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Croatia
Small-Area Estimation of Consumption-Based Poverty (Poverty Maps)

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Contents

Croatia: Poverty Mapping

Background

1. As an EU member state, Croatia has taken part in the Europe 2020 strategy and accordingly aims to reduce the number of persons living at risk of poverty or social exclusion. Achieving that goal depends on developing the right policies and programs and targeting them effectively, which requires detailed knowledge on the disparities in living standards within the country. Croatia is interested in designing policies and programs to reduce regional disparities within its national borders. As one example, the Strategy on Combating Poverty and Social Exclusion in Croatia (2014-2020) specifically cites taking a regional approach as part of its strategy to reduce poverty and social exclusion.

2. The Strategy for Combating Poverty and Social Exclusion in the Republic of Croatia 2014-2020[1] recognizes groups of population that remain vulnerable to poverty, social exclusion, different forms of material deprivation and consequently discrimination. These are: older persons, single households, one-parent families, families with more than two children, children without adequate parental care, persons with lower education attainment, persons with disabilities, Croatian war veterans and victims of war and members of their families, returnees and displaced persons and ethnic minorities (mainly Roma and Serbs).

3. Poverty in Croatia also has a territorial dimension. The highest geographical concentration of factors influencing the share of people at risk of poverty can be found in small towns and settlements in the east and the southeast of the country mainly along the borderline with Bosnia and Herzegovina (BiH) and Serbia that are also the areas mostly affected by the Homeland War in 1990s, as well as in rural areas.

4. The Ministry of Regional Development and European Union Funds (MRDEUF), Ministry of Social Policy and Youth (MSPY), Central Bureau of Statistics (CBS) and other government bodies aim to gain a more detailed and complete evidence on the geographical distribution of poverty and social exclusion and the resources available to combat poverty and social exclusion. This evidence base will then be used by the Government of Croatia to inform the design of policies and the allocation of budgetary as well as EU funded resources to promote inclusion and regional development, in particular of the deprived areas.

5. To help achieve this objective, one of the activities under the MRDEUF project with the World Bank under the Reimbursable Advisory Services on *Spatial Analysis of Poverty and Social Exclusion* is the development of a detailed geo-referenced database that provides information about the geographic distribution of social exclusion using a range of indicators of well-being, deprivation as well as the distribution of social services and infrastructure, which may help inform policies to reduce poverty and social exclusion.

Objective

6. In December 2014, The European Commission adopted the Operational Programme (OP) for Competitiveness and Cohesion 2014-2020 for Croatia.[2] This OP has nine thematic objectives with investment priorities, specific objectives and their financial allocations. Under the Investment Priority 9.b, the specific objective is to develop sustainable physical, social and economic regeneration of pilot

[1]Source: www.vlada.hr

[2]Operational Programme Competitiveness and Cohesion 2014 - 2020,www.strukturnifondovi.hr

deprived areas and develop a model for future sustainable integrated investment and area based regeneration for deprived small and medium sized towns with more than 10,000 to 50,000 inhabitants[3]. In the selected pilot areas, particular attention will be given to the needs of marginalized and vulnerable communities living therein. Integrated regeneration will be embedded as Croatia's future approach to sustainable regeneration linked to poverty reduction and social inclusion.

7. Development of integrated area-based approach to regeneration is planned through three mechanisms: (i) Five pilots independently implemented and formally evaluated; (ii) Complementary activities at the central level: the generation of enhanced small-area data and associated poverty mapping and the establishment of appropriate management and control systems and; and (iii) Institutional capacity-raising of key stakeholders and staff. Interventions undertaken in the Pilot areas are planned to be rolled out to other areas.

8. European Regional Development Fund (ERDF) and European Social Fund (ESF), are sources of financing for OP Competitiveness and Cohesion 2014-20, which has allocated approximately EUR100 million for providing support to physical, economic and social regeneration of deprived communities in urban and rural areas and promoting equal opportunities and active participation, as well as improving employability. Under the ERDF, these would encompass construction or rehabilitation of infrastructure, rehabilitation or construction of housing units as well as providing support to enterprises. Additionally, under the ESF, the output indicators supported would aim to increase the participation of long-term unemployed, as well as Roma and other national minority participants in the active labor market programs. The program specific result indicator (ERDF specific objective 9b1)[4]is a decrease of the population loss in the five Pilot areas affected by social, economic and territorial regeneration program (as measured by the vital index).

9. There is a limited availability of small-area data to support the identification of targeted territories and integrated policy and program development for deprived urban and rural communities. MRDEUF has proposed a development of an index on multiple deprivation (IMD) as well as poverty maps for subnational levels which would help in identification of areas and their deprived households, as well as in designing of policies for social inclusion and development.

10. For Croatia, the World Bank produced the relative poverty maps under the EC/WB Trust Fund[5]. This activity is linked with an initiative of the European Commission (EC) and the World Bank to estimate poverty for small areas (NUTS 3 or lower) in all EU Member States. The EC/WB activity uses the EU at risk of poverty (AROP) definition, namely comparing equivalized disposable income after social transfers to poverty lines set at 60 percent of national median value of that income measure. The methodological note and the results of the income-based poverty maps are presented in Annex 1.

[3] Small towns are considered those below 35,000 inhabitants by Croatian legislation. According to Census 2011 data, in Croatia there are 50 small towns with 10,000 to 35,000 inhabitants and 8 medium sized towns with more than 35,000 to 50,000 inhabitants. Only 9 towns can be considered as large towns including 4 cities with more than 100,000 inhabitants. Also there are 60 very small towns with population below 10,000.

[4] Indicator is measured by the vital index of population to indicate the growth potential of a population as the number of live births per 100 of deaths. It is calculated on the basis of three year average of 5 pilot areas. The base line value for 5 pilot areas is an average of 69.7 and target value is set on 72.5.

[5]Administration Agreement "Part II Europe 2020 Programmatic Single – Donor Trust Fund (TF072367)" – This Agreement covers several countries (Bulgaria, Czech Republic, Lithuania, Hungary and Latvia) including Croatia. The Trust Fund is established to enable the EC and the WB to continue to collaborate and exchange experience and expertise on a number of themes under all three pillars of the Europe 2020 Agenda – of smart, sustainable and inclusive growth.

11. Further, as part of the same MRDEUF efforts to strengthen the local capacity, the MRDEUF requested that the statistical capacity is developed for constructing small-area poverty maps in the future. The World Bank has delivered five-module training to the CBS and MSPY staff on constructing small-area poverty maps on September 19-20, 2016. The training materials are shown in Annex 2.

Methodology for Consumption Poverty Maps Construction

12. Consumption-based poverty, although not as prevalent in European policy circles as the income based at-risk-of-poverty (AROP), is an important measure of the living standards of the Croatian population. Furthermore, consumption is exempt from many of the pitfalls that afflict income measures. First of all, many respondents may be reluctant to report their incomes. Additionally, under the presence of undeclared incomes and employment, consumption is a better measure of welfare since respondents have fewer incentives to underreport.[6]

13. In Croatia, the main source for consumption based statistics is the Household Budget Survey (HBS). The HBS is representative at the national level. The Household budget survey conducted by the Croatian Bureau of Statistics is collected over 12 months, corresponding to the calendar year. The survey collects data on the socio-economic characteristics of Croatian private households, along with household consumption, and income.

14. The 2011 Census for Croatia is collected by the Croatian Bureau of Statistics.[7] The census includes key information on demographics of the household, education, labor force status, economic activity, occupation type, and labor status in the main job. Along with these characteristics, the census also has information on the type of dwelling, the status of the dwelling, number of rooms in the dwelling, living area of the dwelling, and the construction year.

15. Using a poverty threshold that is defined in a similar manner as that of the EU-SILC[8], but based on consumption (23,918.62 HRK), the headcount poverty rate for the Republic of Croatia in 2011 was 16.3 percent (Figure 1). Estimated poverty rates in 2011 using the HBS for the three statistical areas were: 10.3 percent for the Northwest, 28.1 percent for the Central and Eastern area, and 12.6 percent for the Adriatic area. Using the NUTS-2 classification of the Republic of Croatia the estimated poverty rate for Continental Croatia for 2011 was 18.0 percent, while for Adriatic Croatia it was 12.6 percent. However, unlike the EU-SILC,[9] the HBS is not representative below the national level. This implies that although the HBS can be used to obtain rates at lower geographical levels, it is not recommended to do so because the sample size is not sufficient for precise estimates.

[6]Baric and Williams (2013) mention that the undeclared economy in Croatia is second only to Bulgaria in the EU, and that it is highly concentrated in certain sectors. Among these sectors, agriculture is one of the main ones.

[7] Access to the Census data was provided in the Croatian Bureau of Statistics' safe room.

[8]European Union Statistics on Income and Living Conditions Survey (EU-SILC). The AROP is defined as 60 percent of the median household equivalized income.

[9]European Union Statistics on Income and Living Conditions Survey (EU-SILC).

Figure 1.HBS 2011 poverty map at level of representativeness (Republic of Croatia)

Source: CBS

16. Geographical levels at which direct estimates lack the required precision are referred to as small areas (Guadarrama et al., 2015). Small area estimation (SAE) methods are those which seek to overcome the lack of precision. SAE methods achieve this by incorporating data sources with larger coverage, such as Census data, in order to obtain welfare measures at levels at which the HBS is not representative. In practice household survey data provides a reasonable measure of welfare but does not have the necessary coverage, while census data has the necessary coverage its welfare measures are not as detailed as those of household surveys.

17. The Census of Population, Households and Dwellings of 2011 for the Republic of Croatia when combined with the 2011 HBS facilitates the estimation of welfare for all households in the Census. This makes obtaining poverty rates for areas below those of the HBS's representativeness possible. The small area estimation methodology used to obtain the estimates follows the one proposed by Elbers, Lanjouw, and Lanjouw (ELL) (2003).[10] This methodology is perhaps the most widely used for small area estimation, and has been applied to develop poverty maps in numerous countries across the globe. Through the application of the analysis, predicted poverty rates at the NUTS2,[11]NUTS3,[12] as well as at the LAU2[13] levels are obtained.

[10] The methodology is implemented via the World Bank developed software PovMap (accessed on August 1, 2016)
[11] Presently there are only 2 spatial units under NUTS 2 level: Adriatic and Continental Croatia. At the time of the 2011 HBS there were three statistical areas in Croatia: Northwest, Central and Eastern, and Adriatic Croatia.
[12] There are currently 21 spatial units at NUTS3 level (Counties).
[13] There are 556 Local Administrative Units at level 2 (LAU2). In Croatia LAU2 level corresponds to municipalities and cities. Additionally, for the purpose of the analysis the city of Zagreb is subdivided into 19 districts.

Box 1. Mathematical appendix

The discussion below presents themethodology detailed byELL(2002and2003). Interested reader should refer to these documents for the full discussion.

From theestimationofequation 1weobtain the residuals $\hat{u}_{ch}$,and bydefining$\hat{u}_{c.}$asthe weightedaverage of$\hat{u}_{ch}$foraspecificcluster wecanobtain $\hat{e}_{ch}$:

$$\hat{u}_{ch} = \hat{u}_{c.} + (\hat{u}_{ch} - \hat{u}_{c.}) = \hat{\eta}_c + \hat{e}_{ch}$$

The variance of the location effect (η_c) is given by:

$$\hat{\sigma}_{\eta}^2 = \max\left(\frac{\sum_c w_c(u_{c.} - u_{..})^2 - \sum_c w_c(1-w_c)\hat{\tau}_c^2}{\sum_c w_c(1-w_c)}; 0\right)$$

where $u_{..} = \sum_C w_c u_c$.(where the w_c represents the cluster's weight) and:

$$\hat{\tau}_c^2 = \frac{\sum_h (e_{ch} - e_{c.})^2}{n_c(n_c - 1)}$$

where $e_{c.} = \frac{\sum_h e_{ch}}{n_c}$ (n_c is the number of households in the cluster). The parametric from of heteroscedasticity is presented as:

$$\sigma_{e_{ch}}^2 = \left[\frac{A\exp^{Z_{hh}'\alpha} + B}{1 + \exp^{Z_{hh}'\alpha}}\right]$$

This is simplified by setting $B = 0$ and $A = 1.05\max(e_{ch}^2)$, which leads to the simpler form that can be estimated via regular OLS:

$$\ln\left[\frac{e_{ch}^2}{A - e_{ch}^2}\right] = Z_{ch}'\alpha + r_{ch}$$

By defining $B = \exp(Z_{ch}\alpha)$ and using the delta method the household specific variance for e_{ch} is equal to:

$$\hat{\sigma}_{e,ch}^2 \approx \left[\frac{AB}{1+B}\right] + \frac{1}{2}\widehat{Var}(r)\left[\frac{AB(1-B)}{(1+B)^3}\right]$$

The use of $\boldsymbol{\sigma_{\eta}^2}$ and $\boldsymbol{\sigma_{\varepsilon}^2}$ allows us to get the variance covariance matrix used for the OLS estimates:

$$\hat{\Omega}_c = \begin{pmatrix} \hat{\sigma}_{\eta}^2 + \hat{\sigma}_{e,ch}^2 & \hat{\sigma}_{\eta}^2 & \cdots & \hat{\sigma}_{\eta}^2 \\ \hat{\sigma}_{\eta}^2 & \hat{\sigma}_{\eta}^2 + \hat{\sigma}_{e,ch}^2 & \cdots & \hat{\sigma}_{\eta}^2 \\ \vdots & \vdots & \ddots & \vdots \\ \hat{\sigma}_{\eta}^2 & \hat{\sigma}_{\eta}^2 & \cdots & \hat{\sigma}_{\eta}^2 + \hat{\sigma}_{e,ch}^2 \end{pmatrix}$$

$$\Rightarrow \hat{\Omega} = \begin{pmatrix} \hat{\Omega}_1 & \mathbf{0} & \cdots & \mathbf{0} \\ \mathbf{0} & \hat{\Omega}_2 & \cdots & \mathbf{0} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{0} & \mathbf{0} & \cdots & \hat{\Omega}_C \end{pmatrix}$$

The estimates for the GLS detailed by ELL (2003) are:

$$\hat{\beta}_{GLS} = (X'W\Omega^{-1}X)^{-1}X'W\Omega^{-1}Y$$

and

$$Var\left(\hat{\beta}_{GLS}\right) = (X'W\Omega^{-1}X)^{-1}(X'W\Omega^{-1}WX)(X'W\Omega^{-1}X)^{-1}$$

In response to criticisms of the methodology an extensive revision was made to the methods, including the addition of empirical best estimation, by Van der Weide (2014). For a detailed discussion on the EB approach and the other changes implemented readers are guided towards Van der Weide (2014).
The revisions include an improved GLS estimator:

$$\hat{\beta}_{GLS} = \left(X'\hat{\Omega}^{-1}X\right)^{-1}X'\hat{\Omega}^{-1}Y$$

and a new variance covariance matrix:

$$\text{var}\left[\hat{\beta}_{GLS}\right] = \left(X'\hat{\Omega}^{-1}X\right)^{-1}\left(X'\hat{\Omega}^{-1}\hat{\text{V}}\hat{\Omega}^{-1}X\right)\left(X'\hat{\Omega}^{-1}X\right)^{-1}$$

These are the estimates used for the second stage of the estimation (detailed in the methods section).

Modelling Approach

18. The ELL method is conducted in 2 stages. The first stage consists in fitting a welfare model using the 2011 HBS data via ordinary least squares (OLS), and correcting for various shortcomings of this approach to arrive at generalized least squares estimates (GLS). It should be noted that the variables included in the welfare model of the 2011 HBS must be restricted to those variables that are also found in the 2011 Census. This allows us to generate the welfare distribution for any sub-population in the 2011 Census, conditional on the sub-population's observed characteristics (ELL, 2002). After correcting for shortcomings, the estimated regression parameters, standard errors, and variance components from the HBS provide the necessary inputs for the second phase of the analysis. The second stage of the poverty mapping exercise consists in using the estimated parameters from the first stage, and applying these to the 2011 Census data in order to predict welfare at the household level. Finally, the predicted welfare measure is converted into a poverty indicator which is then aggregated in order to predict poverty measures at the desired level of aggregation(NUTS2, NUTS3, or LAU2).

Box 2. Poverty Mapping Software

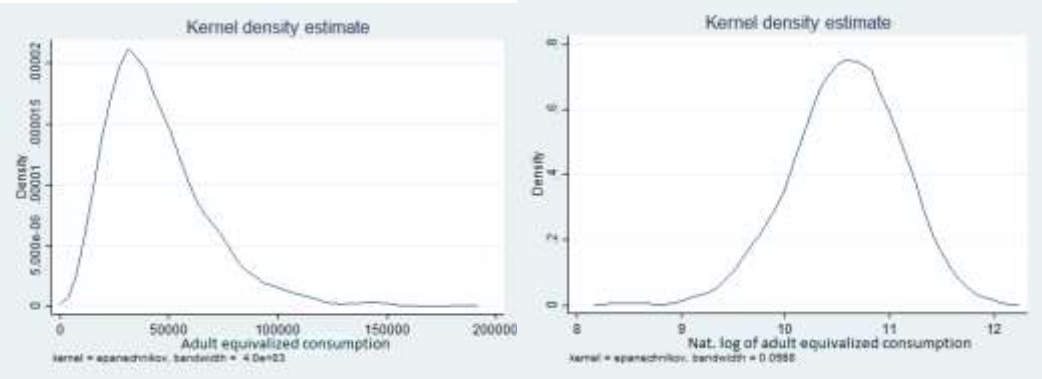
One of the most common small area methods used for poverty mapping was proposed by Elbers, Lanjouw, and Lanjouw (2003). This methodology has been widely adopted by the World Bank and has been applied in numerous poverty maps conducted by the institution. In its efforts to make the implementation of the ELL methodology as simple as possible, the World Bank created a software package that could be easily used by anyone. The software, PovMap (Zhao, 2006), has proven to be an invaluable resource for the World Bank as well as for many statistical agencies seeking to create their own poverty maps. The software is freely available and has a graphical user interface which simplifies its use.

Poverty map results produced in this document have all made use of the PovMap software. The PovMap software can be downloaded, free of charge, at http://iresearch.worldbank.org/PovMap/PovMap2/.

19. Before fitting the welfare model, a comparison between the observable household characteristics from the HBS and the census is necessary. The purpose of the comparison is to ensure that variables have similar distributions, and that these have similar definitions across data sources. Because the exercise consists in predicting welfare in the census data using parameters obtained from HBS observed characteristics, it is imperative that the observed characteristics across surveys are comparable.

20. The next step in the ELL methodology consists in estimating a log adult-equivalized household consumption model which is estimated via *OLS.* The transformation to log consumption is done because consumption tends not to be symmetrically distributed (Figure 2),so taking the logarithm of consumption is done to make the data more symmetrical.

Figure 2.Adult-equivalized consumption and natural logarithm of adult equivalized consumption



21. The household consumption model is defined as:

$$ln\, y_{ch} = X'_{ch}\,\beta + u_{ch} \qquad (1)$$

where $\boldsymbol{y_{ch}}$ is the adult-equivalized consumption of household *h* in locality[14] *c*, $\boldsymbol{X_{ch}}$ are the household and locality characteristics, and $\boldsymbol{u_{ch}}$ is the residual. In the specified model the outcomes of households within a same municipality are usually not independent from one another and the following specification is used to account for this:

$$u_{ch} = \eta_c + \varepsilon_{ch} \qquad (2)$$

where $\boldsymbol{\eta}$ and $\boldsymbol{\varepsilon}$ are assumed to have mean zero and to be independent from each other. Households in the same municipality share the same $\boldsymbol{\eta}$, and it is expected that $\boldsymbol{E[u_{ch}^2] = \sigma_\eta^2 + \sigma_\varepsilon^2}$, the larger the variance of $\boldsymbol{\eta}$ the less precise the estimates of welfare will be when the spatial correlation of the residuals is ignored.

22. The estimation of $\boldsymbol{\sigma_\eta^2}$ and $\boldsymbol{\sigma_\varepsilon^2}$ can be done using the ELL (2003) decomposition method, or utilizing Henderson's method III (Henderson, 1953). In the case where the variance of the household specific error, $\boldsymbol{\sigma_\varepsilon^2}$, is assumed to vary across households a parametric form of heteroscedasticity is assumed and modeled as:

$$ln\left[\frac{\hat{\varepsilon}_{ch}^2}{A - \hat{\varepsilon}_{ch}^2}\right] = Z'_{ch}\alpha + r_{ch} \qquad (3)$$

where $\boldsymbol{A = 1.05\max(\hat{\varepsilon}_{ch}^2)}$. [15] Making use of these estimated parameters it is possible to obtain an estimate for $\sigma^2_{\varepsilon,ch}$. The existence of the variance parameters require a re-estimation of the welfare model given that the *OLS* assumptions are unlikely to hold. The variance covariance matrix utilized for the GLS estimates is household cluster specific, and where the interrelatedness between households within a cluster is also allowed.[16]

[14]Localities in the Croatian case are LAU2 (municipalities, cities) and districts of Zagreb.

[15]For a more detailed description, interested readers should refer to Elbers, Lanjouw and Lanjouw (2003) as well as Van der Weide (2014).

[16]For details on the structure of the variance covariance matrix refer to Van der Weide (2014).

23. Once GLS estimates are obtained it is possible to move on to the second stage of the exercise. Small area estimates of welfare (and standard errors) are obtained by applying the parameter and error estimates from the survey to the census data. In order to do this we must simulate welfare. Since poverty indices are based on non-linear forms of log adult-equivalized consumption, simulations are ideally suited for obtaining estimates of these measures. A value of log adult-equivalized consumption $\tilde{y}_{ch}$ for each household is simulated making use of the β, η, and the ε parameters from the first stage, where each simulation r is equal to:

$$\tilde{y}^{r}{}_{ch} = exp(X'_{ch}\tilde{\beta}^{r} + \tilde{\eta}_{c}^{r} + \tilde{\varepsilon}_{ch}^{r}) \qquad (4)$$

24. For each simulation a set of $\tilde{\beta}^{r}$ are drawn from bootstrapped versions of the HBS sample.[17] On the other hand for the location and household disturbance terms we obtain their variance parameters, $\left(\sigma_{\varepsilon,ch}^{2}\right)^{r}$ and $\left(\sigma_{\eta}^{2}\right)^{r}$,from the r^{th} bootstrapped version of the HBS. $\tilde{\eta}_{c}^{r}$ and $\tilde{\varepsilon}_{ch}^{r}$ are thus drawn from a normal distribution assuming mean zero and variances equal to $\left(\sigma_{\varepsilon,ch}^{2}\right)^{r}$ and $\left(\sigma_{\eta}^{2}\right)^{r}$, respectively. If we define $f(\tilde{y}^{r}{}_{ch})$ as a function that maps the estimated consumption measure to a poverty measure such as the at-risk of poverty headcount-rate (FGT 0) then the estimated mean poverty rate for a locality c is equal to:

$$\boldsymbol{FGT0_{c}} = \frac{\mathbf{1}}{\boldsymbol{R}}\sum_{\boldsymbol{r=1}}^{\boldsymbol{R}}\sum_{\boldsymbol{h=1}}^{\boldsymbol{H}} f\left(\tilde{y}^{r}{}_{ch}\right)w_{ch} \qquad (5)$$

where $\boldsymbol{w_{ch}}$ is the population expansion factor (number of household members in household $\boldsymbol{h}$ divided by the total population of the Republic of Croatia in the census).

25. An alternative for the estimation of $\boldsymbol{\eta}$ is to use the information from the survey, Empirical-Best estimation (EB). The best estimate available to us of $\boldsymbol{\eta}$, for a particular locality is that which comes from the survey ($\mathbf{ln}\,\boldsymbol{y_{ch}} - \boldsymbol{X'_{ch}}\,\boldsymbol{\beta} = \boldsymbol{u_{ch}}$). Therefore making use of this information the estimates for the municipalities, cities and districts of Zagreb that are present in the HBS are tighter since more information is included into their drawing. For all localities that are not present in the survey, the use of EB makes no difference, since for these localities there is no additional information and thus their data generation process is assumed to be normal with mean zero and variance $\left(\sigma_{\eta}^{2}\right)^{r}$.

26. Within the estimated measures there are three main sources of error: model error, error due to the disturbances, and error due to computation. These three sources of error, as noted by ELL (2003) are not correlated. The error in the welfare measure within a locality due to the disturbance arises as a result of unobserved components of consumption within a particular location. The smaller the population of the targeted municipality, city or district of Zagreb, the larger this error will be, and thus limits the degree of disaggregation possible. The exact point at which this becomes unacceptable depends on how well the model fits the data.

27. The model error depends entirely on the properties of the first stage estimators and it is independent from the population size of the municipality, city or district of Zagreb. Within a given location the magnitude of this error component will also depend on how different the $\boldsymbol{X}$ variables are in that location from those of the HBS data.

28. Finally, computation error is due to the method used for computation. This error can be made as small as needed depending on the computational resources at hand. Because often simulations are a finite number, the larger the number of simulations, the smaller the error due to computation will be.

[17] An alternative option is to draw the η from a multivariate normal distribution $\beta \sim N(\beta_{gls}, vcov(\beta_{gls}))$.

Data Description

29. The poverty mapping analysis requires two sources of data. In this instance the Croatian Household Budget Survey (HBS) for 2011, and the Census of Population, Households and Dwellings of 2011 for the Republic of Croatia. The HBS for 2011 is an ideal household survey for the SAE analysis because it corresponds to the 2011 calendar year, and thus are for the same time period as the census.

30. Small area estimation is done under the assumption that the same underlying population is being captured by the survey and the census. This last assumption will be valid if both datasets are from the same time frame. Nevertheless, the inclusion or the use of datasets that are from differing time periods, or if the survey is not representative of the population, will break down this assumption. This last remark is more salient in instances where there have been considerable shocks in between the collection of the survey and the collection of the census (Bedi et al. 2007).

31. **HBS 2011 – Croatia.** The Household Budget Survey conducted by the Croatian Bureau of Statistics is collected over 12 months, corresponding to the calendar year. The survey collects data on the socio-economic characteristics of Croatian private households, along with household consumption, and income. The data collected is used to update the weights of the national consumer price index and the measurement of household consumption, as well as for the needs of national accounts.

32. The 2011 HBS uses the 2001 Census as a sampling frame. The survey is performed as a two-stage sample, where 10 dwellings were selected from 416 segments (groups of neighboring enumeration areas). Consequently, 4,160 dwellings occupied by households were selected. From these households, 2,335 were successfully interviewed.

33. The Republic of Croatia does not currently have any poverty measures based on consumption. As a consequence, the same methodology applied to the EU-SILC is used but in this instance on consumption. More explicitly, the at-risk-of-poverty threshold is defined as 60 percent of the median household equivalized consumption.

34. **Census of Population, Households and Dwellings 2011, Population by Sex and Age.** The 2011 Census for Croatia was provided by the Croatian Bureau of Statistics.[18] The census includes key information on demographics of the household, education, labor force status, economic activity, occupation type, and labor status in the main job. Along with these characteristics, the census also has information on the type of dwelling, the status of the dwelling, number of rooms in the dwelling, living area of the dwelling, and the construction year.

35. **Variable Comparison between HBS and Census.** Because small area methods require an estimation of a welfare model in the first stage which will then be applied to the census it is necessary that the choice of correlates matches across surveys. This not only requires variables to be similar, but requires that these have similar distributions. The selection of candidate variable is done in a two stage process:

(i) Comparison of questionnaires between the 2011 HBS and the 2011 Census. The comparison yields a first set of candidate variables for the estimation. Candidate variables must come from similar questions.

(ii) Comparison of the distribution of the candidate variables across datasets. The comparison is undertaken at the level of the Republic of Croatia and at the statistical region level. The comparability of the variables across surveys ensures that the welfare model from the 2011 HBS

[18] Access to the Census, as well as the EU-SILC was provided in the Croatian Bureaus of Statistics' safe room with excluded direct identifiers for individuals.

can be applied to the 2011 Census such that reliable consumption estimates for the population can be derived.

36. Making use of all variables that meet the above criteria, several welfare models are estimated via *OLS*. Unlike most of econometrics, the purpose of the model is not to find any causal relationships but to find a model that best reflects the consumption level of a household. The adult-equivalized consumption of a household is assumed to be a function of the number of household members present in the household, and the age composition of the household members. Additionally, consumption is assumed to be a function of the marital status of individuals aged 15 and over, their level of education, their occupation, and the sector in which they are employed in. In addition, and while likely not a determinant of consumption, we include a variable which reports the area of the dwelling in square meters. This variable is expected to have reasonable correlation with welfare. Finally, the use of location means of household level variables are included.[19] This is done in order to explain the variation in welfare due to location as much as possible and thus improve precision of the welfare estimates.

37. Table 1 contains a listing of the candidate variables for use in the model. Given that the sampling frame for the 2011 HBS is the previous Census (Census of Population, Households and Dwellings 2001) it is not unexpected that the first moments of the HBS and Census are somewhat different. On population demographics, the differences between the two are slight, but on labor characteristics differences do arise. For example, the HBS contains a larger share individuals living in households where one of the household members is involved in agriculture, mining or fishing.

Table 1. Population weighted candidate variable means in 2011 Census and 2011 HBS

Variable name	Census 2011	HBS-2011
Male	0.483	0.466
Age [0,5)	0.050	0.036
Age [5,15)	0.103	0.093
Age [15,30)	0.186	0.190
Age [30,65)	0.486	0.480
Age [65+)	0.174	0.202
Household size (Share of individuals living in household type)		
Households size of 1	0.088	0.084
Households size of 2	0.183	0.222
Households size of 3	0.202	0.180
Households size of 4	0.248	0.223
Households size of 5	0.143	0.156
Households size of 6	0.076	0.077
Household size of 7 or more	0.060	0.057
Occupation (15+) (Share of individuals in households with at least one member)		
Manager	0.051	0.034
Professionals	0.150	0.110
Technicians	0.182	0.137

[19] This is recommended by ELL (2003) as one method to decrease the variance of η since it includes more information at the cluster level. Variable means at the municipal level are included and come from the Census. These are the share of households in the municipality, city or districts of Zagreb that were built between 1900 and 1940, share of household that have air conditioning, and the proportion of households that have never moved out of their municipality, city or district of Zagreb.

Clerical support	0.129	0.130
Service and sales	0.223	0.194
Skilled agriculture	0.041	0.086
Craft and trade	0.153	0.170
Machine operators	0.112	0.100
Elementary occupations	0.091	0.078
Labor status, age 15-64 (Share of individuals in households with at least one member)		
Employed	0.742	0.706
Retired	0.497	0.541
Student	0.220	0.250
Disabled	0.038	0.032
Other	0.749	0.762
Industry, age 15-64 (Share of individuals in households with at least one member)		
Agriculture, mining, and fishing	0.065	0.123
Manufacturing	0.189	0.158
Services and Sales	0.630	0.593
Share of members with education in HH (age 15-64)		
Primary education	0.086	0.092
Lower secondary	0.199	0.230
Upper secondary	0.547	0.557
Tertiary education	0.169	0.121
Dwelling characteristics		
Square meters	87.542	91.485

38. The final choice of variables for the model is not only dependent upon how well the variables match up, but on how well they explain the variation of consumption. As the numbers on Table 1 illustrate, the two datasets match up reasonably well. The age groups, proportion of males, and household size are very close to one another, yet at the statistical area level the variables are less comparable with one another (Table 2). This is expected given that the 2011 HBS's level of representation is only national.

39. Given that the differences that arise are not significant (save for the primary sector) all of the variables are valid candidates for the welfare model to be estimated in the next stage. Variables that are highly correlated are not included simultaneously. Keeping this in mind the selected model is the one which maximizes the adjusted R-squared of the model, but at the same time conform to prior beliefs of how should the variable be related to consumption.

Table 2.Population weighted candidate variable means in Census and HBS at the Statistical Area levels

	Northwest		Central & Eastern		Adriatic	
Variable name	**Census**	**HBS-2011**	**Census**	**HBS-2011**	**Census**	**HBS-2011**
Male	0.4777	0.4730	0.4843	0.4698	0.4873	0.4552
Age [0,5)	0.0515	0.0384	0.0476	0.0367	0.0483	0.0321
Age [5,15)	0.1021	0.0811	0.1082	0.1023	0.0992	0.0971
Age [15,30)	0.1872	0.2079	0.1897	0.1804	0.1817	0.1770
Age [30,65)	0.4937	0.4772	0.4764	0.4852	0.4899	0.4794
Age [65+)	0.1655	0.1954	0.1782	0.1953	0.1810	0.2143

Household size (Share of individuals living in household type)						
Households size of 1	0.086	0.076	0.086	0.083	0.088	0.094
Households size of 2	0.175	0.198	0.181	0.234	0.195	0.239
Households size of 3	0.200	0.196	0.189	0.154	0.215	0.185
Households size of 4	0.243	0.227	0.237	0.226	0.260	0.217
Households size of 5	0.144	0.177	0.154	0.153	0.133	0.133
Households size of 6	0.083	0.070	0.085	0.091	0.061	0.074
Household size of 7 or more	0.070	0.056	0.067	0.057	0.047	0.059
Occupation (15+) (Share of individuals in households with at least one member)						
Manager	0.066	0.036	0.031	0.028	0.052	0.038
Professionals	0.188	0.134	0.107	0.063	0.145	0.124
Technicians	0.214	0.161	0.140	0.090	0.183	0.150
Clerical support	0.150	0.170	0.103	0.082	0.127	0.125
Service and sales	0.220	0.196	0.192	0.139	0.254	0.240
Skilled agriculture	0.035	0.085	0.064	0.138	0.025	0.042
Craft and trade	0.169	0.198	0.145	0.136	0.140	0.166
Machine operators	0.122	0.121	0.118	0.103	0.093	0.074
Elementary occs.	0.090	0.074	0.103	0.088	0.081	0.073
Labor status, age 15-64 (Share of individuals in households with at least one member)						
Employed	0.793	0.759	0.689	0.629	0.732	0.714
Retired	0.497	0.554	0.515	0.548	0.492	0.520
Student	0.223	0.270	0.220	0.236	0.221	0.240
Disabled	0.036	0.031	0.052	0.035	0.030	0.031
Other	0.727	0.755	0.794	0.782	0.745	0.752
Industry, age 15-64 (Share of individuals in households with at least one member)						
Agriculture, mining, and fishing	0.052	0.123	0.112	0.185	0.041	0.067
Manufacturing	0.225	0.207	0.191	0.156	0.147	0.104
Services and Sales	0.684	0.656	0.532	0.447	0.655	0.652
Share of members with education in HH (age 15-64)						
Primary education	0.075	0.065	0.107	0.123	0.081	0.094
Lower secondary	0.184	0.235	0.263	0.298	0.162	0.165
Upper secondary	0.536	0.559	0.521	0.516	0.578	0.591
Tertiary education	0.206	0.141	0.110	0.063	0.179	0.149
Dwelling characteristics						
Square meters	90.711	92.227	92.523	96.095	83.187	86.506

Model Results

40. The initial welfare model corresponding to equation (1) is presented in column 1 of Table 4**.** The adjusted R-Squared for the model is (0.60) reflecting that the chosen model explains the variation on adult-equivalized consumption well. In addition to the variables present in both the 2011 Census and 2011 HBS, variable means for municipalities are obtained from the Census and introduced to the model; these variables are introduced to improve precision by reducing the unexplained variation in adult-equivalized

consumption due to location. The same is done at the NUTS3 level. With the inclusion of these variables the ratio of the variance of $\boldsymbol{\eta}$ over the model's MSE is 0.097. Without the inclusion of the regional means, the variance of $\boldsymbol{\eta}$ over the model's MSE was considerably larger (greater than 0.16). The variance of the location effect is preferred to be small, this will result in more precise estimates once the parameters are applied to the Census when predicting consumption.

41. As noted earlier, it is likely that consumption levels within a location are highly correlated and as a consequence $\boldsymbol{E[u_{ch}u_{ci}|X] \neq 0}$. Additionally, error terms will likely have differing variances across observations ($\boldsymbol{E[u_{ch}^2|X] \neq \sigma^2}$). Due to these issues the model is re-estimated using Generalized Least Squares (GLS). The results for the GLS fitted model are presented in column 2 of Table 2.The alpha model (equation 3) corresponding to the GLS are presented in **Table 3**.

Table 3.Alpha Model

	Coeff.	Std Err.
HH dependency ratio	-0.2946722	0.18568
Age of oldest member	0.0104073**	0.004439
Constant	-4.937768***	0.24085
Adj. R2	0.0019	
Observations	2,229	

42. Adult-equivalized consumption is positively correlated to household size. The omitted group is households with 7 or more individuals. Furthermore, adult-equivalized consumption is negatively correlated to greater proportion of young children in the household, as opposed to individuals between 15 and 65. A higher proportion of elderly household members is also negatively related to consumption.

43. Education is also significantly related to consumption. The omitted group is the proportion of working age household members who have upper-secondary education. As expected, a higher share of more educated working age members is positively and significantly related to adult-equivalized consumption. Also correlated to consumption is the presence of employed individuals; additionally most of the labor variables included are significantly correlated to adult-equivalized consumption.

44. Location and location variable means are also correlated to adult-equivalized consumption. Consumption is negatively correlated to being located in the Central and Eastern statistical region of Croatia as opposed to being in the Adriatic. On the other hand residing in the Northwest statistical region is positively and significantly correlated to adult-equivalized consumption. The Continental NUTS-2 region is made up of the Northwest and the Central Eastern statistical regions. The opposite signs for the two statistical regions, present evidence of an existing difference within the Continental NUTS2 spatial unit.

Table 4.Weighted OLS & GLS estimates for Consumption model: 2011 HBS

	Coeff. WOLS	Coeff. GLS
1 member HH	0.657756***	0.6703497***
2 member HH	0.5682508***	0.5726704***
3 member HH	0.3872635***	0.392421***
4 member HH	0.3024405***	0.3145275***
5 member HH	0.0944874**	0.0993706**
6 member HH	0.0439142	0.0530178
Proportion of members 0-5	-1.314546***	-1.328288***
Proportion of members 5-15	-1.168229***	-1.155703***
Proportion of members 65+	-0.1095453***	-0.1087755***

Proportion with primary. educ	-0.3553012***	-0.3311279***
Proportion with lower sec. educ	-0.246802***	-0.2389933***
Proportion with tertiary educ.	0.2437605***	0.2219014***
Nat. log sq. meters	0.3114771***	0.3235437***
HH has employed individual	0.1730894***	0.1713931***
HH has retired individual	0.0361665**	0.0321034*
HH has an individual studying	0.0775421***	0.0768194***
HH has a disabled individual	-0.2269558***	-0.21946***
Share of members employed in primary sector	0.1149975*	0.1270248***
Mun. mean sq. meters	0.0016187	0.0016375
Mun. share age 0-5	-6.067059**	-6.509447**
Mun. share age 15-30	4.349534***	4.708873***
Mun. share age 65+	2.136054***	2.06719***
Mun. share of hh with OLF members	0.6910303	0.6229632
Mun. share of hh with members working	0.1825433	0.1071528
Mun. share of hh with retired members	-1.58782***	-1.494652***
Mun. share of hh with disabled members	-2.492525***	-2.621557***
Mun. share in the service sector	0.4156449**	0.4598882**
Mun. share hh with water	-0.1154702*	-0.1407213**
Mun. share hh 1940-1965	-0.2543315	-0.3400682
County share with primary education	0.9007497***	0.9031982***
County share of work in manufacturing	-1.005796***	-1.011724***
Northwestern	0.1277064***	0.139278***
Eastern & Central	-0.2086004***	-0.2050913***
_constant	8.105042***	8.082315***
Number of observations	2,329	2,329
Eta-ratio	0.0973	
Adjusted R-squared	0.5998	

*, **, *** significant at the 10, 5, 1 percent level respectively. All households which have inconsistent labor information are removed.

Croatia Poverty Mapping Results

45. The coefficients estimated in the previous section provide the necessary inputs in order to estimate the first part of equation 4 ($X'_{ch}\hat{\beta}$) by combining coefficients with the Census variables. The vectors of disturbances for households are unknown, and must be estimated. As mentioned before, the error component is decomposed using ELL's method, and the coefficients,$\boldsymbol{\beta}$, are obtained by bootstrapped samples of the 2011 HBS data.

46. The model chosen is the one where $\boldsymbol{\eta}$ and $\boldsymbol{\varepsilon}$ are drawn from a normal distribution, with their respective variance structures. Finally, empirical best methods are chosen since these incorporate more

information and are thus expected to provide a better fit. Additionally, empirical best incorporates different variance structures across locations which in many settings may be more believable.[20]

47. The clustering used for estimations is at the municipal, city and districts of Zagreb level, the resulting poverty map aggregated to the NUTS3 level is presented in Figure 3and the results for municipalities, cities, and the districts of Zagreb are presented in Figure 4. The resulting poverty rates obtained at the statistical region level compared to those of the poverty mapping exercise are presented in Table 5for the relative line. Results for poverty rates at LAU2 are presented in the Statistical Appendix Table 1.

Table 5.Poverty rates from HBS and from poverty mapping exercise

Statistical region	AROP HBS					
	HBS	95% CI		Predicted	95% CI	
Northwestern	**10.3%**	7.6%	13.7%	**11.1%**	9.5%	12.7%
Central & Eastern	**28.1%**	23.5%	33.3%	**30.5%**	28.4%	32.7%
Adriatic	**12.6%**	9.2%	17.0%	**12.6%**	11.0%	14.1%
Republic of Croatia	**16.3%**	14.1%	18.6%	**17.1%**	15.8%	18.5%

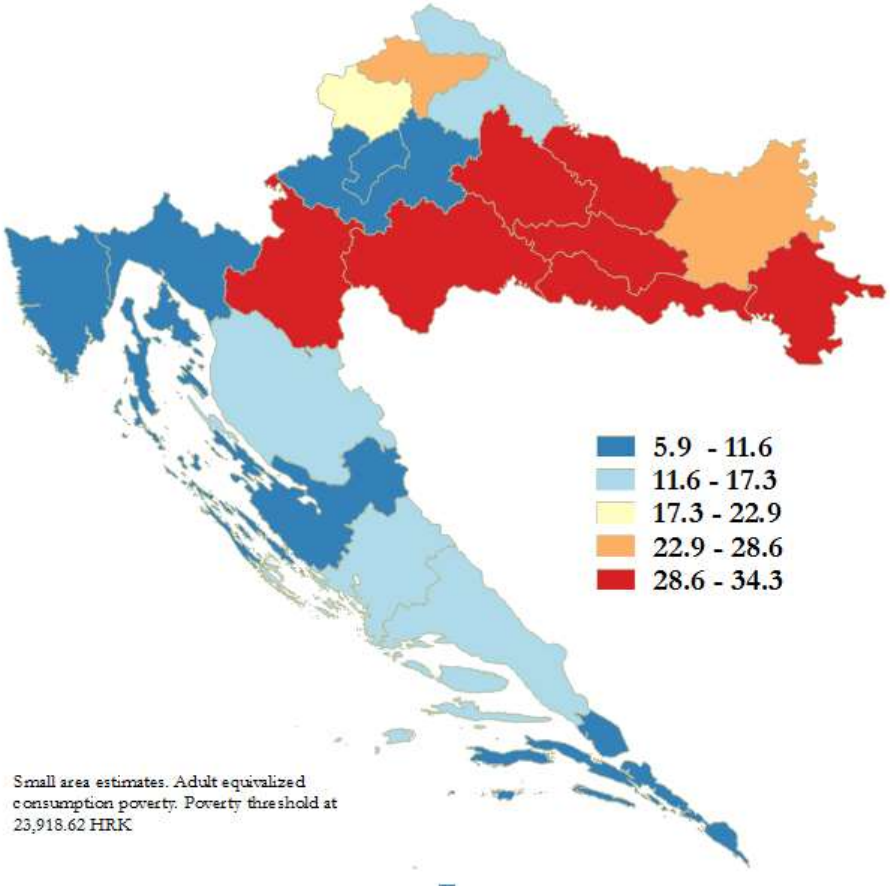
Note: Poverty threshold 23,918.62 HRK per adult equivalent

48. At the statistical area level, the direct estimates for poverty rates obtained from the HBS are not significantly different. However, once again, it is important to note that the 2011 HBS measures of poverty for statistical areas are not statistically representative. The same holds true for the NUTS2 spatial units, the 2011 HBS is not statistically representative below the national level. The direct estimate of poverty from the 2011 HBS for Continental Croatia is 18.0 percent, and for Adriatic Croatia it is 12.6 percent. The small area estimate of poverty for Continental Croatia is 19.4 percent, while for Adriatic Croatia it is 12.6 percent.

49. The Central and Eastern area has the highest levels of poverty, the poverty rate is significantly greater than that of the other two areas. The headcount poverty rate for the Central and Eastern area is more than double the level of the other two areas. Poverty ranges from 24.9 to 34.3 percent in the Central and Eastern statistical region. In the Northwest statistical region, poverty ranges between 5.9 (Grad Zagreb) to 23.7 (Varaždinska) percent. In the Adriatic the range is less wide from 9.1 for Primorsko-goranska to 16.9 for Splitsko-dalmatinska. Furthermore, the Adriatic region has the most counties with poverty rates under 15 percent.

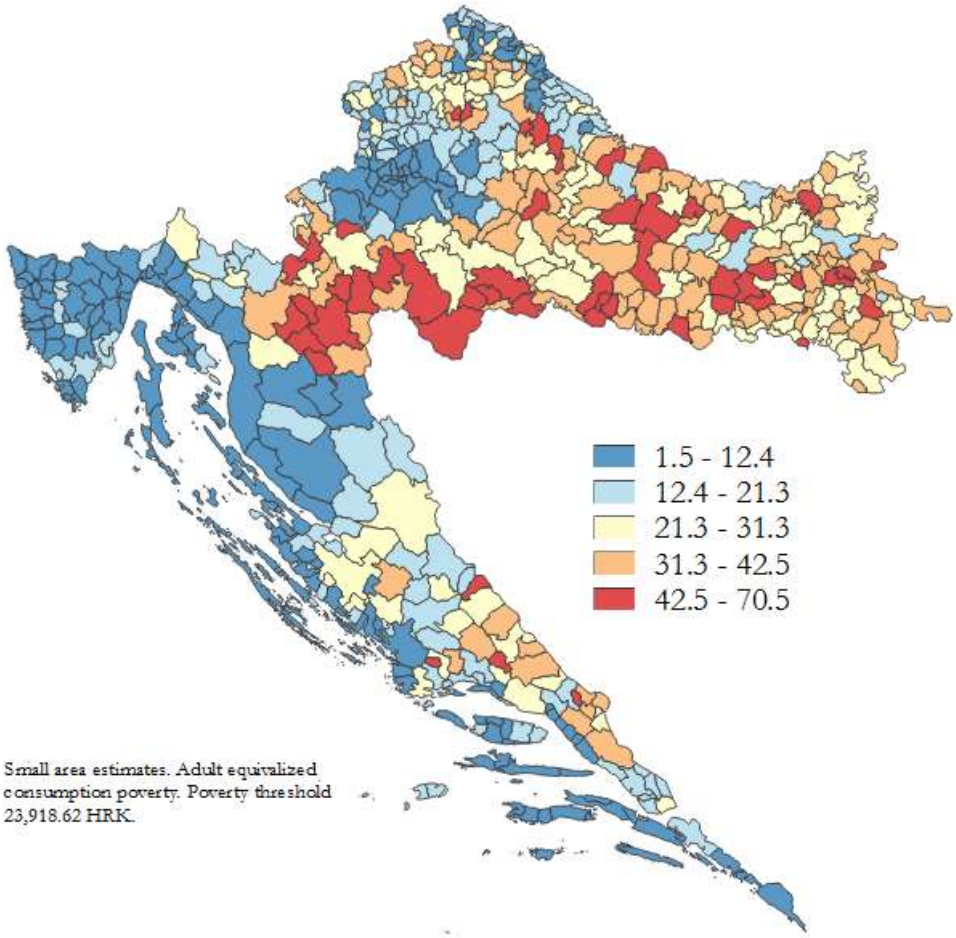
[20]This only applies to municipalities, cities and districts of Zagreb included in the 2011 HBS.

Figure 3.Poverty Map for Croatia (NUTS3 poverty headcount)



50. In Figure 4, which is at the municipal, city and districts of Zagreb level, it is possible to detect localities that have a somewhat higher poverty level than its surroundings. There are some localities with high poverty rates within the Northwest as well as in the Adriatic. In the Central and Eastern region, on the other hand, there are some regions that are better off than their neighbors. The results of the poverty map suggest an overall spatial clustering of poverty, this is further analyzed below, where basic analysis of the spatial association is undertaken.

Figure 4.Poverty Map for the Republic of Croatia (poverty headcount for municipalities, cities, and districts of Zagreb)



51. Although poverty rates may be low in certain counties, the concentration of the poor may not be the lowest in those counties. Figure 5 presents the density of the poor at the county level. One of the counties with the highest concentration of poor individuals are Osječko-baranjska; this is despite having the lowest poverty headcount in the Central and Eastern statistical area. The county with the highest share of poor individuals is in the Adriatic part of the country, Splitsko-dalmatinska which also happens to be the county with the highest poverty rate in the Adriatic. The city of Zagreb is also home to a considerable amount of Croatia's poor with close to 6.3 percent of the nation's poor.

Figure 5.Distribution of the poor by NUTS-3 spatial units for the Republic of Croatia

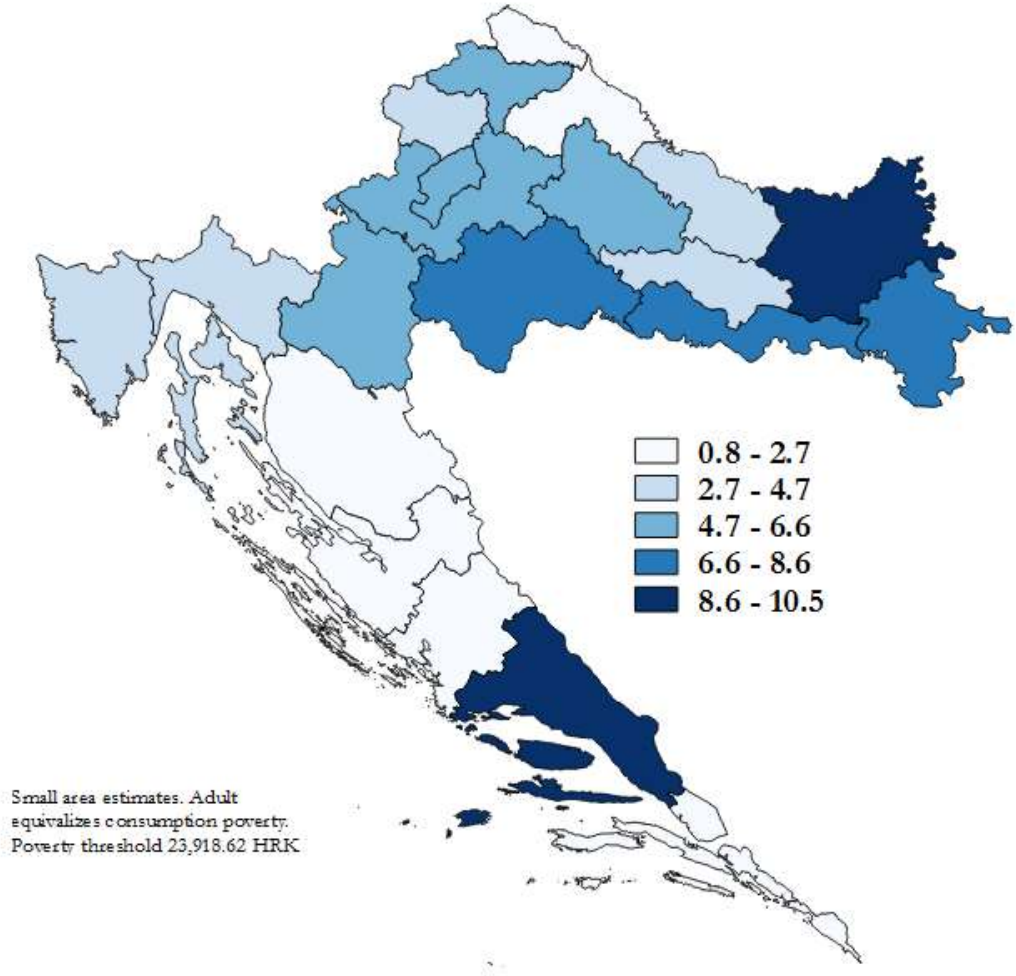


Table 6.County Level Poverty Estimates

	HBS direct estimates				ELL-EB Model prediction		
Statistical Area	**AROP**	**95% CI**		**NUTS-3 (counties)**	**Population**	**AROP**	**95% CI**	
Northwestern	10.3%	7.6%	13.7%	Zagrebačka	311,918	10.9%	8.8%	13.0%
				Krapinsko-zagorska	129,393	17.6%	14.7%	20.4%
				Varaždinska	170,380	23.7%	20.2%	27.2%
				Koprivničko-križevačka	112,540	16.7%	14.5%	18.9%
				Međimurska	110,888	15.0%	12.9%	17.1%
				Grad Zagreb	772,340	5.9%	4.2%	7.6%
Central & Eastern	28.1%	23.5%	33.3%	Sisačko-moslavačka	168,534	31.3%	28.9%	33.7%
				Karlovačka	125,722	34.3%	31.4%	37.2%
				Bjelovarsko-bilogorska	117,420	31.4%	27.5%	35.3%
				Virovitičko-podravska	83,129	30.8%	27.6%	33.9%
				Požeško-slavonska	75,912	32.5%	30.2%	34.7%
				Brodsko-posavska	154,863	33.9%	31.2%	36.6%

				Osječko-baranjska	297,230	24.9%	22.6%	27.2%
				Vukovarsko-srijemska	174,324	32.3%	29.6%	35.0%
				Primorsko-goranska	290,446	9.1%	7.4%	10.8%
				Ličko-senjska	49,766	11.8%	9.5%	14.2%
				Zadarska	167,029	10.1%	8.4%	11.8%
Adriatic	12.6%	9.2%	17.0%	Šibensko-kninska	107,345	14.1%	12.0%	16.1%
				Splitsko-dalmatinska	445,049	16.9%	14.9%	19.0%
				Istarska	204,025	10.2%	8.6%	11.9%
				Dubrovačko-neretvanska	118,707	11.0%	8.8%	13.2%
Republic of Croatia	16.3%	14.1%	18.6%		4,186,960	17.1%	15.8%	18.5%

Note: Poverty line is at 23,918.62 HRK per adult equivalent

The Use of Poverty Maps

Local indicators of spatial association of poverty

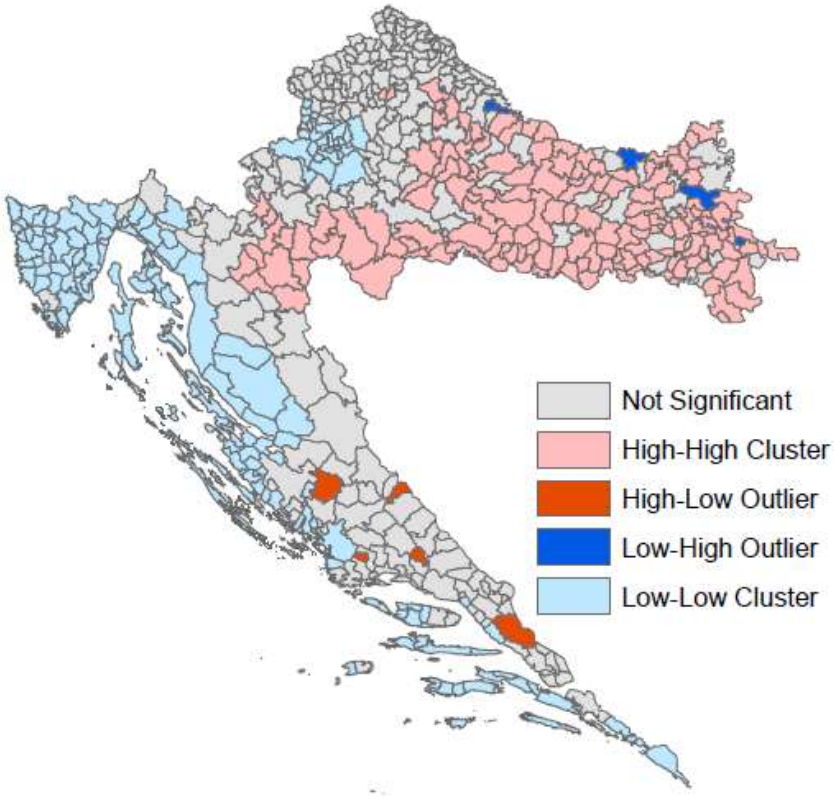
52. Using the poverty map output we seek to determine if there is a pattern to how municipal, city and districts of Zagreb poverty rates are distributed within Croatia. When analyzing geographical data it is assumed that things that are closer are more related to things that are farther away (Tobler, 1970). This supposes that two municipalities that are closer together will be more alike than municipalities which are farther away.

53. The presence of spatial association of headcount poverty is confirmed by a global Moran's I index of 0.19 which is significant at the 1 percent level. Local Moran's I can aid in identifying which localities have a statistically significant relationship with its neighbors. Spatial autocorrelation makes the identification of high poverty areas (particularly in the Central and Eastern statistical region), as well as low poverty areas (around Zagreb and the surrounding areas of Istarska). Confirming the concentration of poverty in the Central and Eastern statistical area of the country, the map in Figure 7 illustrates a massive hotspot of poverty in the area. These results bring to light the challenges that arise for regional development, and add a new layer to the discussion.

54. As noted earlier and in Figure 4, there appears to be some spatial clustering in the results from the poverty maps. In fact the Central and Eastern regions seem to be lagging behind the Adriatic and Northwest. Poverty rates in Central and Eastern regions are considerably greater than the rest of the country, and the region appears to be a hotspot for poverty. Furthermore, there appears to be a clear demarcation of low versus high poverty areas. Insofar as determining if there is in fact spatial correlation we rely on Global Moran's I as well as Local Moran's I statistic, and the Getis-Ord Gi, shown in Figure 6and 7 respectively.

55. Figure 6 presents the results for the Global and Local Moran's I statistics. The significant (Z-score of 57.8) Global Moran's I of 0.20 suggests that there is spatial autocorrelation. Additionally, the map illustrates regions which are significantly different from their neighbors, and regions which are high-poverty areas and low poverty areas. All colored areas show a significant relationship to their neighbors. Those municipalities marked as "High – High" ("Low-Low") are municipalities where poverty is significantly greater (lower) than the neighborhood's poverty and are greater (lower) than the average poverty among municipalities.

Figure 6.Poverty Map for Croatia (Spatial Association of Headcount Poverty)

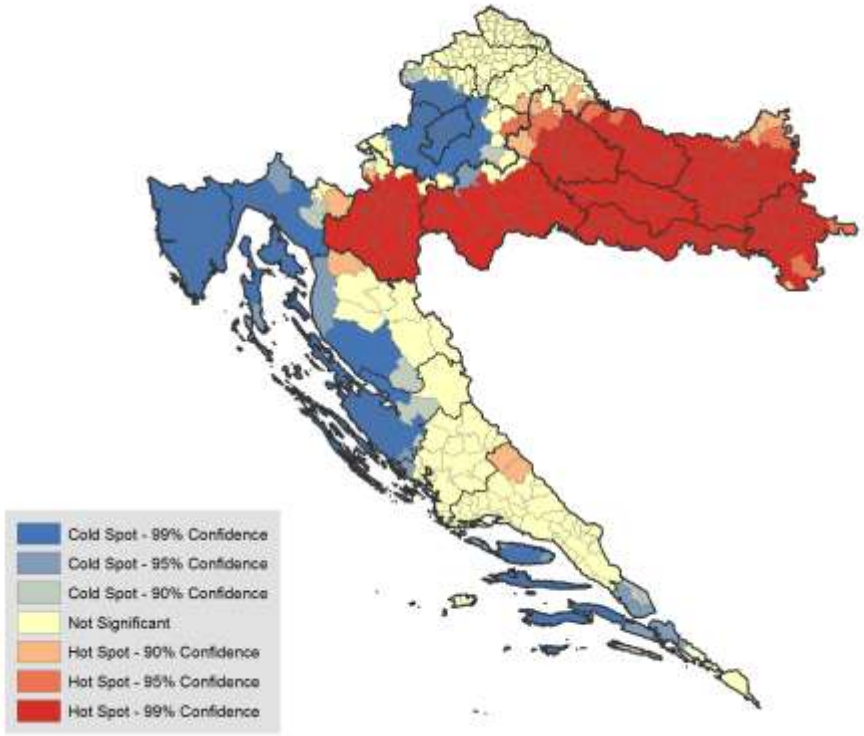


56. In order to obtain spatial statistics it is necessary to establish a degree of spatial proximity between the municipalities in Croatia. A spatial weights matrix is used, which relies on the row-standardized inverse distances between the center of the municipalities and the surrounding municipalities. This ensures that nearer neighbors have a greater influence on the analyzed outcomes, in this instance poverty rates.

57. A cluster of high poverty is clearly delineated in the Eastern Central statistical area (Figure 6 and 7). In Zagreb and surrounding areas a cluster of low poverty is highlighted, the same holds true for the north of the Adriatic region. Municipalities marked as low-high outliers and the high-low outliers are particularly of interest. While poverty may be high (low) in particular areas, there are some municipalities that have a significantly lower (higher) level of poverty than its surroundings. These are mostly observed in the Adriatic and Eastern Central areas.

58. The hot spot analysis in Figure 7, brings to light a demarcation and separation between regions. This was also evident in the results from the OLS and GLS (see Table 4). All three statistical areas are different. Independently from the NUTS-2 classification which aggregates the Northwestern statistical area and the Eastern and Central statistical area, when it comes to welfare these areas are considerably different.

Figure 7. Poverty Map for Croatia: Hot Spot Analysis (Getis-Ord Gi)



Using Poverty Maps to Inform the Allocation of Resources

59. In this section the results from the poverty map are used in order to determine how poverty can be reduced by targeting poverty at different geographical levels. The simulation is taken from Elbers et al. (2006) and illustrates the benefit of having welfare information for small administrative units when attempting to reduce national poverty measures.

60. In order to proceed with the simulation all municipalities/cities/districts are ranked by their poverty severity index, the same is done by ranking NUTS3 spatial units, and NUTS2 spatial units. Additionally, assume a total budget of 1.64billion HRK (0.5 percent of Croatian GDP in 2011) is allocated across the country's poor. This is the transferrable amount to each individual in the priority regions, until the budget is exhausted.

61. The simulated transfer is independent of the individual's status, everyone within the priority regions will receive the same amount. When the transfer is assumed to be done uniformly across the country, the amount transferred to each individual is the close to 390 HRK. When transferring at lower levels of aggregation, the amount transferred to each individual is equal to the budget over the number of poor individuals in the country. Therefore, every individual within the locality receives an equal amount of money regardless of his/her poverty status. If the funds run out before all in the locality receive the same amount, the remaining budget is split evenly amongst the individuals within that locality. Finally, it is assumed that the entire transfer will be devoted to household consumption

62. Since for the poverty maps 100 simulations have been performed we have 100 vectors of consumption for each household. For each of these vectors the transfer amount is added to the household's adult-equivalized consumption, irrespective if the household is poor in that particular

simulation or not. The ranking of locations is done on the final results of severity from the poverty maps, i.e. the mean of the severity rate for each locality for all simulations. This type of targeting is referred to as "naïve" by Elbers et al. (2006). Since the ranking is done on the final results, the transfer in each simulation is also independent on the location's ranking within that particular simulation.

63. Table 7 presents the results from the simulations and the different national poverty measures obtained when targeting is done at different geographical levels. By making use of the results from the small area estimates exercise, the gains to be had by targeting poverty at smaller geographical levels is evident. When targeting at lower geographical levels, poverty alleviation is considerably improved. For example if we target poverty at LAU 2 as opposed to NUTS 1, the poverty alleviation rate is more than 1.6 times the alleviation rate achieved by the transfer at the NUTS 1 level. Considering that this is just a blanket transfer to all individuals within a poor locality, if this were coupled with a means tested targeting mechanism the gains would be considerably greater. As such poverty maps in this instance provide additional information which could be of considerable use for policy makers when allocating resources.

Table 7.Poverty alleviation by level of targeting

Transfer level	Headcount	Gap	Severity
NUTS-1 (baseline)	1.00	1.00	1.00
NUTS-2	1.05	1.10	1.14
NUTS-3	1.50	1.66	1.70
Municipalities, cities, and districts of Zagreb	1.59	1.89	2.03

Note: Transfer is 1.64billion HRK (0.5% of GDP)

Concluding Remarks

64. Direct poverty estimates from the HBS are only reliable at the national level. This complicates the analysis of poverty at more disaggregated levels since the reliability of direct estimates are questionable. Data from the Census of Population, Households and Dwellings 2011 coupled with small area estimation techniques aide policy makers in overcoming the lack of precision at lower geographical levels. The results from the poverty mapping exercise, coupled with spatial analysis reveal the heterogeneity of poverty in Croatia.

65. Results from spatial analysis reveal that there is a cluster of high poverty in the Central and Eastern statistical region of Croatia. There is a clear poverty demarcation in the country, where the Central and Eastern part of the country is clearly doing worse than the rest of the country. Results also reveal that while the Continental NUTS-2 spatial unit, may seem poorer than the Adriatic, the result is mainly driven by the aggregation of the two statistical regions (Northwest, and the Central and Eastern statistical regions).

66. The results of consumption poverty are likely to better reflect long term welfare of a family and its members than household income. By making use of the results of the consumption poverty map the policy relevance of the exercise is presented. The use of the poverty map in order to assist in the guidance of resource allocation can help policy makers achieve considerable gains in poverty reduction. Additionally, the visual format of the maps is simple to understand which makes it easy for the population at large to take notice of where their community stands compared to the rest of the country. Moreover, because the maps are based on established data sets, these are objective. As a consequence the maps may help prevent subjective decision making. Given the mentioned uses of the poverty maps these are valuable component of the policy maker's tool kit when trying to decide where limited funds can be distributed among the population which needs assistance.

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Annex 1. Small area estimates of income poverty in Croatia: methodological report

1. Introduction

The At-Risk-of-Poverty (AROP) rate indicates the percentage of individuals within a country who live on less than 60 percent of the median national equivalized disposable income after social transfers. It is one of the main indicators derived from the European Union Statistics on Income and Living Conditions Survey (EU-SILC). In Croatia the EU-SILC is representative at the NUTS1[21] level as well as at the NUTS2. The National at-risk-of poverty rate for 2012[22] in Croatia is 20.4 percent. While regional poverty rates are considerably different between Continental and Adriatic Croatia, 22 and 17 percent respectively. Nevertheless it is possible that poverty levels within NUTS2[23] spatial units, differ considerably.

Figure 1. EU-SILC poverty map at level of representativeness

Poverty figures at lower levels of aggregation (for example NUTS 3, LAU 1, or LAU 2) for Croatia are not possible with the EU-SILC. Geographical levels at which direct estimates lack the required precision are referred to as small areas (Guadarrama et al., 2015). Small area estimation (SAE) methods are those which seek to overcome the lack of precision. SAE methods achieve this by incorporating data sources with larger coverage. These methods present a way to circumvent the low representativeness of household survey methods by taking advantage of larger coverage surveys such as a census. In practice household surveys provide a satisfactory measure of welfare but possess low coverage, while the census has the coverage

[21] Nomenclature of territory units for statistics (NUTS) based on Regulation (EC) No 1059/2003 of the European Parliament and of the Council of 26 May 2003 on the establishment of a common classification of territorial units for statistics

[22] In the EU-SILC survey income information is gathered on the previously completed calendar year.

[23] Presently there are two regions under NUTS-2 level, Adriatic and Continental Croatia. During the pre-accession period time of the 2012 EU-SILC there were three statistical regions corresponding to NUTS-2 level in Croatia: Northwest, Central and Eastern, and Adriatic Croatia. The 2012 EU-SILC is representative for the three statistical regions corresponding to NUTS 2 level. Continental Croatia is composed of the Northwest, and the Central and Eastern statistical regions.

but lacks a suitable welfare measure. SAE methods take advantage of the best attributes of each data source in order to obtain welfare measures at levels of aggregation below those of the household survey's representativeness. The use of SAE methods provides estimates of higher precision for small areas than those obtained using a household survey alone. Higher precision of welfare for smaller areas allows policy makers to better target assistance and interventions to the most disadvantaged communities.

The Census of Population, Households and Dwellings of 2011 for the Republic of Croatia when combined with the 2012 EU-SILC facilitates the estimation of welfare at the household level. This makes obtaining poverty rates for areas below those of the EU-SILC's representativeness possible. The small area estimation methodology used to obtain the estimates follows the one proposed by Elbers, Lanjouw, and Lanjouw (ELL) (2003).[24] The methodology is perhaps the most widely used for small area estimation, and has been applied to develop poverty maps in numerous countries across the globe. Through the application of the analysis predicted poverty rates at the NUTS 3,[25] as well as at the LAU 2[26] levels are obtained.

2. Modeling Approach

The ELL method is conducted in 2 stages. The first stage consists in fitting a welfare model using the 2012 EU-SILC data via ordinary least squares (OLS), and correcting for various shortcomings of this approach to arrive at generalized least squares estimates (GLS). It should be noted that the variables included in the welfare model of the 2012 EU-SILC must be restricted to those variables that are also found on the 2011 Census. This allows us to generate the welfare distribution for any sub-population in the 2011 Census, conditional on the sub-population's observed characteristics (ELL, 2002).

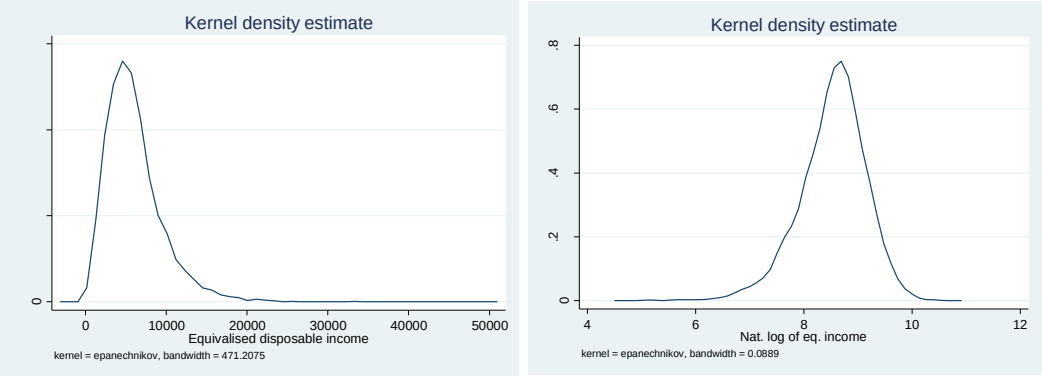
After correcting for shortcomings, the estimated regression parameters, standard errors, and variance components from the EU-SILC model provide the necessary inputs for the second phase of the analysis. The second stage of the poverty mapping exercise consists in using the estimated parameters from the first stage, and applying these to the 2011 Census data in order to predict welfare at the household level. Finally the predicted welfare measure is converted into a poverty indicator which is then aggregated in order to obtain poverty measures at the desired level of aggregation (NUTS2, NUTS3 or LAU2).

Before fitting the welfare model, a comparison between the observable household characteristics from the EU-SILC and the Census is necessary. The purpose of the comparison is to ensure that variables have similar distributions, and that these have similar definitions across data sources. Because the exercise consists in predicting welfare in the census data using parameters obtained from EU-SILC observed characteristics it is imperative that the observed characteristics across surveys are comparable.

The next step in the ELL methodology consists in estimating a log adult equivalized household income model which is estimated via *OLS.* The transformation to log income is done because income tends to not be symmetrically distributed (Figure 2), taking the logarithm of income is done to make the data more symmetrical.

[24]The methodology is implemented via the World Bank developed software PovMap (accessed on August 1, 2016)
[25] There are currently 21 NUTS 3 spatial units (Counties) in Croatia.
[26] There are 556 Local Administrative Units at level 2 (LAU 2). In Croatia LAU-2 level corresponds to municipalities and cities. Additionally, for the purposes of the analysis, the city of Zagreb is sub-divided into 19 districts.

Figure 2. Adult equivalized income and natural logarithm of equivalized income



The household income model is:

$$ln\, y_{ch} = X'_{ch}\, \beta + u_{ch} \quad (1)$$

where $\boldsymbol{y_{ch}}$ is the adult equivalized income of household *h* in municipality *c*, $\boldsymbol{X_{ch}}$ are the household and locality[27] characteristics, and $\boldsymbol{u_{ch}}$ is the residual. In the specified model the use of Households within a same municipality are usually not independent from one another and the following specification is used to account for this:

$$u_{ch} = \eta_c + \varepsilon_{ch} \quad (2)$$

where $\boldsymbol{\eta}$ and $\boldsymbol{\varepsilon}$ are assumed to be independent from each other and uncorrelated with the observables, $\boldsymbol{X_{ch}}$. Households in the same location share the same $\boldsymbol{\eta}$, and it is expected that $\boldsymbol{E[u_{ch}^2] = \sigma_\eta^2 + \sigma_\varepsilon^2}$the larger the variance of $\boldsymbol{\eta}$ the less precise the estimates of welfare will be when the spatial correlation of the residuals is ignored.

The estimation of $\boldsymbol{\sigma_\eta^2}$ and $\boldsymbol{\sigma_\varepsilon^2}$ is done utilizing Henderson's method III (Henderson, 1953).[28] In the case where the variance of the household specific error, $\boldsymbol{\sigma_\varepsilon^2}$, is assumed to vary across households a parametric form of heteroscedasticity is assumed and modeled as:

$$ln\left[\frac{\hat{\varepsilon}_{ch}^2}{A - \hat{\varepsilon}_{ch}^2}\right] = Z'_{ch}\alpha + r_{ch} \quad (3)$$

where $\boldsymbol{A = 1.05\max(\hat{\varepsilon}_{ch}^2)}$.[29] Making use of these estimates it is possible to obtain an estimate for $\sigma_{\varepsilon,ch}^2$. The existence of the variance parameters require a re-estimation of the welfare model given that the *OLS* assumptions are unlikely to hold. The variance covariance matrix utilized for the GLS estimates is household cluster specific, and where the interrelatedness between households within a cluster is also allowed.[30]

Once GLS estimates are obtained it is possible to move on to the second stage of the exercise. Small area estimates of welfare (and standard errors) are obtained by applying the parameter and error estimates from the survey to the census data. In order to do this we must simulate welfare. Since poverty indices are based on non-linear forms of log adult-equivalized income simulations are ideally suited for obtaining estimates of these measures. A value of log income per adult equivalent $\tilde{y}_{ch}$ for each household is

[27] As mentioned above, the locality in the case of the Republic of Croatia refers to LAU-2, and districts of Zagreb.
[28] An additional method is the one proposed by ELL (2003)
[29] For a more detailed description, interested readers should refer to Elbers, Lanjouw and Lanjouw (2003) as well as Van der Weide (2014)
[30] For details on the structure of the variance covariance matrix refer to Van der Weide (2014).

simulated making use of the β, η, and the ε parameters from the first stage, where each simulation r is equal to:

$$\tilde{y}^r{}_{ch} = exp(X'_{ch}\tilde{\beta}^r + \tilde{\eta}_c^r + \tilde{\varepsilon}_{ch}^r) \qquad (4)$$

For each simulation a set of $\tilde{\beta}^r$ are drawn from bootstrapped versions of the EU-SILC sample.[31] On the other hand for the location and household disturbance terms we obtain their variance parameters, $\left(\sigma_{\varepsilon,ch}^2\right)^r$ and $\left(\sigma_\eta^2\right)^r$,from the r^{th} bootstrapped version of the EU-SILC. $\tilde{\eta}_c^r$ and $\tilde{\varepsilon}_{ch}^r$ are thus drawn from a normal distribution assuming mean zero and variances equal to $\left(\sigma_{\varepsilon,ch}^2\right)^r$ and $\left(\sigma_\eta^2\right)^r$, respectively. If we define $f(\tilde{y}^r{}_{ch})$ as a function that maps the estimated adult-equivalized income measure to a poverty measure such as the at-risk of poverty head-count-rate (FGT 0) then the estimated mean poverty rate for a municipality c is equal to:

$$\boldsymbol{FGT0_c} = \frac{\mathbf{1}}{\boldsymbol{R}}\sum_{\boldsymbol{r=1}}^{\boldsymbol{R}}\sum_{\boldsymbol{h=1}}^{\boldsymbol{H}} f\left(\tilde{y}^r{}_{ch}\right)w_{ch} \qquad (\mathbf{5})$$

where $\boldsymbol{w_{ch}}$ is the population expansion factor (number of household members in household $\boldsymbol{h}$ divided by the total population of Croatia in the census).

An alternative for the estimation of $\boldsymbol{\eta}$ is to use the information from the survey, Empirical-Best estimation (EB). The best estimate available to us of $\boldsymbol{\eta}$, for a particular municipality is that which comes from the survey ($\mathbf{ln}\,\boldsymbol{y_{ch}} - \boldsymbol{X'_{ch}}\,\boldsymbol{\beta} = \boldsymbol{u_{ch}}$). Therefore making use of this information the estimates for the municipalities, cities and districts of Zagreb that are present in the EU-SILC are tighter since more information is included into their drawing. For all locations that are not present in the EU-SILC, the use of EB makes no difference, since for these localities there is no additional information and thus their data generation process is still normal with mean zero and variance $\left(\sigma_\eta^2\right)^r$.

Within the estimated measures there are three main sources of error: model error, error due to the disturbance, and due to computation error. These three sources of error, as noted by ELL (2003) are not correlated.

The error in the welfare measure within a municipality due to the disturbance arises as a result of unobserved components of income within a particular locality. The smaller the population of the targeted municipality the larger this error will be, and thus limits the degree of disaggregation possible. The exact point at which this becomes unacceptable depends on how well the model fits the data.

The model error depends entirely on the properties of the first stage estimators it is independent from the population size of the municipality. Within a given municipality the magnitude of this error component will also depend on how different the $\boldsymbol{X}$ variables are in that municipality from those of the EU-SILC data.

Finally, computation error is due to the method used for computation. This error can be made as small as possible depending on computational resources at hand. Because often simulations are a finite number, the larger the number of simulations, the smaller the error due to computation will be.

3. Data Description

The poverty mapping analysis requires two sources of data. In this instance the Croatian EU-SILC for 2012, and the Census of Population, Households and Dwellings of 2011 for the Republic of Croatia. The EU-SILC

[31] An alternative option is to draw the β from a multivariate normal distribution $\beta \sim N(\beta_{gls}, vcov(\beta_{gls}))$

for 2012 is an ideal household survey for the SAE analysis because incomes reported in the 2012 EU-SILC correspond to 2011 calendar year, and thus are for the same time period as the census.

Small area estimation is done under the assumption that the same underlying population is being captured by the survey and the census. This last assumption will be valid if both datasets are from the same time frame. Nevertheless, the inclusion or the use of datasets that are from differing time periods, or if the survey is not representative of the population, will break down this assumption. This last remark is more salient in instances where there have been considerable shocks in between the collection of the survey and the collection of the census (Bedi et al. 2007).

EU-SILC 2012, Croatia

The EU-SILC data is the EU reference source for comparative statistics on income and social exclusion. The 2012 EU-SILC for Croatia was made up of 5,853 households and is representative at the NUTS-2 level. The at-risk-of-poverty threshold[32] in Croatia for 2012 (income year 2011) is 24,000HRK. Using this poverty threshold, the at-risk-of-poverty headcount rate is 20.4 percent.

The 2012 EU-SILC uses the 2001 Census as a sampling frame. The survey is performed as a stratified two-stage sample.

The at-risk-of-poverty threshold is obtained by including all households, among these 2 have reported negative net disposable incomes. For purposes of the analysis done these households are no longer included. The households included in the EU-SILC dataset come from 370 municipalities. Finally, all municipalities with less than 3 households in the EU-SILC must be removed for the analysis.[33] The final sample for the EU-SILC is made up of 5,618 households.

Census of Population, Households and Dwellings 2011, Population by Sex and Age

The 2011 Census for Croatia was provided by the Croatian Bureau of Statistics.[34] The census includes key information on demographics of the household, education, labor force status, economic activity, occupation type, and labor status in main job. Along with these characteristics, the census also has information on the type of dwelling, the status of the dwelling, number of rooms in the dwelling, living area of the dwelling, and the construction year.

Variable comparison between EU-SILC and Census

Because small area methods require an estimation of a welfare model in the first stage which will then be applied to the census it is necessary that the choice of correlates matches across surveys. This not only requires variables to be similar, but requires that these have similar distributions. The selection of candidate variable is done in a two stage process:

1. Comparison of questionnaires between the EU-SILC and the Census. The comparison yields a first set of candidate variables for the estimation. Candidate variables must come from similar questions.
2. Comparison of the distribution of the candidate variables across datasets. The comparison is undertaken at the level of the Republic of Croatia and at the NUTS-2 level. The comparability of

[32] 60 percent of the median household equivalized income

[33] This is necessary in order to estimate the variance of the location effect, σ_{ch}^2, for every municipality.

[34] Access to the Census, as well as the EU-SILC (with excluded direct identifiers of persons and households) was provided in the Croatian Bureau of Statistics' safe room according to the Agreement and inclusion of this exercise in the Annual Implementation Plan 2016.

the variables across surveys ensures that the welfare model from the 2012 EU-SILC can be applied to the Census such that reliable income estimates for the population can be derived.

Making use of all variables that meet the above criteria several welfare models are estimated via *OLS*. Unlike most of econometrics, the purpose of the model is not to find any causal relationships but to find a model that best reflects the income level of a household. The income of a household is assumed to be a function of the number of household members present in the household, and the age composition of the household members. Additionally, income is assumed to be a function of the marital status of individuals aged 15 and over, their level of education, their occupation, and the sector in which they are employed in. In addition, and while likely not a determinant of income, we include a variable which reports the area of the dwelling in square meters. This variable is expected to have reasonable correlation with welfare. Finally, the use of location means of household level variables are included.[35] This is done in order to explain the variation in welfare due to location as much as possible and thus improve precision of the welfare estimates.

Table 1 contains a listing of the candidate variables for use in the model. The EU-SILC and the Census contain a comprehensive set of variables which match the criteria for modelling income at the household level. Both datasets contain information on the number of household members present in a household. Given that the sampling frame for the 2012 EU-SILC is the previous Census (Census of Population, Households and Dwellings 2001) it is not unexpected that the first moments of the EU-SILC and Census are somewhat different. Nevertheless, at the national level the means of the candidate variables match up considerably well.

The mean values for the EU-SILC and for the Census are presented. The final choice of variables for the model is not only dependent upon how well the variables match up, but on how well they explain the variation of income.

As the numbers on Table 1 illustrate, the two datasets match up quite well. The age groups, proportion of males, and household size are very close to one another, even at the statistical area level the variables are comparable with one another (Table 1A).

Comparison between labor market variables also reveal that the datasets are close to each other with some differences arising in some of the occupations. Similarly these slight differences are also reflected at the regional level comparisons.

Given that the differences that arise are not considerable all of the variables are valid candidates for the welfare model to be estimated in the next stage. Variables that are highly correlated are not included simultaneously. Keeping this in mind the selected model is the one which maximizes the adjusted R-squared of the model, but at the same time conforms to prior beliefs of how should the variable be related to income.

Table 1. Population weighted candidate variable means in Census and EU-SILC

Variable name	Census	EU-SILC
Male	0.483	0.482
Age [0,5)	0.050	0.045
Age [5,15)	0.103	0.106

[35]This is recommended by ELL (2002). Variable means at the municipal level are included and come from the Census. These are the share of households in the municipality that were built between 1990 and 2000, share of household that have sewerage access, share of individuals that receive pension income, and the share of employed individuals in the municipality.

Age [15,30)	0.186	0.186
Age [30,65)	0.486	0.490
Age [65+)	0.174	0.172
Household size (Share of individuals living in household type)		
Households size of 1	0.088	0.088
Households size of 2	0.183	0.183
Households size of 3	0.202	0.202
Households size of 4	0.248	0.247
Households size of 5	0.143	0.143
Households size of 6	0.076	0.073
Household size of 7 or more	0.060	0.063
Occupation (15+) (Share of individuals in households with at least one member)		
Manager	0.051	0.032
Professionals	0.150	0.142
Technicians	0.182	0.132
Clerical support	0.129	0.118
Service and sales	0.223	0.214
Skilled agriculture	0.041	0.051
Craft and trade	0.153	0.167
Machine operators	0.112	0.117
Elementary occupations	0.091	0.071
Labor status, age 15-64 (Share of individuals in households with at least one member)		
Employed	0.742	0.724
Retired	0.497	0.503
Student	0.220	0.213
Disabled	0.038	0.024
Other	0.749	0.726
Industry, age 15-64 (Share of individuals in households with at least one member)		
Agriculture, mining, and fishing	0.065	0.068
Manufacturing	0.189	0.195
Services and Sales	0.630	0.572
Share of members with education in HH (age 15-64)		
Primary education	0.086	0.071
Lower secondary	0.199	0.196
Upper secondary	0.547	0.595
Tertiary education	0.169	0.138
Dwelling characteristics		
Square meters	87.542	88.942

4. Model Results

The initial welfare model corresponding to equation (1) is presented in column 1 of Table 2. The adjusted R-Squared for the model is (0.52) reflecting that the chosen model explains the variation on income well.

In addition to the variables present in both the Census and EU-SILC, variable means for municipalities, cities and districts of Zagreb are obtained from the Census and introduced to the model; these variables are introduced to improve precision by reducing the unexplained variation in income due to location. With the inclusion of these variables the ratio of the variance of $\boldsymbol{\eta}$ over the model's MSE is 0.035. The low ratio illustrates the key role the variables play in improving precision of the estimates.

Table 2. Weighted OLS & GLS estimates for Income model: 2012 EU-SILC

	Coeff. WOLS	Coeff. GLS
Intercept	8.4124***	8.5379***
No children under 5	-0.104***	-0.0781***
No children between 5 and 15	-0.1322***	-0.1294***
One child between 5 and 15	-0.0795**	-0.0834**
No indiv. with lower secondary	0.0433**	0.045**
No indiv. with primary	0.2104***	0.1671***
One individual with primary	0.1113	0.0943
One person with tertiary education	0.1123***	0.0989***
Two people with tertiary education	0.1207***	0.1299***
1 member HH	0.8795***	0.9324***
2 member HH	0.7396***	0.8062***
3 member HH	0.533***	0.5899***
4 member HH	0.3815***	0.4271***
5 member HH	0.1972***	0.2414***
6 member HH	0.1801***	0.2069***
Nat. log Sq. M	0.1091***	0.0933***
No married ind. In HH	-0.1337***	-0.134***
Proportion of dwellings built 1990-2000	0.3398**	0.3602**
Proportion of dwellings with sewerage	0.0967***	0.0891***
Proportion of HH with pension income	1.0688***	0.994***
Municipal employment rates	0.9721***	0.9221***
No ind. is a clerk	-0.1071***	-0.1107***
No ind. is elementary teacher	0.0743*	0.0752**
No ind. is a manager	-0.2233***	-0.224***
No ind. is a professional	-0.174***	-0.1781***
No ind. is a technician	-0.1427***	-0.1298***
Northwest × no lower education	0.0966***	0.074**
Northwest × 2p retired	0.0101	0.0251
Central East × lnM2	0.1009**	0.1074***
Central East × 2p workers	-0.0755*	-0.0819**
Central Eastern	-0.3389*	-0.3659**
Adriatic	0.1142***	0.1063***
1 retiree	0.2299***	0.1921***
2 retirees	0.2733***	0.2303***
0 administrative workers	0.085*	0.0788**
0 public employees	-0.1317***	-0.1248***

1p working in HH	0.5493***	0.5428***
2p working in HH	0.3499***	0.3463***
3p working in HH	0.1464***	0.1529***
Adjusted R-squared	0.52	
Ratio of variance of η over Mean Sq. error	0.035	
Number of observations	5,618	5,618

*, **, *** significant at the 10, 5, 1 percent level respectively. All households which have inconsistent labor information are removed.

As noted in section 2, it is likely that income levels within a location are highly correlated and as a consequence $\boldsymbol{E}[\boldsymbol{u_{ch}u_{ci}}|\boldsymbol{X}] \neq \boldsymbol{0}$. Additionally, error terms will likely have differing variances across observations ($\boldsymbol{E}[\boldsymbol{u_{ch}^2}|\boldsymbol{X}] \neq \boldsymbol{\sigma^2}$). Due to these issues the model is re-estimated using Generalized Least Squares (GLS). The results for the GLS fitted model are presented in column 2 of Table 2.[36]

Equivalized income is positively correlated to household size. The omitted group is households with 7 or more individuals. Furthermore, equivalized income is negatively correlated to the absence of children in the household. Under the modified OECD scale, when comparing two households with equal household income, the household with lower adult equivalents will have greater adult equivalized income. Thus, all else equal, a household with 2 adults and a child will have greater adult equivalized income than one with 3 adults. Households with retirees also have greater equivalized incomes, this is most likely due to pensions being received by these individuals. After labor the most important source of labor income in Croatia is pension income.

Education is also strongly correlated to equivalized income, households with members who have tertiary education have on average greater equivalized incomes. Also correlated to income is the presence of working members and most of the labor variables included are significantly correlated to equivalized income. Among these variables, the presence of working members have the greatest coefficients.

Location, and location variable means are also correlated to equivalized income. Adult equivalized income is negatively correlated to being located in Central and Eastern Croatia as opposed to being in the Northwest. On the other hand residing in the Adriatic is positively and significantly correlated to adult equivalized income. In addition, equivalized income is positive and significantly correlated to localities with higher shares of households with pension incomes, households with sewerage, and dwellings built between 1990 and 2000.

5. Poverty Results

The coefficients estimated in the previous section provide the necessary inputs in order to estimate the first part of equation 4 ($X'_{ch}\hat{\beta}$) by combining coefficients with the Census variables. The vectors of disturbances for households are unknown, and must be estimated. As mentioned before, the error component is decomposed using Henderson's method III, and the coefficients, $\boldsymbol{\beta}$, are obtained by bootstrapped samples of the EU-SILC data. The model chosen is where $\boldsymbol{\eta}$ and $\boldsymbol{\varepsilon}$ are drawn from a normal distribution, with their respective variance structures. Finally, empirical best methods are chosen since these incorporate more information and are thus expected to provide a better fit.

The clustering used for estimations is at the municipal, city, and districts of Zagreb level. The resulting poverty map aggregated to the NUTS-3 level is presented in Figure 3 and at the municipal, city, and

[36]The alpha model (equation 3) corresponding to the GLS is presented in Table 2A.

districts of Zagreb level in Figure 4. The resulting poverty rates used for validation of the small area estimation undertaken are presented in Table 3. These compare the poverty rates obtained from the small area estimation to the direct estimates from the EU-SILC at the statistical area level. This provides support to the quality of the estimates obtained.

Table 3. Poverty rates from EU-SILC and from poverty map exercise

Statistical region	AROP EU-SILC					
	EU-SILC	95% CI		Predicted	95% CI	
Northwestern	16.7%	13.6%	20.4%	14.1%	12.8%	15.5%
Central & Eastern	29.1%	26.2%	32.2%	28.0%	25.7%	30.2%
Adriatic	17.0%	14.0%	20.6%	17.4%	15.8%	19.1%
Total	20.4%	18.5%	22.4%	19.2%	18.0%	20.4%

Note: Poverty line is at 24,000 HRK per adult equivalent

Results at the NUTS-3 spatial unit level are presented in Table 4. These estimates illustrate the heterogeneity within the country. Within the Adriatic region poverty rates range from 11.9 to 25.2 percent, within Continental Croatia (composed of the Northwestern, and Central and Eastern statistical area) poverty ranges from 9.8 percent in Grad Zagreb, to 35.9 percent in Brodsko-posavska. Poverty levels within the Central and Eastern statistical area are considerably greater than the country average.

At the municipal, city, and districts of Zagreb level further heterogeneity is revealed. In the Continental NUTS-2 region certain pockets of high poverty levels are detected, particularly in the Central and Eastern statistical region. In the Adriatic region some municipalities with higher poverty rates are also observed. The results of the poverty map suggest an overall spatial clustering of poverty; this is further analyzed in section 6, where basic analysis of the spatial association is undertaken.

Figure 3. Poverty Map for Croatia (NUTS-3 poverty headcount)

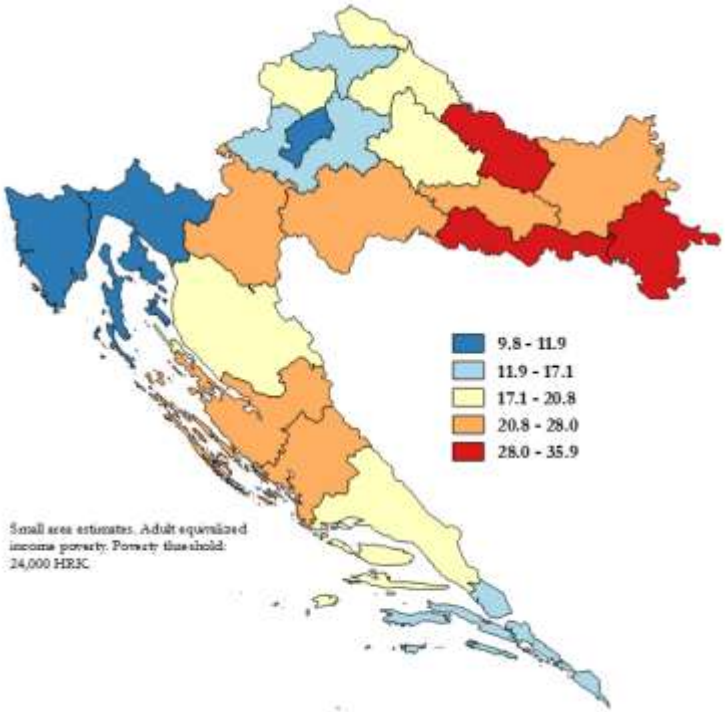
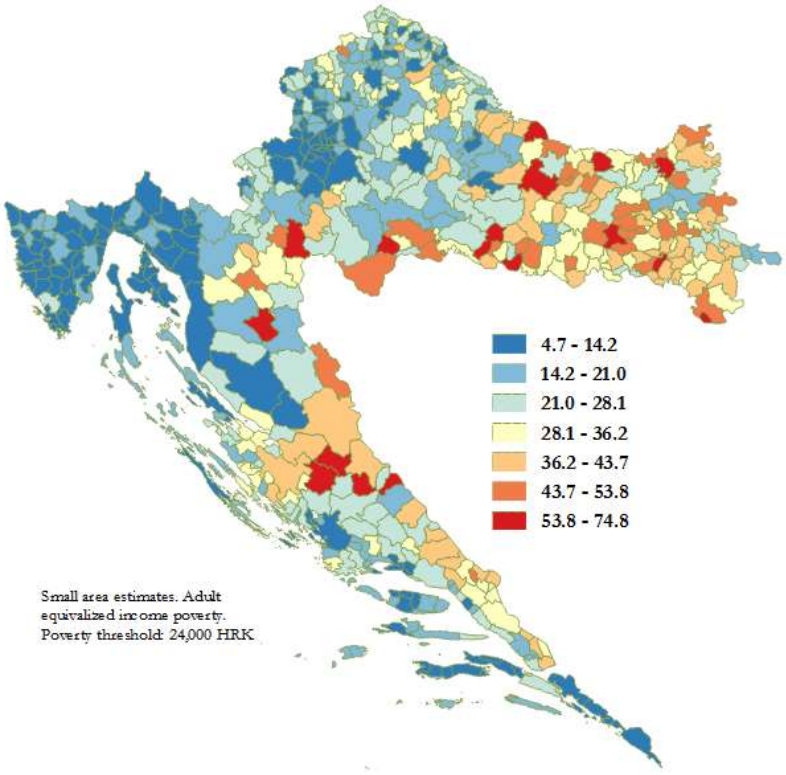


Figure 4.Poverty Map for the Republic of Croatia (poverty headcount for municipalities, cities, and districts of Zagreb)



Finally, the distribution of the Republic of Croatia's population that is at-risk-of-poverty is illustrated in Figure 5. The County with the lowest concentration of poor is in the Adriatic region, Ličko-senjska. The county is one of the least populated in the country, and although it has an at-risk-of-poverty rate which is close to 20 percent it has the fewest poor. On the other hand Grad-Zagreb which is the least poor county in the Republic of Croatia with an at-risk-of-poverty rate close to 10 percent has the third highest concentration of the country's poor.

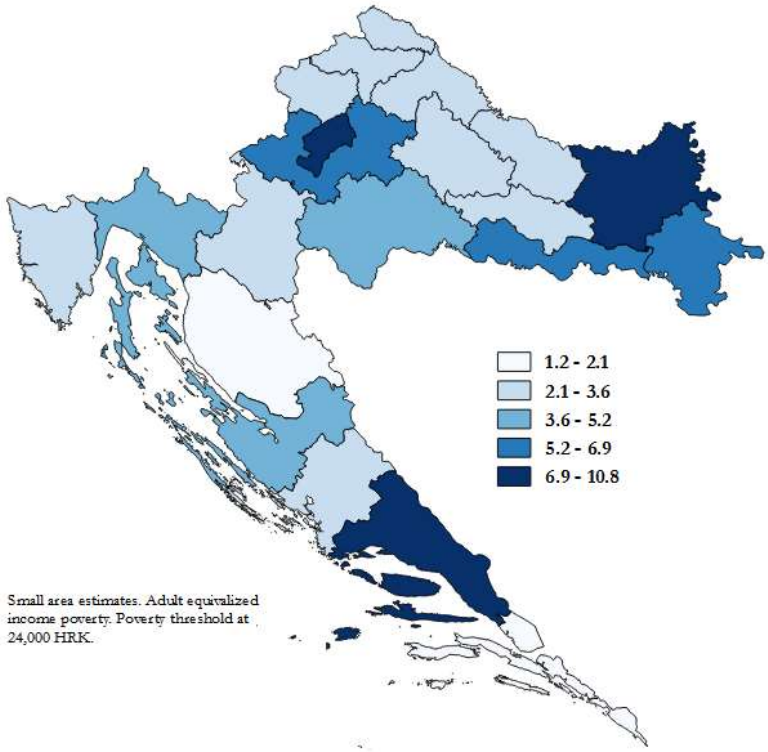
Table 4. County level poverty estimates

	EU-SILC direct estimates				H3-EB Model prediction			
Statistical Area	**AROP**	**95% CI**		**NUTS-3 (counties)**	**Population**	**AROP**	**95% CI**	
Northwestern	16.7%	13.6%	20.4%	Zagrebačka	311,918	16.7%	13.9%	19.5%
				Krapinsko-zagorska	129,393	18.8%	15.9%	21.7%
				Varaždinska	170,380	17.1%	14.6%	19.7%
				Koprivničko-križevačka	112,540	20.3%	17.4%	23.3%
				Međimurska	110,888	20.8%	17.5%	24.0%
				Grad Zagreb	772,340	9.8%	8.0%	11.6%
Central & Eastern	29.1%	26.2%	32.2%	Sisačko-moslavačka	168,534	23.7%	19.6%	27.8%
				Karlovačka	125,722	23.2%	19.4%	27.1%
				Bjelovarsko-bilogorska	117,420	20.0%	15.6%	24.5%
				Virovitičko-podravska	83,129	33.4%	28.7%	38.2%
				Požeško-slavonska	75,912	26.5%	21.1%	31.9%
				Brodsko-posavska	154,863	35.9%	31.6%	40.1%
				Osječko-baranjska	297,230	28.0%	24.8%	31.1%
				Vukovarsko-srijemska	174,324	31.9%	28.4%	35.3%

				Primorsko-goranska	290,446	11.9%	10.0%	13.8%
				Ličko-senjska	49,766	19.8%	15.7%	24.0%
				Zadarska	167,029	25.2%	20.9%	29.5%
Adriatic	17.0%	14.0%	20.6%	Šibensko-kninska	107,345	24.7%	20.7%	28.8%
				Splitsko-dalmatinska	445,049	19.5%	16.9%	22.0%
				Istarska	204,025	11.9%	9.6%	14.1%
				Dubrovačko-neretvanska	118,707	14.5%	11.3%	17.8%
Republic of Croatia	20.4%	18.5%	22.4%		4,186,960	19.2%	18.0%	20.4%

Note: Poverty line is at 24,000 HRK per adult equivalent

Figure 5.Distribution of the poor by NUTS-3 spatial units for the Republic of Croatia



6. The Use of Poverty Maps

Local indicators of spatial association of poverty

Using the poverty map output we seek to determine if there is a pattern to how poverty rates of municipalities, cities, and districts of Zagreb are distributed within the Republic of Croatia. When analyzing geographical data it is assumed that things that are closer are more related to things that are farther away (Tobler, 1970). This supposes that two municipalities that are closer together will be more alike than municipalities which are farther away.

As noted in Section 5 and in Figure 4, there appears to be some spatial clustering in the results from the poverty maps. In fact the Central and Eastern statistical area seems to be lagging behind the Adriatic and Northwest. This illustrates a divergence within the Continental NUTS-2 region. Poverty rates in Central and Eastern regions are considerably greater than the rest of the country, and the region appears to be a

hotspot for poverty. Furthermore, there appears to be a clear demarcation of low versus high poverty areas. Insofar as determining if there is in fact spatial correlation we rely on Global Moran's I as well as Local Moran's I statistic.

In order to undertake analysis of spatial association it is necessary to establish a degree of spatial proximity between the locations in Croatia. In order to do this, a spatial weights matrix is used, which relies on the row-standardized inverse distances between the center of the municipalities and the surrounding municipalities. This ensures that nearer neighbors have a greater influence on the analyzed outcomes, in this instance poverty rates.

The presence of spatial association is confirmed by a global Moran's I index of 0.52 which is significant at the 1 percent level. Local Moran's I can aide in identifying which localities have a statistically significant relationship with its neighbors. Spatial autocorrelation facilitates the identification of high poverty areas noted in the map presented in Figure 4 (particularly in the Central and Eastern statistical area within the Continental NUTS-2), as well as low poverty areas (around Zagreb and the surrounding areas of Istarska). These results bring to light the challenges that arise for regional development, and add a new layer to the discussion.

Figure 6 presents the results for the Global and Local Moran's I statistics. The significant Global Moran's I of 0.52 suggest that there is spatial autocorrelation. Additionally, the map illustrates regions which are significantly different from their neighbours, and regions which are high-poverty areas and low poverty areas. All colored areas show a significant relationship to their neighbours. Those locations marked as "High–High" ("Low-Low") are areas where poverty is significantly greater (lower) than the neighbourhood's poverty and are greater (lower) than the average poverty among municipalities, cities and districts of Zagreb.

A cluster of high poverty is clearly delineated in the Eastern Central statistical area (Figure 6 and 7). In Zagreb and surrounding areas a cluster of low poverty is highlighted, the same holds true for the north of the Adriatic region. Municipalities, cities, and/or districts of Zagreb marked as low-high outliers and the high-low outliers are particularly of interest. While poverty may be high (low) in particular areas, there are some municipalities that have a significantly lower (higher) level of poverty than its surroundings. These are mostly observed in the Adriatic and Eastern Central areas.

The hot spot analysis in Figure 7, brings to light a demarcation and separation between regions. This was also evident in the results from the OLS and GLS (see Table 2). All three statistical areas are different.

Independently from the NUTS-2 classification which aggregates the Northwestern statistical area and the Eastern and Central statistical area, when it comes to welfare these areas are considerably different.

Figure 6. Poverty Map for the Republic of Croatia (Spatial association of headcount poverty)

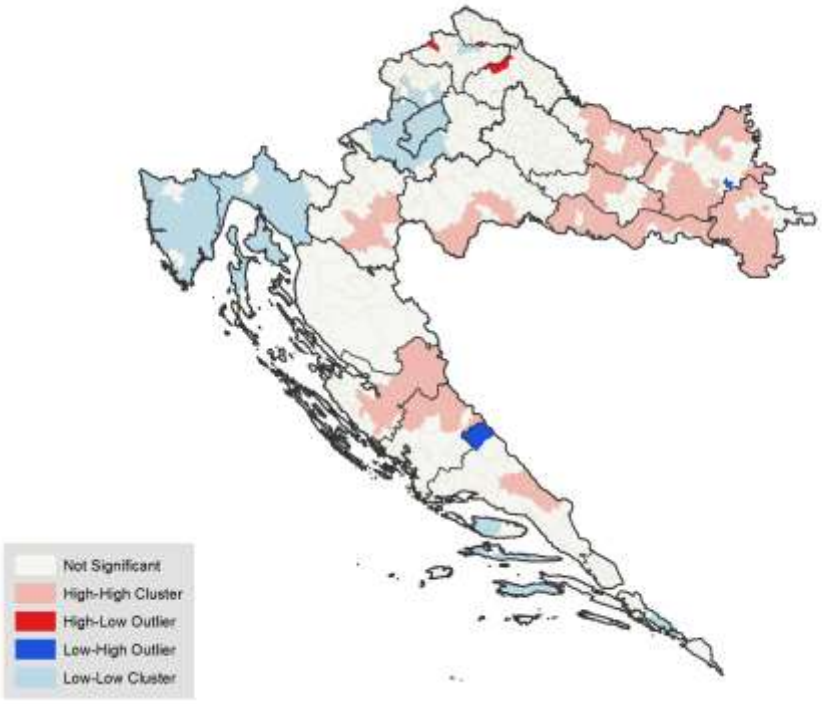
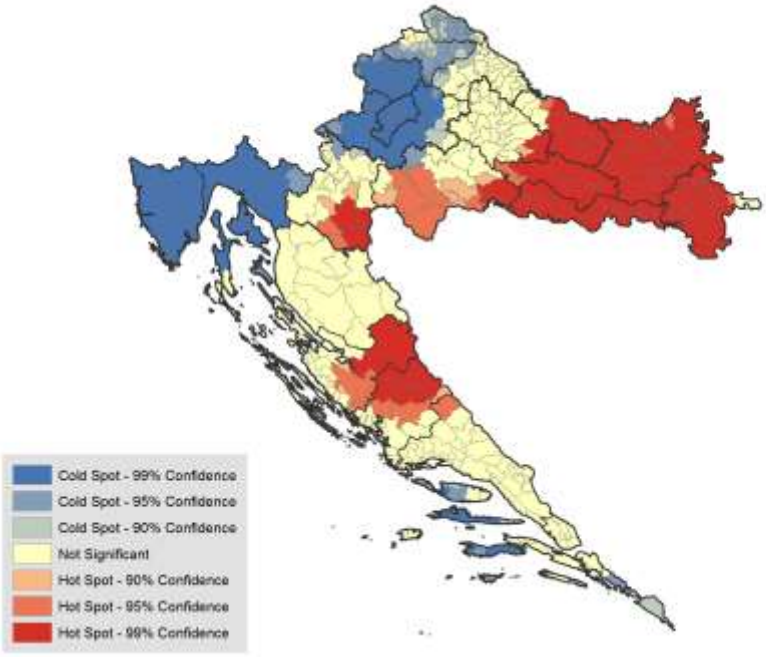


Figure 7: Poverty Map for the Republic of Croatia: hot spot analysis (Getis-Ord Gi)



7. Concluding Remarks

Direct poverty estimates from the EU-SILC are only reliable at the statistical area level, and thus at the NUTS-2 level. This complicates the analysis of poverty at more disaggregated levels since the reliability of direct estimates are questionable. Data from the Census of Population, Households and Dwellings 2011 coupled with small area estimation techniques aid policy makers overcome the lack of precision at lower geographical levels. The results from the poverty mapping exercise, coupled with spatial analysis reveal the heterogeneity of poverty in Croatia.

Results from spatial analysis reveal that there is a cluster of high poverty in the Central and Eastern region of Croatia. There is a clear poverty demarcation in the country, where the Central and Eastern part of the country is clearly doing worse than the rest of the country. Results also reveal that while the Continental NUTS-2 spatial unit, may seem poorer than the Adriatic, the result is mainly driven by the aggregation of the two statistical regions (Northwest, and the Central and Eastern statistical regions).

The use of the poverty map in order to assist in the guidance of resource allocation can help policy makers achieve considerable gains in poverty reduction. Additionally, the visual format of the maps is simple to understand which makes it easy for the population at large to take notice of where their community stands compared to the rest of the country. Moreover, because the maps are based on established data sets, these are objective. As a consequence the maps may help prevent subjective decision making. Given the mentioned uses of the poverty maps these are valuable component of the policy maker's tool kit when trying to decide where limited funds can be distributed among the population which needs assistance.

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9. Appendix

Mathematical appendix

The discussion below presents themethodology detailed byELL(2002and2003). Interested reader should refer to these documents for the full discussion.

From the estimationofequation 1weobtain the residuals $\hat{u}_{ch}$,and bydefining$\hat{u}_{c.}$asthe weighted average of$\hat{u}_{ch}$foraspecificcluster wecanobtain $\hat{e}_{ch}$:

$$\hat{u}_{ch} = \hat{u}_{c.} + (\hat{u}_{ch} - \hat{u}_{c.}) = \hat{\eta}_c + \hat{e}_{ch}$$

The variance of the location effect (η_c) is given by:

$$\hat{u}_{ch} = \hat{u}_{c.} + (\hat{u}_{ch} - \hat{u}_{c.}) = \hat{\eta}_c + \hat{e}_{ch}$$

where $u.. = \sum_C w_c u_c$.(where the w_c represents the cluster's weight) and:

$$\hat{u}_{ch} = \hat{u}_{c.} + \left(\hat{u}_{ch} - \hat{u}_{c.}\right) = \hat{\eta}_c + \hat{e}_{ch}$$

where $e_{c.} = \frac{\sum_h e_{ch}}{n_c}$ (n_c is the number of households in the cluster). The parametric from of heteroscedasticity is presented as:

$$\sigma^2_{e_{ch}} = \left[\frac{A \exp^{z'_{hh}\alpha} + B}{1 + \exp^{z'_{hh}\alpha}}\right]$$

This is simplified by setting $B = 0$ and $A = 1.05\max(e_{ch}^2)$, which leads to the simpler form that can be estimated via regular OLS:

$$\ln\left[\frac{e_{ch}^2}{A - e_{ch}^2}\right] = Z_{ch}^{'}\alpha + r_{ch}$$

By defining $B = \exp(Z_{ch}\alpha)$ and using the delta method the household specific variance for e_{ch} is equal to:

$$\ln\left[\frac{e_{ch}^2}{A - e_{ch}^2}\right] = Z_{ch}^{'}\alpha + r_{ch}$$

The use of $\boldsymbol{\sigma_\eta^2}$ and $\boldsymbol{\sigma_\varepsilon^2}$ allows us to get the variance covariance matrix used for the OLS estimates:

$$\ln\left[\frac{e_{ch}^2}{A - e_{ch}^2}\right] = Z_{ch}^{'}\alpha + r_{ch}$$

$$\Rightarrow \hat{\Omega} = \begin{pmatrix} \hat{\Omega}_1 & \mathbf{0} & \dots & \mathbf{0} \\ \mathbf{0} & \hat{\Omega}_2 & \dots & \mathbf{0} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{0} & \mathbf{0} & \dots & \hat{\Omega}_C \end{pmatrix}$$

The estimates for the GLS detailed by ELL (2003) are:

$$\hat{\beta}_{GLS} = (X'W\Omega^{-1}X)^{-1}X'W\Omega^{-1}Y$$

and

$$Var\left(\hat{\beta}_{GLS}\right) = (X'W\Omega^{-1}X)^{-1}(X'W\Omega^{-1}WX)(X'W\Omega^{-1}X)^{-1}$$

In response to criticisms of the methodology an extensive revision was made to the methods, including the addition of empirical best estimation, by Van der Weide (2014). For a detailed discussion on the EB approach and the other changes implemented readers are guided towards Van der Weide (2014).

The revisions include an improved GLS estimator:

$$\hat{\beta}_{GLS} = \left(X'\hat{\Omega}^{-1}X\right)^{-1}X'\hat{\Omega}^{-1}Y$$

and a new variance covariance matrix:

$$\text{var}\left[\hat{\beta}_{GLS}\right] = \left(X'\hat{\Omega}^{-1}X\right)^{-1}\left(X'\hat{\Omega}^{-1}\hat{\text{V}}\hat{\Omega}^{-1}X\right)\left(X'\hat{\Omega}^{-1}X\right)^{-1}$$

These are the estimates used for the second stage of the estimation (detailed in the methods section).

Poverty mapping software

One of the most common small area methods used for poverty mapping was proposed by Elbers, Lanjouw, and Lanjouw (2003). This methodology has been widely adopted by the World Bank and has been applied

in numerous poverty maps conducted by the institution. In its efforts to make the implementation of the ELL methodology as simple as possible, the World Bank created a software package that could be easily used by anyone. The software, PovMap (Zhao, 2006), has proven to be an invaluable resource for the World Bank as well as for many statistical agencies seeking to create their own poverty maps. The software is freely available and has a graphical user interface which simplifies its use.

Poverty map results produced in this document have all made use of the PovMap software. The PovMap software can be downloaded, free of charge, at http://iresearch.worldbank.org/PovMap/PovMap2/.

Additional tables and graphs

Table A1. Population weighted candidate variable means in Census and EU-SILC at the Statistical Area levels

	Northwest		Central & Eastern		Adriatic	
Variable name	**Census**	**EU-SILC**	**Census**	**EU-SILC**	**Census**	**EU-SILC**
Male	0.4777	0.4771	0.4843	0.4832	0.4873	0.4870
Age [0,5)	0.0515	0.0442	0.0476	0.0512	0.0483	0.0400
Age [5,15)	0.1021	0.1079	0.1082	0.1050	0.0992	0.1059
Age [15,30)	0.1872	0.1873	0.1897	0.1897	0.1817	0.1817
Age [30,65)	0.4937	0.4964	0.4764	0.4801	0.4899	0.4920
Age [65+)	0.1655	0.1642	0.1782	0.1740	0.1810	0.1805
Household size (Share of individuals living in household type)						
Households size of 1	0.086	0.087	0.086	0.087	0.088	0.090
Households size of 2	0.175	0.173	0.181	0.183	0.195	0.196
Households size of 3	0.200	0.199	0.189	0.189	0.215	0.217
Households size of 4	0.243	0.244	0.237	0.238	0.260	0.257
Households size of 5	0.144	0.143	0.154	0.147	0.133	0.140
Households size of 6	0.083	0.089	0.085	0.081	0.061	0.046
Household size of 7 or more	0.070	0.065	0.067	0.074	0.047	0.053
Occupation (15-64) (Share of individuals in households with at least one member)						
Manager	0.066	0.032	0.031	0.015	0.052	0.048
Professionals	0.188	0.173	0.107	0.103	0.145	0.140
Technicians	0.214	0.151	0.140	0.095	0.183	0.140
Clerical support	0.150	0.129	0.103	0.072	0.127	0.145
Service and sales	0.220	0.192	0.192	0.187	0.254	0.263
Skilled agriculture	0.035	0.037	0.064	0.106	0.025	0.021
Craft and trade	0.169	0.202	0.145	0.151	0.140	0.141
Machine operators	0.122	0.135	0.118	0.112	0.093	0.099
Elementary occs.	0.090	0.067	0.103	0.069	0.081	0.080
Labor status, age 15-64 (Share of individuals in households with at least one member)						
Employed	0.793	0.762	0.689	0.671	0.732	0.727
Retired	0.497	0.513	0.515	0.527	0.492	0.470
Student	0.223	0.226	0.220	0.192	0.221	0.216
Disabled	0.036	0.016	0.052	0.045	0.030	0.016

Other	0.727	0.725	0.794	0.754	0.745	0.703
Industry, age 15-64 (Share of individuals in households with at least one member)						
Agriculture, mining, and fishing	0.052	0.047	0.112	0.130	0.041	0.040
Manufacturing	0.225	0.241	0.191	0.177	0.147	0.158
Services and Sales	0.684	0.605	0.532	0.469	0.655	0.624
Share of members with education in HH (age 15-64)						
Primary education	0.075	0.067	0.107	0.074	0.081	0.074
Lower secondary	0.184	0.195	0.263	0.252	0.162	0.149
Upper secondary	0.536	0.569	0.521	0.580	0.578	0.639
Tertiary education	0.206	0.170	0.110	0.093	0.179	0.139
Dwelling characteristics						
Square meters	90.711	87.120	92.523	95.296	83.187	85.564

Table A2: Alpha model

	Coeff.	Std Err.
1 Retiree	-0.2663**	0.1066
No service sector workers	0.3921***	0.1407
1 working person	-0.289**	0.147
2 working persons	-0.2543**	0.1208
Constant	-5.5976***	0.1786
Adj. R2	0.0019	
Observations	2,229	

Figure A1. NUTS 3 Poverty estimates and 95% confidence intervals

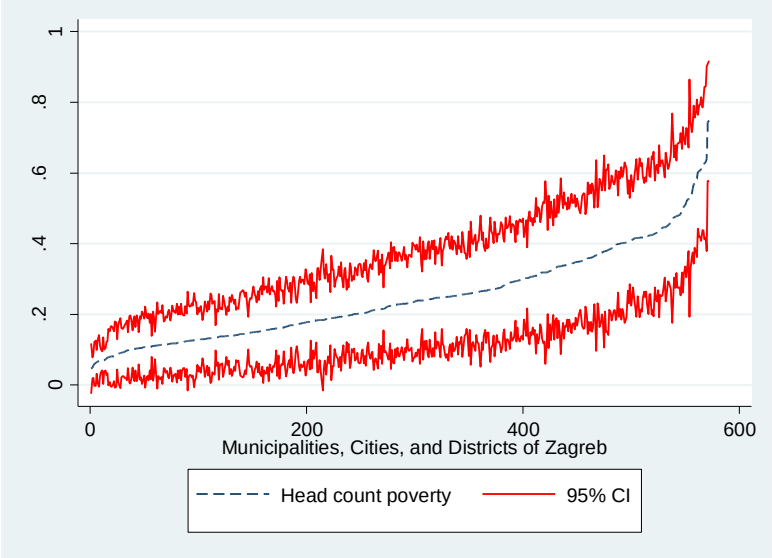


Figure A2: Poverty in the districts of Zagreb

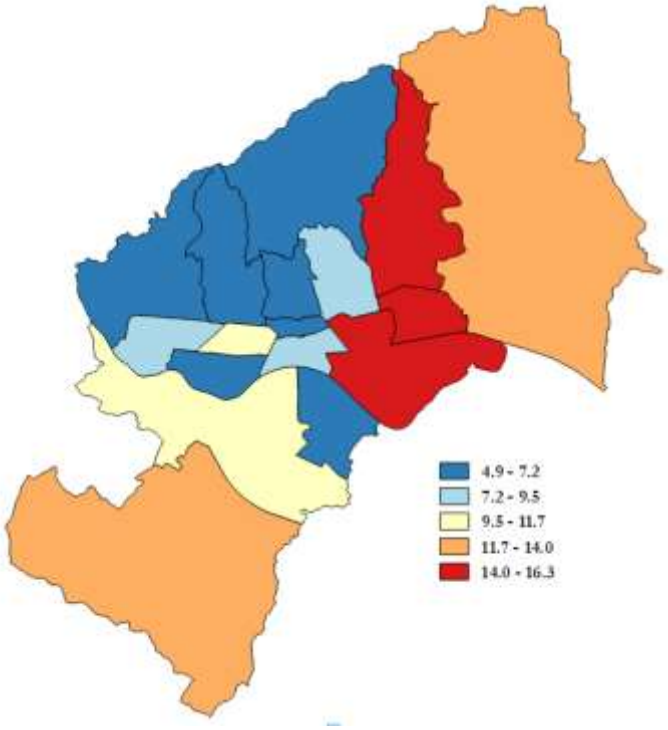


Table A3: Poverty indicators by LAU-2

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Donji Grad	35,609	6.90	1.60	1.60	0.40	0.50	0.20	0.30
Gornji Grad-Medveščak	29,750	5.50	1.80	1.20	0.40	0.40	0.20	0.20
Trnje	41,021	7.30	1.60	1.70	0.40	0.60	0.20	0.30
Maksimir	47,362	7.50	2.40	1.70	0.60	0.60	0.20	0.40
Pešćenica-Žitnjak	55,057	16.00	3.20	4.40	1.00	1.80	0.40	1.00
Novi Zagreb-istok	58,052	6.60	1.70	1.40	0.40	0.50	0.20	0.40
Novi Zagreb-zapad	56,647	10.40	2.30	2.50	0.60	0.90	0.30	0.70
Trešnjevka-sjever	54,197	9.90	2.60	2.40	0.70	0.90	0.30	0.60
Trešnjevka-jug	65,555	6.80	1.70	1.50	0.40	0.50	0.20	0.50
Črnomerec	37,577	6.80	2.20	1.50	0.60	0.50	0.20	0.30
Gornja Dubrava	60,882	16.10	3.90	4.20	1.20	1.70	0.50	1.10
Donja Dubrava	35,871	16.30	3.50	4.30	1.10	1.80	0.50	0.70
Stenjevec	50,678	8.70	2.20	2.10	0.60	0.80	0.20	0.50
Podsused-Vrapče	44,580	6.80	1.40	1.50	0.40	0.50	0.10	0.30
Podsljeme	18,858	4.90	1.50	1.10	0.40	0.40	0.10	0.10
Sesvete	68,924	12.70	6.80	3.30	2.00	1.30	0.90	1.00
Brezovica	11,720	12.30	3.80	2.90	1.10	1.10	0.40	0.20
Grad Zagreb	**772,340**	**9.80**	**0.90**	**2.40**	**0.30**	**0.90**	**0.10**	**8.60**
Andrijaševci	4,020	37.50	8.90	11.10	3.20	4.80	1.60	0.20
Antunovac	3,610	21.30	7.80	5.70	2.50	2.30	1.10	0.10
Babina Greda	3,516	42.60	10.90	13.10	4.20	5.70	2.10	0.20
Bakar	8,211	16.00	4.80	4.00	1.40	1.50	0.60	0.10
Bale - Valle	1,125	13.80	4.80	3.30	1.30	1.20	0.50	0.00
Barban	2,688	10.70	5.80	2.50	1.70	0.90	0.70	0.00
Barilović	2,967	23.90	8.60	6.60	2.80	2.70	1.30	0.10
Baška	1,658	12.60	4.90	2.90	1.40	1.00	0.60	0.00
Baška Voda	2,773	21.60	6.30	5.70	1.90	2.20	0.80	0.10
Bebrina	3,185	40.30	10.70	12.40	4.30	5.50	2.20	0.10
Bedekovčina	7,759	20.00	5.50	5.30	1.70	2.10	0.80	0.20
Bednja	3,954	31.60	7.30	9.30	2.70	4.00	1.30	0.10
Bedenica	1,424	17.70	7.70	4.30	2.30	1.60	1.00	0.00
Beli Manastir	9,459	32.50	6.40	10.50	2.60	4.80	1.40	0.30
Belica	3,150	12.30	5.10	2.90	1.30	1.00	0.50	0.00
Belišće	10,509	36.20	10.20	11.60	4.00	5.30	2.10	0.40
Benkovac	10,934	42.30	8.60	13.20	3.50	5.80	1.80	0.50
Berek	1,437	39.90	10.50	13.10	4.20	6.10	2.20	0.10
Beretinec	2,117	18.30	7.50	4.40	2.10	1.70	0.90	0.00
Bibinje	3,969	30.30	8.50	8.50	3.00	3.50	1.50	0.10
Bilice	2,255	18.20	6.90	4.70	2.10	1.80	0.90	0.00
Bilje	5,590	23.00	6.40	6.50	2.10	2.70	1.00	0.10
Biograd Na Moru	5,501	17.00	6.30	4.30	1.90	1.60	0.80	0.10
Biskupija	1,688	56.70	11.40	18.90	5.60	8.50	3.10	0.10
Bistra	6,389	15.30	6.50	3.70	1.80	1.40	0.80	0.10
Bizovac	4,456	23.00	7.00	6.00	2.20	2.40	1.00	0.10
Bjelovar	39,061	15.80	5.00	4.20	1.60	1.70	0.70	0.70

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Blato	3,460	6.00	3.10	1.10	0.70	0.40	0.20	0.00
Bogdanovci	1,877	24.20	8.40	6.30	2.70	2.40	1.20	0.10
Bol	1,576	16.50	5.90	4.00	1.60	1.50	0.70	0.00
Borovo	4,857	41.80	7.80	13.00	3.30	5.80	1.80	0.20
Bosiljevo	1,253	24.70	6.30	7.00	2.20	2.90	1.10	0.00
Bošnjaci	3,748	43.00	9.90	14.20	4.40	6.50	2.40	0.20
Brckovljani	6,432	26.20	7.20	7.40	2.40	3.10	1.10	0.20
Brdovec	11,048	13.70	4.00	3.30	1.10	1.20	0.40	0.20
Brela	1,698	14.50	5.30	3.50	1.50	1.30	0.60	0.00
Brestovac	3,691	40.20	11.60	12.20	4.50	5.20	2.20	0.20
Breznica	2,188	27.70	9.40	7.60	3.10	3.10	1.40	0.10
Breznički Hum	1,314	25.00	9.20	6.70	2.90	2.60	1.30	0.00
Brinje	3,180	33.30	7.30	9.70	2.70	4.10	1.40	0.10
Brod Moravice	849	20.30	5.60	7.00	2.10	3.50	1.20	0.00
Brodski Stupnik	2,950	47.20	15.10	15.40	6.60	6.90	3.50	0.20
Brtonigla - Verteneglio	1,622	14.60	5.90	3.30	1.50	1.20	0.60	0.00
Budinščina	2,390	36.10	10.70	10.50	3.90	4.40	1.90	0.10
Buje - Buie	5,102	10.70	4.40	2.50	1.20	0.90	0.50	0.10
Bukovlje	3,018	34.80	7.60	10.50	2.80	4.50	1.30	0.10
Buzet	6,048	6.90	3.40	1.50	0.90	0.50	0.30	0.00
Cerna	4,489	37.30	8.00	11.20	3.10	4.80	1.50	0.20
Cernik	3,562	40.10	9.40	12.40	3.90	5.40	2.00	0.20
Cerovlje	1,650	12.20	5.50	2.70	1.30	1.00	0.50	0.00
Cestica	5,504	34.90	6.90	10.70	2.40	4.90	1.20	0.20
Cetingrad	1,921	32.10	11.00	9.40	4.20	3.90	2.10	0.10
Cista Provo	2,310	42.40	11.40	13.10	4.70	5.70	2.40	0.10
Civljane	226	64.00	13.30	22.50	7.00	10.60	4.00	0.00
Cres	2,777	10.70	4.60	2.40	1.20	0.80	0.50	0.00
Crikvenica	10,947	13.00	2.80	3.10	0.80	1.20	0.30	0.20
Crnac	1,445	41.80	8.80	12.80	3.70	5.50	1.90	0.10
Čabar	3,748	4.70	3.70	0.90	0.90	0.30	0.30	0.00
Čačinci	2,758	37.90	8.80	11.30	3.30	4.80	1.60	0.10
Čađavica	1,983	33.90	10.60	9.70	3.80	4.00	1.80	0.10
Čaglin	2,363	46.30	9.80	15.20	4.40	6.90	2.40	0.10
Čakovec	26,422	17.20	3.10	5.30	1.00	2.50	0.50	0.50
Čavle	7,071	12.20	4.10	2.90	1.10	1.00	0.50	0.10
Čazma	7,926	13.20	4.20	3.20	1.10	1.20	0.40	0.10
Čeminac	2,780	27.40	6.80	7.30	2.20	2.90	1.00	0.10
Čepin	11,299	19.50	6.50	5.10	2.00	2.00	0.90	0.30
Darda	6,746	45.50	8.40	16.00	3.70	7.80	2.10	0.30
Daruvar	11,482	10.80	3.40	2.50	0.90	0.90	0.30	0.10
Davor	2,967	33.70	10.20	9.60	3.70	3.90	1.80	0.10
Delnice	5,747	12.90	3.70	3.40	1.10	1.40	0.40	0.10
Dekanovec	735	18.40	7.10	4.50	2.00	1.60	0.80	0.00
Desinić	2,604	26.40	9.30	7.00	2.90	2.80	1.30	0.10
Dežanovac	2,706	37.80	13.90	11.30	5.80	4.90	3.00	0.10

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Dicmo	2,753	29.90	8.50	8.50	3.00	3.50	1.40	0.10
Dobrinj	2,051	14.00	5.30	3.20	1.50	1.10	0.60	0.00
Domašinec	2,217	24.70	7.60	7.40	2.50	3.30	1.20	0.10
Donja Dubrava	1,895	17.60	6.20	4.30	1.80	1.60	0.80	0.00
Donja Motičina	1,637	42.70	11.90	12.90	5.00	5.50	2.50	0.10
Donja Stubica	5,375	15.00	5.10	3.70	1.40	1.40	0.60	0.10
Donja Voća	2,392	44.60	7.20	14.30	3.00	6.40	1.60	0.10
Donji Andrijevci	3,666	32.30	7.70	9.50	2.90	4.00	1.40	0.10
Donji Kraljevec	4,527	12.90	4.80	3.00	1.30	1.10	0.50	0.10
Donji Kukuruzari	1,634	61.20	8.80	21.90	5.00	10.50	3.00	0.10
Donji Lapac	2,028	47.20	11.70	15.70	5.30	7.20	2.90	0.10
Donji Miholjac	9,275	29.30	5.70	8.20	1.90	3.40	0.90	0.30
Donji Vidovec	1,378	21.10	6.00	6.10	1.90	2.60	0.90	0.00
Dragalić	1,340	30.30	9.60	8.90	3.50	3.80	1.70	0.00
Draganić	2,665	23.10	6.70	7.00	2.30	3.10	1.10	0.10
Draž	2,681	47.90	10.40	16.10	4.70	7.50	2.60	0.10
Drenovci	4,969	44.60	8.90	14.60	4.00	6.60	2.10	0.30
Drenje	2,592	51.60	10.80	17.30	4.90	8.00	2.70	0.20
Drniš	7,422	22.80	6.20	5.90	2.10	2.30	0.90	0.20
Drnje	1,832	19.20	5.80	5.90	1.90	2.70	1.00	0.00
Dubrava	5,023	31.80	9.60	8.80	3.40	3.50	1.60	0.20
Dubravica	1,425	18.80	6.50	4.80	2.00	1.90	0.90	0.00
Dubrovačko Primorje	2,081	11.30	4.50	2.70	1.20	1.00	0.50	0.00
Dubrovnik	41,417	7.80	2.30	1.80	0.60	0.60	0.20	0.40
Duga Resa	11,120	19.00	7.00	4.90	2.30	1.90	1.00	0.20
Dugi Rat	6,982	26.00	7.10	7.10	2.30	2.80	1.00	0.20
Dugopolje	3,439	24.80	8.60	6.30	2.60	2.40	1.10	0.10
Dugo Selo	17,201	16.80	4.90	4.30	1.50	1.70	0.60	0.30
Dvor	5,478	45.20	8.10	14.80	3.70	6.70	2.00	0.30
Đakovo	26,790	30.20	6.00	8.70	2.10	3.70	1.00	0.90
Đelekovec	1,490	18.70	5.40	4.90	1.70	1.90	0.80	0.00
Đulovac	3,171	43.50	12.40	14.10	5.10	6.50	2.70	0.20
Đurđenovac	6,598	36.50	7.00	10.80	2.50	4.60	1.20	0.30
Đurđevac	8,090	23.90	5.30	7.70	1.90	3.60	1.00	0.20
Đurmanec	4,150	17.80	6.90	4.20	2.00	1.50	0.80	0.10
Erdut	7,108	48.30	11.70	16.00	5.20	7.30	2.80	0.40
Ernestinovo	2,064	14.40	6.00	3.30	1.60	1.10	0.60	0.00
Ervenik	1,098	62.80	11.00	22.70	6.00	10.80	3.50	0.10
Farkaševac	1,889	30.90	11.30	9.40	4.10	4.20	2.00	0.10
Fažana - Fasana	3,491	11.50	4.10	2.70	1.10	1.00	0.40	0.00
Ferdinandovac	1,739	22.40	9.20	6.30	2.90	2.60	1.40	0.00
Feričanci	2,093	39.00	9.10	12.10	3.70	5.30	1.90	0.10
Funtana - Fontane	907	15.50	5.90	3.70	1.60	1.40	0.60	0.00
Fužine	1,570	10.40	4.20	2.30	1.10	0.80	0.40	0.00
Galovac	1,226	25.30	8.60	6.60	2.70	2.50	1.20	0.00
Garčin	4,729	41.70	10.30	13.30	4.10	5.90	2.10	0.20

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Garešnica	10,258	26.70	5.70	7.90	2.00	3.40	1.00	0.30
Generalski Stol	2,586	23.90	7.10	6.10	2.10	2.40	0.90	0.10
Glina	8,757	28.10	6.30	8.10	2.20	3.40	1.10	0.30
Gola	2,389	22.90	6.80	6.00	2.00	2.40	0.90	0.10
Goričan	2,777	17.80	5.40	4.30	1.50	1.60	0.60	0.10
Gorjani	1,564	40.10	11.00	12.10	4.20	5.20	2.00	0.10
Gornja Rijeka	1,753	22.40	7.80	5.40	2.20	2.00	0.90	0.00
Gornja Stubica	5,258	23.30	6.70	6.00	2.00	2.30	0.90	0.10
Gornja Vrba	2,478	34.50	8.70	10.10	3.20	4.20	1.60	0.10
Gornji Bogićevci	1,957	52.60	7.50	18.70	3.70	9.00	2.20	0.10
Gornji Kneginec	5,252	20.70	6.10	5.30	1.80	2.00	0.70	0.10
Gornji Mihaljevec	1,911	24.90	8.30	6.50	2.70	2.50	1.20	0.10
Gospić	12,320	14.10	3.60	3.50	1.00	1.30	0.40	0.20
Gračac	4,661	43.40	8.40	13.80	3.60	6.10	1.80	0.20
Gračišće	1,416	11.50	4.70	2.60	1.20	0.90	0.50	0.00
Gradac	3,237	25.80	9.00	7.30	3.10	3.00	1.50	0.10
Gradec	3,601	25.70	7.80	7.10	2.60	2.90	1.20	0.10
Gradina	3,799	55.60	9.20	19.20	4.60	9.00	2.60	0.20
Gradište	2,627	34.20	8.00	10.00	3.00	4.20	1.50	0.10
Grožnjan - Grisignana	733	19.10	5.40	4.60	1.60	1.70	0.70	0.00
Grubišno Polje	6,383	19.40	4.20	5.30	1.30	2.10	0.60	0.10
Gundinci	2,013	58.50	11.40	20.50	5.80	9.70	3.30	0.10
Gunja	3,637	60.30	8.20	23.20	4.50	11.80	2.70	0.20
Gvozd	2,889	42.10	9.80	12.80	4.20	5.50	2.10	0.10
Hercegovac	2,378	15.90	6.20	4.00	1.80	1.50	0.80	0.00
Hlebine	1,271	23.20	6.90	6.60	2.30	2.90	1.10	0.00
Hrašćina	1,535	22.10	6.80	5.30	2.00	1.90	0.80	0.00
Hrvace	3,595	39.60	10.80	11.80	4.20	5.00	2.10	0.20
Hrvatska Dubica	2,070	47.60	8.10	15.60	3.60	7.00	2.00	0.10
Hrvatska Kostajnica	2,734	27.40	7.80	7.40	2.70	2.90	1.30	0.10
Hum Na Sutli	4,851	11.80	5.70	2.80	1.60	1.00	0.70	0.10
Hvar	4,218	12.10	4.00	2.80	1.00	1.00	0.40	0.10
Ilok	6,500	19.30	5.80	5.00	1.80	1.90	0.80	0.10
Imotski	10,671	39.20	9.20	12.70	3.80	5.70	2.00	0.50
Ivanec	13,447	16.90	3.20	4.20	0.90	1.60	0.40	0.30
Ivanić-Grad	14,292	20.60	4.40	5.60	1.40	2.30	0.60	0.30
Ivankovo	7,762	36.70	6.90	10.50	2.60	4.40	1.20	0.30
Ivanska	2,908	24.50	8.40	7.00	2.70	3.00	1.30	0.10
Jagodnjak	1,969	62.20	9.40	24.30	5.60	12.60	3.50	0.10
Jakovlje	3,813	15.00	5.40	3.60	1.50	1.30	0.60	0.10
Jakšić	3,986	26.70	7.50	7.50	2.60	3.10	1.20	0.10
Jalžabet	3,120	23.40	6.50	6.20	2.00	2.50	0.90	0.10
Janjina	544	8.10	4.30	1.70	1.10	0.50	0.40	0.00
Jarmina	2,440	31.10	9.80	8.50	3.30	3.40	1.50	0.10
Jasenice	1,395	25.60	9.00	6.60	2.80	2.50	1.20	0.00
Jasenovac	1,987	34.40	10.10	10.00	3.70	4.10	1.80	0.10

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Jastrebarsko	15,625	13.10	3.90	3.20	1.10	1.20	0.40	0.20
Jelenje	5,277	19.20	6.00	4.70	1.70	1.80	0.70	0.10
Jelsa	3,556	16.10	6.90	4.00	2.10	1.50	0.90	0.10
Jesenje	1,512	21.50	7.90	5.40	2.40	2.00	1.00	0.00
Josipdol	3,723	30.00	8.80	9.10	3.10	4.10	1.50	0.10
Kali	1,628	18.90	9.00	4.50	2.80	1.60	1.20	0.00
Kalinovac	1,596	13.30	4.90	3.40	1.50	1.30	0.60	0.00
Kalnik	1,351	28.80	8.60	8.20	2.90	3.40	1.40	0.00
Kamanje	855	17.00	6.30	3.90	1.70	1.40	0.70	0.00
Kanfanar	1,541	8.10	3.60	1.80	0.90	0.60	0.40	0.00
Kapela	2,939	37.50	10.20	11.50	4.00	5.00	2.00	0.10
Kaptol	3,446	40.20	10.00	12.70	4.00	5.60	2.00	0.20
Karlobag	915	25.90	10.30	7.00	3.70	2.80	1.70	0.00
Karlovac	54,120	18.00	2.80	4.80	0.90	1.90	0.40	1.10
Karojba	1,427	12.90	4.60	2.90	1.20	1.00	0.50	0.00
Kastav	10,346	9.20	3.40	2.10	0.90	0.70	0.30	0.10
Kaštela	38,044	20.30	5.20	5.20	1.60	2.00	0.70	0.90
Kaštelir-Labinci	1,463	17.30	6.80	4.30	2.00	1.60	0.90	0.00
Kijevo	415	24.40	8.40	5.90	2.50	2.10	1.00	0.00
Kistanje	3,429	74.80	8.60	32.50	6.40	17.80	4.40	0.30
Klakar	2,251	29.60	8.30	8.10	2.90	3.30	1.40	0.10
Klana	1,966	9.70	4.00	2.20	1.00	0.80	0.40	0.00
Klanjec	2,911	8.90	4.00	2.00	1.00	0.70	0.40	0.00
Klenovnik	2,006	20.30	7.20	5.20	2.20	2.00	0.90	0.00
Klinča Sela	5,108	14.50	6.30	3.50	1.80	1.30	0.70	0.10
Klis	4,738	23.10	5.20	6.00	1.60	2.30	0.70	0.10
Kloštar Ivanić	5,990	27.50	7.70	7.70	2.70	3.20	1.30	0.20
Kloštar Podravski	3,200	41.00	8.30	15.40	3.70	8.00	2.10	0.10
Kneževi Vinogradi	4,517	41.50	9.10	13.30	3.80	6.00	2.00	0.20
Knin	15,011	42.70	7.70	14.00	3.40	6.30	1.80	0.70
Kolan	789	10.10	4.80	2.10	1.20	0.70	0.40	0.00
Komiža	1,519	16.30	5.40	3.90	1.50	1.40	0.60	0.00
Konavle	8,549	10.40	4.60	2.40	1.20	0.90	0.50	0.10
Končanica	2,340	11.20	6.20	2.70	1.70	1.00	0.70	0.00
Konjščina	3,658	18.60	8.00	4.80	2.50	1.80	1.10	0.10
Koprivnica	29,930	14.70	2.30	3.80	0.70	1.50	0.30	0.50
Koprivnički Bregi	2,270	20.50	4.90	5.20	1.50	2.00	0.70	0.10
Koprivnički Ivanec	1,972	19.70	7.60	5.00	2.30	1.90	1.00	0.00
Korčula	5,585	12.70	5.70	2.90	1.60	1.10	0.60	0.10
Kostrena	4,152	10.70	4.10	2.60	1.10	0.90	0.50	0.10
Koška	3,889	34.80	8.40	10.30	3.20	4.40	1.60	0.20
Kotoriba	3,080	25.80	5.70	9.40	2.20	4.80	1.30	0.10
Kraljevec Na Sutli	1,727	10.30	4.20	2.10	1.00	0.70	0.40	0.00
Kraljevica	4,490	11.50	3.90	2.60	1.00	0.90	0.40	0.10
Krapina	12,105	13.00	3.90	3.10	1.00	1.20	0.40	0.20
Krapinske Toplice	5,249	14.00	5.60	3.50	1.60	1.30	0.70	0.10

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Krašić	2,511	21.30	7.00	5.50	2.20	2.10	1.00	0.10
Kravarsko	1,966	34.20	9.00	9.90	3.30	4.10	1.60	0.10
Križ	6,794	26.90	6.20	7.30	2.00	2.90	0.90	0.20
Križevci	20,631	15.10	4.60	3.70	1.30	1.40	0.60	0.40
Krk	5,951	10.50	5.20	2.30	1.30	0.80	0.50	0.10
Krnjak	1,826	48.20	10.50	16.20	4.80	7.50	2.70	0.10
Kršan	2,913	15.90	5.40	4.00	1.60	1.50	0.70	0.10
Kukljica	686	16.20	7.30	3.90	2.20	1.40	0.90	0.00
Kula Norinska	1,608	37.70	9.60	11.60	3.80	5.10	2.00	0.10
Kumrovec	1,587	16.20	5.60	4.00	1.60	1.50	0.70	0.00
Kutina	22,337	19.70	4.00	5.50	1.30	2.30	0.60	0.50
Kutjevo	6,165	30.70	8.50	8.70	3.00	3.60	1.40	0.20
Labin	11,497	6.70	3.10	1.40	0.80	0.50	0.30	0.10
Lanišće	328	17.80	6.90	4.00	2.00	1.40	0.90	0.00
Lasinja	1,612	15.00	6.60	3.80	1.90	1.50	0.80	0.00
Lastovo	792	16.50	7.20	4.00	2.10	1.50	0.90	0.00
Lećevica	577	34.10	9.70	9.80	3.60	4.00	1.80	0.00
Legrad	2,185	11.80	4.60	3.00	1.30	1.10	0.50	0.00
Lekenik	5,885	22.90	6.20	6.10	1.90	2.50	0.90	0.20
Lepoglava	7,437	22.70	6.40	6.10	2.10	2.40	1.00	0.20
Levanjska Varoš	1,016	60.50	9.50	23.40	5.60	11.90	3.60	0.10
Lipik	6,002	22.50	6.40	6.10	2.10	2.40	0.90	0.20
Lipovljani	3,450	17.50	6.30	4.30	1.80	1.60	0.80	0.10
Lišane Ostovičke	686	32.30	10.00	9.70	3.90	4.20	2.00	0.00
Ližnjan - Lisignano	3,806	14.10	4.60	3.40	1.30	1.30	0.50	0.10
Lobor	2,818	25.50	6.10	6.60	1.90	2.50	0.80	0.10
Lokve	1,004	15.60	5.40	3.60	1.50	1.30	0.60	0.00
Lokvičići	783	50.80	8.80	16.30	4.20	7.20	2.30	0.00
Lopar	1,233	22.70	7.60	6.00	2.40	2.30	1.10	0.00
Lovas	1,207	15.70	7.50	3.80	2.10	1.40	0.90	0.00
Lovinac	995	13.20	6.30	3.30	1.80	1.30	0.80	0.00
Lovran	4,033	9.50	3.80	2.20	1.00	0.80	0.40	0.00
Lovreć	1,691	35.10	9.80	10.50	3.80	4.50	1.90	0.10
Ludbreg	8,223	10.70	4.20	2.60	1.10	1.00	0.50	0.10
Luka	1,323	20.10	6.70	5.10	2.00	2.00	0.90	0.00
Lukač	3,568	41.30	6.90	12.80	2.70	5.60	1.40	0.20
Lumbarda	1,211	11.40	5.70	2.60	1.40	0.90	0.60	0.00
Lupoglav	918	13.70	6.20	3.10	1.60	1.10	0.60	0.00
Ljubešćica	1,837	21.80	6.20	5.60	1.90	2.20	0.80	0.00
Mače	2,511	30.60	8.00	8.20	2.80	3.30	1.30	0.10
Magadenovac	1,904	26.60	10.90	7.60	3.60	3.20	1.70	0.10
Majur	1,185	33.90	8.80	10.00	3.30	4.20	1.60	0.00
Makarska	13,684	11.60	3.40	2.80	1.00	1.10	0.40	0.20
Mala Subotica	5,274	24.80	4.60	9.40	1.80	5.00	1.10	0.10
Mali Bukovec	2,185	21.40	7.10	5.80	2.20	2.40	1.00	0.10
Mali Lošinj	7,916	14.70	4.50	3.40	1.20	1.20	0.50	0.10

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Malinska-Dubašnica	3,050	13.40	5.20	3.10	1.40	1.10	0.60	0.00
Marčana	4,199	13.70	4.00	3.30	1.10	1.20	0.50	0.10
Marija Bistrica	5,889	18.30	4.80	4.60	1.40	1.70	0.60	0.10
Marija Gorica	2,214	16.90	6.10	4.40	1.80	1.70	0.80	0.00
Marijanci	2,358	28.60	8.10	7.50	2.50	2.90	1.10	0.10
Marina	4,496	24.00	5.90	6.20	1.90	2.40	0.80	0.10
Markušica	2,524	49.30	8.90	16.70	4.00	7.70	2.10	0.10
Martijanec	3,788	16.60	6.60	3.90	1.80	1.40	0.80	0.10
Martinska Ves	3,393	26.30	7.50	7.10	2.50	2.80	1.10	0.10
Maruševec	6,275	15.00	4.30	3.70	1.10	1.40	0.50	0.10
Matulji	11,121	11.10	4.10	2.60	1.10	1.00	0.50	0.10
Medulin	6,374	6.20	3.20	1.40	0.80	0.50	0.30	0.00
Metković	15,956	29.00	7.20	8.40	2.50	3.50	1.20	0.50
Mihovljan	1,921	35.00	8.10	10.10	3.00	4.20	1.40	0.10
Mikleuš	1,449	47.60	10.30	15.40	4.60	6.90	2.50	0.10
Milna	1,022	14.50	6.30	3.40	1.80	1.20	0.70	0.00
Mljet	1,061	20.10	6.40	5.30	2.10	2.10	0.90	0.00
Molve	2,147	23.70	8.10	6.10	2.50	2.40	1.10	0.10
Muć	3,838	25.50	7.10	6.60	2.30	2.50	1.00	0.10
Murter - Kornati	2,040	20.80	6.80	5.20	2.10	1.90	0.90	0.00
Mošćenička Draga	1,526	10.10	4.30	2.30	1.10	0.80	0.40	0.00
Motovun - Montona	916	19.60	6.90	5.10	2.10	1.90	0.90	0.00
Mrkopalj	1,205	12.80	5.50	2.90	1.40	1.00	0.60	0.00
Mursko-Središće	6,209	24.90	7.00	7.90	2.40	3.70	1.20	0.20
Našice	15,912	24.30	5.80	7.00	1.90	3.00	0.90	0.40
Nedelišće	11,700	23.90	4.10	8.40	1.50	4.20	0.80	0.30
Negoslavci	1,370	40.20	11.20	12.30	4.30	5.30	2.20	0.10
Nerežišća	845	13.80	5.80	3.00	1.50	1.00	0.50	0.00
Netretić	2,791	22.20	7.30	5.70	2.20	2.20	0.90	0.10
Nin	2,710	23.00	6.90	6.00	2.40	2.30	1.10	0.10
Nova Bukovica	1,769	50.50	9.70	17.00	4.50	7.80	2.50	0.10
Nova Gradiška	13,880	26.70	6.10	7.90	2.10	3.40	1.00	0.40
Nova Kapela	4,108	35.20	9.70	10.00	3.50	4.00	1.70	0.20
Nova Rača	3,391	20.20	7.20	5.20	2.10	2.00	0.90	0.10
Novalja	3,613	16.20	5.30	3.80	1.40	1.40	0.60	0.10
Novi Golubovec	971	31.90	10.00	9.00	3.50	3.70	1.60	0.00
Novi Marof	13,103	14.20	3.80	3.40	1.00	1.30	0.40	0.20
Novi Vinodolski	4,976	13.90	4.30	3.40	1.20	1.30	0.50	0.10
Novigrad	2,365	25.80	5.80	6.80	1.80	2.70	0.80	0.10
Novigrad - Cittanova	4,145	9.30	3.50	2.10	0.90	0.70	0.40	0.00
Novigrad Podravski	2,758	32.90	7.50	10.10	2.70	4.60	1.30	0.10
Novo Virje	1,169	18.40	7.60	4.30	2.10	1.60	0.80	0.00
Novska	13,404	25.20	7.80	7.10	2.70	2.90	1.30	0.40
Nuštar	5,486	25.00	6.90	7.00	2.30	2.90	1.00	0.20
Nijemci	4,643	38.30	12.30	11.80	4.80	5.20	2.40	0.20
Obrovac	4,254	43.70	9.30	14.50	4.10	6.70	2.30	0.20

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Ogulin	13,687	19.60	5.30	5.20	1.60	2.10	0.70	0.30
Okrug	3,326	26.70	6.40	7.30	2.10	2.90	1.00	0.10
Okučani	3,362	63.10	10.90	24.00	6.60	12.10	4.20	0.20
Omiš	14,654	27.10	6.70	7.50	2.30	3.00	1.00	0.50
Omišalj	2,973	14.00	4.90	3.70	1.50	1.50	0.70	0.00
Opatija	11,369	12.40	4.00	2.90	1.10	1.10	0.40	0.20
Oprisavci	2,481	24.70	7.30	6.50	2.20	2.60	1.00	0.10
Oprtalj - Portole	850	19.30	7.80	5.00	2.40	1.90	1.00	0.00
Opuzen	3,133	18.60	6.50	4.70	2.00	1.80	0.90	0.10
Orahovica	5,090	25.40	6.70	6.90	2.30	2.80	1.00	0.10
Orebić	4,031	9.00	5.00	2.00	1.30	0.70	0.50	0.00
Orehovica	2,478	39.90	7.00	16.30	3.50	8.90	2.30	0.10
Oriovac	5,719	33.50	7.80	9.80	2.90	4.20	1.40	0.20
Orle	1,924	28.10	6.80	8.10	2.30	3.50	1.10	0.10
Oroslavje	6,039	14.20	4.00	3.50	1.10	1.30	0.50	0.10
Osijek	105,841	18.30	3.20	4.90	1.00	1.90	0.40	2.20
Otočac	9,516	17.30	4.00	4.50	1.20	1.80	0.50	0.20
Otok (Split)	5,401	41.70	11.50	12.90	4.70	5.70	2.40	0.30
Otok (Vinkovci)	6,218	35.90	10.90	10.70	4.20	4.50	2.10	0.30
Ozalj	6,537	27.00	10.40	7.40	3.30	3.00	1.50	0.20
Pag	3,802	11.30	4.60	2.50	1.20	0.90	0.40	0.00
Pakoštane	4,090	39.90	10.50	12.50	4.40	5.50	2.30	0.20
Pakrac	8,345	24.10	5.90	6.60	2.00	2.60	0.90	0.20
Pašman	2,069	29.00	9.60	7.80	3.30	3.10	1.50	0.10
Pazin	8,570	18.40	10.20	4.60	3.00	1.80	1.30	0.20
Perušić	2,636	25.00	8.30	7.00	2.80	2.90	1.30	0.10
Peteranec	2,648	29.50	6.70	10.10	2.50	5.00	1.30	0.10
Petlovac	2,350	45.70	9.00	14.60	3.90	6.50	2.00	0.10
Petrijanec	4,695	24.10	7.20	8.40	2.50	4.30	1.40	0.10
Petrijevci	2,761	30.20	8.30	8.50	2.80	3.50	1.30	0.10
Petrinja	23,896	19.00	4.50	5.10	1.50	2.00	0.70	0.50
Petrovsko	2,643	25.20	8.00	6.70	2.40	2.70	1.10	0.10
Pićan	1,805	12.60	5.40	2.80	1.40	0.90	0.50	0.00
Pirovac	1,850	26.60	7.40	7.00	2.50	2.70	1.10	0.10
Pisarovina	3,661	10.40	4.70	2.40	1.20	0.90	0.50	0.00
Pitomača	9,782	40.80	6.20	13.50	2.50	6.30	1.40	0.50
Plaški	2,057	52.40	10.20	17.10	4.80	7.70	2.60	0.10
Pleternica	11,115	28.70	8.10	8.00	2.90	3.20	1.30	0.40
Plitvička Jezera	4,299	15.40	5.20	3.70	1.50	1.40	0.60	0.10
Ploče	9,776	21.00	6.20	5.50	2.00	2.10	0.90	0.20
Podbablje	4,679	35.30	6.70	10.90	2.60	4.80	1.30	0.20
Podcrkavlje	2,544	33.80	8.30	10.20	3.20	4.40	1.60	0.10
Podgora	2,505	25.10	6.70	6.80	2.20	2.70	1.00	0.10
Podgorač	2,834	53.80	9.10	19.40	4.20	9.70	2.40	0.20
Podravska Moslavina	1,153	35.10	9.40	10.20	3.40	4.30	1.60	0.00
Podravske Sesvete	1,616	20.40	6.20	5.30	1.90	2.10	0.80	0.00

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Podstrana	8,932	11.40	3.40	2.80	0.90	1.10	0.40	0.10
Podturen	3,810	29.20	8.30	8.80	2.70	4.00	1.30	0.10
Pojezerje	896	38.00	11.70	10.90	4.40	4.50	2.10	0.00
Polača	1,452	31.50	9.30	8.70	3.30	3.50	1.50	0.10
Poličnik	4,454	29.60	8.80	8.00	3.00	3.10	1.30	0.10
Pokupsko	2,210	40.50	8.90	12.60	3.50	5.60	1.80	0.10
Popovac	2,044	43.00	9.50	14.00	4.30	6.30	2.30	0.10
Popovača	11,394	25.70	6.00	7.70	2.10	3.40	1.00	0.30
Poreč - Parenzo	16,438	11.50	3.50	2.80	1.00	1.00	0.40	0.20
Posedarje	3,565	32.50	8.70	9.20	3.10	3.80	1.40	0.10
Postira	1,542	11.80	4.40	2.70	1.20	1.00	0.50	0.00
Povljana	756	17.00	7.00	4.10	2.00	1.50	0.80	0.00
Požega	25,406	18.80	3.80	4.90	1.20	1.90	0.50	0.50
Pregrada	6,485	24.70	6.50	6.30	2.00	2.40	0.80	0.20
Preko	3,339	17.40	5.90	4.10	1.70	1.50	0.70	0.10
Prelog	7,638	14.60	4.60	3.50	1.30	1.30	0.50	0.10
Preseka	1,413	11.80	5.50	2.50	1.30	0.80	0.50	0.00
Prgomet	665	14.40	6.10	3.40	1.80	1.20	0.70	0.00
Pribislavec	3,096	32.00	6.10	13.10	2.70	7.20	1.70	0.10
Primorski Dolac	769	19.30	7.30	4.80	2.10	1.70	0.90	0.00
Primošten	2,794	18.40	5.80	4.40	1.70	1.60	0.70	0.10
Privlaka (Zadar)	2,211	25.10	8.70	6.70	2.70	2.60	1.20	0.10
Privlaka (Vinkovci)	2,754	33.60	9.60	9.60	3.40	4.00	1.60	0.10
Proložac	3,491	38.30	8.70	11.70	3.40	5.10	1.70	0.20
Promina	1,048	27.20	9.70	6.90	3.10	2.60	1.30	0.00
Pučišća	2,144	14.90	5.00	3.50	1.30	1.20	0.50	0.00
Pula - Pola	55,918	11.20	2.00	2.60	0.50	0.90	0.20	0.70
Punat	1,907	10.50	4.30	2.30	1.10	0.80	0.40	0.00
Punitovci	1,750	36.60	9.50	10.40	3.40	4.30	1.60	0.10
Pušća	2,615	13.40	5.30	3.30	1.50	1.30	0.60	0.00
Rab	7,942	15.20	6.10	3.60	1.70	1.30	0.70	0.10
Radoboj	3,339	25.30	6.00	6.60	1.80	2.50	0.80	0.10
Rakovec	1,238	15.50	7.60	3.50	2.10	1.20	0.80	0.00
Rakovica	2,368	23.00	8.20	6.10	2.60	2.30	1.20	0.10
Rasinja	3,171	40.50	7.00	13.10	2.80	6.00	1.40	0.10
Raša	3,074	14.90	4.90	3.50	1.40	1.30	0.50	0.10
Ravna Gora	2,426	8.10	4.00	1.70	1.00	0.50	0.40	0.00
Ražanac	2,900	32.70	10.10	9.20	3.60	3.80	1.70	0.10
Rešetari	4,653	52.90	17.10	18.80	8.80	9.00	5.20	0.30
Ribnik	473	18.40	8.40	4.40	2.60	1.60	1.10	0.00
Rijeka	125,857	10.90	1.50	2.60	0.40	0.90	0.20	1.60
Rogoznica	2,339	31.10	8.50	8.90	3.00	3.70	1.50	0.10
Rovinj	13,942	12.90	4.00	3.00	1.10	1.10	0.50	0.20
Rovišće	4,749	30.20	6.70	8.90	2.30	3.90	1.10	0.20
Rugvica	7,661	25.30	7.10	6.90	2.20	2.80	1.00	0.20
Runovići	2,373	28.50	9.60	8.40	3.50	3.60	1.80	0.10

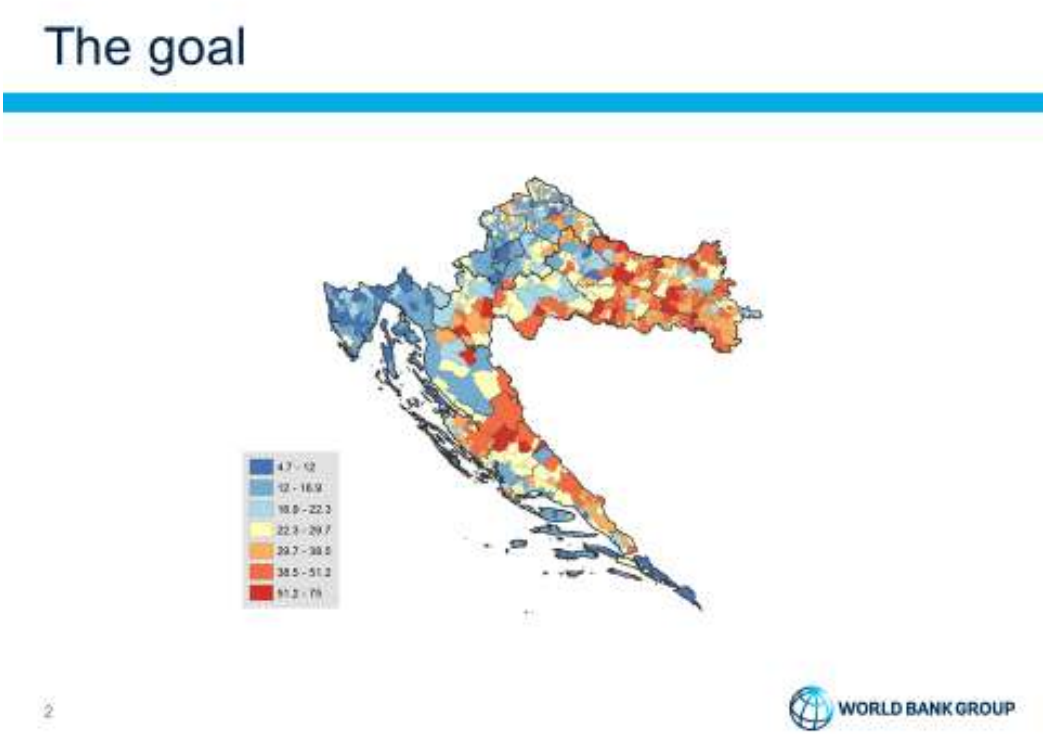
Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Ružić	1,559	22.60	8.40	5.60	2.60	2.10	1.10	0.00
Saborsko	626	33.60	12.70	10.10	4.80	4.30	2.40	0.00
Sali	1,672	14.00	5.90	3.00	1.60	1.00	0.60	0.00
Samobor	37,186	13.90	3.60	3.40	1.00	1.30	0.40	0.60
Satnica Đakovačka	2,082	44.70	10.70	14.10	4.50	6.30	2.40	0.10
Seget	4,787	26.00	7.30	6.90	2.30	2.70	1.00	0.10
Selca	1,786	17.80	5.70	4.30	1.70	1.60	0.70	0.00
Selnica	2,885	26.10	6.10	6.90	2.00	2.70	0.90	0.10
Semeljci	4,219	44.20	9.80	15.20	4.20	7.30	2.30	0.20
Senj	7,095	13.50	3.70	3.20	1.00	1.10	0.40	0.10
Severin	873	21.20	8.70	5.40	2.60	2.10	1.10	0.00
Sibinj	6,815	35.90	9.20	10.60	3.60	4.50	1.80	0.30
Sikirevci	2,461	41.60	11.30	12.30	4.30	5.20	2.10	0.10
Sinj	24,471	24.30	7.70	6.70	2.60	2.70	1.20	0.70
Sirač	2,201	23.40	8.60	6.10	2.70	2.40	1.20	0.10
Sisak	46,762	17.00	3.70	4.50	1.20	1.80	0.50	0.90
Skrad	1,054	8.60	4.70	1.70	1.10	0.50	0.40	0.00
Skradin	3,701	25.00	7.30	6.70	2.40	2.60	1.10	0.10
Slatina	13,529	25.90	5.30	7.40	1.80	3.10	0.90	0.40
Slavonski Brod	57,296	30.30	4.40	9.10	1.60	4.00	0.80	2.00
Slavonski Šamac	2,112	41.50	10.10	13.30	4.20	5.90	2.20	0.10
Slivno	1,906	22.80	7.50	6.00	2.20	2.40	1.00	0.00
Slunj	5,012	36.00	9.30	10.70	3.60	4.50	1.80	0.20
Smokvica	874	8.00	3.70	1.60	0.90	0.50	0.30	0.00
Sokolovac	3,346	34.00	9.00	10.10	3.40	4.30	1.70	0.10
Solin	23,670	12.00	4.00	2.90	1.10	1.10	0.40	0.30
Sopje	2,242	49.50	11.90	15.70	5.40	6.90	2.90	0.10
Split	173,163	13.40	1.80	3.30	0.50	1.20	0.20	2.60
Sračinec	4,689	18.50	5.90	4.80	1.70	1.90	0.70	0.10
Stankovci	1,982	31.90	10.00	8.60	3.50	3.40	1.60	0.10
Stara Gradiška	1,349	42.10	11.20	13.20	4.60	5.80	2.40	0.10
Stari Grad	2,744	15.60	6.20	3.70	1.80	1.30	0.70	0.00
Stari Jankovci	4,322	40.90	9.40	12.80	3.80	5.60	1.90	0.20
Stari Mikanovci	2,864	38.10	11.70	11.70	4.80	5.10	2.50	0.10
Starigrad	1,869	29.30	8.10	8.00	2.80	3.10	1.30	0.10
Staro Petrovo Selo	5,090	47.40	8.70	15.70	3.90	7.20	2.10	0.30
Ston	2,287	24.90	8.80	6.80	3.00	2.70	1.40	0.10
Strahoninec	2,653	10.30	4.70	2.30	1.20	0.80	0.50	0.00
Strizivojna	2,494	42.00	7.90	12.90	3.00	5.60	1.50	0.10
Stubičke Toplice	2,736	14.10	5.20	3.50	1.50	1.30	0.60	0.00
Stupnik	3,652	12.10	5.20	3.00	1.50	1.20	0.60	0.10
Sućuraj	458	21.40	8.50	5.00	2.50	1.80	1.00	0.00
Suhopolje	6,477	36.00	10.50	11.50	4.30	5.10	2.20	0.30
Sukošan	4,533	31.80	7.90	8.80	2.80	3.60	1.30	0.20
Sunja	5,709	44.50	9.80	14.30	4.30	6.40	2.30	0.30
Supetar	3,997	12.60	5.00	2.90	1.40	1.10	0.50	0.10

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Sutivan	800	11.60	4.90	2.50	1.30	0.80	0.50	0.00
Sveti Filip I Jakov	4,434	30.70	7.30	8.70	2.50	3.60	1.20	0.20
Sveti Ivan Zelina	15,623	19.90	4.90	5.10	1.50	2.00	0.70	0.40
Sveti Križ Začretje	6,037	19.40	5.50	4.80	1.70	1.80	0.70	0.10
Sveti Lovreč	1,014	10.10	4.90	2.10	1.20	0.70	0.50	0.00
Sveta Nedelja	2,880	8.60	4.80	1.90	1.20	0.60	0.50	0.00
Sveti Petar U Šumi	1,052	8.10	4.40	1.60	1.00	0.50	0.40	0.00
Svetvinčenat	2,184	13.20	5.40	3.40	1.60	1.30	0.70	0.00
Sveta Marija	2,284	11.20	4.60	2.40	1.20	0.80	0.40	0.00
Sveta Nedelja	17,785	11.00	5.00	2.60	1.30	0.90	0.50	0.20
Sveti Đurđ	3,763	27.20	7.90	7.80	2.60	3.40	1.20	0.10
Sveti Ilija	3,357	15.50	6.30	3.80	1.80	1.40	0.70	0.10
Sveti Ivan Žabno	5,086	21.20	7.30	5.30	2.10	2.00	0.90	0.10
Sveti Juraj Na Bregu	4,909	31.90	13.20	9.10	4.70	3.80	2.20	0.20
Sveti Martin Na Muri	2,586	21.40	5.00	5.50	1.50	2.10	0.60	0.10
Sveti Petar Orehovec	4,449	12.50	5.30	2.80	1.30	1.00	0.50	0.10
Šandrovac	1,742	14.40	5.00	3.70	1.50	1.50	0.70	0.00
Šenkovec	2,795	6.80	3.80	1.50	0.90	0.50	0.40	0.00
Šestanovac	1,849	38.70	10.50	11.50	4.10	4.80	2.00	0.10
Šibenik	45,426	13.90	3.00	3.40	0.90	1.20	0.40	0.70
Škabrnja	1,770	23.90	8.10	6.40	2.60	2.60	1.20	0.00
Šodolovci	1,598	31.80	10.30	9.30	3.80	3.90	1.80	0.10
Šolta	1,668	20.40	7.60	5.00	2.30	1.80	0.90	0.00
Špišić Bukovica	4,171	41.90	8.60	13.20	3.50	5.90	1.80	0.20
Štefanje	1,988	23.60	8.10	7.40	2.90	3.40	1.50	0.10
Štitar	2,049	41.80	10.70	12.60	4.30	5.30	2.10	0.10
Štrigova	2,526	24.90	6.80	6.70	2.10	2.70	1.00	0.10
Tar-Vabriga - Torre-Abrega	1,982	9.10	3.60	2.20	0.90	0.80	0.40	0.00
Tinjan	1,660	11.30	4.90	2.60	1.30	0.90	0.50	0.00
Tisno	3,089	22.80	7.50	5.70	2.30	2.10	0.90	0.10
Tkon	754	27.90	8.70	7.50	2.90	3.00	1.30	0.00
Tompojevci	1,523	37.40	10.70	11.00	4.20	4.60	2.10	0.10
Topusko	2,956	23.70	7.40	6.70	2.60	2.70	1.20	0.10
Tordinci	2,004	33.50	10.30	9.60	3.70	4.00	1.70	0.10
Tounj	1,143	38.80	9.80	11.60	3.90	5.00	2.00	0.10
Tovarnik	2,736	26.10	7.80	7.20	2.60	2.90	1.20	0.10
Tribunj	1,534	19.00	7.00	4.50	2.00	1.60	0.80	0.00
Trilj	8,801	42.30	8.40	13.00	3.40	5.60	1.70	0.40
Trnava	1,568	53.70	10.80	18.50	5.00	8.80	2.80	0.10
Trnovec Bartolovečki	6,470	11.70	4.10	2.70	1.10	0.90	0.40	0.10
Trogir	12,784	20.10	5.60	5.10	1.70	2.00	0.70	0.30
Trpanj	705	13.20	6.50	3.00	1.70	1.00	0.70	0.00
Trpinja	5,386	41.60	8.40	12.80	3.40	5.60	1.80	0.30
Tučepi	1,925	20.20	7.00	5.40	2.30	2.10	1.00	0.00
Tuhelj	1,973	18.20	5.50	4.40	1.60	1.70	0.60	0.00
Udbina	1,791	23.90	9.20	6.10	2.90	2.30	1.20	0.00

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Umag	13,383	13.00	4.00	3.10	1.10	1.20	0.40	0.20
Unešić	1,637	24.10	8.00	5.90	2.40	2.10	1.00	0.00
Valpovo	11,216	21.50	5.30	5.70	1.70	2.30	0.80	0.30
Varaždin	45,378	10.20	2.70	2.40	0.70	0.90	0.30	0.50
Varaždinske Toplice	6,316	17.30	6.20	4.30	1.80	1.60	0.80	0.10
Vela Luka	4,059	13.00	5.50	3.00	1.50	1.10	0.60	0.10
Velika	5,393	34.80	8.00	10.40	3.10	4.50	1.50	0.20
Velika Gorica	62,711	13.80	3.90	3.50	1.10	1.30	0.50	1.00
Velika Kopanica	3,258	47.90	10.50	15.40	4.60	6.90	2.40	0.20
Velika Ludina	2,614	27.00	8.00	7.80	2.70	3.30	1.30	0.10
Velika Pisanica	1,775	11.30	4.90	2.50	1.20	0.80	0.40	0.00
Velika Trnovitica	1,356	27.50	8.30	7.90	2.90	3.30	1.40	0.00
Veliki Bukovec	1,411	22.60	8.30	6.10	2.60	2.50	1.20	0.00
Veliki Grđevac	2,808	18.40	7.10	4.90	2.10	1.90	0.90	0.10
Veliko Trgovišće	4,856	26.90	8.70	7.20	2.80	2.80	1.30	0.10
Veliko Trojstvo	2,687	29.90	8.20	8.40	2.70	3.40	1.20	0.10
Vidovec	5,325	16.60	5.50	4.00	1.50	1.50	0.60	0.10
Viljevo	2,038	61.10	10.40	22.30	5.20	11.00	3.00	0.10
Vinica	3,336	15.90	5.50	3.90	1.60	1.50	0.70	0.10
Vinkovci	34,453	21.50	3.10	5.90	1.00	2.40	0.50	0.80
Vinodolska Općina	3,539	13.80	4.10	3.20	1.10	1.20	0.40	0.10
Vir	2,972	26.60	8.50	7.20	2.80	2.90	1.30	0.10
Virje	4,451	30.90	7.80	9.00	2.80	3.80	1.40	0.20
Virovitica	20,924	18.20	4.30	4.70	1.30	1.80	0.60	0.40
Vis	1,842	14.90	5.80	3.40	1.60	1.20	0.70	0.00
Visoko	1,498	35.30	7.90	9.40	2.70	3.60	1.30	0.10
Viškovci	1,885	36.70	13.80	11.70	5.70	5.30	3.00	0.10
Viškovo	14,235	12.20	3.80	2.90	1.00	1.10	0.40	0.20
Višnjan - Visignano	2,261	11.80	4.70	2.60	1.20	0.90	0.50	0.00
Vižinada - Visinada	1,146	10.80	4.80	2.40	1.20	0.80	0.50	0.00
Vladislavci	1,836	40.20	9.50	11.90	3.50	5.00	1.70	0.10
Voćin	2,274	74.30	8.40	31.20	6.00	16.70	4.10	0.20
Vođinci	1,931	34.80	9.20	9.90	3.30	4.10	1.50	0.10
Vodice	8,784	24.60	4.90	6.50	1.60	2.50	0.70	0.20
Vodnjan - Dignano	5,943	23.90	7.10	6.70	2.30	2.80	1.10	0.20
Vojnić	4,524	57.20	9.40	20.50	4.90	9.90	2.90	0.30
Vratišinec	1,953	20.20	7.00	4.80	2.00	1.70	0.80	0.00
Vrbanja	3,815	34.40	8.70	9.80	3.10	4.00	1.50	0.10
Vrbje	2,162	60.70	9.50	22.10	5.00	10.80	2.90	0.10
Vrbnik	1,244	9.00	4.70	2.00	1.20	0.70	0.50	0.00
Vrbovec	14,406	22.40	5.40	6.00	1.70	2.40	0.80	0.40
Vrbovsko	5,025	17.60	5.60	4.50	1.70	1.70	0.70	0.10
Vrgorac	6,336	34.10	7.90	10.10	2.90	4.30	1.40	0.20
Vrhovine	1,378	57.50	10.10	20.30	5.20	9.60	3.00	0.10
Vrlika	1,968	15.80	5.60	3.90	1.60	1.40	0.70	0.00
Vrpolje	3,457	41.60	9.70	13.10	4.00	5.80	2.00	0.20

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Vrsar - Orsera	2,152	9.80	4.30	2.20	1.10	0.80	0.40	0.00
Vrsi	2,036	26.10	8.40	6.60	2.60	2.50	1.10	0.10
Vuka	1,145	29.40	8.70	8.00	2.90	3.20	1.30	0.00
Vukovar	26,975	25.80	5.10	7.20	1.80	2.90	0.80	0.80
Zabok	8,938	12.60	5.00	3.10	1.40	1.10	0.60	0.10
Zadar	73,680	19.60	3.80	5.10	1.20	2.00	0.50	1.60
Zadvarje	250	15.00	5.90	3.80	1.70	1.40	0.80	0.00
Zagorska Sela	990	12.50	7.10	2.80	1.80	0.90	0.70	0.00
Zagvozd	1,186	30.70	8.40	8.50	2.90	3.40	1.40	0.00
Zaprešić	24,935	10.30	3.10	2.50	0.80	0.90	0.30	0.30
Zažablje	720	38.60	9.20	12.50	3.90	5.60	2.10	0.00
Zdenci	1,869	44.90	9.90	13.90	4.00	6.00	2.00	0.10
Zemunik Donji	1,885	19.80	6.90	5.00	2.10	1.90	0.90	0.00
Zlatar	6,014	20.10	5.00	5.20	1.50	2.00	0.70	0.10
Zlatar Bistrica	2,562	13.40	4.10	3.30	1.10	1.20	0.40	0.00
Zmijavci	2,038	29.10	8.40	8.00	2.80	3.20	1.30	0.10
Zrinski Topolovac	861	27.00	8.40	7.70	2.70	3.30	1.30	0.00
Žakanje	1,856	13.10	4.90	3.10	1.30	1.10	0.50	0.00
Žminj	3,462	7.90	4.10	1.70	1.00	0.60	0.40	0.00
Žumberak	830	24.40	7.10	6.00	2.10	2.30	0.90	0.00
Županja	11,622	34.70	9.70	11.00	3.90	5.00	2.10	0.50
Župa Dubrovačka	8,056	10.90	4.70	2.50	1.20	0.90	0.40	0.10

Annex 2. Poverty Mapping Workshop: Presented materials



Today's outline

- What are small area methods
- Data requirements
- Methods

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What are small area methods?

- A small area is commonly defined as "any subpopulation for which direct estimates of adequate precision cannot be produced" (Rao, 2003)
  - It can be geographical
  - It can be a group of the population (race, age)
- For example using the Croatian EU-SILC direct estimates are only reliable up to NUTS 2

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Croatia poverty map EU-SILC (level of representativeness)

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Other EU-SILC results

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The big picture

- **Household surveys** such as EU Statistics on Income and Living Conditions (EU-SILC) are the main source of indicators of living conditions, poverty, and social exclusion.
  - Provide detailed information on multiple indicators of well-being
  - Samples too small to be representative for small sub-national units.

- **Population censuses**
  - Provide 100% coverage, permitting assessment for small areas
  - Very limited information on poverty and social exclusion indicators

➔ Combine survey and census data to exploit the strengths of each information source. Hands-on work with national statistical institutes, used official data sources (population censuses and EU-SILC surveys) to estimate risk of poverty at lowest possible sub-national level.

Data Sources

- **Household surveys**
  - **EU-SILC (income)**
  - **HBS (consumption)**

- **Population censuses**
  - **Census of Population, Households and Dwellings 2011**

Data requirements

- HBS/EU-SILC and Census have variables in common between them
  - Questions should be defined in a similar manner in both data sources
  - Variables should have similar data generating processes
- Common variables should be sufficiently correlated with the welfare measure of interest (income or consumption)
- Additionally we need a location (cluster) variable in order to link the census and survey at that level
- Each location (cluster) in the household survey data should have at least 3 viable observations

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Data requirements

- Location Code Matching:
  - Ensure consistency of location codes between Census and household survey
- Definition Matching:
  - Create common variables in Census and household survey
- Statistical Matching:
  - Ensure statistical properties (usually means) of the common variables are the same between Census and household survey
- Creating location variables
  - Auxiliary data sources: GIS data; Other census
  - Create census aggregated variables at the cluster or higher levels (this last step is crucial; more on this later)

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The methods

- Ideally, every household is in the Census.
- Not every household is in the survey
- Not every cluster from the Census is included into the household survey.
- Use household welfare regression parameters in order to be able to impute welfare in the Census

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Three steps

- Prepare the data in the household survey and the Census
  - Ensure that data is comparable
- Prepare a welfare model using the household survey
  - Fine tune welfare model
- Simulation phase
  - Take the parameters obtained from the welfare model from the household survey and apply these to the Census

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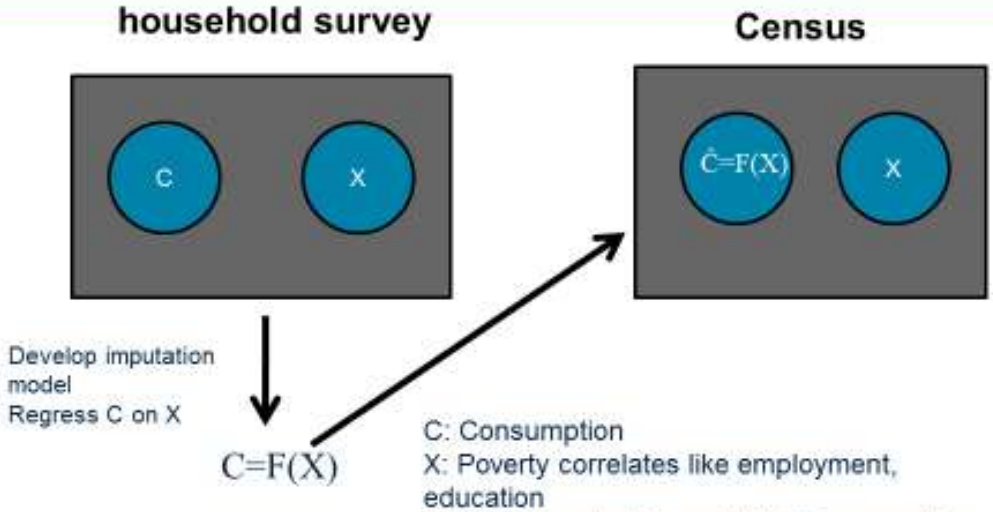
How does it work?



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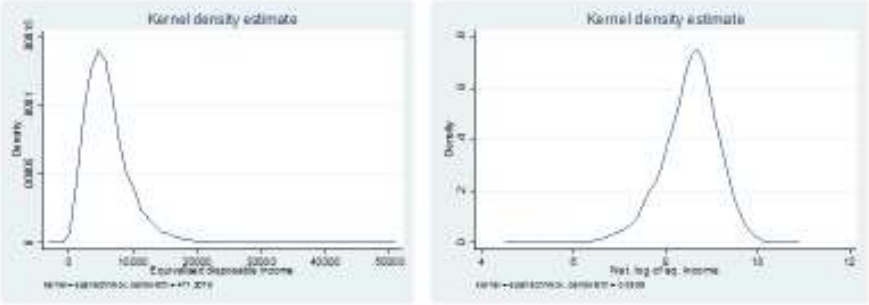
Elbers, Lanjouw, and Lanjouw (2003)

- **The OLS "beta model" (this is obtained using the household survey data)**

$$\ln Y = X\beta_{ols} + u_{ch} \qquad (1)$$



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Elbers, Lanjouw, and Lanjouw (2003)

- The ELL method accounts for spatial correlation by allowing for part of the model error to be shared by all households living in the same locality – This common error is referred to as the location error:

$$u_{ch} = \eta_c + \varepsilon_{ch} \qquad (2)$$

- Households in the same municipality share the same η, and:

$$E\left[u_{ch}^2\right] = \sigma_\eta^2 + \sigma_\varepsilon^2$$

- The larger the variance of η the less precise the estimates of welfare
- Variance may be lowered by inclusion of cluster level variables (cluster means from the census)
- This error is decomposed via ELL's proposed methodology or via Henderon's method III

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Heteroskedasticity – different variances across households

- ELL introduces different variances for different households (σ_ε)
- Literature often shows variances of expenditures among rich households are larger than those among poor households
  - In reality, this is an empirical question
  - ELL method estimates variances of errors at the household level from household/individual characteristics and location variables "alpha model"

$$ln\left[\frac{\hat{\varepsilon}_{ch}^2}{A - \hat{\varepsilon}_{ch}^2}\right] = Z'_{ch}\alpha + r_{ch} \qquad (3)$$

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Heteroskedasticity – different variances across households

- The alpha-model matters for the point estimates as well as for the standard errors
- This is because measures of poverty and inequality are non-linear functions of household incomes, and thereby non-linear functions of the error terms
  - As a result, the expected value of poverty and inequality measures will be a function of all moments of the error distribution functions
- In practice, the adjusted R-squared of the alpha-model is often very modest
  - Even so, the estimated poverty rates are not insensitive to the choice of the alpha-model

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GLS estimation (why not just use OLS?)

- OLS estimates regression coefficients under the assumption that the distribution of errors is the same for all households
- But the final model assumes the distribution of errors varies across areas and households
- GLS estimates regression coefficient while taking into account differences in the distribution of errors across areas and households
- GLS estimators are more efficient than OLS estimators

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Simulations

- **Making use of the first stage outputs household welfare in the Census is simulated *r* times**

$$\tilde{y}^r{}_{ch} = exp(X'_{ch}\tilde{\beta}^r + \tilde{\eta}^r_c + \tilde{\varepsilon}^r_{ch})$$

- **By defining $f(\tilde{y}^r{}_{ch})$, such that welfare is mapped to a poverty measure then the mean estimated poverty rate for municipality *c* is:**

$$FGT0_c = \frac{1}{R}\sum_{r=1}^{R}\sum_{h=1}^{H} f(\tilde{y}^r{}_{ch})w_{ch}$$

- **w_{ch} is the population expansion factor (number of household members in household h divided by the total population in the census)**

- **The parameters can be obtained by 2 different ways: parametrically, and non-parametrically**

Simulations (parametric)

- **GLS estimates not only give us regression coefficients but also the distributions of the coefficients and errors**

- **From the coefficients:**

$$\tilde{\beta}_{GLS} \sim N\left(\hat{\beta_{GLS}},\ Var\left(\hat{\beta}_{GLS}\right)\right)$$

- **From the estimated cluster components we can draw:**

$$\tilde{\eta}_c \sim N\left(0, \hat{\sigma}^2_{\eta}\right)$$

- **The variance of the η can be drawn from:**

$$\hat{\sigma}^2_{\eta} \sim Gamma\left(\hat{\sigma}^2_{\eta}, Var\left(\hat{\sigma}^2_{\eta}\right)\right)$$

Simulations (parametric)

- **Household error terms are also drawn**

$$\tilde{\varepsilon}^{r}_{ch} \sim N(0, \hat{\sigma}^{2}_{\varepsilon,ch})$$

- **Combine all simulated parameters and obtain:**

$$\tilde{y}^{r}{}_{ch} = exp(X'_{ch}\tilde{\beta}^{r} + \tilde{\eta}^{r}_{c} + \tilde{\varepsilon}^{r}_{ch})$$

- **The X in the above comes from the Census**
- **Use standard deviations of poverty rates as standard errors**
- **Parametric simulations have the advantage of speed**

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Empirical best estimation of η

- **The idea of Empirical Best (EB) estimation is that the residuals for households sampled in area a, $e_{ch} = y_{ch} - x^{T}_{ch}\beta$, are informative of the latent area error η_c**
- **This means that conditioning on these residuals should enable us to tighten the distributions from which to simulate η_c**
- **Only areas that have been sampled into the survey benefit from EB**
- **The difference between EB and non-EB, is that EB also estimates the area error η_c**
- **For areas not sampled in the survey, the best estimate for η_c is simply 0, in which case EB coincides with ELL**
- **Cannot be done with parametric drawings**

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Simulations (non-parametric)

- All parameters from the first stage $(\beta, \alpha, \sigma_{\eta}, \sigma_{\varepsilon}, \eta, \varepsilon)$ can be obtained from bootstrap methods
- It is done by obtaining a random sample with replacement from the household survey, r times
- From each sample a new set of parameters is obtained
- These parameters are used in conjunction with the Census to obtain:

$$\bar{y}^{r}_{ch} = exp(X'_{ch}\bar{\beta}^{r} + \bar{\eta}^{r}_{c} + \bar{\varepsilon}^{r}_{ch})$$

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Agenda

I. Data for Training

II. Model Estimation

III. Simulation

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I. Data for training

- Bangladesh Household Income Expenditure Survey, 2005
- Census
  - 10,080 HHs and 48,969 persons
- Survey (2-stage stratified sampling, 6%)
  - 640 HHs and 3,137 persons
- No consumption data in Census

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Povmap 2 software

Very user-friendly and powerful software for poverty mapping
- Step-by-step input
- Can use very large data sets (e.g. census) smoothly
- Strong data management capability in addition to estimation

But has some issues
- Bugs (error messages)
- Possible crash (But Povmap saves your input automatically and frequently)

Povmap 2 can import Stata-format data.
- Supports older Stata version *.dta (use "saveold" in Stata)

Let's start using Povmap2!

You have:

- Survey.dta
- Census.dta

In your folder.

Convert survey data into Povmap format

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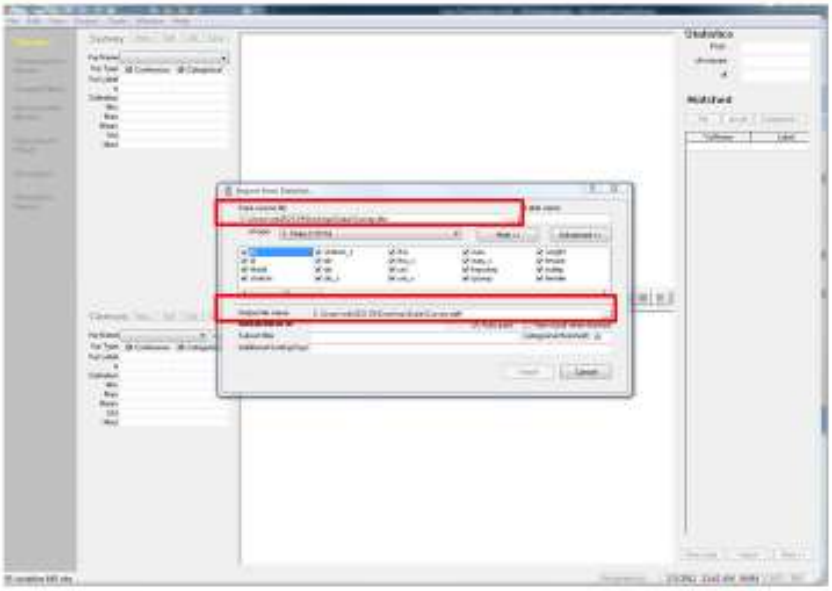
Choose data source and output files



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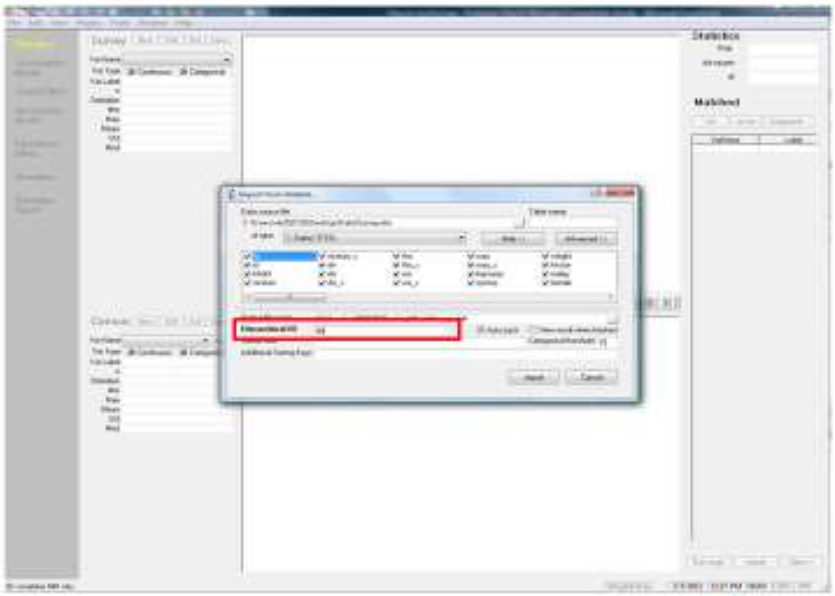
Specify Hierarchical ID



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Hierarchical location ID

Hierarchical location ID (lid) is 12 digits = RDDZZMMMMMMM

Digit in Loc. ID	Census	Survey
R	Rural/Urban (2)	
DD	Admn. Division (6)	
ZZ	Zila (64)	
MMMMMMM	Mauza (504)	Mauza (64)
	20 HH	10 HH

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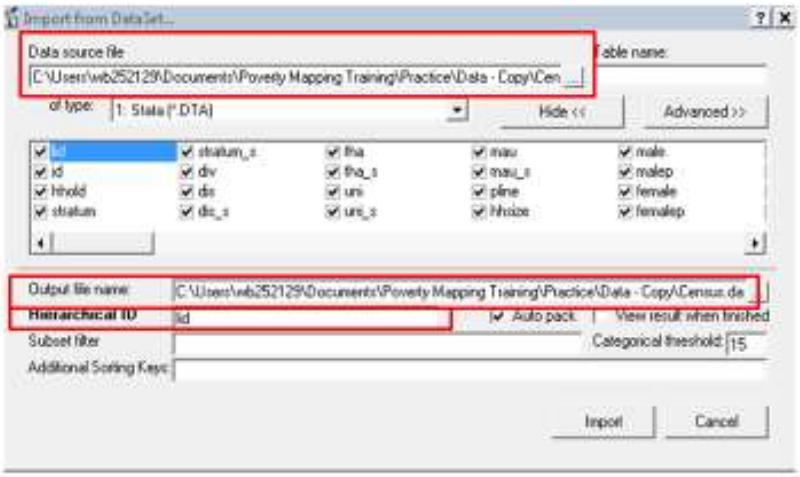
Convert census data into Povmap format (follow the same step)



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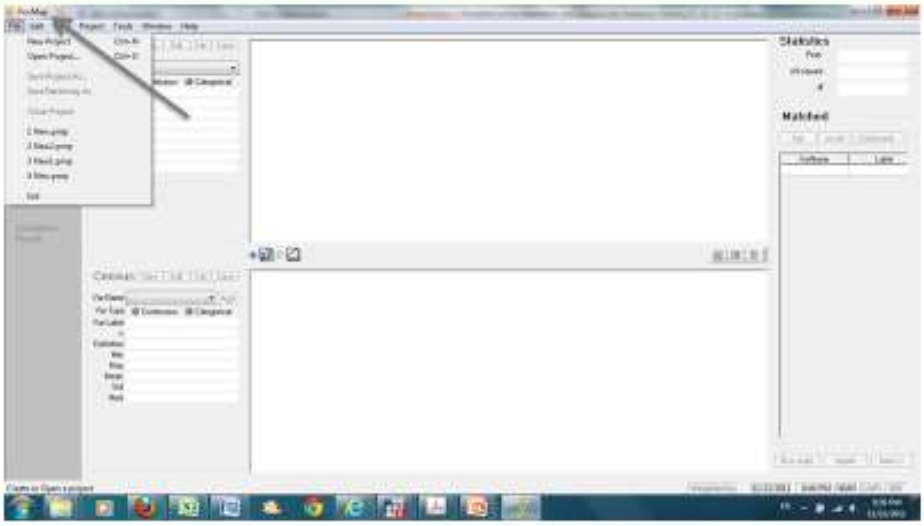
Create Povmap project file



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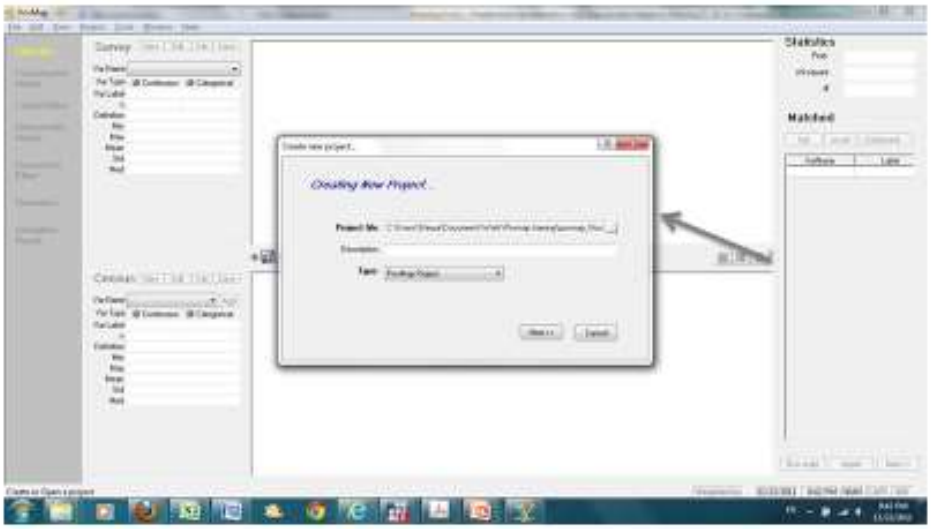
Name your project.



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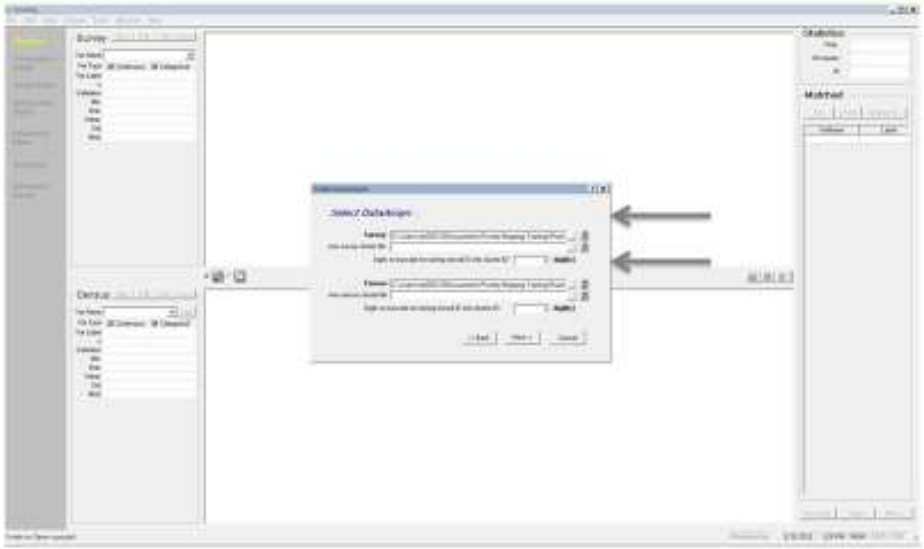
Select saved Povmap survey and census data



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Check if cluster sizes in survey and census are right.

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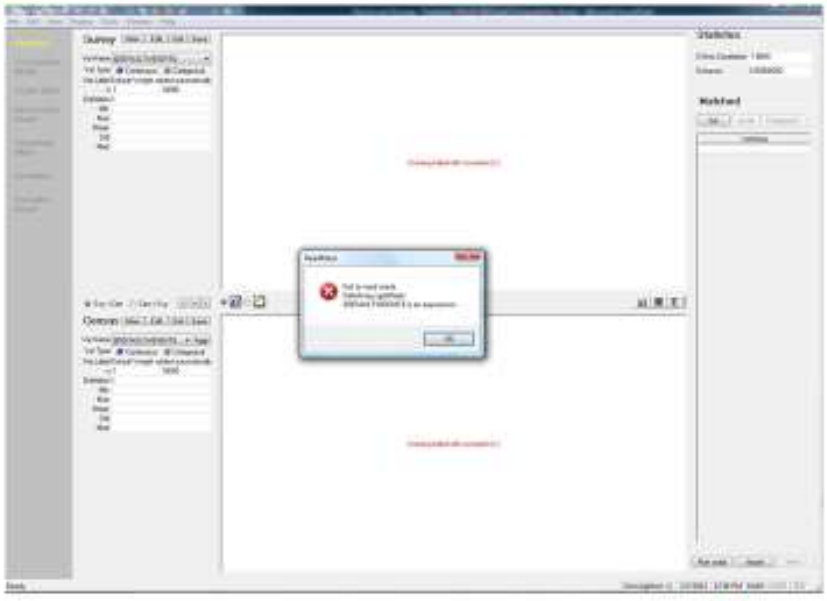
Skip four error messages on weights



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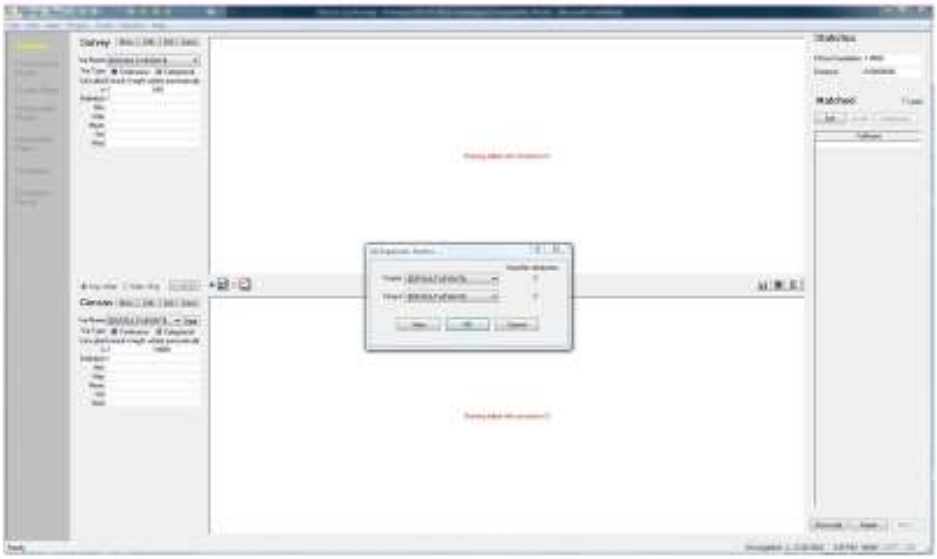
Choose default weights for Survey and Census



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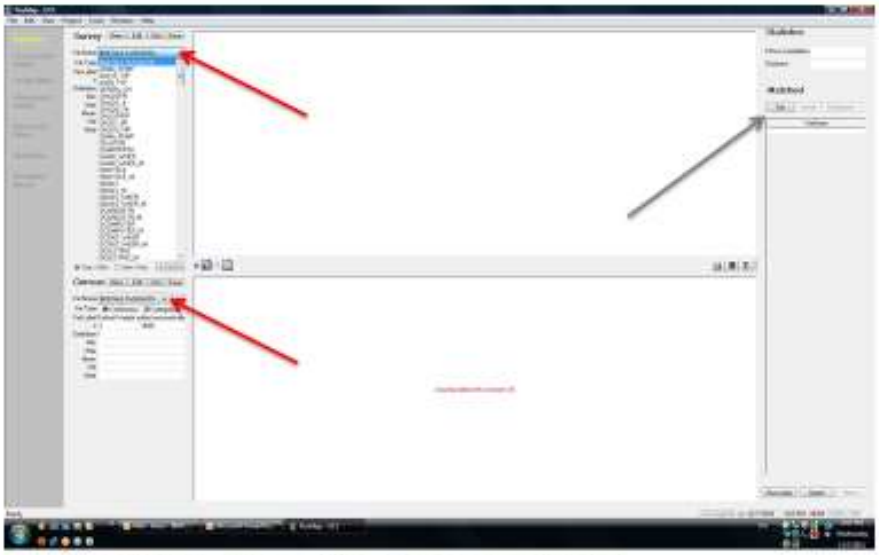
Start adding variables (hd_age)



- Let's start from hd_age (Age of household head).
- If you have the same names in Survey and Census, …

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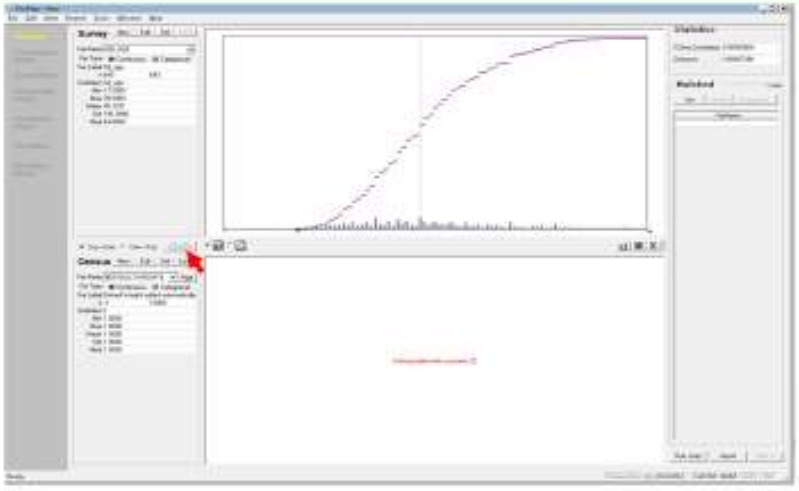
How to select the same variable names in Survey and Census data



Click = to select the same variables.

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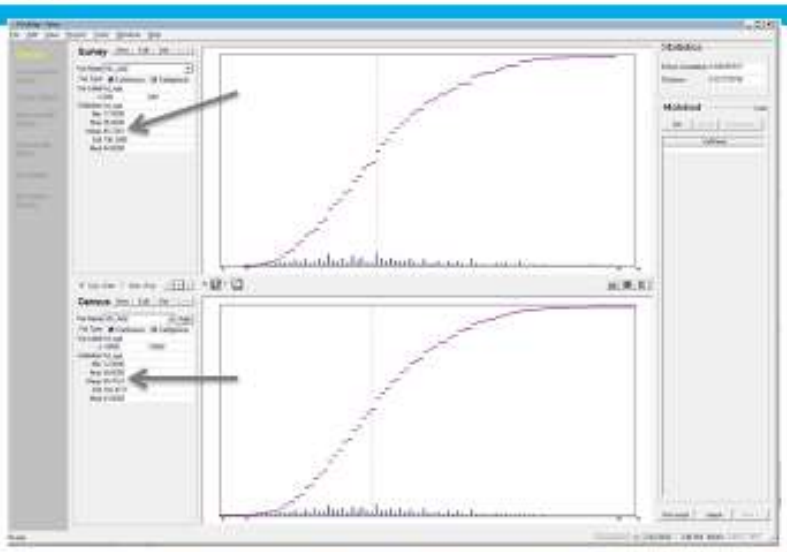
Compare two variables in Survey and Census: Distribution



•Click "=" to show statistics (e.g., mean) and distributions in graphs.

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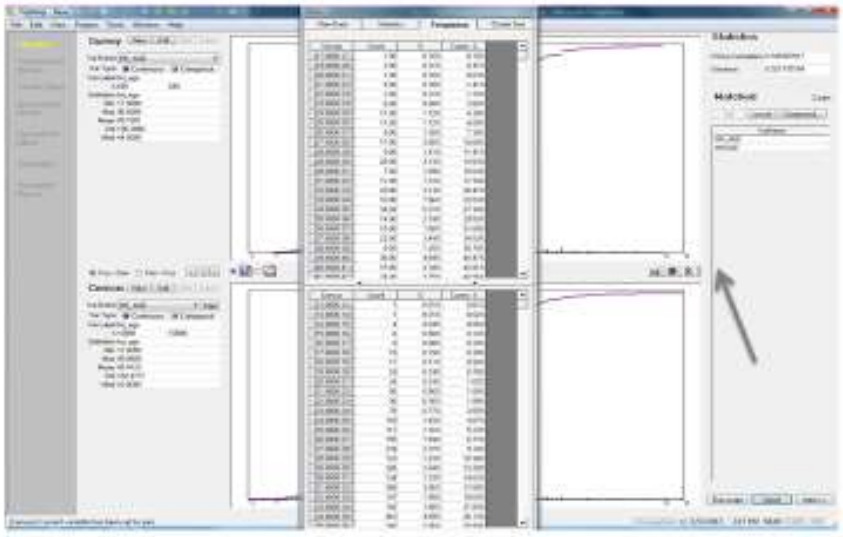
Compare two variables in Survey and Census: Frequency Table.



- Clicking "sigma icon" shows frequency tables.

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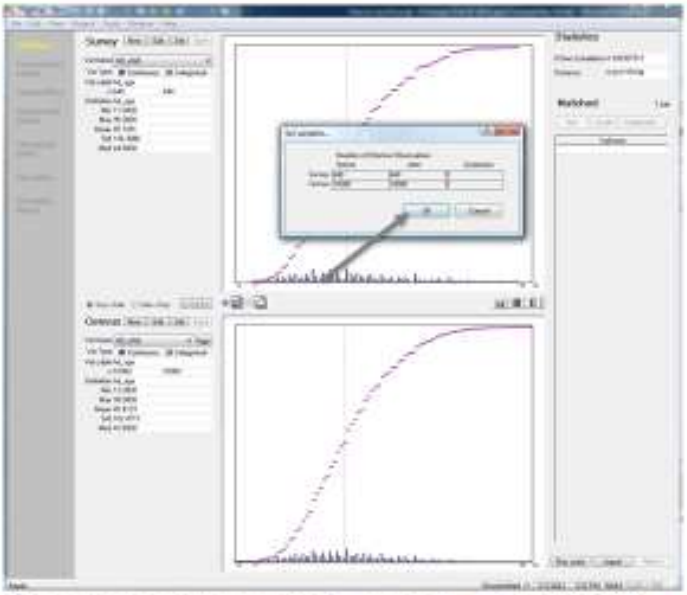
Adding variables in the pool of candidates



Check the reduction of observations and click OK.

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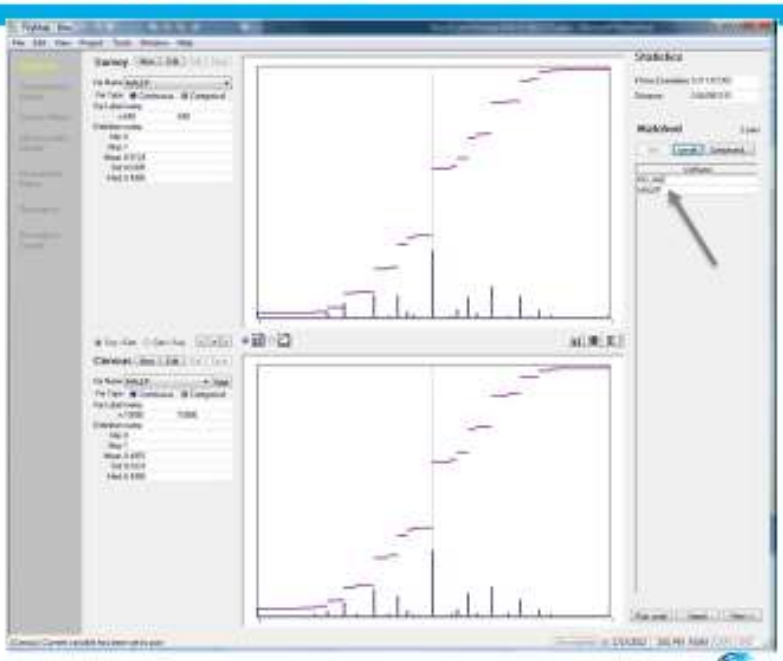
Select malep (percentage of male members in HH)



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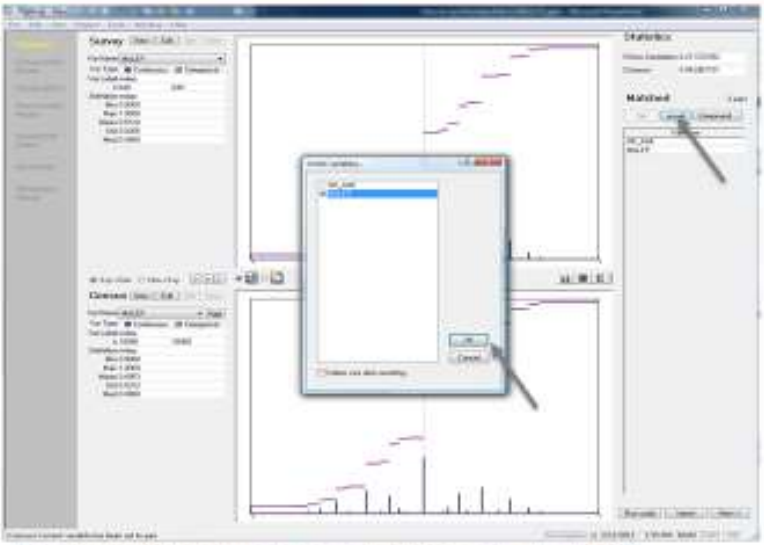
WORLD BANK GROUP

Choose data source and output files



In your RHS, click malep and click unset. Then OK.

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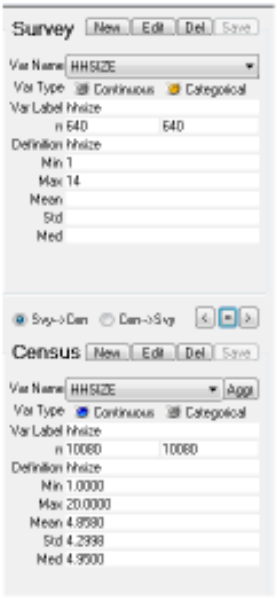
WORLD BANK GROUP

Let's set household size (HHSIZE).



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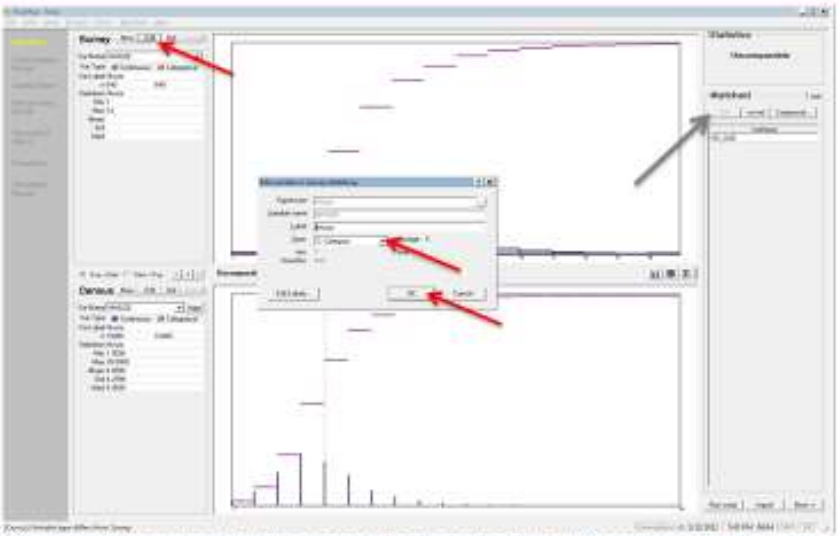
Change Type of variable: HHSIZE



Change the variable type from "categorical" to "Continuous" by using Edit.

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Continuous and Categorical variable in Povmap

- PovMap2 automatically detects variable types ("Continuous" or "Categorical")

- Continuous variables in Povmap
  - Household size is one example.
  - Order (2 person > 1 person), and Distance (3-1=2 persons) matter.
  - Other examples: percentage of dependent household members, years of schooling
  - Want to have one variable in consumption model.

- Categorical variable in Povmap
  - Location variable, Division is one example.
  - With six divisions, division A can be either 1 to 6 (or any number).
  - 2-1 = Division B – Division A is not meaningful.
  - Other examples: Literacy of household head, ownership of durable goods, location variables
  - Want to have dummy variable(s) in consumption model

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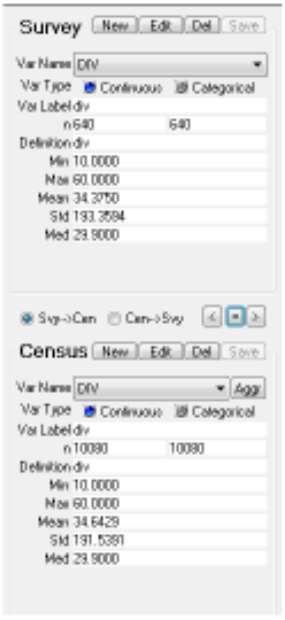
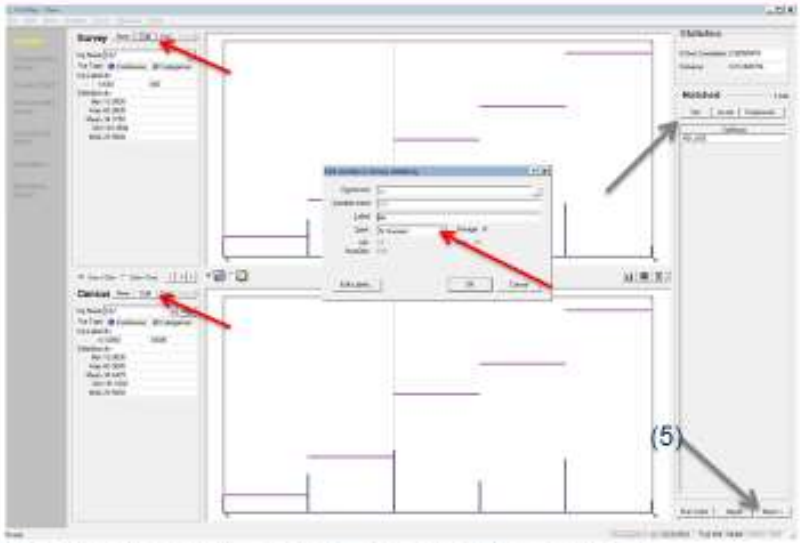
Let's set division (div).



WORLD BANK GROUP

Change Type of variable: DIV



Change variable types into "Categorical" by using Edit.

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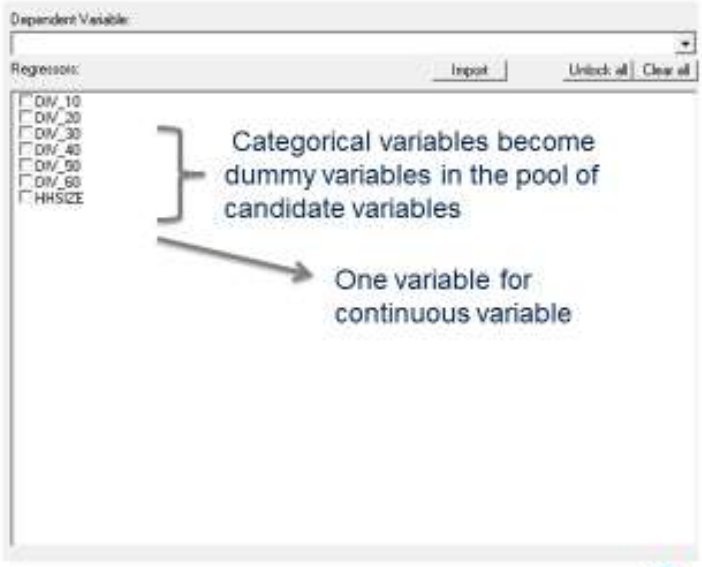
Type of Variables and Regressors in Model



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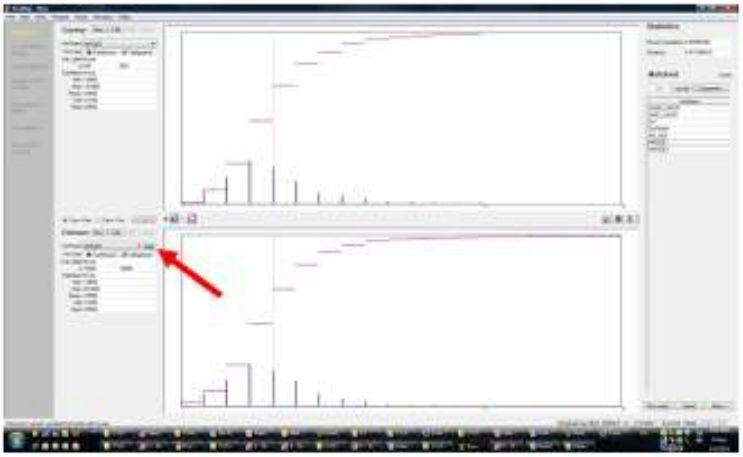
Produce Aggregated Census Variable

$$y_{ict} = \alpha + \beta_1 * hhsize_{ict} + \beta_2 * edu\_head_{ict} + \gamma_{ct} * pop_{ct} + \eta_{ct} + \epsilon_{ict}$$



- Add Mauza(cluster)-level total population size using HHSIZE.

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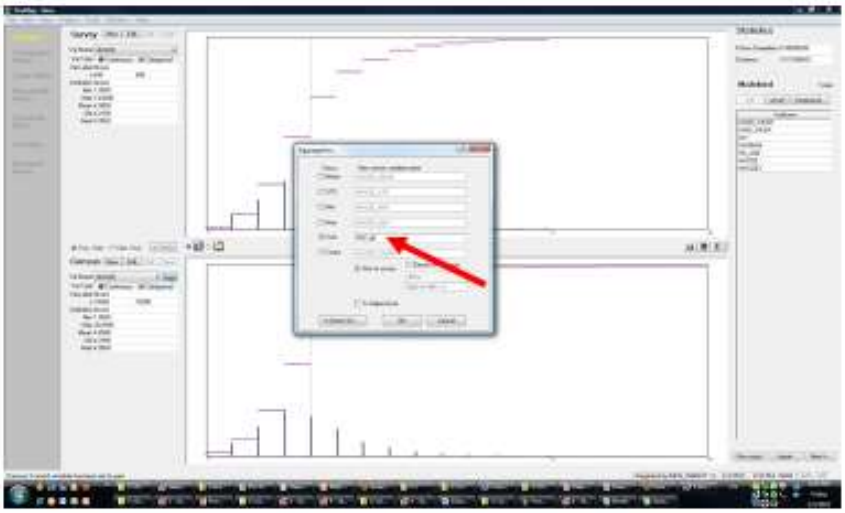
Produce Aggregated Census Variable



- Add Mauza(cluster)-level total population size using HHSIZE.

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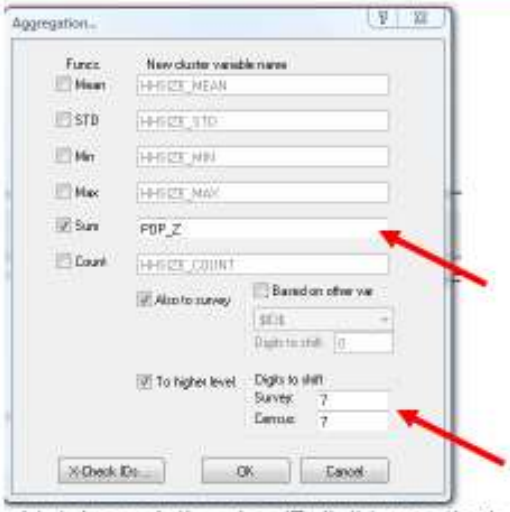
Produce Aggregated Census Variable



- Add Zila-level total population size (7 digit truncation) using HHSIZE.

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Other useful functions

- Create a new variable using formula
- Create compound variables
- Create a new location variable and change them into dummy variables

➔ Explained in the appendix of this PPT

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List of candidate variables

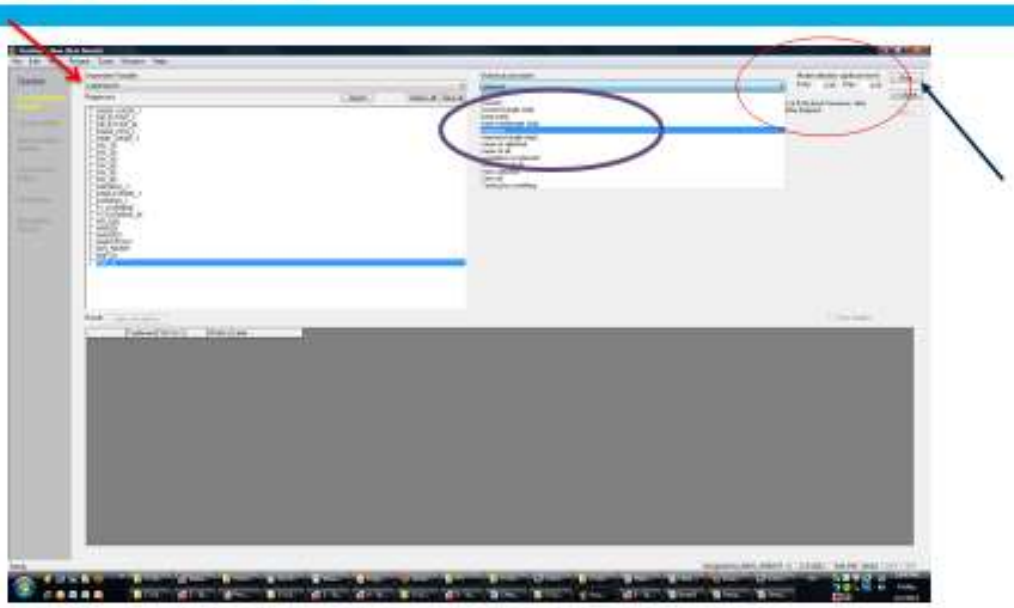
	Variable name	Description	Included in data set?
1	hd_age	Age of HH head	Y
2	hhsize	Household size	Y
3	div	Dummy (6 administrative divisions)	Y
4	pop_m	Mauza-level total population (sum of hhsize)	N
5	pop_z	Zila-level total population (sum of hhsize)	N
6	Hhsize2	Squared household size	Y
7	Delectric	Dummy (Household has electricity)	Y
8	delectric_m	Mauza-level ratio of households with electricity	N
9	Highstedu	Highest year of schooling for HH member	Y
10	n15_59yrp	Ratio of HH members age 15-59	Y
11	Dmobile	Dummy (Own mobile phone)	Y
12	f1_durable	Principal component score (Household durables)	Y
13	Durban	Dummy (Urban=1)	Y
14	dind_wker	Dummy (HH head worked in industry)	Y
15	dagr_wker	Dummy (HH head worked in agricultural worker)	Y

Steps of estimation in PovMap2

Four steps:

1. Using stepwise regression, we select variables that are highly significant
2. Estimate variance of household expenditure (2 error terms)
3. Carry out GLS on the variables selected in step1 and variances estimated in step 2
4. Carry out simulation

Let's run modeling



- Dep. Var. = LNRPCEXP
- Stepwise, P=0.05

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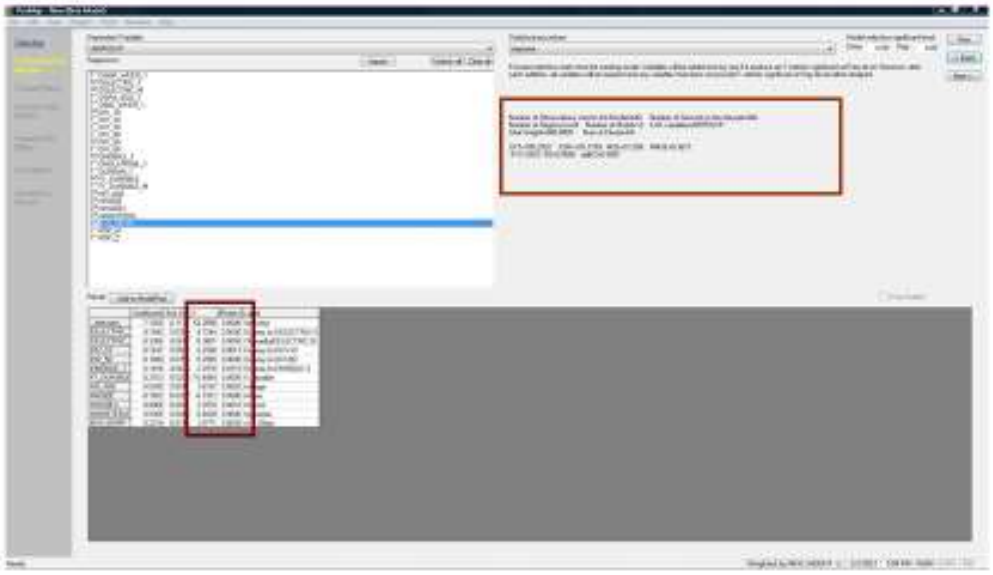
Step 1 and assessment of modeling



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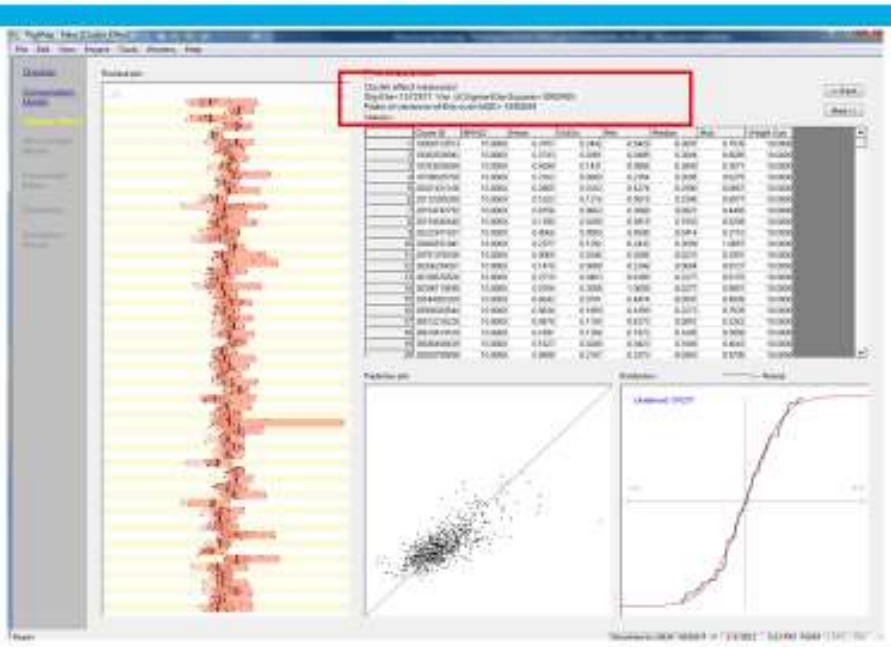
Assessment of modeling in step 2



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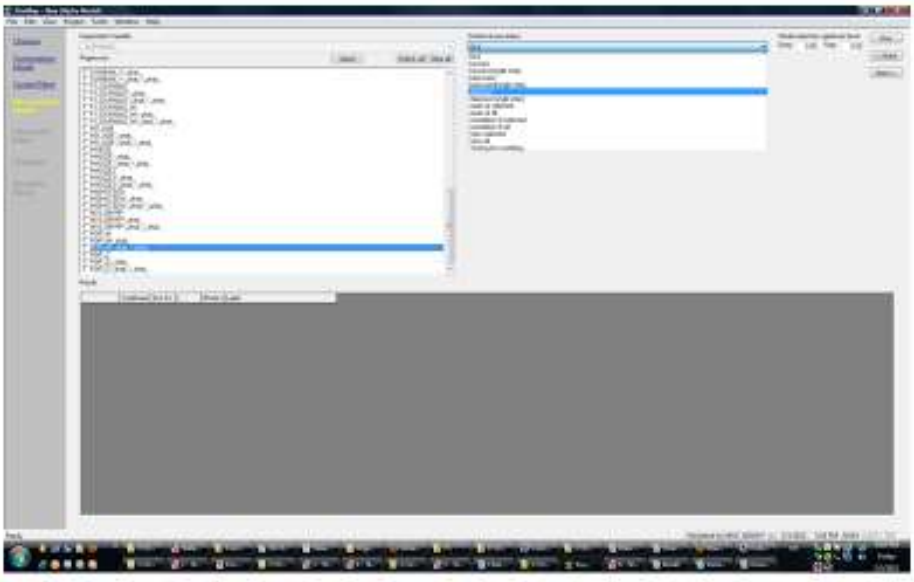
Modeling Household level error (Heteroskedasticity model) in Step 2



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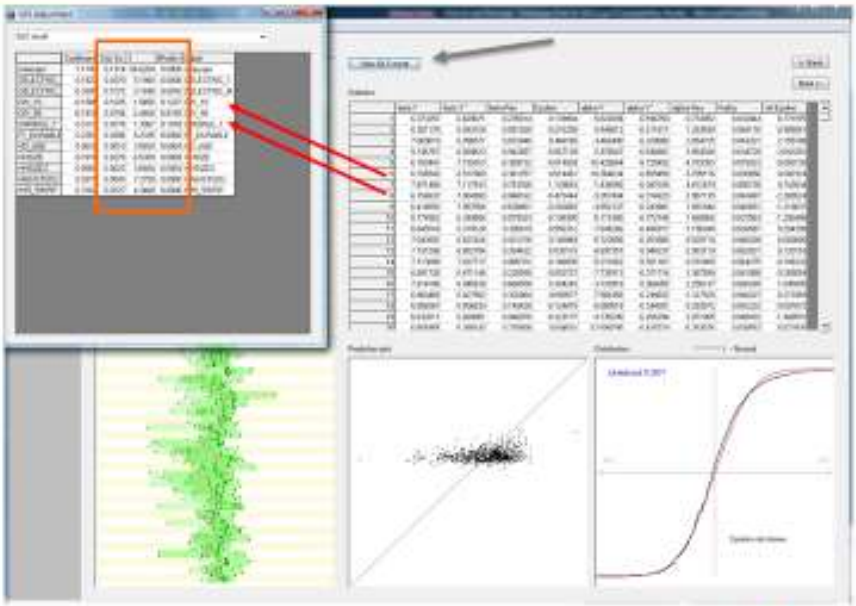
Assessment of modeling in Step 3



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Let's go back to modeling in Step 1

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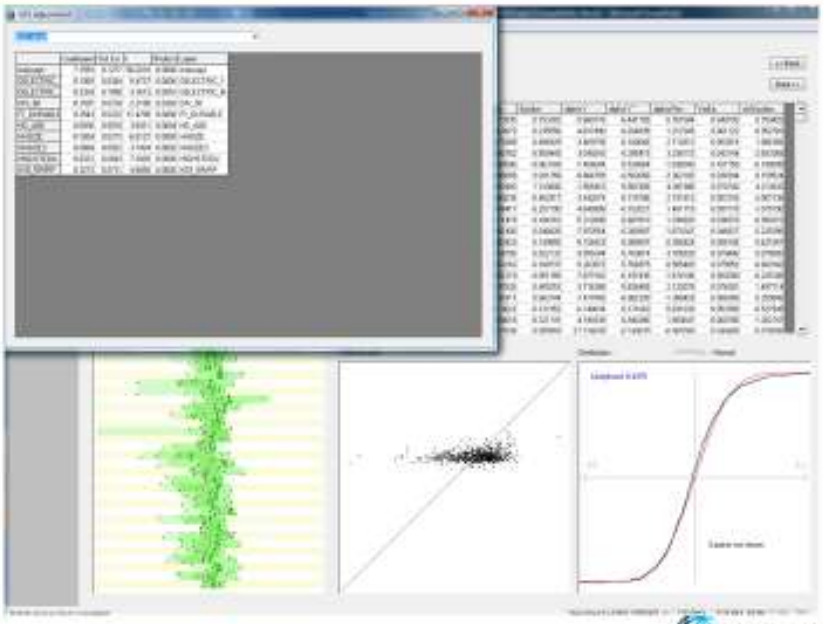
GLS – finalization of modeling in Step 3



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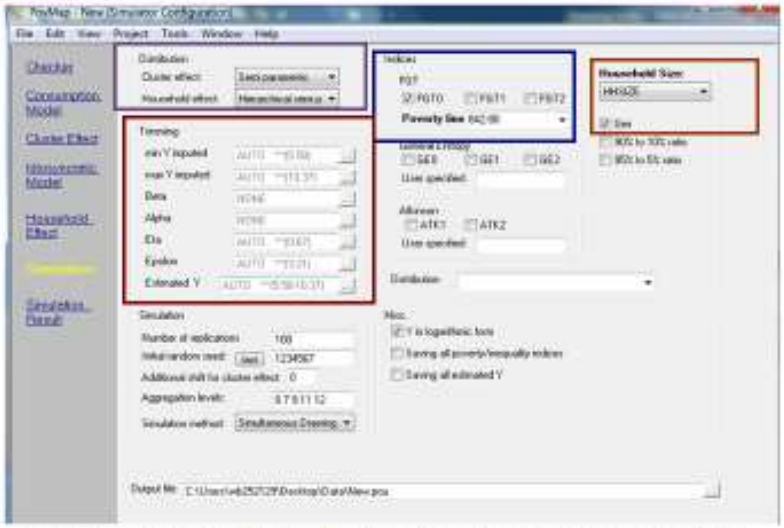
Step 4: Now simulation!



Aggregation levels: 0 7 9 11 12 Poverty line=pline or 842.08
Household size: hhsize

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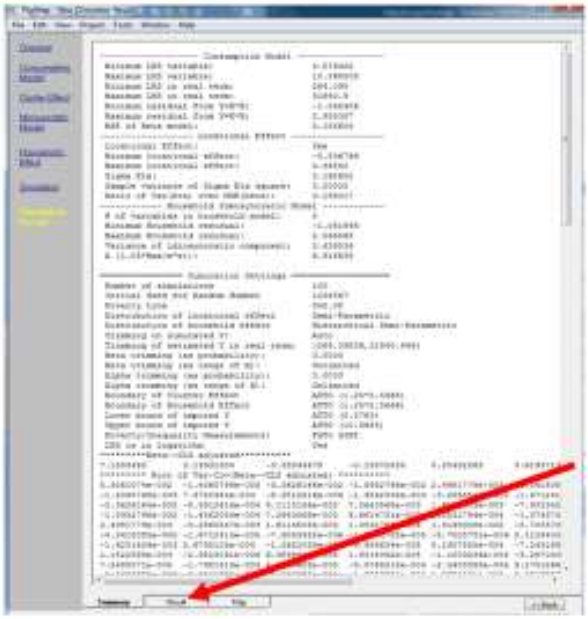
Simulation Results and the assessment 1



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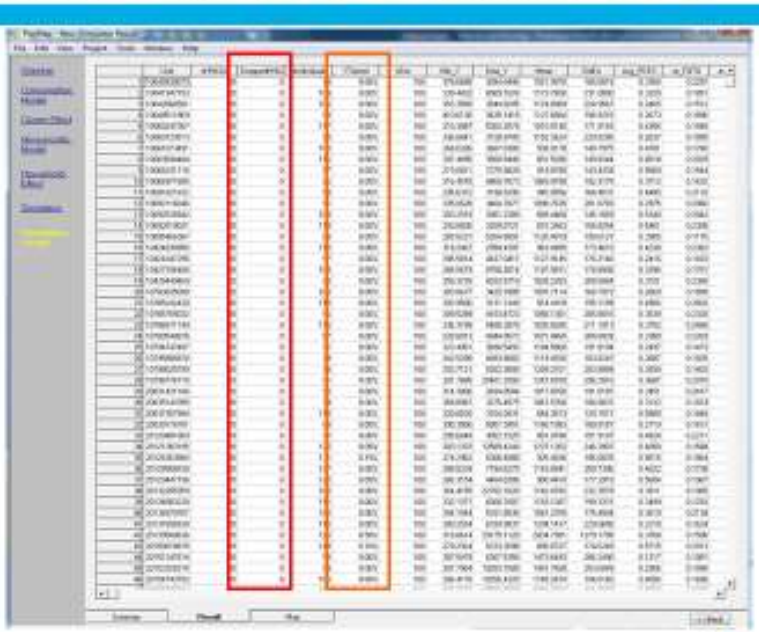
Simulation Results and the assessment 2



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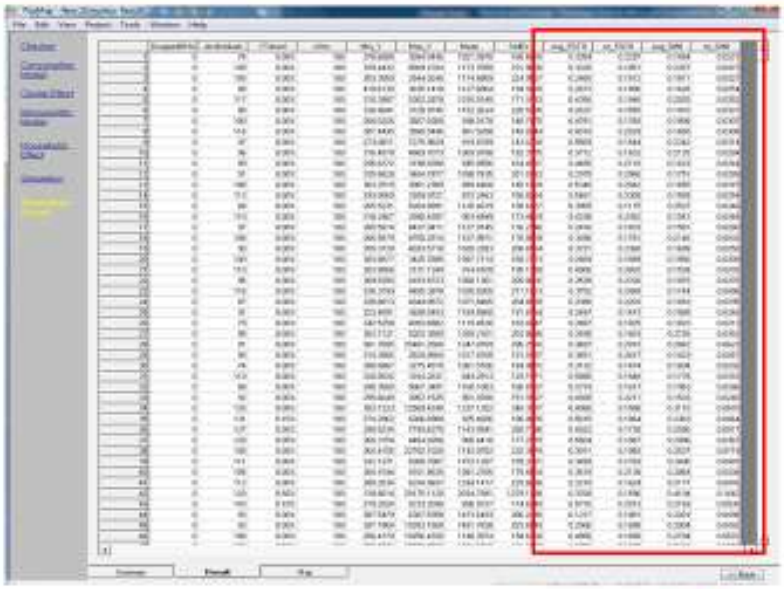
Simulation Results and the assessment 3



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Thank you.

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Appendix

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Creating compound variables

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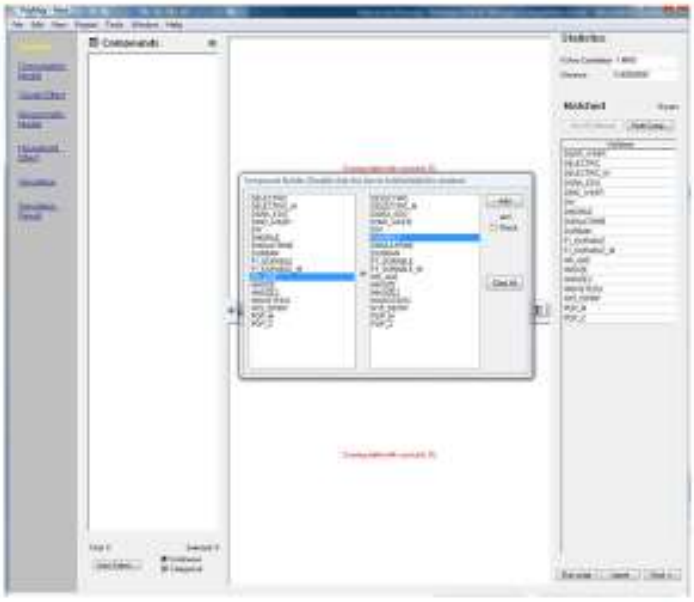
Creating compound variables



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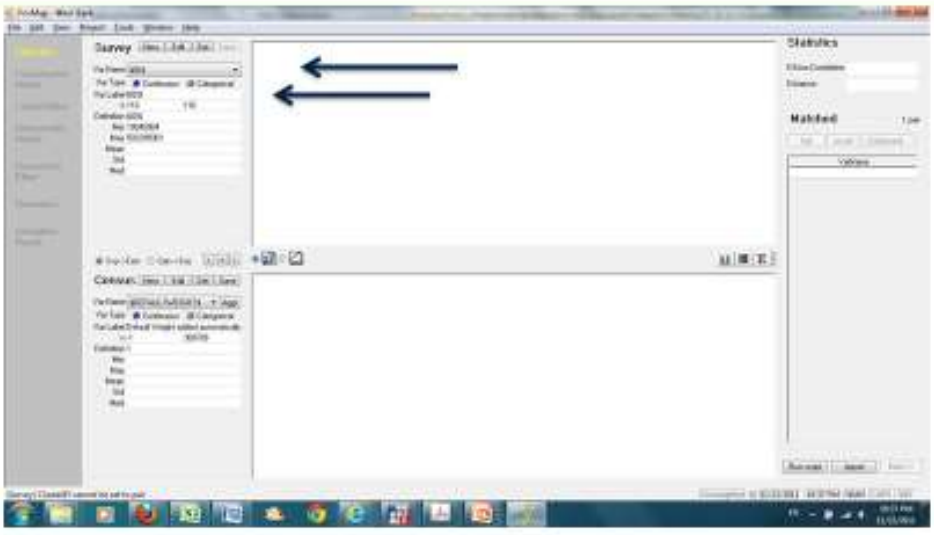
Create rural/urban dummy variables from hierarchical location ID 1



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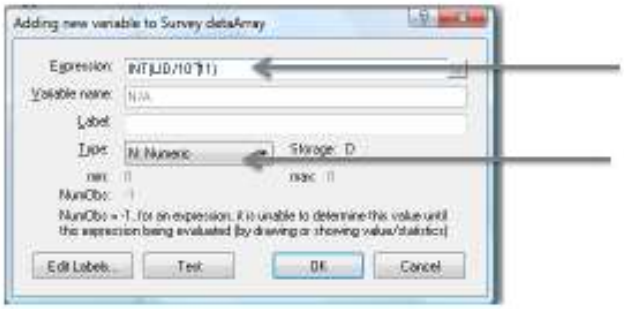
Create rural/urban dummy variables from hierarchical location ID 2

- Expression: Int(LID/10^11)
- Choose 'Categoric'



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Create rural/urban dummy variables from hierarchical location ID 3

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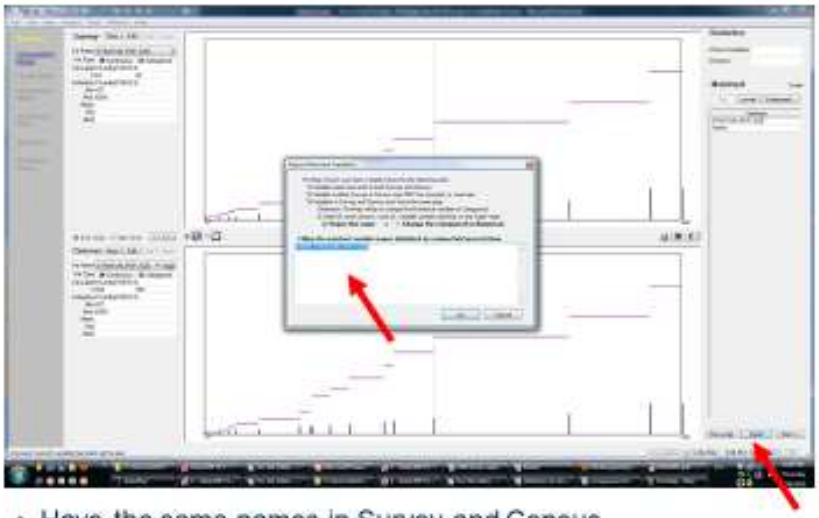
Add more than one variables altogether



- Have the same names in Survey and Census.
- Copy and paste listed variables.
- Carefully need to check each variable afterwards.

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Annex 3. Small area estimations of consuption powerty in Croatia: Statistical Appendix

Table A1: Poverty indicators by LAU2

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Donji Grad	35,609	1.50	0.50	0.20	0.10	0.10	0.00	0.10
Gornji Grad-Medveščak	29,750	1.80	0.40	0.30	0.10	0.10	0.00	0.10
Trnje	41,021	3.00	0.70	0.60	0.10	0.20	0.00	0.20
Maksimir	47,362	3.20	0.80	0.50	0.10	0.10	0.00	0.20
Pešćenica-Žitnjak	55,057	8.50	1.70	1.90	0.40	0.70	0.20	0.60
Novi Zagreb-istok	58,052	4.50	1.00	0.80	0.20	0.20	0.10	0.30
Novi Zagreb-zapad	56,647	4.80	1.10	0.80	0.20	0.20	0.10	0.40
Trešnjevka-sjever	54,197	3.20	0.80	0.60	0.20	0.20	0.10	0.20
Trešnjevka-jug	65,555	2.80	0.70	0.40	0.10	0.10	0.00	0.20
Črnomerec	37,577	4.70	0.90	0.80	0.20	0.20	0.10	0.20
Gornja Dubrava	60,882	9.20	1.20	1.80	0.30	0.60	0.10	0.70
Donja Dubrava	35,871	11.60	1.80	2.40	0.50	0.80	0.20	0.50
Stenjevec	50,678	5.10	0.90	0.80	0.20	0.20	0.10	0.30
Podsused-Vrapče	44,580	9.20	1.40	1.70	0.30	0.50	0.10	0.50
Podsljeme	18,858	6.40	1.50	1.10	0.30	0.30	0.10	0.20
Sesvete	68,924	11.00	1.60	2.10	0.40	0.60	0.10	1.00
Brezovica	11,720	9.80	1.90	1.80	0.40	0.50	0.20	0.20
Grad Zagreb	**772,340**	**5.90**	**0.90**	**1.10**	**0.20**	**0.30**	**0.10**	**6.00**
Andrijaševci	4,020	41.30	2.50	11.20	0.90	4.20	0.50	0.20
Antunovac	3,610	39.30	3.70	10.60	1.40	4.10	0.70	0.20
Babina Greda	3,516	27.70	3.00	6.70	1.00	2.40	0.40	0.10
Bakar	8,211	10.90	1.40	2.10	0.30	0.60	0.10	0.10
Bale - Valle	1,125	7.20	1.70	1.30	0.40	0.40	0.10	0.00
Barban	2,688	10.40	1.90	1.80	0.40	0.50	0.10	0.00
Barilović	2,967	41.40	2.70	10.80	1.10	4.00	0.50	0.20
Baška	1,658	13.50	2.10	2.80	0.50	0.90	0.20	0.00
Baška Voda	2,773	11.10	1.70	2.00	0.40	0.60	0.10	0.00
Bebrina	3,185	41.70	2.40	11.80	1.00	4.60	0.50	0.20
Bedenica	1,424	19.90	3.30	4.20	0.80	1.30	0.30	0.00
Bedekovčina	7,759	17.60	1.80	3.90	0.50	1.30	0.20	0.20
Bednja	3,954	40.00	4.50	10.80	1.70	4.10	0.80	0.20
Beli Manastir	9,459	30.30	1.90	8.40	0.70	3.50	0.30	0.40
Belica	3,150	12.40	1.90	2.40	0.50	0.70	0.20	0.10
Belišće	10,509	32.20	1.90	9.10	0.70	3.90	0.30	0.40
Benkovac	10,934	24.20	2.10	5.60	0.60	1.90	0.30	0.30
Berek	1,437	48.20	3.80	15.90	1.60	7.40	0.90	0.10
Beretinec	2,117	28.10	3.70	6.30	1.10	2.10	0.40	0.10
Bibinje	3,969	14.60	2.40	2.80	0.60	0.80	0.20	0.10
Bilice	2,255	17.90	2.20	3.80	0.60	1.20	0.30	0.10
Bilje	5,590	25.10	2.80	6.00	0.90	2.10	0.40	0.20
Biograd Na Moru	5,501	12.60	1.60	2.40	0.40	0.70	0.20	0.10

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Biskupija	1,688	27.10	4.30	6.30	1.20	2.20	0.50	0.10
Bistra	6,389	13.80	1.60	2.70	0.40	0.80	0.20	0.10
Bizovac	4,456	28.60	2.30	6.70	0.80	2.30	0.30	0.20
Bjelovar	39,061	24.70	1.80	6.10	0.60	2.30	0.30	1.30
Blato	3,460	6.90	2.10	1.20	0.40	0.30	0.10	0.00
Bogdanovci	1,877	36.30	3.30	9.40	1.20	3.50	0.60	0.10
Bol	1,576	4.10	1.00	0.70	0.20	0.20	0.10	0.00
Borovo	4,857	50.70	3.80	15.30	1.70	6.40	0.90	0.30
Bosiljevo	1,253	44.10	3.70	11.70	1.40	4.40	0.70	0.10
Bošnjaci	3,748	29.00	2.00	7.50	0.70	2.80	0.30	0.10
Brckovljani	6,432	13.70	1.50	3.00	0.40	1.00	0.20	0.10
Brdovec	11,048	8.90	1.20	1.60	0.30	0.50	0.10	0.10
Brela	1,698	4.90	1.80	0.80	0.30	0.20	0.10	0.00
Brestovac	3,691	44.20	2.20	12.60	0.90	5.00	0.40	0.20
Breznica	2,188	36.10	4.50	9.00	1.60	3.20	0.70	0.10
Brinje	3,180	25.00	2.70	6.10	0.80	2.20	0.40	0.10
Brod Moravice	849	20.60	2.70	6.90	0.80	3.50	0.40	0.00
Brodski Stupnik	2,950	38.80	2.30	10.30	0.80	3.90	0.40	0.20
Brtonigla - Verteneglio	1,622	1.70	0.90	0.20	0.10	0.00	0.00	0.00
Budinščina	2,390	25.90	3.40	6.40	1.00	2.30	0.50	0.10
Buje - Buie	5,102	8.90	1.20	1.70	0.30	0.50	0.10	0.10
Bukovlje	3,018	32.60	3.20	8.30	1.10	3.10	0.50	0.10
Buzet	6,048	11.70	1.40	2.20	0.40	0.60	0.10	0.10
Cerna	4,489	30.10	2.00	7.50	0.70	2.70	0.30	0.20
Cernik	3,562	37.30	3.10	10.20	1.10	4.00	0.50	0.20
Cerovlje	1,650	11.10	2.10	2.00	0.50	0.60	0.20	0.00
Cestica	5,504	33.50	3.30	9.00	1.10	3.60	0.50	0.20
Cetingrad	1,921	39.60	3.00	11.00	1.20	4.40	0.60	0.10
Cista Provo	2,310	25.50	3.10	5.80	0.90	2.00	0.40	0.10
Civljane	226	65.80	16.00	20.50	8.10	8.50	4.30	0.00
Cres	2,777	5.40	1.30	0.80	0.30	0.20	0.10	0.00
Crikvenica	10,947	9.80	1.20	1.90	0.30	0.50	0.10	0.10
Crnac	1,445	37.20	3.60	10.10	1.20	4.00	0.60	0.10
Čabar	3,748	23.70	3.20	5.20	0.90	1.70	0.40	0.10
Čačinci	2,758	28.80	2.20	6.80	0.70	2.40	0.30	0.10
Čađavica	1,983	40.50	4.40	10.60	1.60	4.00	0.70	0.10
Čaglin	2,363	47.70	3.40	14.20	1.50	5.90	0.80	0.10
Čakovec	26,422	11.40	1.00	3.30	0.30	1.50	0.20	0.40
Čavle	7,071	10.60	1.20	2.00	0.30	0.60	0.10	0.10
Čazma	7,926	32.40	3.10	8.30	1.10	3.10	0.50	0.30
Čeminac	2,780	34.10	3.20	8.70	1.10	3.30	0.50	0.10
Čepin	11,299	22.50	1.80	5.20	0.60	1.80	0.20	0.30
Darda	6,746	34.60	1.70	10.60	0.70	4.70	0.40	0.30
Daruvar	11,482	25.20	1.80	5.70	0.60	1.90	0.20	0.40
Davor	2,967	34.00	3.10	8.80	1.00	3.30	0.50	0.10
Dekanovec	735	18.70	3.90	3.60	1.00	1.00	0.40	0.00

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Delnice	5,747	14.90	1.90	3.70	0.50	1.50	0.20	0.10
Desinić	2,604	22.20	2.70	4.80	0.80	1.50	0.30	0.10
Dežanovac	2,706	37.10	3.20	10.00	1.20	3.90	0.60	0.10
Dicmo	2,753	47.70	3.80	13.70	1.60	5.40	0.80	0.20
Dobrinj	2,051	7.70	1.40	1.60	0.30	0.50	0.10	0.00
Domašinec	2,217	17.30	2.40	4.40	0.50	1.80	0.30	0.10
Donja Dubrava	1,895	11.90	2.20	2.20	0.50	0.70	0.20	0.00
Donja Motičina	1,637	25.00	3.00	5.90	0.90	2.00	0.40	0.10
Donja Stubica	5,375	19.50	1.80	4.20	0.50	1.40	0.20	0.10
Donja Voća	2,392	32.10	4.10	7.90	1.30	2.80	0.60	0.10
Donji Andrijevci	3,666	35.00	2.10	9.50	0.80	3.60	0.40	0.20
Donji Kraljevec	4,527	11.40	1.80	2.00	0.40	0.60	0.10	0.10
Donji Kukuruzari	1,634	48.10	3.00	14.80	1.30	6.30	0.70	0.10
Donji Lapac	2,028	15.90	2.30	3.40	0.60	1.10	0.20	0.00
Donji Miholjac	9,275	18.70	1.90	4.30	0.60	1.50	0.20	0.20
Dugopolje	3,439	23.70	3.10	5.10	0.90	1.70	0.40	0.10
Donji Vidovec	1,378	17.50	3.10	4.30	0.70	1.70	0.30	0.00
Dragalić	1,340	46.70	3.50	14.70	1.40	6.50	0.70	0.10
Draganić	2,665	44.00	2.90	12.80	1.10	5.40	0.60	0.20
Draž	2,681	26.50	3.00	6.70	0.90	2.50	0.40	0.10
Drenovci	4,969	30.60	2.00	7.90	0.80	3.00	0.40	0.20
Drenje	2,592	48.00	3.90	14.40	1.70	6.10	0.90	0.20
Drniš	7,422	19.00	1.70	4.10	0.50	1.30	0.20	0.20
Drnje	1,832	18.80	2.70	5.60	0.80	2.60	0.40	0.00
Dubrava	5,023	19.60	2.70	4.20	0.80	1.40	0.30	0.10
Dubrovačko Primorje	2,081	15.20	2.50	3.40	0.70	1.10	0.30	0.00
Dubravica	1,425	12.50	2.50	2.30	0.60	0.60	0.20	0.00
Dubrovnik	41,417	8.60	1.00	1.60	0.30	0.40	0.10	0.50
Duga Resa	11,120	34.30	1.90	8.70	0.70	3.20	0.30	0.50
Dugi Rat	6,982	16.50	1.80	3.30	0.50	1.00	0.20	0.20
Dugo Selo	17,201	10.60	1.60	2.00	0.40	0.60	0.10	0.20
Dvor	5,478	45.30	3.00	13.00	1.20	5.20	0.60	0.30
Đakovo	26,790	22.50	1.50	5.20	0.50	1.80	0.20	0.80
Đelekovec	1,490	11.80	2.00	2.50	0.50	0.80	0.20	0.00
Đulovac	3,171	45.30	4.70	14.20	2.00	6.10	1.10	0.20
Đurđenovac	6,598	47.70	3.00	14.30	1.30	6.00	0.70	0.40
Đurđevac	8,090	18.40	1.40	5.20	0.40	2.20	0.20	0.20
Đurmanec	4,150	20.90	2.40	4.50	0.70	1.40	0.30	0.10
Erdut	7,108	39.50	2.80	11.00	1.10	4.40	0.50	0.40
Ernestinovo	2,064	38.50	3.70	10.70	1.30	4.30	0.60	0.10
Ervenik	1,098	18.40	3.70	3.80	0.90	1.30	0.40	0.00
Farkaševac	1,889	24.30	3.00	6.00	1.00	2.20	0.50	0.10
Fažana - Fasana	3,491	13.60	1.90	2.70	0.50	0.80	0.20	0.10
Ferdinandovac	1,739	14.80	2.90	3.10	0.70	1.00	0.30	0.00
Feričanci	2,093	31.30	2.70	8.10	0.90	3.10	0.40	0.10
Funtana - Fontane	907	6.30	1.80	1.00	0.40	0.30	0.10	0.00

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Fužine	1,570	14.80	2.30	3.00	0.60	1.00	0.20	0.00
Galovac	1,226	15.60	2.60	3.10	0.70	1.00	0.30	0.00
Garčin	4,729	36.70	3.40	9.80	1.20	3.80	0.60	0.20
Garešnica	10,258	39.50	2.60	11.60	1.10	4.80	0.50	0.50
Generalski Stol	2,586	28.30	3.60	6.70	1.20	2.40	0.50	0.10
Glina	8,757	44.80	2.60	12.90	1.00	5.30	0.50	0.50
Gola	2,389	19.60	2.30	4.50	0.70	1.50	0.30	0.10
Goričan	2,777	8.80	1.60	1.70	0.30	0.50	0.10	0.00
Gorjani	1,564	35.00	3.40	8.80	1.20	3.20	0.50	0.10
Gornja Rijeka	1,753	53.10	5.50	16.60	2.60	7.10	1.40	0.10
Gornji Bogićevci	1,957	43.90	3.30	13.40	1.30	5.70	0.70	0.10
Gornji Kneginec	5,252	26.20	2.30	6.10	0.70	2.10	0.30	0.20
Gornji Mihaljevec	1,911	23.90	2.70	5.20	0.80	1.70	0.30	0.10
Gornja Stubica	5,258	15.30	2.00	2.90	0.50	0.90	0.20	0.10
Gornja Vrba	2,478	34.80	2.60	9.20	0.90	3.50	0.40	0.10
Gospić	12,320	11.90	1.40	2.50	0.40	0.80	0.10	0.20
Gračac	4,661	22.40	1.90	5.30	0.60	1.80	0.30	0.10
Gračišće	1,416	9.50	2.10	1.60	0.40	0.40	0.20	0.00
Gradac	3,237	18.70	1.90	4.40	0.60	1.60	0.30	0.10
Gradec	3,601	14.70	1.70	3.20	0.50	1.00	0.20	0.10
Gradina	3,799	52.30	3.30	16.10	1.50	6.80	0.80	0.30
Gradište	2,627	38.60	2.80	10.90	1.10	4.40	0.50	0.10
Grožnjan - Grisignana	733	8.60	2.10	1.50	0.50	0.40	0.20	0.00
Grubišno Polje	6,383	33.20	2.90	8.90	1.00	3.50	0.50	0.30
Gundinci	2,013	40.50	3.80	10.80	1.40	4.00	0.60	0.10
Gunja	3,637	38.00	2.30	10.70	0.90	4.30	0.50	0.20
Gvozd	2,889	51.30	3.60	14.90	1.50	6.10	0.80	0.20
Hercegovac	2,378	30.70	3.50	7.70	1.20	2.80	0.50	0.10
Hlebine	1,271	17.30	2.50	4.20	0.70	1.50	0.30	0.00
Hrašćina	1,535	29.00	3.50	6.70	1.00	2.30	0.40	0.10
Hrvace	3,595	35.50	2.60	8.70	0.90	3.10	0.40	0.20
Hrvatska Dubica	2,070	46.30	2.90	14.00	1.30	5.90	0.70	0.10
Hrvatska Kostajnica	2,734	37.80	2.00	10.00	0.70	3.80	0.40	0.10
Breznički Hum	1,314	39.20	4.90	10.00	1.70	3.60	0.80	0.10
Hum Na Sutli	4,851	17.00	2.20	3.50	0.60	1.10	0.20	0.10
Hvar	4,218	7.00	1.10	1.20	0.30	0.30	0.10	0.00
Ilok	6,500	31.80	2.80	8.00	0.90	2.90	0.40	0.30
Imotski	10,671	37.30	3.40	9.60	1.30	3.50	0.60	0.50
Ivanec	13,447	27.30	2.70	6.30	0.90	2.10	0.40	0.50
Ivanić-Grad	14,292	10.40	1.10	2.30	0.30	0.80	0.10	0.20
Ivankovo	7,762	31.20	2.60	7.70	0.90	2.70	0.40	0.30
Ivanska	2,908	39.60	5.00	11.10	1.90	4.50	0.90	0.20
Jagodnjak	1,969	43.20	3.30	13.70	1.40	6.10	0.80	0.10
Janjina	544	6.20	2.50	1.30	0.60	0.40	0.20	0.00
Jakovlje	3,813	16.30	2.10	3.20	0.50	0.90	0.20	0.10
Jakšić	3,986	24.50	2.20	5.60	0.70	1.90	0.30	0.10

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Jalžabet	3,120	35.80	3.20	9.10	1.10	3.40	0.50	0.10
Jarmina	2,440	29.30	3.20	7.00	1.00	2.40	0.40	0.10
Jasenice	1,395	16.40	2.70	2.90	0.60	0.80	0.20	0.00
Jasenovac	1,987	39.50	2.70	11.40	1.10	4.80	0.60	0.10
Jastrebarsko	15,625	8.60	1.20	1.60	0.30	0.50	0.10	0.20
Jelenje	5,277	10.30	1.60	1.80	0.30	0.50	0.10	0.10
Jelsa	3,556	10.20	1.50	1.90	0.40	0.60	0.10	0.00
Jesenje	1,512	33.40	4.60	8.20	1.50	2.90	0.70	0.10
Josipdol	3,723	43.60	2.00	12.70	0.80	5.30	0.40	0.20
Kali	1,628	5.30	1.50	0.80	0.30	0.20	0.10	0.00
Kalinovac	1,596	8.40	2.30	1.70	0.60	0.50	0.20	0.00
Kanfanar	1,541	8.80	1.80	1.40	0.40	0.40	0.10	0.00
Kalnik	1,351	30.10	3.70	7.70	1.30	2.80	0.60	0.10
Kamanje	855	13.00	3.00	2.50	0.80	0.80	0.30	0.00
Kapela	2,939	44.50	3.00	12.70	1.20	5.20	0.60	0.20
Kaptol	3,446	33.80	2.20	8.70	0.80	3.30	0.40	0.20
Karlobag	915	11.40	2.40	2.30	0.50	0.70	0.20	0.00
Karlovac	54,120	26.40	1.60	6.30	0.50	2.20	0.20	1.90
Karojba	1,427	15.10	2.70	2.80	0.60	0.80	0.20	0.00
Kastav	10,346	7.40	1.30	1.20	0.30	0.30	0.10	0.10
Kaštela	38,044	12.90	1.20	2.40	0.30	0.70	0.10	0.60
Kaštelir-Labinci	1,463	5.20	1.40	0.80	0.30	0.20	0.10	0.00
Kijevo	415	21.30	3.20	4.60	1.00	1.50	0.40	0.00
Kistanje	3,429	41.00	4.40	13.20	1.80	5.80	1.00	0.20
Klakar	2,251	26.50	3.10	6.10	1.00	2.10	0.40	0.10
Klana	1,966	18.80	2.90	3.60	0.80	1.00	0.30	0.00
Klanjec	2,911	12.30	2.10	2.40	0.50	0.80	0.20	0.00
Klenovnik	2,006	26.50	3.60	6.00	1.10	2.00	0.40	0.10
Klinča Sela	5,108	11.20	2.00	2.00	0.50	0.50	0.20	0.10
Klis	4,738	16.10	1.60	3.10	0.40	0.90	0.20	0.10
Kloštar Ivanić	5,990	14.70	2.00	3.20	0.60	1.10	0.20	0.10
Kloštar Podravski	3,200	28.00	2.40	8.70	0.90	4.00	0.50	0.10
Kneževi Vinogradi	4,517	25.70	1.90	6.80	0.60	2.60	0.30	0.20
Knin	15,011	17.20	1.90	3.60	0.50	1.20	0.20	0.30
Kolan	789	7.40	2.50	1.30	0.50	0.40	0.20	0.00
Komiža	1,519	15.70	2.20	3.30	0.50	1.10	0.20	0.00
Konavle	8,549	8.60	2.00	1.40	0.40	0.40	0.10	0.10
Končanica	2,340	24.30	4.20	6.20	1.20	2.30	0.50	0.10
Konjščina	3,658	15.30	2.30	3.20	0.60	1.00	0.20	0.10
Koprivnica	29,930	9.60	0.90	2.00	0.20	0.70	0.10	0.40
Koprivnički Bregi	2,270	16.50	2.50	3.60	0.70	1.20	0.30	0.00
Koprivnički Ivanec	1,972	9.50	1.60	1.90	0.40	0.70	0.20	0.00
Korčula	5,585	4.70	1.10	0.70	0.20	0.20	0.10	0.00
Kostrena	4,152	5.10	1.00	0.90	0.20	0.20	0.10	0.00
Koška	3,889	26.30	2.50	6.80	0.90	2.60	0.40	0.10
Kotoriba	3,080	24.00	2.00	8.40	0.70	4.20	0.40	0.10

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Kraljevec Na Sutli	1,727	13.50	3.20	2.60	0.80	0.80	0.30	0.00
Kraljevica	4,490	9.60	1.60	1.70	0.40	0.50	0.10	0.10
Krapina	12,105	15.50	1.50	3.10	0.40	1.00	0.20	0.20
Krapinske Toplice	5,249	12.30	1.90	2.40	0.50	0.70	0.20	0.10
Krašić	2,511	13.10	2.20	2.60	0.50	0.80	0.20	0.00
Kravarsko	1,966	25.90	3.60	6.00	1.10	2.00	0.50	0.10
Križ	6,794	16.50	1.60	3.60	0.50	1.20	0.20	0.10
Križevci	20,631	12.90	1.10	2.60	0.30	0.80	0.10	0.30
Krk	5,951	5.10	1.10	0.80	0.20	0.20	0.10	0.00
Krnjak	1,826	60.90	3.20	19.60	1.60	8.70	0.90	0.10
Kršan	2,913	9.80	1.60	1.70	0.40	0.50	0.10	0.00
Kukljica	686	6.40	1.90	1.00	0.40	0.30	0.10	0.00
Kula Norinska	1,608	14.70	2.20	3.00	0.50	0.90	0.20	0.00
Kumrovec	1,587	16.50	2.40	3.40	0.70	1.10	0.30	0.00
Kutina	22,337	25.00	1.80	6.40	0.60	2.50	0.30	0.70
Kutjevo	6,165	42.20	2.00	12.00	0.80	4.90	0.40	0.30
Labin	11,497	12.60	1.40	2.40	0.40	0.70	0.10	0.20
Lanišće	328	6.30	2.80	1.00	0.50	0.30	0.20	0.00
Lasinja	1,612	41.70	3.60	11.40	1.40	4.40	0.70	0.10
Lastovo	792	4.60	1.90	0.80	0.40	0.20	0.10	0.00
Lećevica	577	41.40	4.70	10.80	1.80	4.00	1.00	0.00
Legrad	2,185	8.70	2.80	2.20	0.70	0.90	0.30	0.00
Lekenik	5,885	27.10	3.30	6.50	1.00	2.30	0.50	0.20
Lepoglava	7,437	28.70	3.20	6.90	1.00	2.40	0.40	0.30
Levanjska Varoš	1,016	70.50	4.30	26.60	2.60	13.20	1.70	0.10
Lipik	6,002	30.80	2.30	8.10	0.70	3.10	0.30	0.20
Lipovljani	3,450	25.60	3.00	6.00	1.00	2.10	0.40	0.10
Lišane Ostrovičke	686	12.30	3.60	2.20	0.80	0.60	0.30	0.00
Ližnjan - Lisignano	3,806	11.00	1.70	2.10	0.40	0.60	0.10	0.10
Lobor	2,818	14.40	2.20	2.80	0.60	0.80	0.20	0.10
Lokve	1,004	27.70	4.30	6.00	1.20	1.90	0.50	0.00
Lokvičići	783	47.50	4.30	13.90	1.90	5.60	1.00	0.00
Lopar	1,233	10.40	1.90	1.80	0.40	0.50	0.20	0.00
Lovas	1,207	29.30	3.40	7.20	1.00	2.60	0.50	0.00
Lovinac	995	13.50	2.60	3.30	0.80	1.10	0.40	0.00
Lovran	4,033	4.70	0.90	0.80	0.20	0.20	0.10	0.00
Lovreć	1,691	20.20	2.50	4.30	0.70	1.40	0.30	0.00
Ludbreg	8,223	21.90	2.00	5.00	0.60	1.70	0.30	0.20
Luka	1,323	13.20	2.60	2.50	0.60	0.70	0.20	0.00
Lukač	3,568	36.50	2.60	9.90	1.00	3.90	0.50	0.20
Lumbarda	1,211	5.20	1.70	0.90	0.40	0.20	0.10	0.00
Lupoglav	918	9.10	2.00	1.70	0.50	0.50	0.20	0.00
Ljubešćica	1,837	27.60	3.80	6.30	1.00	2.10	0.40	0.10
Mače	2,511	15.80	2.30	3.20	0.60	1.00	0.20	0.10
Magadenovac	1,904	26.70	3.00	6.90	0.90	2.70	0.40	0.10
Makarska	13,684	10.80	1.20	2.00	0.30	0.60	0.10	0.20

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Mala Subotica	5,274	22.50	1.70	8.50	0.60	4.60	0.40	0.20
Mali Bukovec	2,185	35.80	2.80	9.30	1.00	3.50	0.50	0.10
Mali Lošinj	7,916	5.50	0.90	0.90	0.20	0.30	0.10	0.10
Malinska-Dubašnica	3,050	9.20	1.50	1.70	0.40	0.50	0.10	0.00
Marčana	4,199	15.30	2.10	3.00	0.50	0.90	0.20	0.10
Marija Bistrica	5,889	12.60	1.70	2.40	0.40	0.70	0.20	0.10
Marija Gorica	2,214	19.30	2.90	4.00	0.80	1.30	0.30	0.10
Marijanci	2,358	23.90	2.90	5.80	0.90	2.10	0.40	0.10
Marina	4,496	30.30	2.70	7.10	0.90	2.40	0.40	0.20
Markušica	2,524	43.20	2.70	12.50	1.10	5.20	0.60	0.10
Martijanec	3,788	38.30	3.60	9.50	1.30	3.40	0.60	0.20
Martinska Ves	3,393	37.20	3.00	9.80	1.10	3.70	0.50	0.20
Maruševec	6,275	32.20	2.90	7.50	1.00	2.50	0.40	0.30
Matulji	11,121	6.50	1.10	1.10	0.20	0.30	0.10	0.10
Medulin	6,374	8.60	1.30	1.70	0.30	0.60	0.10	0.10
Metković	15,956	17.80	2.00	3.70	0.50	1.20	0.20	0.40
Mihovljan	1,921	37.90	4.10	9.50	1.40	3.40	0.60	0.10
Mikleuš	1,449	38.30	2.80	10.80	1.10	4.30	0.60	0.10
Milna	1,022	13.90	2.50	2.70	0.70	0.80	0.30	0.00
Mljet	1,061	3.80	1.30	0.70	0.30	0.20	0.10	0.00
Molve	2,147	22.10	3.30	5.10	1.00	1.70	0.40	0.10
Mošćenička Draga	1,526	7.10	1.90	1.10	0.40	0.30	0.10	0.00
Motovun - Montona	916	14.30	3.10	3.00	0.70	1.00	0.30	0.00
Mrkopalj	1,205	20.80	3.60	4.00	0.80	1.20	0.30	0.00
Muć	3,838	31.70	2.40	7.40	0.70	2.50	0.30	0.20
Mursko-Središće	6,209	16.60	1.70	4.40	0.50	1.80	0.20	0.10
Murter - Kornati	2,040	11.40	1.90	2.20	0.50	0.70	0.20	0.00
Našice	15,912	21.10	1.80	5.20	0.50	2.00	0.20	0.40
Nedelišće	11,700	18.70	1.30	6.80	0.50	3.50	0.30	0.30
Negoslavci	1,370	16.90	3.50	3.60	0.90	1.10	0.30	0.00
Nerežišća	845	4.40	1.80	0.70	0.30	0.20	0.10	0.00
Netretić	2,791	57.80	3.50	17.10	1.60	7.00	0.80	0.20
Nin	2,710	10.00	2.10	1.70	0.50	0.50	0.20	0.00
Nova Bukovica	1,769	47.30	3.30	13.20	1.30	5.20	0.60	0.10
Nova Gradiška	13,880	32.00	1.90	8.50	0.70	3.30	0.30	0.60
Nova Kapela	4,108	37.10	3.10	9.80	1.20	3.70	0.60	0.20
Nova Rača	3,391	32.20	3.50	8.10	1.20	2.90	0.50	0.10
Novalja	3,613	4.30	1.00	0.70	0.20	0.20	0.10	0.00
Novi Golubovec	971	18.60	3.70	3.70	1.00	1.10	0.40	0.00
Novi Marof	13,103	22.30	2.30	4.80	0.70	1.60	0.30	0.40
Novi Vinodolski	4,976	7.50	1.10	1.50	0.30	0.50	0.10	0.00
Novigrad	2,365	14.10	2.10	2.60	0.50	0.70	0.20	0.00
Novigrad - Cittanova	4,145	8.00	1.20	1.40	0.30	0.40	0.10	0.00
Novigrad Podravski	2,758	16.30	1.80	4.20	0.50	1.70	0.30	0.10
Novo Virje	1,169	23.10	3.70	5.40	1.20	1.90	0.50	0.00
Novska	13,404	30.20	1.80	7.90	0.70	3.00	0.30	0.50

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Nuštar	5,486	32.00	2.40	8.40	0.90	3.10	0.40	0.20
Nijemci	4,643	34.50	3.30	9.30	1.10	3.70	0.50	0.20
Obrovac	4,254	22.00	2.50	5.30	0.80	1.90	0.30	0.10
Ogulin	13,687	31.60	1.70	7.90	0.60	2.90	0.30	0.60
Okrug	3,326	13.50	2.00	2.70	0.50	0.80	0.20	0.10
Okučani	3,362	44.80	3.00	13.80	1.30	5.90	0.70	0.20
Omiš	14,654	25.70	1.70	5.90	0.60	2.00	0.20	0.50
Omišalj	2,973	3.70	0.80	0.90	0.20	0.30	0.10	0.00
Opatija	11,369	5.10	0.90	0.90	0.20	0.30	0.10	0.10
Oprisavci	2,481	30.00	3.70	7.30	1.20	2.60	0.50	0.10
Oprtalj - Portole	850	6.00	1.90	1.00	0.40	0.20	0.10	0.00
Opuzen	3,133	12.60	2.10	2.50	0.50	0.70	0.20	0.10
Orahovica	5,090	20.40	2.10	4.40	0.60	1.50	0.20	0.10
Orebić	4,031	5.80	1.80	0.90	0.40	0.20	0.10	0.00
Orehovica	2,478	37.90	2.60	15.80	1.30	8.60	0.90	0.10
Orle	1,924	13.90	2.00	3.50	0.60	1.30	0.30	0.00
Oriovac	5,719	45.00	2.10	12.60	0.80	5.00	0.40	0.30
Oroslavje	6,039	19.20	2.00	4.10	0.50	1.30	0.20	0.20
Osijek	105,841	16.80	1.40	3.60	0.40	1.20	0.20	2.30
Otočac	9,516	10.20	1.30	2.00	0.30	0.60	0.10	0.10
Otok (Split)	5,401	36.90	3.60	9.40	1.20	3.40	0.50	0.30
Otok (Vinkovci)	6,218	34.40	1.80	8.80	0.70	3.20	0.30	0.30
Ozalj	6,537	33.10	2.70	8.20	1.00	2.90	0.40	0.30
Pag	3,802	4.10	0.90	0.70	0.20	0.20	0.10	0.00
Pakoštane	4,090	11.70	1.80	2.30	0.50	0.70	0.20	0.10
Pakrac	8,345	35.60	2.10	9.20	0.70	3.50	0.30	0.40
Pašman	2,069	7.70	1.70	1.30	0.40	0.30	0.10	0.00
Pazin	8,570	8.10	1.10	1.40	0.30	0.40	0.10	0.10
Perušić	2,636	16.10	2.30	4.10	0.60	1.60	0.30	0.10
Peteranec	2,648	20.90	1.90	6.80	0.60	3.30	0.40	0.10
Petlovac	2,350	34.70	3.00	9.50	1.00	3.80	0.50	0.10
Petrijanec	4,695	31.80	2.80	10.30	0.90	5.10	0.50	0.20
Petrijevci	2,761	24.30	2.50	5.70	0.80	2.00	0.40	0.10
Petrinja	23,896	29.90	1.60	7.40	0.60	2.70	0.30	0.90
Petrovsko	2,643	15.70	3.00	3.10	0.80	0.90	0.30	0.10
Pićan	1,805	12.10	2.30	2.20	0.50	0.60	0.20	0.00
Pirovac	1,850	18.90	2.20	4.30	0.60	1.50	0.30	0.00
Pisarovina	3,661	14.60	2.80	3.20	0.70	1.10	0.30	0.10
Pitomača	9,782	31.70	2.30	8.70	0.80	3.50	0.40	0.40
Plaški	2,057	53.30	3.90	16.30	1.60	6.90	0.90	0.10
Pleternica	11,115	37.70	2.20	10.10	0.90	3.90	0.40	0.50
Plitvička Jezera	4,299	11.90	1.60	2.40	0.40	0.70	0.10	0.10
Ploče	9,776	18.50	2.40	4.00	0.70	1.30	0.30	0.20
Podbablje	4,679	38.60	4.20	10.00	1.40	3.70	0.60	0.20
Podcrkavlje	2,544	45.60	2.70	13.50	1.20	5.50	0.70	0.20
Podgora	2,505	8.20	1.60	1.50	0.40	0.40	0.10	0.00

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Podgorač	2,834	41.10	2.70	12.80	1.10	5.70	0.60	0.20
Podravska Moslavina	1,153	23.60	3.50	5.70	1.00	2.10	0.50	0.00
Podravske Sesvete	1,616	12.80	2.50	2.70	0.60	0.90	0.30	0.00
Podstrana	8,932	9.60	1.70	1.70	0.40	0.50	0.10	0.10
Podturen	3,810	19.60	2.10	5.30	0.60	2.30	0.30	0.10
Pojezerje	896	20.90	3.90	4.20	1.00	1.30	0.40	0.00
Pokupsko	2,210	40.40	5.40	11.10	2.10	4.40	1.00	0.10
Polača	1,452	21.40	2.70	4.70	0.80	1.60	0.30	0.00
Poličnik	4,454	16.80	2.20	3.30	0.60	1.00	0.20	0.10
Popovac	2,044	36.00	3.30	10.10	1.20	4.10	0.60	0.10
Popovača	11,394	32.30	1.50	9.00	0.50	3.70	0.30	0.50
Poreč - Parenzo	16,438	7.10	1.00	1.30	0.20	0.40	0.10	0.20
Posedarje	3,565	16.40	2.10	3.40	0.60	1.10	0.20	0.10
Postira	1,542	9.20	1.90	1.70	0.40	0.50	0.20	0.00
Povljana	756	6.90	1.90	1.10	0.40	0.30	0.10	0.00
Požega	25,406	23.70	1.40	5.60	0.50	2.00	0.20	0.80
Pregrada	6,485	24.30	2.10	5.40	0.60	1.80	0.30	0.20
Preko	3,339	5.30	1.10	0.90	0.20	0.20	0.10	0.00
Prelog	7,638	8.40	1.30	1.40	0.30	0.40	0.10	0.10
Preseka	1,413	13.10	3.90	2.70	0.90	0.80	0.30	0.00
Prgomet	665	24.20	4.90	5.50	1.50	1.80	0.60	0.00
Pribislavec	3,096	29.60	2.50	12.50	1.10	7.10	0.70	0.10
Primorski Dolac	769	55.00	4.30	17.00	1.90	7.20	1.10	0.10
Primošten	2,794	8.40	1.40	1.40	0.30	0.30	0.10	0.00
Privlaka (Zadar)	2,211	11.10	1.90	2.20	0.50	0.70	0.20	0.00
Privlaka (Vinkovci)	2,754	25.50	2.40	6.50	0.80	2.40	0.40	0.10
Proložac	3,491	32.60	3.30	8.10	1.10	2.90	0.50	0.10
Promina	1,048	17.00	2.50	3.50	0.80	1.10	0.30	0.00
Pučišća	2,144	17.80	2.50	3.70	0.70	1.20	0.30	0.00
Pula - Pola	55,918	10.70	0.90	2.10	0.30	0.70	0.10	0.80
Punat	1,907	9.10	1.40	1.80	0.40	0.60	0.20	0.00
Punitovci	1,750	28.90	2.60	7.10	0.90	2.60	0.40	0.10
Pušća	2,615	25.10	3.20	6.00	1.00	2.10	0.50	0.10
Rab	7,942	10.60	1.70	2.00	0.40	0.60	0.10	0.10
Radoboj	3,339	20.90	2.80	4.40	0.70	1.40	0.30	0.10
Rakovec	1,238	15.60	5.10	3.00	1.20	0.90	0.40	0.00
Rakovica	2,368	42.50	3.60	12.10	1.50	4.80	0.80	0.10
Rasinja	3,171	22.50	2.00	5.90	0.60	2.30	0.30	0.10
Raša	3,074	14.70	2.30	2.90	0.50	0.90	0.20	0.10
Ravna Gora	2,426	23.80	2.70	5.40	0.80	1.80	0.40	0.10
Ražanac	2,900	8.00	1.50	1.40	0.40	0.40	0.10	0.00
Rešetari	4,653	41.50	3.10	11.70	1.20	4.70	0.60	0.30
Ribnik	473	37.50	4.80	9.40	1.70	3.40	0.80	0.00
Rijeka	125,857	8.30	0.90	1.60	0.20	0.50	0.10	1.40
Rogoznica	2,339	12.40	2.00	2.60	0.50	0.80	0.20	0.00
Rovinj	13,942	8.50	1.00	1.60	0.20	0.50	0.10	0.20

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Rovišće	4,749	35.20	2.70	9.90	1.00	4.00	0.50	0.20
Rugvica	7,661	9.30	1.20	1.80	0.30	0.60	0.10	0.10
Runovići	2,373	30.50	3.10	7.70	1.00	2.80	0.50	0.10
Ružić	1,559	25.00	3.50	5.60	1.10	1.80	0.50	0.10
Saborsko	626	59.20	6.20	17.70	2.70	7.40	1.40	0.00
Sali	1,672	2.00	1.10	0.30	0.20	0.10	0.00	0.00
Samobor	37,186	8.60	1.10	1.50	0.30	0.40	0.10	0.40
Satnica Đakovačka	2,082	27.50	2.80	6.70	0.80	2.40	0.40	0.10
Seget	4,787	21.00	2.20	4.60	0.60	1.50	0.30	0.10
Selca	1,786	16.20	2.40	3.10	0.60	0.90	0.20	0.00
Selnica	2,885	13.70	2.10	2.70	0.50	0.80	0.20	0.10
Semeljci	4,219	35.80	2.90	11.10	1.00	5.00	0.50	0.20
Senj	7,095	8.40	1.30	1.50	0.30	0.40	0.10	0.10
Severin	873	52.90	4.60	16.30	2.00	6.90	1.10	0.10
Sibinj	6,815	29.00	2.50	6.80	0.80	2.30	0.30	0.30
Sikirevci	2,461	28.60	4.20	6.60	1.30	2.30	0.50	0.10
Sinj	24,471	22.10	2.00	4.80	0.60	1.60	0.20	0.70
Sirač	2,201	28.40	2.60	7.00	0.80	2.60	0.40	0.10
Sisak	46,762	25.40	1.50	6.30	0.50	2.30	0.20	1.60
Skrad	1,054	15.60	3.00	2.80	0.70	0.80	0.20	0.00
Skradin	3,701	25.70	2.90	5.60	0.80	1.80	0.30	0.10
Slatina	13,529	25.80	1.80	6.20	0.60	2.20	0.30	0.50
Slavonski Brod	57,296	28.80	1.40	7.50	0.50	2.90	0.30	2.20
Slavonski Šamac	2,112	44.90	4.10	12.80	1.60	5.20	0.80	0.10
Slivno	1,906	14.70	2.40	3.10	0.60	1.10	0.20	0.00
Slunj	5,012	46.20	3.00	12.70	1.30	4.90	0.70	0.30
Smokvica	874	3.30	1.90	0.50	0.30	0.10	0.10	0.00
Sokolovac	3,346	39.40	4.20	10.60	1.60	4.00	0.80	0.20
Solin	23,670	20.50	2.00	4.30	0.60	1.40	0.20	0.60
Sopje	2,242	40.30	5.50	10.80	2.00	4.20	0.90	0.10
Split	173,163	11.30	0.90	2.10	0.30	0.60	0.10	2.60
Sračinec	4,689	37.60	3.50	9.30	1.20	3.40	0.50	0.20
Stankovci	1,982	29.20	3.30	6.70	0.90	2.30	0.40	0.10
Stara Gradiška	1,349	58.00	3.10	18.00	1.50	7.60	0.90	0.10
Stari Grad	2,744	8.40	1.40	1.50	0.30	0.40	0.10	0.00
Stari Jankovci	4,322	45.60	2.80	13.50	1.10	5.60	0.60	0.30
Stari Mikanovci	2,864	40.50	2.50	11.50	1.00	4.60	0.50	0.20
Starigrad	1,869	8.70	1.80	1.50	0.40	0.40	0.20	0.00
Staro Petrovo Selo	5,090	41.60	3.00	11.80	1.20	4.70	0.60	0.30
Ston	2,287	9.00	1.80	1.70	0.40	0.50	0.10	0.00
Strahoninec	2,653	7.90	1.60	1.30	0.40	0.40	0.10	0.00
Strizivojna	2,494	35.00	2.70	9.10	1.00	3.40	0.50	0.10
Stubičke Toplice	2,736	10.40	1.60	1.90	0.40	0.50	0.10	0.00
Stupnik	3,652	7.90	1.70	1.40	0.40	0.40	0.10	0.00
Sućuraj	458	10.00	3.10	1.60	0.70	0.40	0.20	0.00
Suhopolje	6,477	36.20	2.20	9.70	0.80	3.80	0.40	0.30

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Sukošan	4,533	7.60	1.60	1.30	0.30	0.30	0.10	0.00
Sunja	5,709	43.90	2.50	12.20	1.00	4.90	0.50	0.30
Supetar	3,997	5.80	1.00	0.90	0.20	0.20	0.10	0.00
Sutivan	800	7.30	1.60	1.40	0.40	0.40	0.20	0.00
Sveta Marija	2,284	17.10	2.60	3.50	0.60	1.10	0.20	0.10
Sveta Nedelja	2,880	10.10	1.40	1.80	0.30	0.50	0.10	0.00
Sveti Filip I Jakov	4,434	12.00	1.70	2.40	0.40	0.70	0.20	0.10
Sveti Ivan Zelina	15,623	13.30	1.40	2.60	0.40	0.80	0.10	0.30
Sveti Križ Začretje	6,037	19.50	2.30	4.10	0.60	1.30	0.20	0.20
Sveti Lovreč	1,014	11.40	2.30	2.10	0.50	0.60	0.20	0.00
Sveti Petar U Šumi	1,052	8.80	2.20	1.30	0.40	0.30	0.10	0.00
Svetvinčenat	2,184	12.00	2.10	2.10	0.50	0.60	0.20	0.00
Sveta Nedelja	17,785	8.70	1.70	1.50	0.30	0.40	0.10	0.20
Sveti Đurđ	3,763	39.70	3.30	10.60	1.20	4.20	0.60	0.20
Sveti Ilija	3,357	29.70	3.40	6.50	1.00	2.10	0.40	0.10
Sveti Ivan Žabno	5,086	15.80	2.10	3.20	0.50	1.00	0.20	0.10
Sveti Juraj Na Bregu	4,909	9.80	1.60	1.70	0.30	0.50	0.10	0.10
Sveti Martin Na Muri	2,586	16.80	2.10	3.30	0.60	1.00	0.20	0.10
Sveti Petar Orehovec	4,449	34.90	4.90	8.30	1.60	2.90	0.70	0.20
Šandrovac	1,742	32.40	3.60	9.90	1.40	4.30	0.70	0.10
Šenkovec	2,795	10.50	1.90	2.00	0.40	0.60	0.20	0.00
Šestanovac	1,849	18.00	2.40	3.70	0.70	1.10	0.30	0.00
Šibenik	45,426	8.80	1.00	1.60	0.20	0.40	0.10	0.50
Škabrnja	1,770	8.30	2.50	1.30	0.50	0.30	0.20	0.00
Šodolovci	1,598	36.40	4.00	9.60	1.40	3.70	0.70	0.10
Šolta	1,668	11.50	2.10	2.30	0.50	0.70	0.20	0.00
Špišić Bukovica	4,171	46.10	2.90	13.50	1.10	5.50	0.60	0.30
Štefanje	1,988	33.00	3.50	9.80	1.10	4.50	0.60	0.10
Štitar	2,049	24.70	2.90	5.80	1.00	1.90	0.40	0.10
Štrigova	2,526	9.10	1.90	1.70	0.40	0.50	0.10	0.00
Tar-Vabriga - Torre-Abrega	1,982	8.80	1.80	1.60	0.40	0.50	0.20	0.00
Tinjan	1,660	13.00	2.20	2.30	0.50	0.60	0.20	0.00
Tisno	3,089	5.30	1.10	0.80	0.20	0.20	0.10	0.00
Tkon	754	20.40	3.60	4.70	1.10	1.60	0.50	0.00
Tompojevci	1,523	30.30	3.40	7.10	1.10	2.40	0.50	0.10
Topusko	2,956	39.00	2.60	10.40	0.90	3.90	0.50	0.20
Tordinci	2,004	47.10	3.50	13.20	1.40	5.10	0.70	0.10
Tounj	1,143	54.80	3.50	16.50	1.60	7.00	0.90	0.10
Tovarnik	2,736	24.80	2.40	5.80	0.70	2.10	0.30	0.10
Tribunj	1,534	16.40	2.60	3.40	0.70	1.10	0.30	0.00
Trilj	8,801	34.80	2.50	8.70	0.80	3.10	0.40	0.40
Trnava	1,568	47.70	3.30	14.30	1.40	6.00	0.80	0.10
Trnovec Bartolovečki	6,470	23.60	2.30	4.90	0.60	1.50	0.20	0.20
Trogir	12,784	14.40	1.40	2.80	0.40	0.80	0.10	0.20
Trpanj	705	6.70	2.00	1.20	0.50	0.30	0.20	0.00
Trpinja	5,386	40.50	3.40	10.80	1.30	4.10	0.60	0.30

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Tučepi	1,925	12.20	2.40	2.30	0.50	0.70	0.20	0.00
Tuhelj	1,973	16.50	3.10	3.30	0.80	1.00	0.30	0.00
Udbina	1,791	14.50	2.40	3.30	0.60	1.10	0.30	0.00
Umag	13,383	7.30	1.00	1.30	0.20	0.40	0.10	0.10
Unešić	1,637	20.30	3.60	4.20	0.90	1.30	0.40	0.00
Valpovo	11,216	27.30	1.70	6.60	0.60	2.40	0.30	0.40
Varaždin	45,378	10.10	1.30	1.90	0.30	0.60	0.10	0.60
Varaždinske Toplice	6,316	21.60	2.20	4.60	0.70	1.50	0.30	0.20
Vela Luka	4,059	8.70	1.50	1.60	0.30	0.50	0.10	0.00
Velika	5,393	38.80	2.40	10.30	0.90	3.90	0.40	0.30
Velika Gorica	62,711	7.90	0.90	1.50	0.20	0.40	0.10	0.70
Velika Kopanica	3,258	25.00	3.00	6.20	0.90	2.30	0.40	0.10
Velika Ludina	2,614	37.30	2.90	10.40	1.00	4.20	0.50	0.10
Velika Pisanica	1,775	29.70	5.60	7.30	1.80	2.60	0.80	0.10
Velika Trnovitica	1,356	35.60	3.10	9.40	1.20	3.60	0.60	0.10
Veliki Bukovec	1,411	19.50	3.40	4.10	1.00	1.30	0.40	0.00
Veliki Grđevac	2,808	26.20	3.80	6.60	1.20	2.50	0.50	0.10
Veliko Trgovišće	4,856	21.50	3.00	4.60	0.80	1.50	0.30	0.10
Veliko Trojstvo	2,687	52.20	3.40	16.10	1.50	6.80	0.80	0.20
Vidovec	5,325	16.80	1.90	3.40	0.50	1.00	0.20	0.10
Viljevo	2,038	23.50	2.70	6.00	0.80	2.30	0.40	0.10
Vinica	3,336	24.80	3.10	5.10	0.80	1.60	0.30	0.10
Vinkovci	34,453	26.60	1.60	6.50	0.60	2.30	0.30	1.20
Vinodolska Općina	3,539	12.00	1.80	2.20	0.40	0.60	0.20	0.10
Vir	2,972	16.40	3.60	3.70	1.00	1.30	0.40	0.10
Virje	4,451	18.10	1.80	4.30	0.50	1.60	0.20	0.10
Virovitica	20,924	20.70	1.60	4.60	0.50	1.50	0.20	0.60
Vis	1,842	16.30	2.00	3.40	0.60	1.10	0.20	0.00
Visoko	1,498	50.40	4.50	14.90	2.20	6.00	1.20	0.10
Viškovci	1,885	48.40	4.40	14.40	1.70	6.00	0.80	0.10
Viškovo	14,235	10.50	1.70	1.90	0.40	0.60	0.10	0.20
Višnjan - Visignano	2,261	10.60	1.90	2.10	0.50	0.70	0.20	0.00
Vižinada - Visinada	1,146	9.60	2.10	1.70	0.50	0.50	0.20	0.00
Vladislavci	1,836	35.20	3.60	9.70	1.30	3.80	0.60	0.10
Voćin	2,274	45.90	4.10	14.20	1.70	5.90	0.90	0.10
Vodice	8,784	11.90	1.50	2.20	0.30	0.60	0.10	0.10
Vodnjan - Dignano	5,943	18.80	1.80	4.70	0.50	1.80	0.20	0.10
Vođinci	1,931	24.40	3.30	5.60	1.00	1.90	0.40	0.10
Vojnić	4,524	61.90	2.80	20.80	1.50	9.40	0.90	0.40
Vratišinec	1,953	10.00	2.00	1.90	0.40	0.50	0.20	0.00
Vrbanja	3,815	26.80	2.50	6.60	0.90	2.40	0.40	0.10
Vrbje	2,162	38.90	3.80	10.60	1.40	4.20	0.60	0.10
Vrbnik	1,244	6.90	1.70	1.20	0.40	0.30	0.20	0.00
Vrbovec	14,406	11.20	1.30	2.20	0.30	0.70	0.10	0.20
Vrbovsko	5,025	16.60	1.90	3.60	0.50	1.20	0.20	0.10
Vrgorac	6,336	35.00	2.50	8.50	0.90	2.90	0.40	0.30

Location	Population	Head count poverty	Std. Err. Head count poverty	Poverty Gap	Std. Err. Poverty Gap	Poverty Gap Sq.	Std. Err. Poverty Gap Sq.	Share of poor
Vrhovine	1,378	11.30	2.50	2.30	0.60	0.70	0.20	0.00
Vrlika	1,968	23.80	3.80	5.30	1.20	1.80	0.50	0.10
Vrpolje	3,457	38.90	2.50	11.10	0.90	4.50	0.50	0.20
Vrsar - Orsera	2,152	11.70	1.90	2.10	0.40	0.60	0.20	0.00
Vrsi	2,036	9.60	1.80	1.80	0.40	0.50	0.20	0.00
Vuka	1,145	20.50	3.00	4.40	0.90	1.40	0.40	0.00
Vukovar	26,975	37.00	2.60	9.70	0.90	3.70	0.40	1.30
Zabok	8,938	13.10	1.80	2.50	0.40	0.70	0.20	0.20
Zadar	73,680	5.00	0.70	0.80	0.10	0.20	0.00	0.50
Zadvarje	250	5.00	2.70	0.90	0.60	0.20	0.20	0.00
Zagorska Sela	990	11.20	2.60	1.90	0.60	0.50	0.20	0.00
Zagvozd	1,186	33.10	3.80	7.90	1.10	2.80	0.50	0.10
Zaprešić	24,935	9.20	1.10	1.70	0.30	0.50	0.10	0.30
Zažablje	720	28.10	3.40	6.40	1.10	2.20	0.50	0.00
Zdenci	1,869	31.80	3.40	8.50	1.00	3.30	0.50	0.10
Zemunik Donji	1,885	9.60	1.80	1.90	0.40	0.50	0.20	0.00
Zlatar	6,014	15.60	2.10	3.10	0.60	1.00	0.20	0.10
Zlatar Bistrica	2,562	16.40	2.10	3.40	0.50	1.10	0.20	0.10
Zmijavci	2,038	29.20	4.10	6.60	1.10	2.20	0.40	0.10
Zrinski Topolovac	861	53.40	6.20	16.80	2.70	7.40	1.40	0.10
Žakanje	1,856	29.40	3.20	6.60	1.00	2.20	0.40	0.10
Žminj	3,462	13.60	1.90	2.50	0.40	0.70	0.20	0.10
Žumberak	830	16.40	3.30	3.50	1.00	1.10	0.40	0.00
Župa Dubrovačka	8,056	11.60	2.30	2.20	0.50	0.60	0.20	0.10
Županja	11,622	22.20	1.80	5.20	0.60	1.90	0.20	0.30

Figure A1: Municipal, City, and districts of Zagreb poverty estimates and 95% confidence intervals

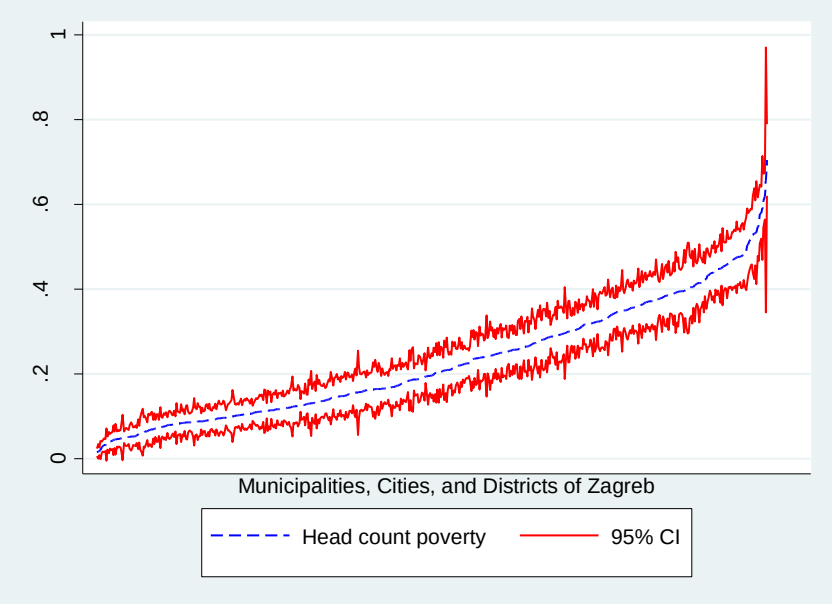

Figure A2: Poverty in the districts of Zagreb