{Y}_{.g}$ is equal to $\overline{Y}_{hg}$ i.e. mean for the common part of h-th small area and g-th stratum.

The form of synthetic estimators is similar to formulas of post-stratification. The difference between them lies in the fact that post-stratification estimators are function of those elements from the sample, which belong to the small area and synthetic estimators are functions of elements of the random sample from the whole population. Let us notice that synthetic estimators $\hat{T}_{h.}$ of the total value $T_{h.}$ for $h = 1, \ldots, H$ have the following property

$$\sum_{h=1}^{H} \hat{T}_{h.} = \sum_{h=1}^{H} \sum_{g=1}^{G} \frac{\hat{T}_{.g}}{X_{.g}} X_{hg} = \sum_{i=1}^{H} \frac{\hat{T}_{.g}}{X_{.g}} \left(\sum_{g=1}^{G} X_{hg} \right) = \sum_{g=1}^{G} \hat{T}_{.g} = \hat{T} \tag{19}$$

Formulas (5)–(9) and (13), (15), (17), (18) present estimators of the total value $T_{h.}$. In order to obtain estimators of mean $\overline{Y}_n$ we need to divide $\hat{T}_{h.}$ by number $N_{h.}$.

In addition to the given estimators for the small area in case of stratum sampling other estimators e.g. synthetic regression estimates are known.

As well as synthetic estimation we can also study regression estimation whose idea is different from basis of construction of synthetic regression estimator (see D o l, 1991).

The method of sampling has an influence on the form of estimators used in investigations.

The presented estimators are defined for one-stage stratum sampling.

3. METHODS OF ANALYSIS OF UMEMPLOYMENT IN SMALL AREAS

3.1. General remarks

The phenomenon of unemployment can be analysed on the scale of the whole population (e.g. for a given country or a given group of countries) or on the scale of distinguished subpopulations. In the latter case methods of small area statistics can be used to estimate parameters characterizing the labour market such as: number of economically active people, number of the unemployed, number of people looking for a job due to: loss of place of work, leaving a job, intention of taking up a job after a break or intention of taking up the first job. These parameters may be treated as total values of respective variables and estimators presented in Section 2 can be used to estimate them if sampling was done according to stratum sampling, individual and direct. In case we choose a different way of sampling, formulas for estimators of total value take a different form and become much more complex when the research is carried out on the basis of information gathered by means of multistage methods of sampling (see e.g. R u s s o, F a l o r s i 1992; B r a c h a, 1994; G o ł a t a, 1996).

Application of methods of small area statistics to investigate the phenomenon of unemployment in regional approach is recommended because of possibility of using data collected for research of the whole population (both in representative studies and in complete studies e.g. current registration of job – seekers). Conducting statistical research for large populations is usually quite expensive and time – consuming. Methods of small area statistics allow us to avoid carrying out special research in order to collect the needed information. It seems reasonable to follow the rule of maximum use of the gathered statistical data. Development of small area statistics provides more possibilities of making analyses on the regional scale.

The paper presents analysis of the problem of unemployment on the example of the Łódź Macroprovince, Poland. The methods applied here can be used in an analogous way for other regional research of unemployment.

3.2. Categories of population by economic activity

In accordance with international standards, population of persons aged 15 or more is divided into three categories:

- working,
- unemployed,
- economically inactive.

The working people and the unemployed are treated as economically active, while the remaining part of population belongs to the group of economically inactive.

The analyses of economic activity of population are being carried out systematically in many countries and they show various aspects of the problem. This type of research is also being developed in Poland (see: Kałaska, Witkowski, 1993) on the basis of e.g. current registration in employment agencies or special questionnaires. Investigation of economic activity of population (Badanie Aktywności Ekonomicznej Ludności – BAEL) is one of them, and it has been conducted since 1992. The information is gathered four times a year (in February, May, August and November) on the basis of a sample obtained in two-stage sampling. The first stage units are drawn, with stratification according to administrative provinces, which are, in turn, divided into rural stratum and 2 to 5 urban strata.

In the second stage units are households and all the inhabitants of the drawn household belong to the sample. According with the definition accepted in BAEL-investigation (see: Dobrzyńska, Gałka, Kostrubiec *et. al*, 1996) all the people who worked or not, in a given week but were employed by a certain employer, are included into the group of working.

The unemployed are people aged 15 or more who do not work but expect to start working in the period of the next 30 days or fulfill three conditions:

- during the week under investigation they were not working people,
- actively looked for a job i.e. in the last 4 weeks proceeding the investigation they undertook actions aimed at finding a job,
- were ready to take up job in the week under investigation or the next one.

In our paper we accepted a slightly different definition of the unemployed. They are persons who treat themselves as people looking for a job or they are expecting to take up employment. The other notions i.e. economically active, working and economically inactive are understood in the way described earlier. However, it should be remembered that the change in the definition of the unemployed results in the change in number of the groups of the economically active. The introduced modifications were caused by the intention to carry out an investigation different from the BAEL analyses, whose results are published by the Central Statistical Office in Poland, in spite of the fact that our research uses statistical data gathered

in BAEL-investigation. The results of our research offer a slightly different assessment of unemployment than the analyses based on definitions accepted in BAEL-investigation.

3.3. Results of research on unemployment in the Łódź Macroregion

The Łódź Macroregion (Łódź Macroprovince) consists of the Łódź Province and the neighbouring provinces: Piotrków Province, Płock Province, Sieradz Province, Skierniewice Province.

Data gathered in BAEL-investigation in November 1996 were used in the present study. They are shown in Tab. 1–5 in a way which is essential for our analysis. In order to determine estimates of total values of some variables which characterize the labour market in the Łódź Macroregion two estimators were used viz.: direct estimator (9) and indirect estimator (18). This means that for simplification of calculations we used estimators which correspond to one-stage stratum sampling (a province which belongs to the Łódź Macroregion was taken as a stratum). We considered two small areas: subpopulation of men in the Łódź Macroregion and subpopulation of women in the Łódź Macroregion.

The obtained results allow to formulate conclusions concerning both the evaluation of the used estimator and the situation on the labour market in the Łódź Macroregion for men and for women judged from the point of view of economic activity of population and causes of looking for a job. Results of the calculations are presented in Tab. 6–7.

Estimates of unemployment rate obtained on the basis of synthetic estimator (18) are the same for the subpopulation of men and for the subpopulation of women. This results from a specific construction of this estimator.

It is built with the assumption that population structure (parameters which characterize the population) does not differ significantly from the structure of small areas. We take that estimator (9) gives better estimates because some deviations from presented assumption can be observed. Results from other studies of the problem of unemployment also support this statement (see. Domański, Nowakowska, 1996; Kostrubiec, Kowalska, 1997).

The estimates we obtained prove that there are more unemployed women than unemployed men both in the whole Łódź Macroregion and in particular administrative provinces (the only exception is the Piotrków Province). The main reason why people look for employment is loss of job, and the next one is the intention to take up the first job. The lowest percentage of job-seekers are the people who are looking for a job because they resigned from the previous one. The presented results show clearly that the situation of women on the labour market in the Łódź Macroregion is less favourable than the situation of men.

Table 1

Structure of population of Poland and Łódź Macroprovince by economic activity in BAEL-sample (November 1996)

Specification	Number of persons						Totals		
	economically active			economically inactive					
	total	men	women	total	men	women	total	men	women
Poland	31 443	16 806	14 637	23 228	8 989	14 239	54 671	25 795	28 876
Łódź Province	882	462	420	733	274	459	1 615	736	879
Piotrków Province	558	301	257	392	154	238	950	455	495
Płock Province	470	253	217	324	119	205	794	372	422
Sieradz Province	374	197	177	241	98	143	615	295	320
Skierniewice Province	444	235	209	279	105	174	723	340	383
Łódź Macroprovince	2 728	1 448	1 280	1 969	750	1 219	4 697	2 198	2 499

Source: Author's calculation on the basis of BAEL-sample from November 1996.

Table 2

Structure of economically active population for Poland and Łódź Macroprovince in BAEL-sample (November 1996)

Specification	Number of economically active persons						Number of unemployed unable to take up job in the period of next 2 weeks		
	working			unemployed					
	total	men	women	total	men	women	total	men	women
Poland	27 384	14 956	12 428	4 059	1 850	2 209	462	182	280
Łódź Province	752	398	354	130	64	66	12	6	6
Piotrków Province	486	263	223	72	38	34	7	2	5
Płock Province	412	230	182	58	23	35	3	2	1
Sieradz Province	342	185	157	32	12	20	5	0	5
Skierniewice Province	406	221	185	38	14	24	3	1	2
Łódź Macroprovince	2 398	1 297	1 101	330	151	179	30	11	19

Source: Author's calculation on the basis of BAEL-sample from November 1996.

Table 3

Structure of number of the unemployed for Poland and Łódź Macroprovince in BAEL-sample (November 1996)

Specification	Number of people						Number of unemployed		
	looking for a job			awaiting to start a job					
	total	men	women	total	men	women	total	men	women
Poland	3 981	1 798	2 183	78	52	26	4 059	1 850	2 209
Łódź Province	127	63	64	3	1	2	130	64	66
Piotrków Province	71	38	33	1	0	1	72	38	34
Płock Province	57	23	34	1	0	1	58	23	35
Sieradz Province	32	12	20	0	0	0	32	12	20
Skierniewice Province	38	14	24	0	0	0	38	14	24
Łódź Macroprovince	325	150	175	5	1	4	330	151	179

Source: Author's calculation on the basis of BAEL-sample from November 1996.

Table 4

Number of unemployed awaiting to start job or ready to take up a job in the period of next two weeks for Poland and Łódź Macroprovince according to reasons of looking for a job in BAEL-sample (November 1996)

Specification	Reasons for seeking employment												Totals		
	loss of job			resignation from job			intention to come back to work after a break			intention to take up the first job					
	total	men	women	total	men	women	total	men	women	total	men	women	total	men	women
Poland	1935	957	979	251	133	118	643	231	412	768	345	423	3 597	1 668	1 929
Łódź Province	66	33	33	11	5	6	25	10	15	16	10	6	118	58	60
Piotrków Province	39	20	19	2	1	1	9	6	3	15	9	6	65	36	29
Płock Province	38	17	21	2	0	2	6	2	4	9	2	7	55	21	34
Sieradz Province	15	7	8	2	2	0	3	0	3	7	3	4	27	12	15
Skierniewice Province	24	6	18	1	1	0	1	0	1	9	6	3	33	13	22
Łódź Macroprovince	182	83	99	18	9	9	44	18	26	56	30	26	300	140	160

Source: Author's calculation on the basis of BAEL-sample from November 1996.

Table 5

Structure of population of Poland and Łódź Macroprovince by sex in 1996

Specification	Number of inhabitants (in thousands)		
	total	men	women
Poland	38 618.0	18 796.7	19 821.3
Łódź Province	1 113.3	514.9	598.4
Piotrków Province	643.7	314.8	328.9
Płock Province	521.8	255.0	266.8
Sieradz Province	412.8	203.2	209.6
Skierniewice Province	423.7	207.4	216.3
Łódź Macroprovince	3 115.3	1 495.3	1 620.0

Source: *Rocznik Statystyczny 1997*, GUS, Warszawa 1998, Tab. 8(152), p. 92.

Table 6

Evaluations of total values for different variables characterizing labour market for Łódź Macroprovince determined on the basis of estimator (9)

Specification	Number of economically active persons		Number of unemployed		Number of persons who seek employment according to reasons of looking for a job								Unemployment rate	
					loss of job		resignation from job		intention to come back to work after a break		intention to take up the first job			
	men	women	men	women	men	women	men	women	men	women	men	women	men	women
Łódź Province	323 215	285 936	44 774	44 933	23 087	22 466	3 498	4 085	6 996	10 212	6 986	4 085	0.139	0.157
Piotrków Province	208 262	170 751	26 292	22 590	13 838	12 624	692	664	4 151	1 993	6 227	3 986	0.126	0.132
Płock Province	173 432	137 187	15 767	22 127	11 654	13 276	0	1 264	1 371	2 529	1 371	4 425	0.091	0.161
Sieradz Province	135 694	115 935	8 266	13 100	4 822	5 240	1 378	0	0	1 965	2 066	2 620	0.061	0.113
Skierniewice Province	143 350	118 043	8 540	13 555	3 660	10 166	610	0	0	565	3 660	1 694	0.060	0.115
Łódź Macroprovince	983 953	827 852	103 639	116 305	57 061	63 772	6 178	6 013	12 518	17 264	20 320	16 810	0.105	0.140

Source: Author's calculation on the basis of BAEL-sample from November 1996.

Table 7

Evaluations of total values for different variables characterizing labour market for Łódź Macroprovince determined on the basis of estimator

Specification	Number of economically active persons		Number of unemployed		Number of persons who seek employment according to reasons of looking for a job								Unemployment rate	
					loss of job		resignation from job		intention to come back to work after a break		intention to take up the first job			
	men	women	men	women	men	women	men	women	men	women	men	women	men	women
Łódź Province	280 879	327 084	41 399	48 210	21 018	24 476	3 503	4 079	7 962	9 271	5 095	5 934	0.147	0.147
Piotrków Province	184 891	193 210	23 857	24 930	12 922	13 504	663	6 092	2 982	3 116	4 970	5 194	0.129	0.129
Płock Province	151 044	157 840	18 640	19 478	12 212	12 762	643	671	1 928	2 015	2 892	3 023	0.123	0.123
Sieradz Province	123 506	127 523	10 567	10 911	4 953	5 115	660	682	991	1 023	2 311	2 387	0.086	0.086
Skierniewice Province	127 230	132 954	10 889	11 379	6 877	7 187	287	299	287	299	2 579	2 695	0.086	0.086
Łódź Macroprovince	867 550	938 611	105 352	114 908	57 982	63 044	5 756	6 423	14 150	15 724	17 847	19 233	0.122	0.122

Source: Author's calculation on the basis of BAEL-sample from November 1996.

The obtained results may be error biased resulting from the use of estimators, which correspond to a simpler sampling than the sampling in BAEL-investigation.

4. FINAL REMARKS

Methods of small area statistics give quite a wide range of possibilities of application in many fields of economic and social research.

It seems they can have a more widespread application if there is a need to gather auxiliary information necessary to build effective estimators of respective parameters in representative or global research.

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