Journal of Finance and Investment Analysis, vol. 6, no. 3, 2017, 61-84
ISSN: 2241-0998 (print version), 2241-0996(online)
Scienpress Ltd, 2017

Poverty in Greece using Small Area Estimation Methods

Stefanos G. Giakoumatos[1] and Malapani Eleni[2]

Abstract

In this paper, the Small Area methods are presented. We use this method to produce estimates of poverty in Greece, at county (NUTS3) level. This is succeeded by combining survey data from EU-SILC 2013 with auxiliary data derived from the 2011 Census. In the application section, we adopt the Fay and Herriot model and we provide estimates for the percentage of Greek population under the poverty line in 2013 and also the mean equivalized income.

JEL classification numbers: C13, C31, C51
Keywords: Small area model, EBLUP, Fay and Herriot model, poverty, EU-SILC

1 Introduction

In the last years many surveys have been conducted concerning the income and the living conditions of households in every country. It is widely acceptable that while those surveys examine a large number of variables, they do not produce reliable results about areas where the sample is small. On the other hand the data from the census in every decade do not cover all the time periods and many times do not examine enough variables concerning the households in order to result in the desirable estimations. Nevertheless, the combination of the above data, that is the surveys on the households and on the census, has been noted to have given reliable estimators of the variables of the households we are interested. In the present study we combine the above data types in order to derive reliable results on the poverty level in Greece on county (NUTS 3) level for the year 2012.

[1] Dept of Acounting and Finance, Technological Institute of Peloponnese, Greece
[2] Ph.D Candidate, Panteion University, Greece

Article Info: *Received* : April 19, 2017. *Revised* : June l8, 2017
Published online : September 1, 2017

2 Definition of Poverty

There are many different approaches in defining poverty as it is composite and multidimentional. One of those approaches is the objective poverty. According to this approach, individuals, families and groups in the population can be said to be in poverty when they lack the resources to obtain the types of diet, participate in the activities and have the living conditions and amenities which are customary, or at least widely encouraged or approved, in the society to which they belong" (Townsend, 1979, p 31).
Three ingredients are required in computing a poverty measure. First one has to choose the relevant dimension and indicator of well-being. Second one has to select a poverty line, that is, a threshold below which a given household or individual will be classified as poor. Finally one has to select a poverty measure to be used for reporting for the population as a whole or for a population subgroup only.

When measured, poverty may be absolute or relative. Absolute poverty refers to the set of resources a person must acquire in order to maintain a "minimum standard of living". Relative poverty is concerned with how well off an individual is with respect to others in the same society. In theory, therefore, while an absolute poverty line is a measure that could, adjusting for price fluxes, remain stable over time, a relative poverty line is one that could be expected to shift with the overall standard of living in a given society. In EU and in the most of the developed countries, the relative poverty indices are used. According to Eurostat the poverty line is calculated with its relative concept (poor in relation to others) and it is defined at 60% of the median total equivalised disposable income of the household, using modified OECD equivalised scale.

3 Small Area Estimation

3.1 Introduction

In recent years, the demand for small area estimates of some socioeconomic indicators (poverty, unemployment,…) has greatly increased worldwide. An area (domain) is regarded as small if the domain-specific sample is not large enough to support direct estimates of adequate precision. The official statistical office of the states produce estimates on a national or at the best case on a regional level. In order for these characteristics to be estimated, large samples are required on a national level (so that to provide enough sampling units on a local area and to produce reliable estimation) which equals a geometrical rise of the cost, a case that the states do not want or cannot cover. A way to resolve this problem is by using small area estimation (SAE) (Rao 2003).

Small area estimation (SAE) is widely used for producing estimates of population parameters for areas (domains) with small, or even zero, sample size. In those areas, direct estimators that only relies on domain-specific observations may lead to estimates with large sampling variability . When direct estimation is not possible, one has to rely upon indirect estimators. Indirect estimators borrow strength by using values of the variable of interest, y, from related areas and/or time periods and thus increase the effective sample size. These values are brought into the estimation process through a model (either implicit or explicit) that provides a link to related areas and/or time periods through the use of the supplementary information related to y, such as recent census database and current administrative records.

3.2 Small Area Models

Explicit linking models based on random area-specific effects that account for between area variation beyond that is explained by auxiliary variables included in the model will be called "Small Area Models". Indirect estimators based on small area models will be called "model-based estimators", (Rao, 2003). We classify small area models into two brad types:

- Area level models that relate small area direct estimators to area-specific covariates. Such models are necessary if unit (or element) level data are not available, (Fay and Herriot, 1979).
- Unit level models that relate the unit values of a study variable to unit-specific covariates, (Battese, Harter and Fuller, 1988)

3.3 Fay and Herriot model

Fay and Herriot model was introduced by Fay and Herriot (1979) to obtain small area estimators of median income in some places in the United States. This model is widely used area level model in SAE, is the basic tool when only aggregated auxiliary data at the area level are available. The SAE under this model is one of the most popular method used by private and public agencies because of its flexibility in combining different sources of information and explaining different sources of errors

Fay and Herriot model uses mixed (random) effects models for SAE (F-H 1979, Battese 1988). A mixed effects model consists of a fixed effects part and a random effects part with the latter accounting for between area variations beyond that explained by the auxiliary variables included in the fixed part of the model.

We assume that $\theta_i = g(\bar{Y}_i)$ is a known function of $\bar{Y}_i$ and $z_i = \left(z_{1i}, z_{2i,}, ..., z_{pi}\right)$ is the known auxiliary vector for the i-th area, i=1,…,m.

The function $g(.)$ is related to area specific auxiliary data z_i, through a linear model $\theta_i = z_i^T \beta + b_i v_i$, i=1,…,m, where the b_i 's are known positive constants and $\beta = (\beta_1, \beta_2, ..., \beta_p)^T$ is the px1 vector of regression coefficients. The v_i 's are area

specific random effects assumed to be independent and identically distributed (iid) with $E_m(v_i) = 0$ and $V_m(v_i) = \sigma_v^2 \ (\geq 0)$.

Normality of the random effects v_i is also often used, but it is possible to make robust inferences by relaxing the normality assumption. The parameter σ_v^2 is a measure of homogeneity of the areas after counting for the covariates z_i.

In some applications, not all areas are selected in the sample. We assume that we have M areas in the population and only m areas are selected in the sample. We assume the population model $\theta_i = z_i^T \beta + b_i v_i$, i=1,…,M **(1).** We also assume that the sample areas obey the population model. We want to estimate the population mean of the i-th area. For making inferences about $\bar{Y}_i$ under model (1) we assume that:

- The direct estimators $\hat{\bar{Y}}_i$ are available
- $\hat{\theta}_i = g(\hat{\bar{Y}}_i) = \theta_i + e_i$, i=1,…,m **(2)** (as in the James-Stein method), where the sampling errors e_i are independent with $E_p(e_i / \theta_i) = 0$ and $V_p(e_i / \theta_i) = \psi_i$. The sampling variances, ψ_i, are known.

Combining model (1) and (2) we obtain the Fay and Herriot model $\hat{\theta}_i = z_i^T \beta + b_i v_i + e_i$, i=1,…,m. We assume that v_i and e_i are independent.

4 Application

4.1 Research characteristics

In our research we make an estimation at NUTS 3 area (in Greek Nomos) using the model of Fay and Herriot. The variables of interest are:

- The percentage of Greek people under the poverty line and
- The average disposable income

We have derived the data of our sample from the EU Survey of income and Living Conditions EU-SILC 2013, while the data of the auxiliary variables from the 2011 Census database. The auxiliary variables were the following two:

- The percentage of people per county with a lower educational level (X1)
- The percentage of inactive people per NUTS 3 (individuals who are not interested in working) (X2)

We have also used the relative poverty lines. Poverty line is the level of income under which the individual is considered poor. We consider that this is (according to OECD) 60 % of the median total equivalized disposable income of the household. As an equivalent available individual income is considered the total available income of household after it has been divided with the equivalent size of the household. The equivalent size of household is calculated according to the modified scale of OECD. Equivalent size refers to OECD modified scale gives weight 1.0 to the first adult of the household, 0.5 to other persons above the age of 14 and 0.3 to every child under the age of 14 of the household. The income components included in the survey are :

- Income from work
- Income from property
- Social transfers and pensions
- Monetary transfers from other households and
- Imputed income from the use of company car

4.2 EU -SILC Greece 2013

The EU Survey of income and Living Conditions EU-SILC is conducted on an annual basis in all the EU since 2003 with the responsibility of the Eurostat. The aim of EU-SILC is to gather reliable and comparable data on the income, the living conditions, on the labour of people and of households in the EU states. Collecting the necessary data has been achieved through questionnaires answered by a representative sample of households in each member state of the EU. The year in reference in the present study is 2012, the final sample was of 7349 households and 18030 people (15318 age 16+). According to the EU-SILC the line of poverty rises in 5023 euro per person annually and the 23.1% of the total population is placed under the poverty line. The chart below demonstrates the evolution of poverty since 1995-2012.

For the production of our results we used the programming language R.

4.3 Application Results

- **Poverty estimates**

From the results below, we observe that using Fay and Herriot model the percentages of poverty changed in several areas, including Imathia, Kefalonia, Lasithi, Samos and Thesprotia. Also, using the model of Fay and Herriot standard deviations of the estimates were improved in all prefectures. Especially in counties with small sample (30-70) as Thesprotia, Samos, Grevena, Lefkada, Chios and Lasithi the difference in standard deviations between direct and Fay and Herriot estimator was great. In these areas the direct estimation method gave large standard deviations and the Fay and Herriot method much smaller. Features mention Thesprotia where the direct estimator gave poverty rate 57.13 % while the Fay and Herriot estimator 29.15 % with standard deviations 17.24 % and 5.92 % respectively . Finally note that in areas such as the prefecture of Attica , Thessaloniki etc. where the sample size is large , the differences between direct and Fay and Herriot estimator are too small to negligible both poverty rates and the corresponding standard deviations.

- **Income estimates**

Respectively with poverty rates, we notice several differences in income between direct and Fay and Herriot estimator , in regions such as Evritania , Laconia , Lefkada , Lasithi , Chios , Samos and Grevena. Even greater are the differences between the two estimators as reference standard deviations in the above areas .

The standard deviations of Fay and Herriot estimator is for all counties smaller than the direct estimator.

5 Conclusions and further Research

In this paper, we adopt the small area methods to produce estimates for the poverty in Greece into a small geographical areas. In detail, we apply the Fay and Herriot model using as independent (auxiliary) variables data from the Census of 2011. For this first approach, we use only two independent variables in order to produce estimates, but the results are very promising. The reduction of the standard deviation of the estimates was large in many areas where the standard deviation for the direct estimates was high (see Figure 3, 4, 7, 8). Therefore, the accuracy of the estimators for the poverty was increased using the small are methods. For further research, the author plan to produce a model that include a larger set of auxiliary information for the census and other administrative sources in order to improve the accuracy and conclude to the final SAE model for the estimation of Greek Poverty Indices.

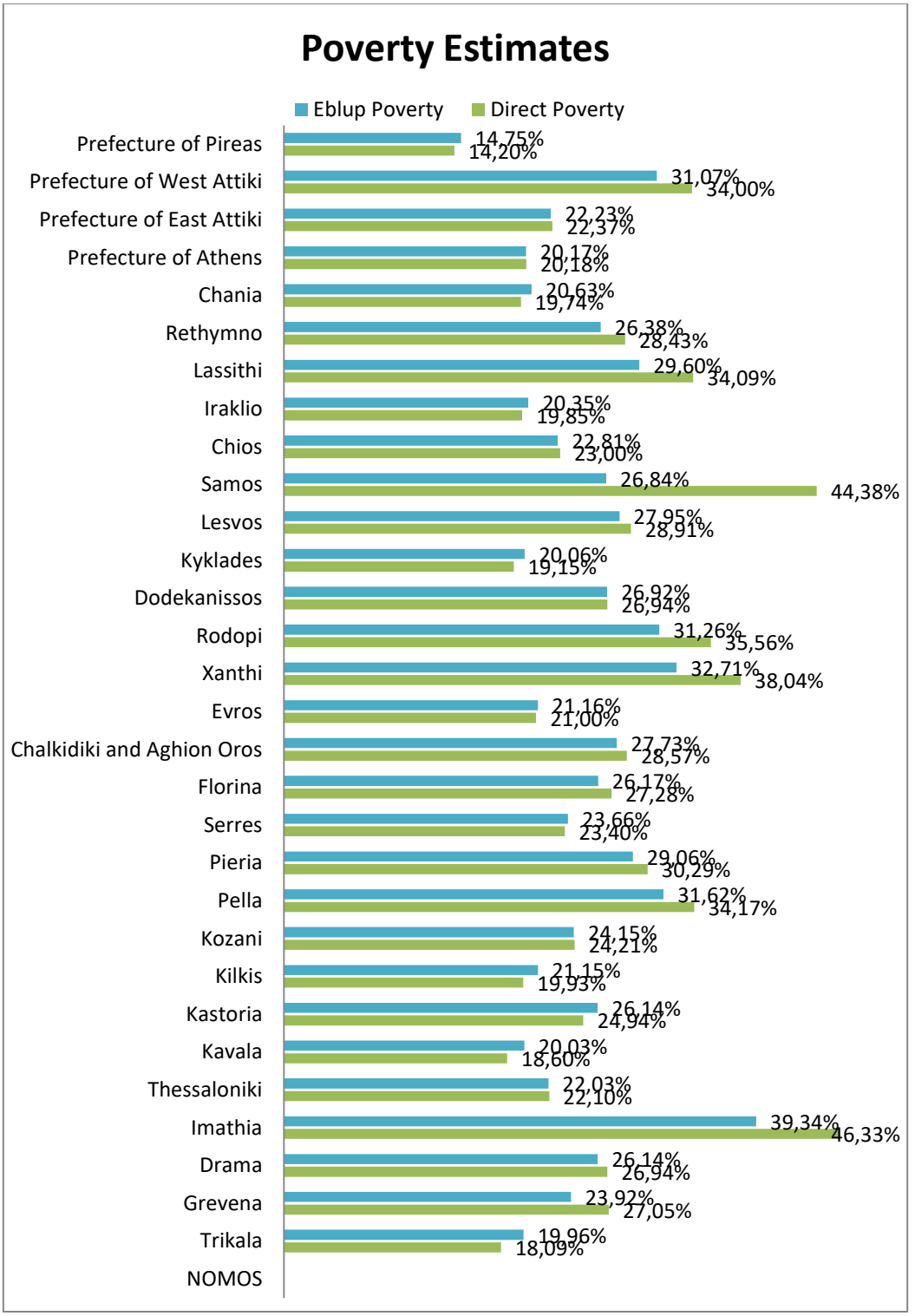

Figure 1: Poverty Estimates (First part)

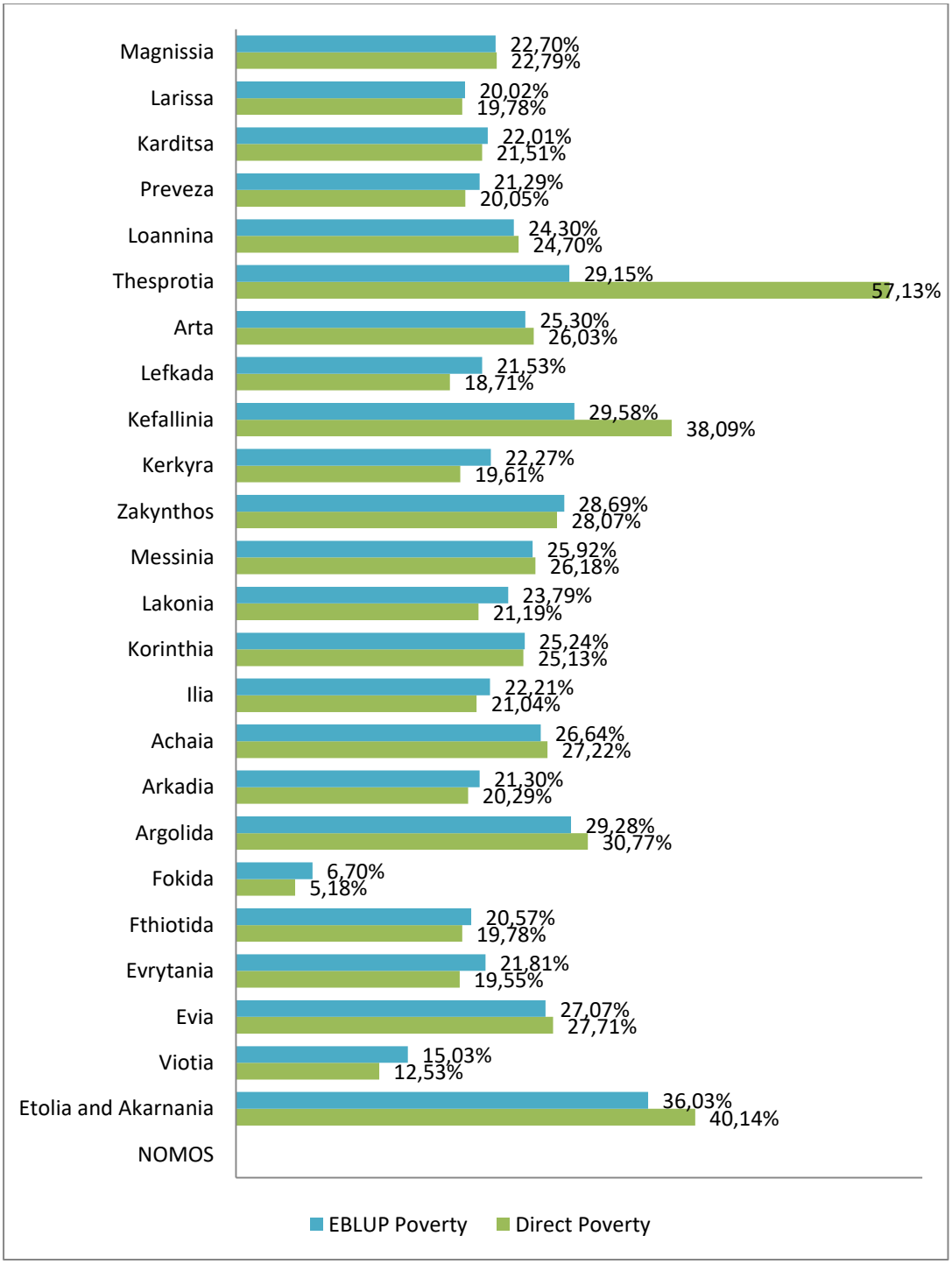

Figure 2: Poverty Estimates (Second part)

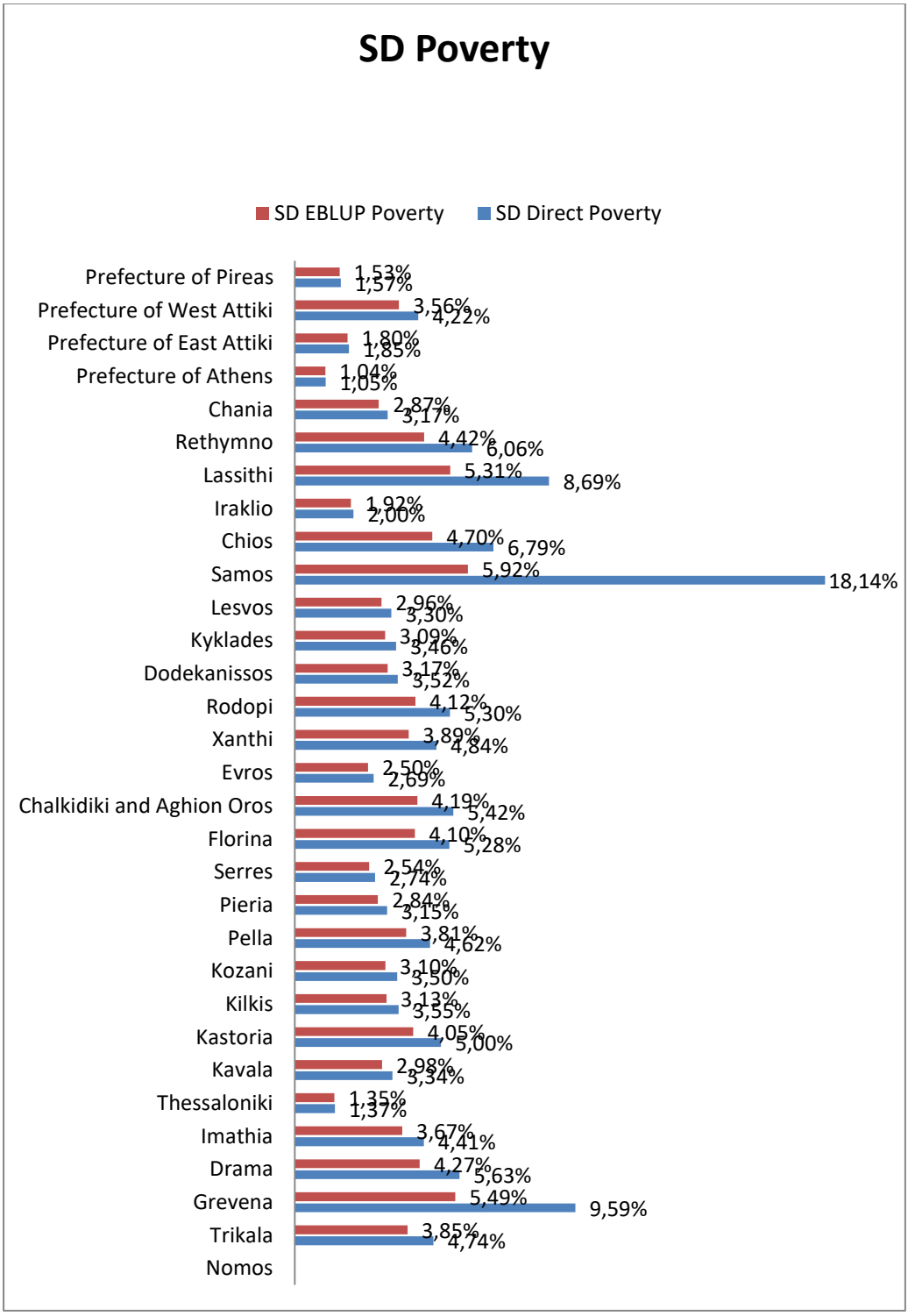

Figure 3: Poverty Standard Deviation (First part)

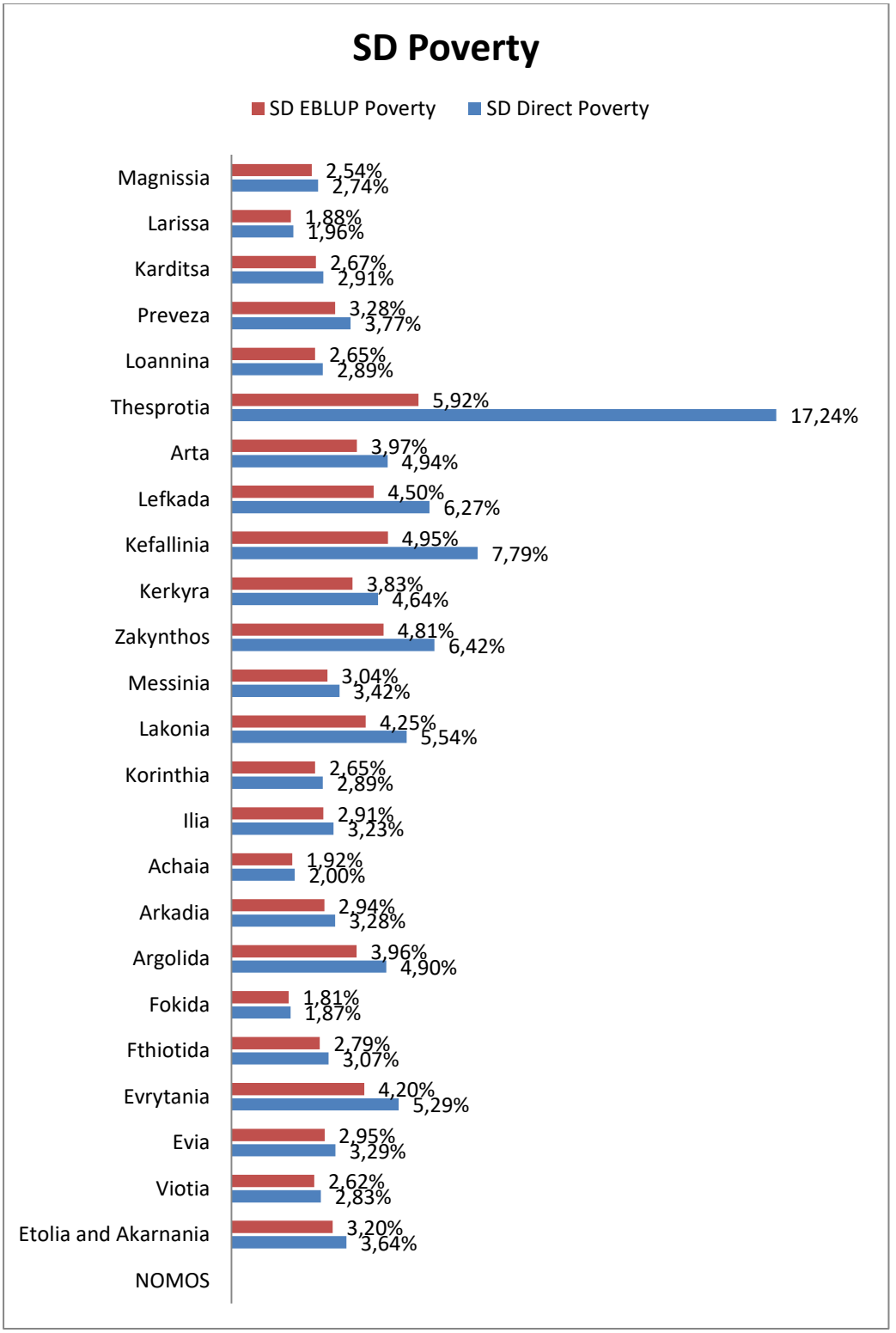

Figure 4: Poverty Standard Deviation (Second part)

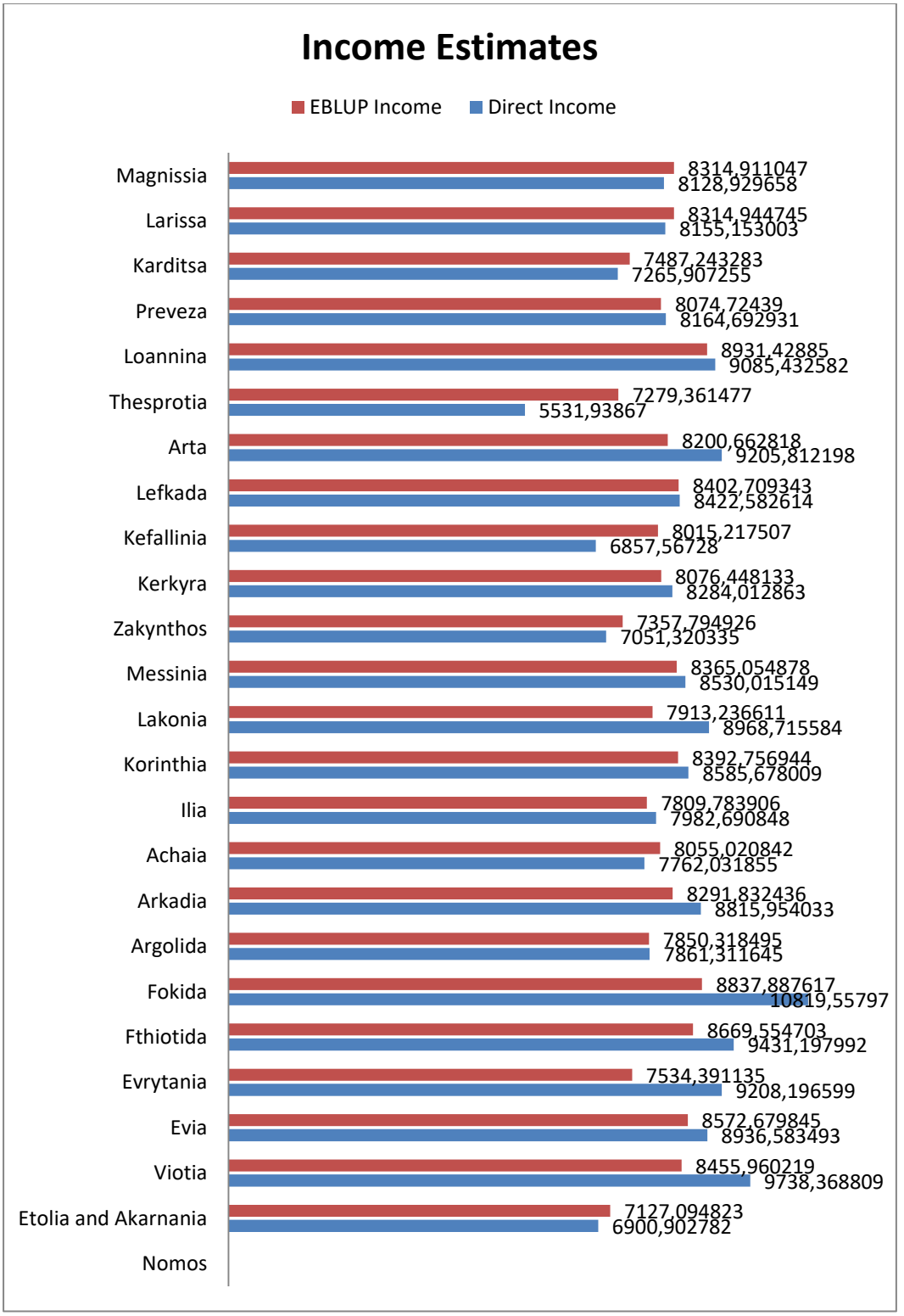

Figure 5: Income Estimates (First part)

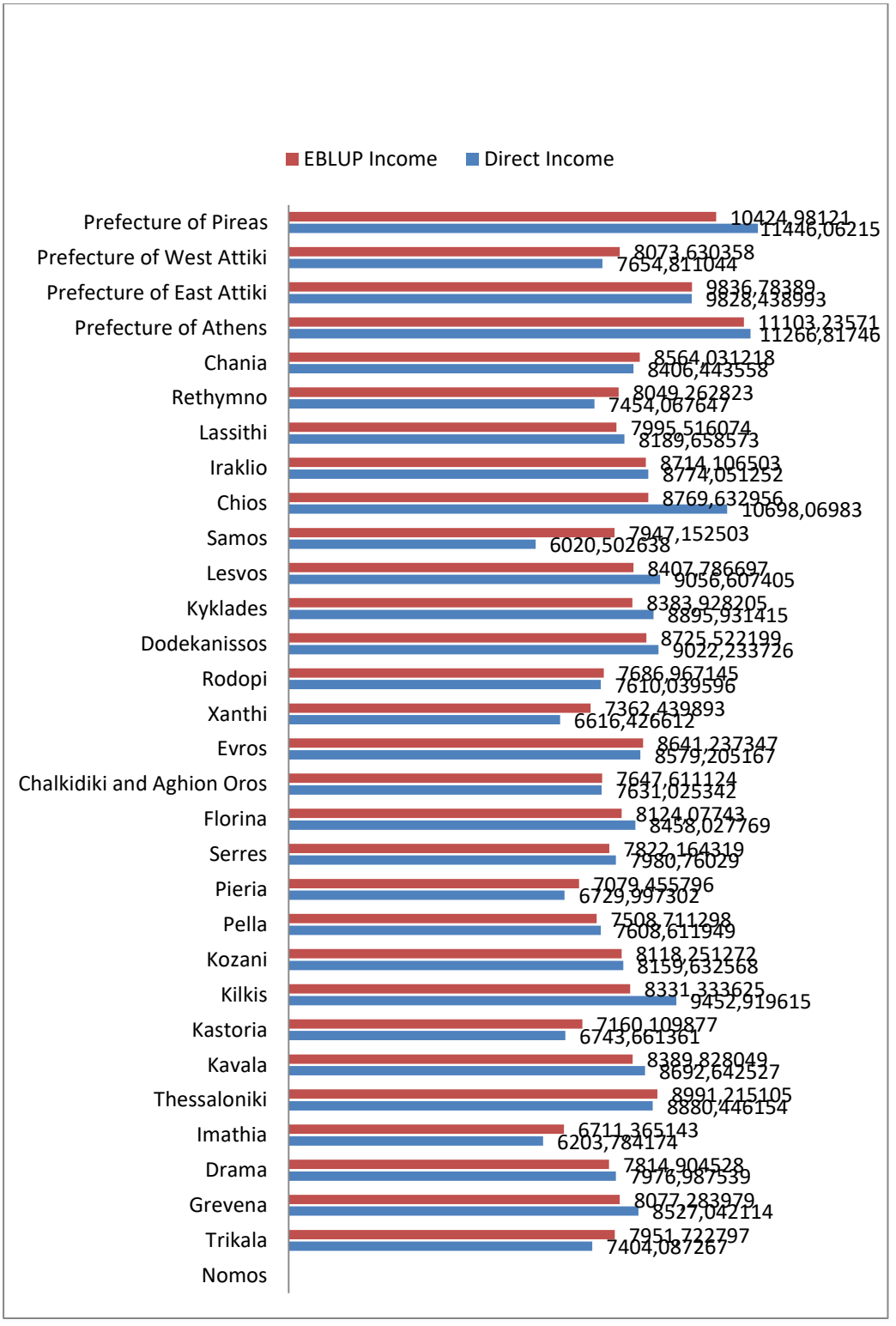

Figure 6: Income Estimates (Second part)

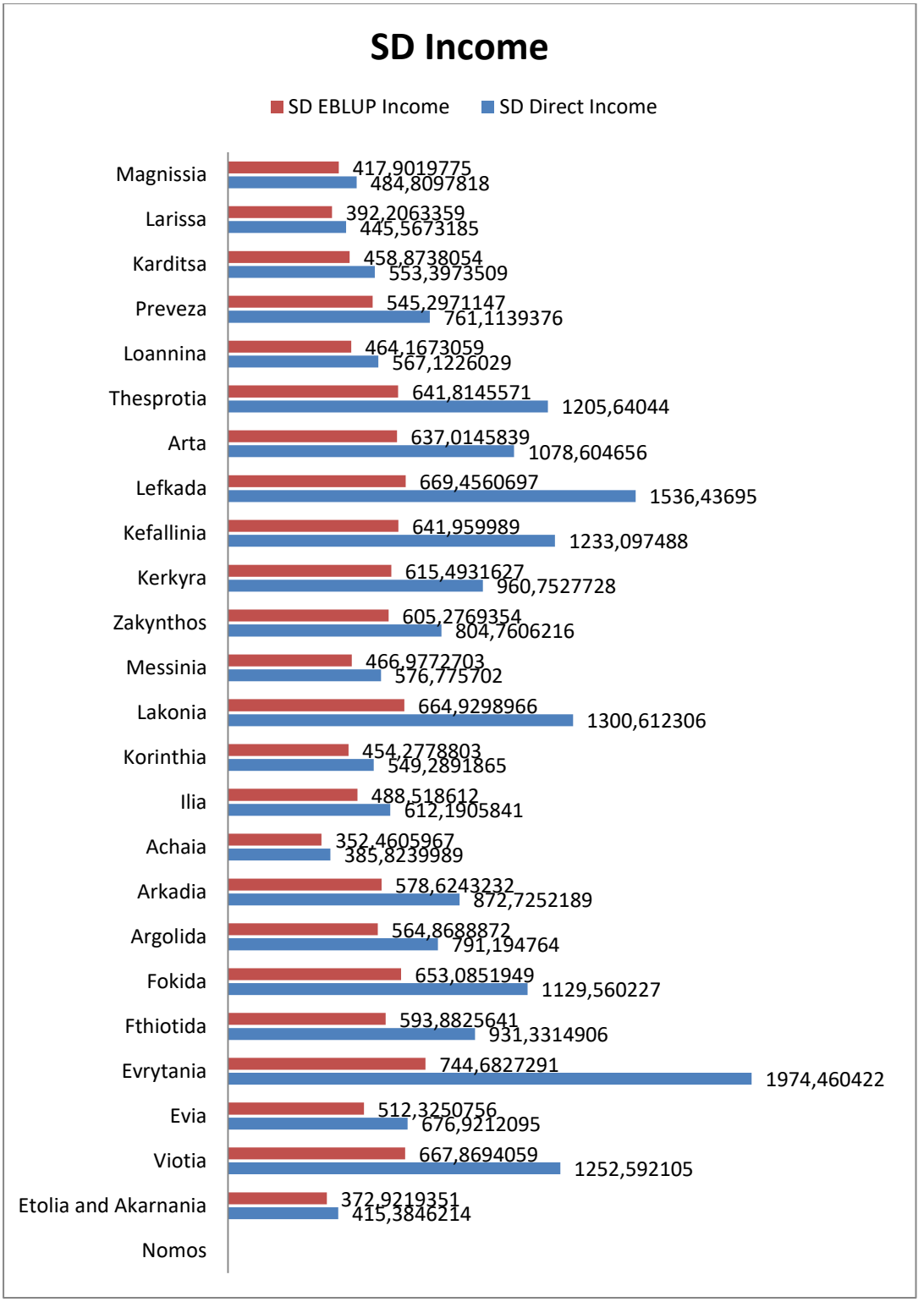

Figure 7: Income Standard Deviation (First part)

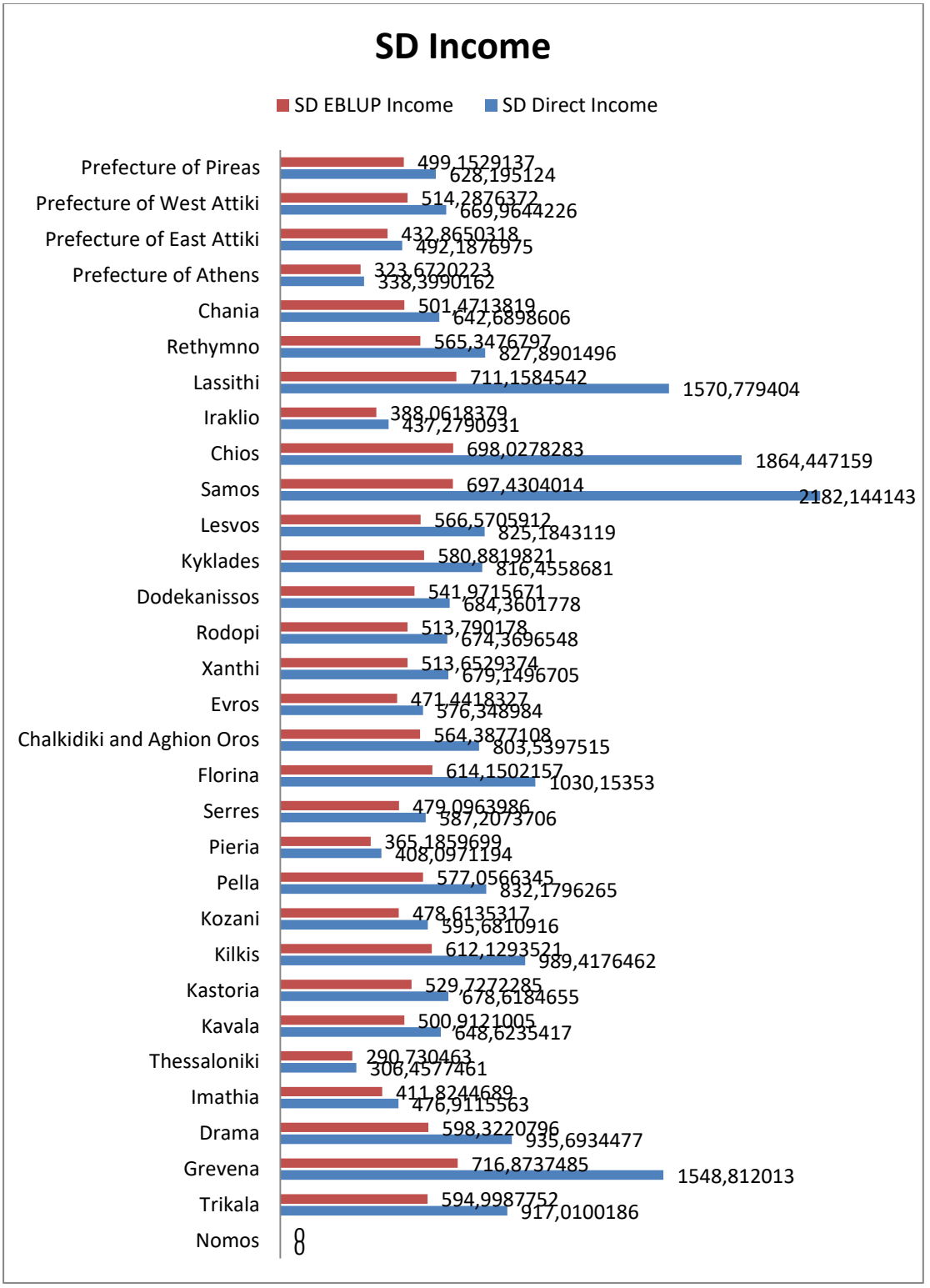

Figure 8: Income Standard Deviation (Second part)

References

[1] Alessandro Tarozzi and Angus Deaton (2009). "Using Census and Survey Data to Estimate Poverty and Inequality for Small Areas". Review of Economics and Statistics, 91(4), 773-792.
[2] Atkinson, A.B. (1991). "Measuring Poverty and Differences in Family Composition", Economica, 59, 1–16.
[3] Battese, G.E., Harter, R.M., and Fuller, W.A. (1988). An error component model for prediction of county crop areas using survey and satellite data. J. Amer. Statist. Assoc. 83, 28-36.
[4] Chandra, H., Sud, UC. and Gupta V.K. (2013). Small Area Estimation under Area Level Model Using R Software.
[5] Cochran, W. G. (1977),Sampling Techniques, Third Edition, New York: JohnWiley & Sons, Inc.
[6] DATTA, G. S. (2009). Model-Based Approach to Small Area Estimation. In: Handbook of Statistics 29B; Sample Surveys: Inference and Analysis. Eds. D. Pfeffermann and C.R. Rao. North Holland. pp. 251-288.
[7] Fay and Herriot, 1979 R.E. Fay, R.A. Herriot Estimates of income for small places: an application of James–Stein procedures to census data, J. Amer. Statist. Assoc., 74 (1979), pp. 269–277.
[8] Ghosh, M. and Rao, J.N.K. (1994). Small Area Estimation: An Appraisal.
[9] Hagenaars, A., K. de Vos and M.A. Zaidi (1994), Poverty Statistics in the Late 1980s: Research Based on Micro-data, Office for Official Publications of the European Communities. Luxembourg.
[10] Isabel Molina, J. N. K. Rao. 2010. Small area estimation of poverty indicators. Canadian Journal of Statistics 38:3, 369-385.
[11] Rao, J. N. K. (2003). Small Area Estimation. Wiley, Hoboken, New Jersey.
[12] Rao, J.N.K. (1999). Some Recent Advances in Model-Based Small Area Estimation. Survey Methodology. 25, 175-186.
[13] Ravallion, Martin (1994), Poverty Comparisons, Fundamentals of Pure and Applied Economics Volume 56, Chur, Switzerland: Harwood Academic Publishers.
[14] Robert Haveman & Barbara Wolfe, 1990. "The Economic Well-Being of the Disabled: 1962-84," Journal of Human Resources, University of Wisconsin Press, vol. 25(1), pages 32-54.
[15] Sen, A. (1979). Equality of What? The Tanner Lectures on Human Values.
[16] Sen, Amartya K. (1992), Inequality Re-examined, Oxford: Clarendon Press. Stanford University, May 22, 1979.
[17] Townsend, P. (1979) Poverty in the United Kingdom,Harmondsworth, Penguin Books Ltd.

APPENDIX

I. Estimating Poverty at NUTS3

Direct Estimator

	Domain	SampSize	Direct POVERTY	SD	CV
Etolia and Akarnania	300001	410	0,401382	0,036449	9,080926
Viotia	300003	143	0,125327	0,028251	22,5417
Evia	300004	341	0,277133	0,032941	11,88621
Evrytania	300005	71	0,195504	0,052933	27,07525
Fthiotida	300006	242	0,197842	0,030702	15,51837
Fokida	300007	128	0,051831	0,01875	36,17431
Argolida	300011	146	0,307691	0,048982	15,91937
Arkadia	300012	206	0,202858	0,032785	16,16178
Achaia	300013	794	0,272157	0,019959	7,333704
Ilia	300014	242	0,210363	0,032254	15,33247
Korinthia	300015	373	0,251297	0,028902	11,50095
Lakonia	300016	63	0,211938	0,055386	26,133
Messinia	300017	333	0,261845	0,03423	13,0725
Zakynthos	300021	106	0,280742	0,064222	22,87598
Kerkyra	300022	113	0,196137	0,046391	23,65214
Kefallinia	300023	69	0,380932	0,077898	20,44937
Lefkada	300024	40	0,187066	0,062689	33,51147
Arta	300031	126	0,260256	0,049419	18,98854
Thesprotia	300032	31	0,571288	0,17239	30,1756
Loannina	300033	417	0,246968	0,028888	11,69714
Preveza	300034	178	0,200535	0,037747	18,82332
Karditsa	300041	269	0,215052	0,029087	13,52577
Larissa	300042	563	0,197767	0,019615	9,918352
Magnissia	300043	430	0,227893	0,027369	12,00981
Trikala	300044	83	0,180892	0,04742	26,2144
Grevena	300051	37	0,270485	0,095891	35,45158
Drama	300052	104	0,269402	0,056295	20,89617
Imathia	300053	292	0,463332	0,044141	9,526753
Thessaloniki	300054	1520	0,221002	0,013733	6,213892
Kavala	300055	255	0,18601	0,033391	17,95107
Kastoria	300056	135	0,249433	0,050008	20,04867
Kilkis	300057	165	0,199317	0,035475	17,79833
Kozani	300058	268	0,242074	0,034979	14,44957

Pella	300059	199	0,341688	0,046218	13,52628
Pieria	300061	370	0,302909	0,03146	10,38598
Serres	300062	327	0,234048	0,027409	11,71104
Florina	300063	106	0,272819	0,05278	19,34606
Chalkidiki and Aghion Oros	300064	120	0,285653	0,054174	18,96499
Evros	300071	332	0,210024	0,026885	12,80086
Xanthi	300072	173	0,380403	0,04838	12,71815
Rodopi	300073	230	0,355588	0,052988	14,90136
Dodekanissos	300081	253	0,269381	0,035233	13,07939
Kyklades	300082	173	0,191467	0,034609	18,07564
Lesvos	300083	295	0,289127	0,033027	11,42304
Samos	300084	28	0,443847	0,181398	40,86957
Chios	300085	62	0,23003	0,067912	29,52323
Iraklio	300091	622	0,198484	0,019958	10,05538
Lassithi	300092	56	0,340881	0,08693	25,5016
Rethymno	300093	125	0,284306	0,06058	21,30792
Chania	300094	244	0,197354	0,031679	16,05168
Prefecture of Athens	300101	3873	0,201803	0,010519	5,212367
Prefecture of East Attiki	300102	871	0,223703	0,018537	8,286498
Prefecture of West Attiki	300103	226	0,340047	0,042185	12,40557
Prefecture of Pireas	300104	652	0,141999	0,015676	11,03985

Fay and Herriot Estimator

	NOMOS	DIRECT-POVERTY	SD	EBLUPFH-POVERTY	SD
Etolia and Akarnania	300001	40,14%	3,64%	36,03%	3,20%
Viotia	300003	12,53%	2,83%	15,03%	2,62%
Evia	300004	27,71%	3,29%	27,07%	2,95%
Evrytania	300005	19,55%	5,29%	21,81%	4,20%
Fthiotida	300006	19,78%	3,07%	20,57%	2,79%
Fokida	300007	5,18%	1,87%	6,70%	1,81%
Argolida	300011	30,77%	4,90%	29,28%	3,96%
Arkadia	300012	20,29%	3,28%	21,30%	2,94%
Achaia	300013	27,22%	2,00%	26,64%	1,92%
Ilia	300014	21,04%	3,23%	22,21%	2,91%
Korinthia	300015	25,13%	2,89%	25,24%	2,65%
Lakonia	300016	21,19%	5,54%	23,79%	4,25%
Messinia	300017	26,18%	3,42%	25,92%	3,04%

Zakynthos	300021	28,07%	6,42%	28,69%	4,81%
Kerkyra	300022	19,61%	4,64%	22,27%	3,83%
Kefallinia	300023	38,09%	7,79%	29,58%	4,95%
Lefkada	300024	18,71%	6,27%	21,53%	4,50%
Arta	300031	26,03%	4,94%	25,30%	3,97%
Thesprotia	300032	57,13%	17,24%	29,15%	5,92%
Loannina	300033	24,70%	2,89%	24,30%	2,65%
Preveza	300034	20,05%	3,77%	21,29%	3,28%
Karditsa	300041	21,51%	2,91%	22,01%	2,67%
Larissa	300042	19,78%	1,96%	20,02%	1,88%
Magnissia	300043	22,79%	2,74%	22,70%	2,54%
Trikala	300044	18,09%	4,74%	19,96%	3,85%
Grevena	300051	27,05%	9,59%	23,92%	5,49%
Drama	300052	26,94%	5,63%	26,14%	4,27%
Imathia	300053	46,33%	4,41%	39,34%	3,67%
Thessaloniki	300054	22,10%	1,37%	22,03%	1,35%
Kavala	300055	18,60%	3,34%	20,03%	2,98%
Kastoria	300056	24,94%	5,00%	26,14%	4,05%
Kilkis	300057	19,93%	3,55%	21,15%	3,13%
Kozani	300058	24,21%	3,50%	24,15%	3,10%
Pella	300059	34,17%	4,62%	31,62%	3,81%
Pieria	300061	30,29%	3,15%	29,06%	2,84%
Serres	300062	23,40%	2,74%	23,66%	2,54%
Florina	300063	27,28%	5,28%	26,17%	4,10%
Chalkidiki and Aghion Oros	300064	28,57%	5,42%	27,73%	4,19%
Evros	300071	21,00%	2,69%	21,16%	2,50%
Xanthi	300072	38,04%	4,84%	32,71%	3,89%
Rodopi	300073	35,56%	5,30%	31,26%	4,12%
Dodekanissos	300081	26,94%	3,52%	26,92%	3,17%
Kyklades	300082	19,15%	3,46%	20,06%	3,09%
Lesvos	300083	28,91%	3,30%	27,95%	2,96%
Samos	300084	44,38%	18,14%	26,84%	5,92%
Chios	300085	23,00%	6,79%	22,81%	4,70%
Iraklio	300091	19,85%	2,00%	20,35%	1,92%
Lassithi	300092	34,09%	8,69%	29,60%	5,31%
Rethymno	300093	28,43%	6,06%	26,38%	4,42%
Chania	300094	19,74%	3,17%	20,63%	2,87%
Prefecture of Athens	300101	20,18%	1,05%	20,17%	1,04%
Prefecture of East Attiki	300102	22,37%	1,85%	22,23%	1,80%

Prefecture of West Attiki	300103	34,00%	4,22%	31,07%	3,56%
Prefecture of Pireas	300104	14,20%	1,57%	14,75%	1,53%

	Province	SampleSize	DIR POVERTY	SYNTHETIC POVERTY	COMPOSITE POVERTY
Etolia and Akarnania	300001	410	40,1382	19,9915	33,4226
Viotia	300003	143	12,53272	20,58073	15,21538
Evia	300004	341	27,71333	21,10085	25,50917
Evrytania	300005	71	19,55044	20,17901	19,75996
Fthiotida	300006	242	19,78421	21,22147	20,2633
Fokida	300007	128	5,183109	21,57386	10,64672
Argolida	300011	146	30,76907	21,1233	27,55383
Arkadia	300012	206	20,28579	21,22919	20,60026
Achaia	300013	794	27,21571	22,28021	25,57055
Ilia	300014	242	21,03634	19,86309	20,64526
Korinthia	300015	373	25,12969	21,55146	23,93695
Lakonia	300016	63	21,19384	20,78007	21,05592
Messinia	300017	333	26,18446	21,23268	24,53387
Zakynthos	300021	106	28,07419	20,67783	25,60873
Kerkyra	300022	113	19,61375	21,32784	20,18511
Kefallinia	300023	69	38,09322	21,51048	32,56571
Lefkada	300024	40	18,70662	21,19893	19,53739
Arta	300031	126	26,02561	20,19943	24,08356
Thesprotia	300032	31	57,12881	20,23308	44,82976
Loannina	300033	417	24,69683	22,17439	23,85602
Preveza	300034	178	20,05354	20,61642	20,24117
Karditsa	300041	269	21,50516	19,93131	20,98054
Larissa	300042	563	19,77668	21,22384	20,25907
Magnissia	300043	430	22,78926	21,9722	22,51691
Trikala	300044	83	18,08918	20,3716	18,84997
Grevena	300051	37	27,04845	20,06818	24,72168
Drama	300052	104	26,94022	20,79767	24,89269
Imathia	300053	292	46,33321	20,35841	37,67494
Thessaloniki	300054	1520	22,10018	23,19271	22,46436
Kavala	300055	255	18,601	21,35243	19,51814
Kastoria	300056	135	24,9433	21,39023	23,75893
Kilkis	300057	165	19,9317	20,26451	20,04264
Kozani	300058	268	24,2074	21,29236	23,23572
Pella	300059	199	34,16877	20,13661	29,49134
Pieria	300061	370	30,29085	20,62862	27,07011

Serres	300062	327	23,4048	20,22389	22,34449
Florina	300063	106	27,28189	20,74172	25,10186
Chalkidiki and Aghion Oros	300064	120	28,56532	20,856	25,99552
Evros	300071	332	21,00244	20,74062	20,91516
Xanthi	300072	173	38,04035	19,41216	31,83101
Rodopi	300073	230	35,55884	19,62396	30,24718
Dodekanissos	300081	253	26,93811	21,36927	25,08183
Kyklades	300082	173	19,1467	21,25422	19,8492
Lesvos	300083	295	28,91271	20,98466	26,27003
Samos	300084	28	44,38466	22,1704	36,97998
Chios	300085	62	23,00296	22,67375	22,89323
Iraklio	300091	622	19,8484	21,33559	20,34413
Lassithi	300092	56	34,08811	21,44589	29,87414
Rethymno	300093	125	28,43058	21,19678	26,01929
Chania	300094	244	19,73537	22,05502	20,50859
Prefecture of Athens	300101	3873	20,18033	24,74542	21,70202
Prefecture of East Attiki	300102	871	22,37029	23,03939	22,59332
Prefecture of West Attiki	300103	226	34,00473	20,15446	29,38799
Prefecture of Pireas	300104	652	14,19992	22,77935	17,05973

II. Estimating Income at NUTS3

Direct Estimator

Domain	SampSize	Direct INCOME	SD	CV
300001	410	6900,903	415,3846	6,019279
300003	143	9738,369	1252,592	12,86244
300004	341	8936,583	676,9212	7,57472
300005	71	9208,197	1974,46	21,44242
300006	242	9431,198	931,3315	9,875007
300007	128	10819,56	1129,56	10,43998
300011	146	7861,312	791,1948	10,06441
300012	206	8815,954	872,7252	9,899385
300013	794	7762,032	385,824	4,970657
300014	242	7982,691	612,1906	7,668975
300015	373	8585,678	549,2892	6,397738
300016	63	8968,716	1300,612	14,50166
300017	333	8530,015	576,7757	6,76172
300021	106	7051,32	804,7606	11,41291
300022	113	8284,013	960,7528	11,59767
300023	69	6857,567	1233,097	17,98156
300024	40	8422,583	1536,437	18,24187
300031	126	9205,812	1078,605	11,71656
300032	31	5531,939	1205,64	21,79418
300033	417	9085,433	567,1226	6,242109
300034	178	8164,693	761,1139	9,322015
300041	269	7265,907	553,3974	7,616356
300042	563	8155,153	445,5673	5,463629
300043	430	8128,93	484,8098	5,964005
300044	83	7404,087	917,01	12,38519
300051	37	8527,042	1548,812	18,16353
300052	104	7976,988	935,6934	11,72991
300053	292	6203,784	476,9116	7,68743
300054	1520	8880,446	306,4577	3,450927
300055	255	8692,643	648,6235	7,461753
300056	135	6743,661	678,6185	10,06306
300057	165	9452,92	989,4176	10,46679
300058	268	8159,633	595,6811	7,300342
300059	199	7608,612	832,1796	10,93734
300061	370	6729,997	408,0971	6,063853

300062	327	7980,76	587,2074	7,357787
300063	106	8458,028	1030,154	12,1796
300064	120	7631,025	803,5398	10,52991
300071	332	8579,205	576,349	6,717976
300072	173	6616,427	679,1497	10,2646
300073	230	7610,04	674,3697	8,861579
300081	253	9022,234	684,3602	7,585263
300082	173	8895,931	816,4559	9,177857
300083	295	9056,607	825,1843	9,111406
300084	28	6020,503	2182,144	36,24522
300085	62	10698,07	1864,447	17,42788
300091	622	8774,051	437,2791	4,983776
300092	56	8189,659	1570,779	19,18004
300093	125	7454,068	827,8901	11,10656
300094	244	8406,444	642,6899	7,645205
300101	3873	11266,82	338,399	3,003501
300102	871	9828,439	492,1877	5,007791
300103	226	7654,811	669,9644	8,752201
300104	652	11446,06	628,1951	5,488308

Fay and Herriot estimator

	NOMOS	DIRECT INCOME	SD	EBLUP INCOME	SD
Etolia and Akarnania	300001	6900,903	415,3846	7127,095	372,9219
Viotia	300003	9738,369	1252,592	8455,96	667,8694
Evia	300004	8936,583	676,9212	8572,68	512,3251
Evrytania	300005	9208,197	1974,46	7534,391	744,6827
Fthiotida	300006	9431,198	931,3315	8669,555	593,8826
Fokida	300007	10819,56	1129,56	8837,888	653,0852
Argolida	300011	7861,312	791,1948	7850,318	564,8689
Arkadia	300012	8815,954	872,7252	8291,832	578,6243
Achaia	300013	7762,032	385,824	8055,021	352,4606
Ilia	300014	7982,691	612,1906	7809,784	488,5186
Korinthia	300015	8585,678	549,2892	8392,757	454,2779
Lakonia	300016	8968,716	1300,612	7913,237	664,9299
Messinia	300017	8530,015	576,7757	8365,055	466,9773
Zakynthos	300021	7051,32	804,7606	7357,795	605,2769
Kerkyra	300022	8284,013	960,7528	8076,448	615,4932
Kefallinia	300023	6857,567	1233,097	8015,218	641,96

Lefkada	300024	8422,583	1536,437	8402,709	669,4561
Arta	300031	9205,812	1078,605	8200,663	637,0146
Thesprotia	300032	5531,939	1205,64	7279,361	641,8146
Loannina	300033	9085,433	567,1226	8931,429	464,1673
Preveza	300034	8164,693	761,1139	8074,724	545,2971
Karditsa	300041	7265,907	553,3974	7487,243	458,8738
Larissa	300042	8155,153	445,5673	8314,945	392,2063
Magnissia	300043	8128,93	484,8098	8314,911	417,902
Trikala	300044	7404,087	917,01	7951,723	594,9988
Grevena	300051	8527,042	1548,812	8077,284	716,8737
Drama	300052	7976,988	935,6934	7814,905	598,3221
Imathia	300053	6203,784	476,9116	6711,365	411,8245
Thessaloniki	300054	8880,446	306,4577	8991,215	290,7305
Kavala	300055	8692,643	648,6235	8389,828	500,9121
Kastoria	300056	6743,661	678,6185	7160,11	529,7272
Kilkis	300057	9452,92	989,4176	8331,334	612,1294
Kozani	300058	8159,633	595,6811	8118,251	478,6135
Pella	300059	7608,612	832,1796	7508,711	577,0566
Pieria	300061	6729,997	408,0971	7079,456	365,186
Serres	300062	7980,76	587,2074	7822,164	479,0964
Florina	300063	8458,028	1030,154	8124,077	614,1502
Chalkidiki and Aghion Oros	300064	7631,025	803,5398	7647,611	564,3877
Evros	300071	8579,205	576,349	8641,237	471,4418
Xanthi	300072	6616,427	679,1497	7362,44	513,6529
Rodopi	300073	7610,04	674,3697	7686,967	513,7902
Dodekanissos	300081	9022,234	684,3602	8725,522	541,9716
Kyklades	300082	8895,931	816,4559	8383,928	580,882
Lesvos	300083	9056,607	825,1843	8407,787	566,5706
Samos	300084	6020,503	2182,144	7947,153	697,4304
Chios	300085	10698,07	1864,447	8769,633	698,0278
Iraklio	300091	8774,051	437,2791	8714,107	388,0618
Lassithi	300092	8189,659	1570,779	7995,516	711,1585
Rethymno	300093	7454,068	827,8901	8049,263	565,3477
Chania	300094	8406,444	642,6899	8564,031	501,4714
Prefecture of Athens	300101	11266,82	338,399	11103,24	323,672
Prefecture of East Attiki	300102	9828,439	492,1877	9836,784	432,865
Prefecture of West Attiki	300103	7654,811	669,9644	8073,63	514,2876
Prefecture of Pireas	300104	11446,06	628,1951	10424,98	499,1529