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Evidence from 2016 Census Data

Sadegh Hossein Zadeh
and Atiyeh Vahidmanesh

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Hossein Zadeh, Sadegh, MA in Economics, Faculty of Economics, University of Tehran.
Phone: +989013802003, Email: hosseinzadeh.s@ut.ac.ir
Vahidmanesh, Atiyeh, Assistant Professor of Economics, Faculty of Economics, University of Tehran,
Phone: +989126873728, Email: a.vahidmanesh@ut.ac.ir[1]
Address: North Kargar Avenue, Jalal Ahmad Street, Tehran, Iran. PO BOX: 14155-6445.

Abstract

Effective poverty alleviation requires identifying deprived populations at a geographic scale that is small enough for targeted interventions but still statistically reliable. This paper produces county-level poverty estimates for Iran by combining the 2016 Household Expenditure and Income Survey (HEIS) with a 2% random sample of the 2016 General Population and Housing Census. We implement a unit-level small-area estimation approach following Elbers, Lanjouw, and Lanjouw (2003), enriched with k-means clustering of counties and LASSO-based variable selection, to generate headcount poverty rates and poverty maps for 429 counties. County-level headcount ratios range from about 7 to 83 percent, while provincial poverty varies between roughly 10 and 39 percent, with Sistan & Baluchestan, Qom, and Kermanshah at the top and Semnan and Mazandaran at the bottom. High-poverty counties are concentrated in Sistan & Baluchestan but also appear in provinces with relatively low average poverty—for example, Miami in Semnan—indicating substantial within-province heterogeneity. Standard errors of county estimates fall mostly between 0.03 and 0.13, and comparison with existing estimates based on survey data alone shows close agreement in levels and rankings. The resulting poverty maps highlight that relying on provincial averages can seriously misguide targeting, and they provide a practical tool for prioritizing socioeconomic, health, and education programs at both national and regional levels.

Keywords: Poverty, Small Area Estimation, Poverty Map
JEL Classifications: O12, C31, I32, R11

[1] Corresponding Author

1. Introduction

Reducing poverty remains a central objective of economic policy. Beyond its ethical and humanitarian dimensions, a high incidence of poverty and inequality undermines market size, industrialization, and long-run growth in developing economies (Murphy et al., 1989) and constrains people's capabilities and freedom of choice (Sen, 1999). Despite substantial progress in some regions, recent World Bank figures indicate that around 44 percent of the global population in middle-income countries live below national poverty lines, and nearly 700 million people still subsist on less than 2.15 dollars per day. At current rates of reduction, eradicating extreme poverty remains a distant prospect.

A large literature has documented poverty trends and correlates, but for policy design the crucial question is where the poor live and how finely policymakers can target them. Most anti-poverty programs—cash transfers, food subsidies, social protection schemes—are implemented at subnational levels. If the geographic unit is too coarse, deprived communities are averaged together with better-off areas; if it is too fine, data become too sparse for reliable measurement (Pratesi, 2016). In practice, administrative data, censuses, and sample surveys are rarely aligned in a way that directly yields accurate poverty estimates at the scale at which decisions are made.

Iran faces exactly this problem. Social protection and support to low-income households absorb a sizeable share of the national budget: according to the Parliament Research Center, social welfare expenditures account for roughly 28 percent of general government resources in the 2023 budget bill (Omati & Fahimi, 2022). Yet most official poverty indicators are produced only at the provincial level and rely on the Household Expenditure and Income Survey (HEIS). This mismatch between the budgeting scale (often de facto county or program level) and the measurement scale (province) creates obvious risks of mis-targeting. When poverty is heterogeneous within provinces, allocating resources uniformly by province can underfund deprived counties in relatively better-off regions and, conversely, oversubsidize non-poor counties in provinces classified as poor overall.

At the same time, Iran has rich but incomplete data infrastructure. The census covers the full population but does not collect detailed information on income or expenditures. The HEIS provides the necessary welfare variables but, due to sample size, only supports estimates at the national or provincial level. This is precisely the setting for the small-area estimation (SAE) literature, which develops methods to combine census and survey data to predict welfare indicators at fine geographic scales. Since the early 1990s, the World Bank and others have used SAE-based poverty mapping in multiple countries (Alderman et al., 2002; Hentschel et al., 2000; Demombynes et al., 2002; Elbers, Lanjouw, & Lanjouw, 2003; Elbers et al., 2007; Lanjouw, Marra, & Nguyen, 2013). These applications show that micro-level poverty maps can substantially improve geographic targeting relative to relying on provincial averages.

For Iran, existing evidence remains limited. The Parliament Research Center has recently produced updated poverty lines and provincial poverty estimates (Shahbazian et al., 2018; Kaviani, 2023), but does not provide county-level measures. Einian and Souri (2018) construct poverty maps for 2011, but more recent and methodologically updated estimates are lacking, especially for the post-2010 decade of economic shocks and sanctions. In addition, previous work has highlighted that poverty estimates are highly sensitive to how housing costs are treated in the construction of poverty lines, which can distort poverty levels in high-cost provinces like Tehran and Alborz.

This paper addresses these gaps by producing county-level poverty estimates for Iran in 2016, using a micro-level estimation framework that combines the 2016 HEIS with a 2 percent sample of the 2016

Population and Housing Census. Following Elbers, Lanjouw, and Lanjouw (2003), we estimate unit-level models of (log) per capita household expenditure and use them, together with Monte Carlo simulation, to derive Foster–Greer–Thorbecke (FGT) poverty measures at the county level. To accommodate heterogeneity in living conditions, we first cluster counties into six groups (three predominantly urban, three predominantly rural) using k-means on census-based indicators and then estimate separate models for each cluster. Within each cluster, LASSO regression is used for variable selection, and generalized least squares accounts for within-county correlation. Absolute poverty lines are taken from the Parliament Research Center's 2016 estimates, which are based on the repeated basic-needs methodology.

Our main findings are threefold. First, poverty is highly dispersed across space: county-level headcount ratios range from about 7 to 83 percent, and provincial poverty varies from roughly 10 percent in Semnan to about 39 percent in Sistan & Baluchestan. Second, within-province heterogeneity is substantial. While Sistan & Baluchestan concentrates many of the poorest counties, several high-poverty counties appear in provinces with moderate or low provincial poverty—for example, Miami in Semnan—indicating that provincial averages seriously understate pockets of deprivation. Third, the estimates are statistically precise and consistent with existing sources: county-level standard errors mostly lie between 0.03 and 0.13, and provincial poverty rankings closely match those obtained directly from HEIS-based estimates, except in provinces with atypically high housing costs, where we document and discuss the reasons for divergence.

The contribution of this paper is therefore both empirical and methodological. Empirically, it provides the first comprehensive and internally consistent poverty map for all 429 counties of Iran in 2016, with separate urban and rural components. Methodologically, it shows how a combination of clustering, LASSO-based variable selection, and the Elbers–Lanjouw–Lanjouw framework can be implemented in a context where census data lack direct housing-cost information, and where poverty lines are externally determined and themselves sensitive to regional housing markets. The resulting county-level poverty measures and maps offer a practical tool for national and provincial authorities to prioritize social assistance, health, and education programs, and they establish a baseline for future work on dynamic and multidimensional poverty in Iran.

The remainder of the paper is organized as follows. Section 2 describes the data and poverty lines. Section 3 outlines the small-area estimation methodology. Section 4 presents the implementation and results, including provincial and county-level poverty rates and maps, as well as sensitivity analysis. Section 5 concludes with policy implications and directions for further research.

2. Data

This study employs two main data sources: the Household Expenditure and Income Survey (HEIS) 2016 and the 2% sample of the 2016 Population and Housing Census. The HEIS has been conducted annually by the Statistical Center of Iran since 1984, with the latest release available for 2023. To minimize estimation error arising from the time gap between the most recent census (2016) and the latest HEIS, we use the 2016 HEIS, which coincides with the census year. The survey provides detailed information on household demographics, housing characteristics, consumption expenditures, and income. In this study, the dependent variable is annual per capita household expenditure, calculated as the sum of food and non-food expenditures. The census covers the entire population but contains fewer details on household expenditures. The publicly available 2% sample includes 483,385 households and 1,579,435 individuals, providing sufficient sample size for estimation below the provincial level. These data include demographic and housing characteristics, as well as information on household members' education, employment, age, and gender.

Independent variables are restricted to those available in both datasets. The first set consists of basic household and individual characteristics (e.g., household size, housing type, and the age, sex, education, and employment status of the household head). Additional variables are constructed from both the survey and census, including household ratios (e.g., share of employed members, share of literate members, dependency ratios). Furthermore, county- and province-level aggregates (e.g., median age of household heads, mode of building materials) are calculated from the census and merged with both census and survey data.

Poverty Line

To calculate poverty rates, defining the poverty line is essential. In this study, a new poverty line is not estimated; instead, we rely on existing figures from previous research. In developing countries, where a significant share of the population still struggles to meet basic needs, the absolute poverty line is more relevant than the relative one. Accordingly, this study adopts the absolute poverty line calculated by the Islamic Parliament Research Center of Islamic Republic of Iran. Poverty lines can be estimated using different approaches; in the referenced report, the repeated minimum basic needs cost method was applied to determine poverty thresholds for both urban and rural areas (Shahbazian et al., 2018).

Table 1 – Poverty line in urban and rural areas

	Cluster	Poverty Line (Monthly per capita, Rials)	Provinces or counties
Urban	Cluster 1	4,107,570	Markazi, West Azerbaijan, Kurdistan, Bushehr, Hormozgan, Gilan, Isfahan, Hamedan, Zanjan, Qazvin, Mazandaran, Golestan, Lorestan, Semnan, North Khorasan, Tabriz County, Isfahan County, Ahvaz County, Sistan & Baluchestan
	Cluster 2	3,642,510	East Azerbaijan, Kerman, Ilam, Yazd, Ardabil, Khuzestan, Razavi Khorasan, Fars, South Khorasan, Chaharmahal and Bakhtiari, Kohgiluyeh and Boyer-Ahmad
	Cluster 3	5,055,730	Kermanshah, Alborz, Qom, Tehran, Mashhad County, Shiraz
	Cluster 4	7,689,100	Tehran County
Rural	Cluster 1	4,323,140	Tehran, Alborz
	Cluster 2	2,338,640	Khuzestan, Chaharmahal va Bakhtiari, Hormozgan, Gilan, Kerman, Fars, Lorestan, Golestan, Mazandaran, Bushehr
	Cluster 3	2,194,200	East Azerbaijan, West Azerbaijan, Kurdistan, Yazd, Markazi, Hamedan, Ardabil, Semnan, North Khorasan, Razavi Khorasan, South Khorasan
	Cluster 4	2,763,930	Zanjan, Kermanshah, Isfahan, Qom, Qazvin
	Cluster 5	2,012,640	Sistan & Baluchestan, Ilam, Kohgiluyeh and Boyer-Ahmad

Source: Shahbazian et al.,2018.

3. Methodology

As mentioned earlier, the aim of this study is to estimate the poverty rate at the county level in Iran. In model-based poverty estimation methods, two categories of models are commonly discussed: area-level models and unit-level models. Area-level models are designed based on direct estimates for each area and macro-level variables, and by incorporating random area effects, they improve the accuracy of poverty rate estimation. On the other hand, unit-level models use individual or household data along with relevant explanatory variables to separately model within-area variations and between-area differences, and then estimate the poverty rate of each area through the aggregation of predictions (Rao & Molina, 2016). In this study, the unit-level method of Elbers et al. (2003) is employed. This model is implemented in two stages, as follows:

3.1. Stage One: Regression Model

Consumption Model:

This model is specifically designed for estimating poverty indicators based on household per capita expenditure. The foundation of this model is the assumption that household per capita expenditure is related to a number of household characteristics. These characteristics are measured in both census data and household income and expenditure surveys through identical or closely related questions. Accordingly, in this method, household per capita expenditure y from the income and expenditure data is modeled as a function of household-related variables x (which are available in both the census and the income and expenditure data) as follows:

$$\ln y_{ch} = x_{ch}^T\beta + u_{ch} \qquad (1)$$

Where y_{ch} is the per capita expenditure of household h in cluster c, β is the vector of k model coefficients, u_{ch} is the error term with distribution $u \sim \mathcal{N}(0, \sigma^2)$. The cluster unit here refers to the smallest census division (in the 2016 Iran census data, this unit is the county).

To estimate per capita expenditure in the census data using the coefficients β, it is essential that these parameters be estimated from samples that are representative of the actual population. Therefore, when estimating the model with household income and expenditure data, household weights from the same dataset are used as importance factors, so that the estimates are less affected by sampling fluctuations (Elbers et al., 2003). Assuming the possibility of error correlation within each cluster, the following form is used for the residuals:

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

where η_c is the cluster-level error for cluster c, and e_{ch} is the household-level error for household h in cluster c. It is also assumed that η_c and e_{ch} are independent of each other and uncorrelated with x_{ch} (Bates et al., 1988).

Stage One of this method consists of two parts: In the first part, regression is estimated using Ordinary Least Squares (OLS) or Weighted Least Squares (WLS) with household income and expenditure data. In the second part, by employing the variance–covariance matrix of the errors from the first stage together with household income and expenditure data, Generalized Least Squares (GLS) regression is estimated as the final model. Because of the correlation among households within a cluster, the coefficients obtained from OLS or WLS regressions are not optimally efficient. Therefore, the final coefficients are extracted through GLS estimation, which fully accounts for intra-cluster correlation and the variances at both the cluster and household levels. These estimated coefficients and variances are then used in the simulation stage to estimate poverty indicators in the census data (Elbers et al., 2003).

To obtain the matrix used in the GLS regression, we need to estimate the variance of the household-level and cluster-level errors. From the results of Equation (1), we have:

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

where the dot in $\hat{u}_{c.}$ denotes the mean within cluster c. If n_c is the number of observations in cluster c, then the cluster-level error is equal to the mean of household errors within cluster c: $\hat{u}_{c.} = \hat{\eta}_c = \frac{\sum_h \hat{u}_{ch}}{n_c}$

To estimate the variance of η_c, the following relation is used (Elbers et al., 2002):

$$\hat{\sigma}_\eta^2 = \max\left(\frac{\sum_c w_c(u_{c.} - u_{..})^2 - \sum_c w_c(1-w_c)\hat{\tau}_c^2}{\sum_c w_c(1-w_c)}; 0\right) \quad (3)$$

where $u_{..} = \sum_c w_c u_c$ is the weighted mean of clusters, and $w_c = \sum_h w_{hc}$ is the cluster weight.

Furthermore, $\hat{\tau}_c^2$ is the estimated variance of household-level residuals within cluster c, given by:

$$\hat{\tau}_c^2 = \frac{\sum_h (e_{ch} - e_{c.})^2}{n_c(n_c - 1)} \quad (4)$$

Where: $e_{c.} = \frac{\sum_h e_{ch}}{n_c}$

Alpha Model

Up to this point, we have calculated the cluster-level error and its variance. To examine the assumption of homoscedasticity of the disturbance term, two approaches exist: when the disturbance term in Equation (1) does not reject the homoscedasticity assumption, the household-level error variance can be calculated as:

$$\hat{\sigma}_e = \hat{\sigma}_u - \hat{\sigma}_\eta$$

However, in the case of observed heteroscedasticity, it can be modeled as follows. The part of Equation (1) is referred to as the Beta model, and the heteroscedasticity component is called the Alpha model. Below, we review the steps for estimating the Alpha model.

In Elbers et al. (2003), household error heteroscedasticity is modeled using a logistic function:

$$E[{e_{ch}}^2] = \sigma_{e_{ch}}^2 = \left[\frac{A\, exp^{\acute{Z}_{ch}\alpha} + B}{1 + exp^{\acute{Z}_{ch}\alpha}}\right] \quad (5)$$

In practice, by setting $B = 0$ and $A = 1.05\max(\hat{e}_{ch}^2)$, the equation is simplified, and the following is estimated using OLS:

$$ln\left[\frac{{e_{ch}}^2}{A - {e_{ch}}^2}\right] = \acute{Z}_{ch}\alpha + r_{ch} \quad (6)$$

By defining $exp^{\acute{Z}_{ch}\alpha} = D$ and applying the delta method, the conditional variance of e_{ch} is approximated as (Elbers et al., 2002):

$$\hat{\sigma}^2_{e,ch} \approx \left[\frac{AD}{1+D}\right] + \frac{1}{2}\widehat{Var}(r)\left[\frac{AD(1-D)}{(1+D)^3}\right] \tag{7}$$

where $\widehat{Var}(r)$ is the estimated variance of the residuals from Equation (6). Through these steps, in addition to the consumption expenditure model (Beta), a coherent model for household error heteroscedasticity (Alpha) is obtained.

Generalized Least Squares Estimation

To obtain the final parameters of the consumption model, we apply Generalized Least Squares. The variance–covariance matrix of residuals is constructed using the estimated cluster-level and household-level variances (Ω). With household weights (W) incorporated, the GLS estimator is (Elbers et al., 2003):

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

and its variance is:

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

3.2. Stage Two: Monte Carlo Simulation

Given the method of estimating the variance of disturbance components and the necessity of measuring uncertainty in poverty rates, different approaches have been used by Elbers et al. (2003) for the simulation stage. The steps of the simulation in this study are as follows:

Step One: In each simulation repetition, the vector of model coefficients $\tilde{\beta}_{GLS}$ is obtained by drawing a sample from the distribution: $\tilde{\beta}_{GLS} \sim N\left(\hat{\beta}_{GLS},\ Var\left(\hat{\beta}_{GLS}\right)\right)$

Step Two: For each cluster c, a value of the cluster error $\tilde{\eta}_c$is drawn semi-parametrically from the distribution: $\tilde{\eta}_c \sim N\left(0,\ \hat{\sigma}^2_{\eta}\right)$

Step Three: Due to heteroscedasticity, $\tilde{e}_{ch}$ is drawn from: $\tilde{e}_{ch} \sim N\left(0,\ \tilde{\sigma}^2_{e,ch}\right)$.To compute $\tilde{\sigma}^2_{e,ch}$, α is drawn from the distribution: $\alpha \sim N(\hat{\alpha},\ Var(\hat{\alpha}))$ and applied to the census data to obtain a new $D = exp^{\acute{Z}_{ch}\alpha}$. Using this new D, along with A and $\widehat{Var}(r)$ from Step One, the household-level error variance is approximated as:

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

Step four: in one repetition, the simulated target variable for each household ch is:

$$\tilde{Y}_{ch} = X_{ch}\tilde{\beta}_{GLS} + \tilde{\eta}_c + \tilde{e}_{ch}$$

This process is repeated independently R times to obtain an $N \times R$ matrix of simulated $\tilde{Y}$ values. For each repetition r, using the specified poverty line, the poverty status of each household (0/1) is determined. Then, for the cluster or area of interest, the mean poverty status in repetition r is calculated. Finally, the distribution of poverty rates across R repetitions is obtained as the average poverty rate over all repetitions.

In this study, before implementing the Elbers et al. (2003) method, we first applied clustering to improve model accuracy. Given the large number of census variables, we initially used hierarchical clustering (Lance and Williams, 1967) to group highly correlated variables and then selected one representative variable from each group. Using these selected variables, we performed k-means clustering (MacQueen, 1967) on the census data, which separated the counties into six clusters—three corresponding to rural areas and three to urban areas. The optimal number of clusters was determined using the elbow method (Thorndike, 1953) and the silhouette index (Rousseeuw, 1987), and a separate model was estimated for each cluster (these clusters represent groups of counties and should not be confused with the clusters in Elbers, Lanjouw, & Lanjouw). In the first stage of estimation, variable selection was conducted using the LASSO method (Tibshirani, 1996) to handle the large set of potential predictors. Finally, poverty was measured using the Foster–Greer–Thorbecke (FGT) indices (Foster, Greer, and Thorbecke, 1984). The general form of the index is given by:

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{z - E_i}{z}\right)^{\alpha} \; . \; I(E_i < z)$$

Where N is the total population, E_i denotes the per capita expenditure of household i, z is the poverty line, $I(E_i < z)$ is an indicator function equal to 1 if household i is poor ($E_i < z$), and 0 otherwise. By setting $\alpha = 0$, the headcount ratio was calculated for each county. Larger values of α (e.g., $\alpha = 1,2$) place increasing weight on the poorest households, allowing the framework to capture not only the incidence of poverty but also its depth and severity.

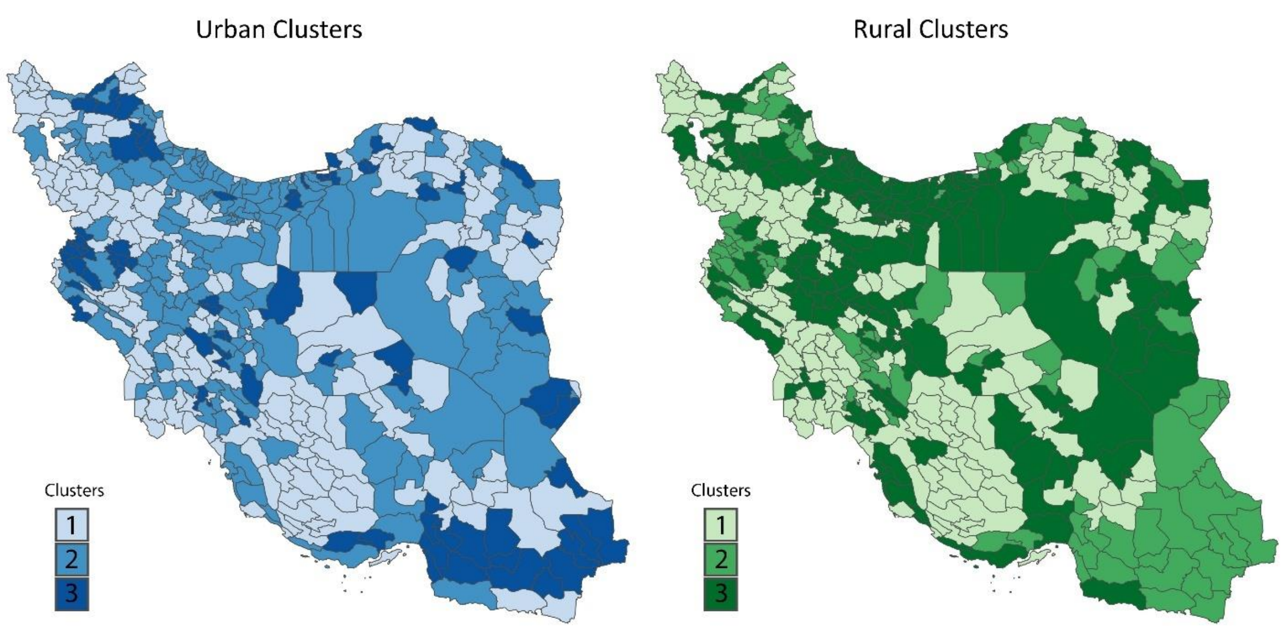
4. Implementation and Results

As described in Section 3, the counties of Iran were first grouped into clusters based on household living conditions and social characteristics, separately for urban and rural areas. For each cluster in each sector, a weighted least squares regression was estimated. Using the error structure specified in Equation (2) and the variance components derived from Equations (3) and (7), county-level and household-level error variances were obtained. With the variance matrix constructed from these components, a generalized least squares regression was then estimated for each cluster. The resulting models were subsequently used in the simulation stage to estimate poverty rates. Details of the clustering and model estimation are presented below.

4.1. Clustering Results

For each of the 429 counties, census data were used to compute ratios for categorical variables and means for numerical variables. Separate analyses were conducted for urban and rural sectors. First, hierarchical clustering was applied to group highly correlated variables, and one representative variable from each group was selected for use in the k-means algorithm. The elbow and silhouette methods indicated that either two or three clusters would be appropriate in both sectors. Between these alternatives, k=3 yielded regression models with stronger explanatory power. Accordingly, three clusters were adopted for each sector. Based on the selected variables and the 429 county observations, k-means clustering divided the counties into three clusters for the urban sector and three clusters for the rural sector.

Map 1 - Clustering Results for Urban and Rural Counties



4.2. Model Selection

Using the LASSO method, a subset of variables was selected for each model. In LASSO, the penalty parameter λ controls the degree of shrinkage applied to coefficients, with larger values eliminating more variables. Different values of λ were tested for each cluster, and the choice was based on minimizing the average standard error of simulated poverty rates. The final set of variables retained through the LASSO procedure is presented in Table 2.

Table 2 - Selected Variables for Urban and Rural Sectors

	Final Variables for Urban Clusters		Final Variables for Rural Clusters
1	Floor area, household size, ratio of literate members, number of members with university education, ratio of income-earning members, median ratio of household members aged 0–6 at the provincial level, median ratio of student members at the provincial level, median ratio of household members aged 7–14 at the county level, construction materials of the dwelling	1	Floor area, household size, ratio of household members aged 0–6, ratio of employed members, ratio of literate members, number of members with university education, median household size at the provincial level, median ratio of employed members at the provincial level, median ratio of literate members at the provincial level, median floor area at the county level, median household size at the county level, construction materials of the dwelling
2	Floor area, household size, ratio of literate members, number of members with university education, ratio of income-earning members, median floor area at the provincial level, median ratio of student members at the provincial level, median age of household head at the county level, median ratio of student members at the county level, median number of literate members at the county level, median number of members with university education at the county level, construction materials of the dwelling	2	Floor area, household size, ratio of household members aged 0–6, ratio of employed members, ratio of literate members, number of members with university education, median floor area at the provincial level, median age of household head at the provincial level, median floor area at the county level, median household size at the county level, median age of household head at the county level, median ratio of income-earning members at the county level, construction materials of the dwelling
3	Floor area, household size, number of employed members, ratio of student members, ratio of literate members, number of members with university education, ratio of income-earning members, median floor area at the provincial level, median household size at the provincial level, median ratio of household members aged 0–6 at the provincial level, median age of household head at the provincial level, median ratio of employed members at the county level, median ratio of student members at the county level, median ratio of income-earning members at the county level, median ratio of household members aged 0–6 at the county level, construction materials of the dwelling	3	Floor area, household size, ratio of employed members, ratio of literate members, number of members with university education, median household size at the provincial level, median ratio of employed members at the provincial level, median ratio of female members at the county level, median ratio of employed members at the county level, construction materials of the dwelling

4.3. Model Estimation Results

After selecting the variables for each cluster, weighted regressions were estimated for each cluster. Using the residuals from the initial regressions, a variance–covariance matrix of the residuals was constructed, and generalized least squares regressions were then estimated for each cluster. Summary statistics of the first-stage regressions are presented in Table 3. The R-Squared values in the ordinary least squares regressions ranged from 0.27 to 0.55 in the rural sector and from 0.40 to 0.53 in the urban sector. Overall, the explanatory power of the models was higher in the urban sector than in the rural sector. These preliminary results provide a sound basis for incorporating the first-stage estimates into the second-stage regressions. Full results for one cluster, as an example, are reported in Tables 7 and 8 in the appendix.

Table 3 - Summary Statistics of the first stage regressions

Urban					Rural				
Clusters	Num observations	R_Squared	F_Statistic	P_Value	Clusters	Num observations	R_Squared	F_Statistic	P_Value
OLS									
1	5389	0.4	243.57	0.001>	1	6972	0.27	143.02	0.001>
2	11487	0.53	724.83	0.001>	2	3333	0.55	209.52	0.001>
3	1759	0.51	85.39	0.001>	3	8900	0.34	281.67	0.001>
GLS									
1	5389	0.37	173.67	0.001>	1	6972	0.27	156.44	0.001>
2	11487	0.43	572.59	0.001>	2	3333	0.5	184.2	0.001>
3	1759	0.5	83.98	0.001>	3	8900	27	173.76	0.001>

The generalized least squares regression coefficients, along with the estimated household-level and county-level error variances from this stage, were used to estimate poverty rates in the second stage.

4.4. Normality and Homoscedasticity

For all estimated models, tests for normality of the error term (such as Shapiro–Wilk and Anderson–Darling) and tests for homoscedasticity rejected the basic assumptions. To address heteroscedasticity, the alpha model (Section 2.1) was applied. Subsequently, due to the influence of outliers on statistical tests, 198 observations (equivalent to 0.05% of the total sample) were removed. These households had expenditures at least six times higher or as low as 0.17 times the sample mean.

Upon re-examining the residuals, histograms indicated an approximately normal distribution, with no unusual skewness or kurtosis. In the quantile–quantile plots, sample points closely followed the 45-degree line, with only minor deviations at the tails. These plots are presented in Figures 1 and 2 in the appendix.

Despite this visual evidence, the normality assumption was still statistically rejected due to the high sensitivity of tests in large samples. To assess the impact of this rejection on estimation accuracy, the simulation stage employed the Student-t distribution for error terms. Results showed that the difference in poverty rates between the normal and Student-t assumptions was minimal: the average difference was 0.0006 in the rural sector and 0.0003 in the urban sector. Therefore, based on visual diagnostics and simulation results, the statistical rejection of normality can be considered negligible in practice.

4.5. County- and Province-Level Poverty Results

In the second stage, 100 simulations were run for each model. Using the method described in Section 2.2 and the poverty lines reported in Table 1, poverty rates were estimated for all 429 counties. Counties with poverty rates above 50% and below 10% are listed in Table 4. Full results are provided in the appendix (Table 6).

Table 4 - Counties with poverty rates above 50% and below 10%

County	Province	HCR	County	Province	HCR
Counties with HCR Above 50%					
Sarbaz	Sistan & Baluchestan	0.82 (0.05)	Sib va Suran	Sistan & Baluchestan	0.54 (0.06)
Bashagard	Hormozgan	0.64 (0.13)	Manujan	Kerman	0.54 (0.06)
Qasre Qand	Sistan & Baluchestan	0.6 (0.06)	Mehristan	Sistan & Baluchestan	0.53 (0.06)
Salase Babajani	Kermanshah	0.59 (0.06)	Konarak	Sistan & Baluchestan	0.53 (0.06)
Delgan	Sistan & Baluchestan	0.58 (0.08)	Fanouj	Sistan & Baluchestan	0.53 (0.06)
Nikshahr	Sistan & Baluchestan	0.57 (0.05)	Nimrouz	Sistan & Baluchestan	0.5 (0.08)
Rigan	Kerman	0.56 (0.09)	Saravan	Sistan & Baluchestan	0.5 (0.05)
Counties with HCR Below 10%					
Osku	East Azerbaijan	0.07 (0.03)	Saman	Chaharmahal & Bakhtiari	0.09 (0.03)
Badreh	Ilam	0.07 (0.04)	Ajabshir	East Azerbaijan	0.09 (0.03)
Mehdishahr	Semnan	0.08 (0.03)	Garmsar	Semnan	0.09 (0.03)
Gachsaran	Kohgiluyeh & Boyer-Ahmad	0.08 (0.03)	Semnan	Semnan	0.09 (0.03)
Sari	Mazandaran	0.09 (0.03)	Natanz	Isfahan	0.09 (0.03)
Shahre Kord	Chaharmahal & Bakhtiari	0.09 (0.03)	Jolfa	East Azerbaijan	0.09 (0.03)

County	Province	HCR	County	Province	HCR
Hashtrood	East Azerbaijan	0.09 (0.03)	Tabas	South Khorasan	0.09 (0.03)

Note. Standard errors are reported in parentheses below the poverty rates.

Spatial analysis of poverty rates indicates that the largest number of counties with poverty rates above 50 percent are concentrated in Sistan & Baluchestan Province, which also has the highest provincial poverty rate in the country. However, the results presented in Tables 4 and 6 show that counties with high poverty rates are also scattered across other regions of the country. Therefore, relying solely on provincial average poverty rates does not provide an accurate picture of deprivation distribution and may lead to insufficient resource allocation for disadvantaged counties in provinces with lower average poverty rates. Hence, accounting for the spatial dispersion of poor counties nationwide is essential for effective policymaking.

In addition, intra-provincial analysis of poverty distribution is of particular importance. Uniform allocation of resources to all counties within a province is inefficient, especially when one or more counties with high poverty rates exist in provinces with relatively low overall poverty. For example, in Semnan Province, according to the second part of Table 4, several counties have the lowest poverty rates. At the same time, the county of Meyami, with a poverty rate of 29 percent, is also located in this province. A uniform approach to resource allocation in this province may overlook the real needs of Meyami and other relatively deprived counties, whereas targeted focus on critical points can lead to more optimal resource distribution.

Across all estimates, the standard error of poverty rates ranges between 0.031 and 0.132, with higher values mainly resulting from limited observations in certain counties. According to Hentschel et al. (2000), when the number of observations reaches at least 500, the standard error becomes relatively small; but as sample size decreases, error increases and the accuracy of estimates in areas with limited observations declines. To enhance the reliability of estimates, we also calculated poverty rates at the provincial level. The results (Table 5) show that due to the large number of observations at this level, the standard error falls within the range of 0.014 to 0.068. At this level, the provinces of Sistan & Baluchestan, Qom, and Kermanshah recorded the highest poverty rates.

Comparing the results of this study with poverty rates calculated in the 2016 Poverty Line Report by the Parliament Research Center—based on household budget data and actual household expenditures (not imputed expenditures)—the differences are generally minor. The average difference between the census-based poverty estimates in this study and the poverty rates calculated by the Research Center using household income and expenditure data is only 0.04 (excluding Tehran and Alborz). Furthermore, the ranking of provinces by poverty rates in both studies is largely similar. Significant differences in poverty rates between this study and the Research Center's report are observed only in provinces with extremely high or extremely low average housing costs, the reasons for which are fully explained in the next section.

A comparison between the results of this study and those of Einian & Souri (2018) for the year 2011 shows that, in the ten counties with the highest headcount ratios (HCR) in both studies, 6 urban counties and 4 rural counties were the same. It should be noted that the present study refers to 2016, five years after the 2011 version, and therefore some changes in the ranking of counties are expected. Overall, the ordering of counties remains broadly similar. In both studies, Sistan & Baluchestan records the highest HCR among the provinces.

Table 5 - Poverty rates and their standard errors by province

code Province	Province	Urban HCR	Rural HCR	HCR	code Province	Province	Urban HCR	Rural HCR	HCR
00	Markazi	0.21 (0.04)	0.09 (0.03)	0.15 (0.02)	16	Ilam	0.25 (0.04)	0.08 (0.02)	0.16 (0.02)
01	Gilan	0.21 (0.04)	0.08 (0.03)	0.15 (0.02)	17	Kohkiloyeh	0.21 (0.04)	0.07 (0.02)	0.14 (0.02)
02	Mazandaran	0.18 (0.03)	0.07 (0.01)	0.13 (0.01)	18	Bushehr	0.27 (0.04)	0.15 (0.04)	0.21 (0.03)
03	E.Azarbaijan	0.19 (0.04)	0.08 (0.02)	0.14 (0.02)	19	Zanjan	0.29 (0.05)	0.19 (0.05)	0.24 (0.03)
04	W.Azarbaijan	0.36 (0.03)	0.14 (0.03)	0.25 (0.02)	20	Semnan	0.15 (0.03)	0.05 (0.02)	0.10 (0.02)
05	Kermanshah	0.39 (0.06)	0.21 (0.06)	0.30 (0.04)	21	Yazd	0.23 (0.04)	0.08 (0.03)	0.15 (0.03)
06	Khuzestan	0.31 (0.04)	0.18 (0.04)	0.25 (0.03)	22	Hormozgan	0.36 (0.05)	0.18 (0.05)	0.27 (0.03)
07	Fars	0.27 (0.04)	0.09 (0.02)	0.18 (0.02)	23	Tehran	-	-	-
08	Kerman	0.32 (0.03)	0.15 (0.03)	0.23 (0.02)	24	Ardebil	0.28 (0.04)	0.10 (0.04)	0.19 (0.03)
09	R.Khorasan	0.32 (0.06)	0.13 (0.04)	0.22 (0.04)	25	Qom	0.45 (0.10)	0.26 (0.11)	0.35 (0.07)
10	Isfahan	0.18 (0.03)	0.14 (0.03)	0.16 (0.02)	26	Qazvin	0.23 (0.05)	0.20 (0.06)	0.21 (0.05)
11	Sistan & Baluchestan	0.54 (0.05)	0.23 (0.04)	0.39 (0.03)	27	Golestan	0.36 (0.04)	0.15 (0.03)	0.26 (0.02)
12	Kurdestan	0.32 (0.04)	0.17 (0.03)	0.25 (0.03)	28	N.Khorasan	0.39 (0.05)	0.15 (0.03)	0.27 (0.03)
13	Hamadan	0.22 (0.04)	0.10 (0.03)	0.16 (0.03)	29	S.Khorasan	0.22 (0.04)	0.10 (0.03)	0.16 (0.02)
14	Bakhtiari	0.19 (0.03)	0.09 (0.03)	0.14 (0.02)	30	Alborz	-	-	-

code Province	Province	Urban HCR	Rural HCR	HCR	code Province	Province	Urban HCR	Rural HCR	HCR
15	Lorestan	0.28 (0.04)	0.12 (0.03)	0.20 (0.03)					

Note. Standard errors are reported in parentheses below the poverty rates.

4.6. Sensitivity of Poverty Rates to Housing Costs

In the supporting report for the poverty line estimates by the Parliament Research Center, it was stated that poverty rates calculated based on the provincial poverty lines in the "Provincial Poverty Line Report, 2016" show high sensitivity to clustering. Specifically, shifting a province from one cluster to another significantly changes its poverty rate. The main reason for this sensitivity is the heavy reliance of the 2016 clustering on housing prices; thus, regions with high housing costs and relatively low food prices, when placed in inappropriate clusters, experienced artificially inflated poverty rates.

Unlike the 2016 report, in this study clustering was conducted using census data, which does not include housing costs. As a result, a cluster may contain cities with very different housing prices. For example, Tehran and Alborz, despite their high housing costs, were grouped with provinces that have lower housing costs due to other statistical similarities. Since none of the census variables directly reference housing costs, the per capita household expenditure in high-cost areas (such as Tehran) is underestimated, leading to artificially high poverty rates.

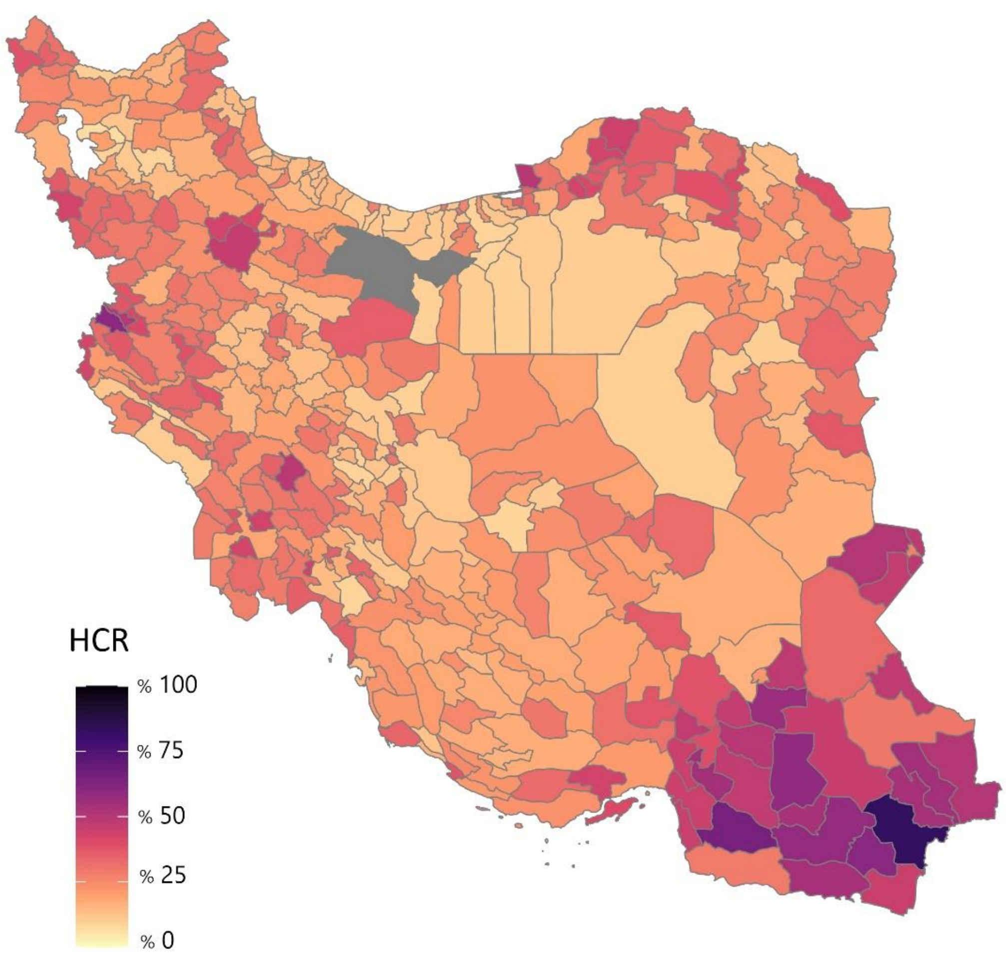
According to the 2016 Statistical Yearbook of Building and Housing (by Statistical Center of Iran), the average monthly rent (rent plus 3 percent of deposit) per square meter of residential floor space, based on contracts signed between landlords and tenants in real estate agencies, was reported for provincial capitals. The national average for this indicator was 57,180 rials. In Tehran, the average rent was 3.87 times this national average, and in Karaj 1.70 times, representing the highest values among all provincial capitals and causing distortions in poverty rate estimates for these provinces. Qazvin Province (1.43 times the average) showed a similar, though less pronounced, distortion. Other provinces had rent levels closer to the national average, resulting in more accurate poverty rate estimates.

Since the accuracy of poverty rate estimates in Tehran and Alborz was lower compared to other regions, these two provinces were excluded from the final poverty rate table. Furthermore, to ensure robustness, poverty rates were recalculated after removing Tehran and Alborz data, which showed that results for counties in other clusters remained unchanged, and the average changes in the cluster associated with Tehran and Alborz were minor and negligible.

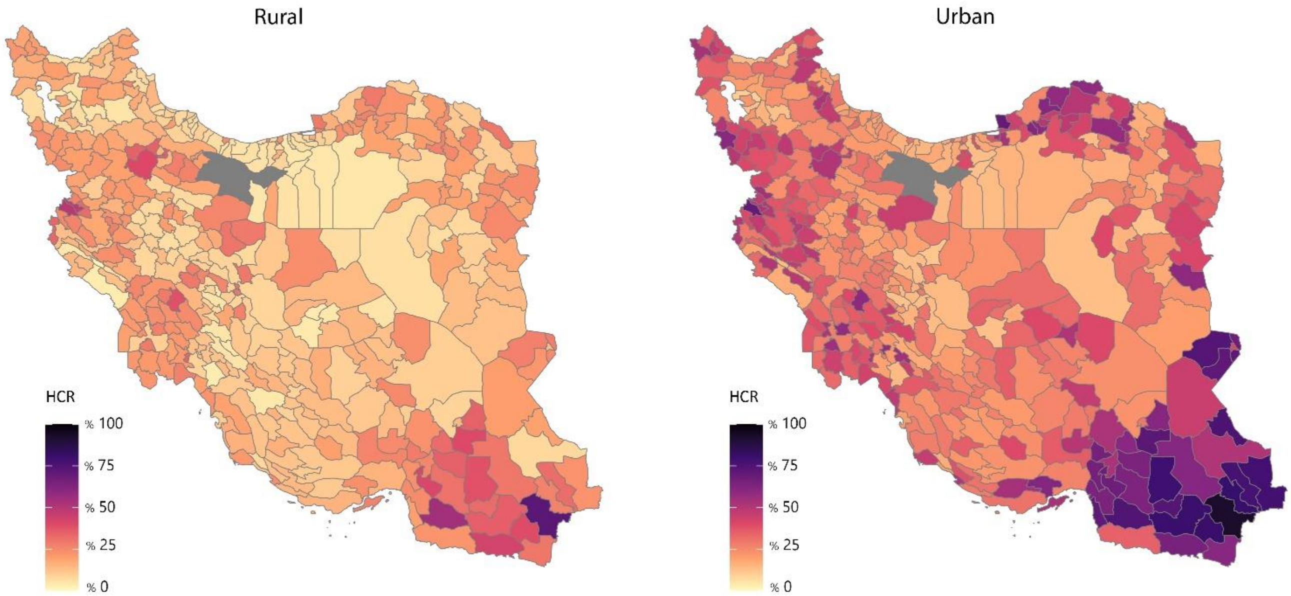
4.7. County- and Province-Level Poverty Maps

In the following results, maps of overall, urban, and rural poverty are presented at both the county and provincial levels. The numerical results for provincial and county poverty rates are provided in Tables 5 and 6 (in the appendix). The provinces of Tehran and Alborz, for the reasons mentioned in Section 4.6, are marked in gray.

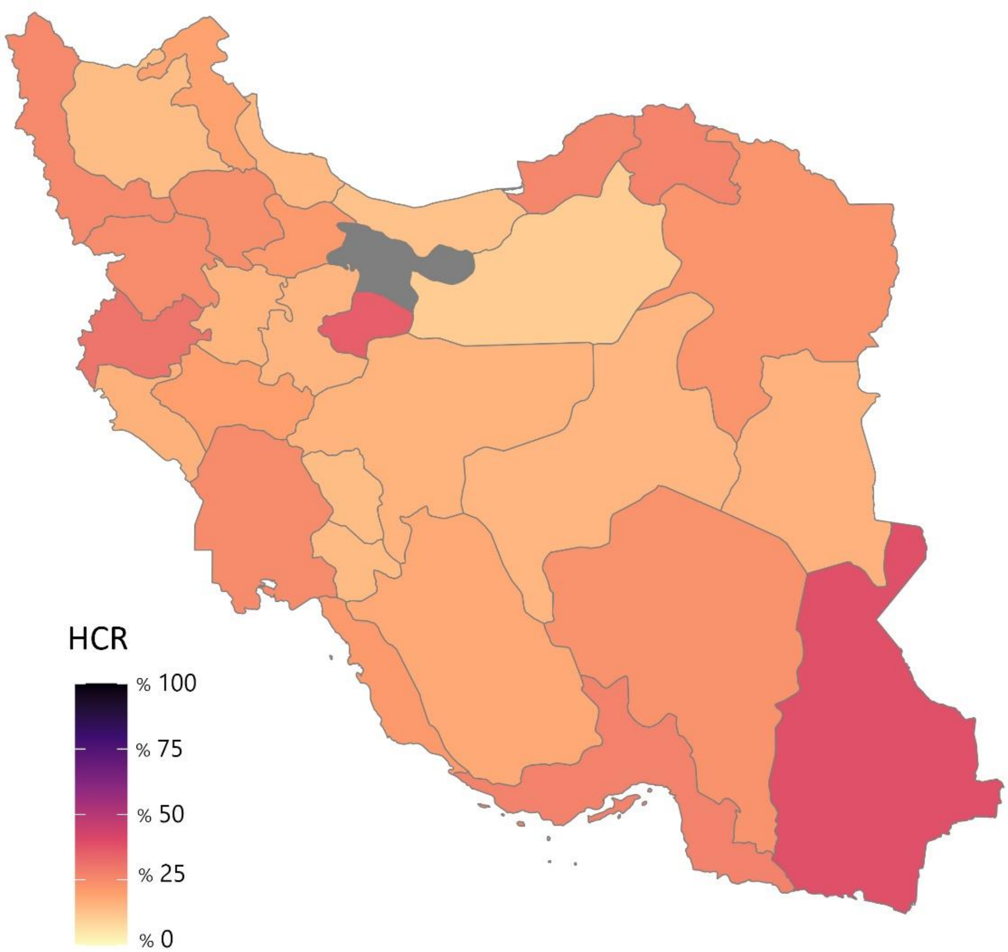
Map 2- County-Level Poverty Headcount Ratios



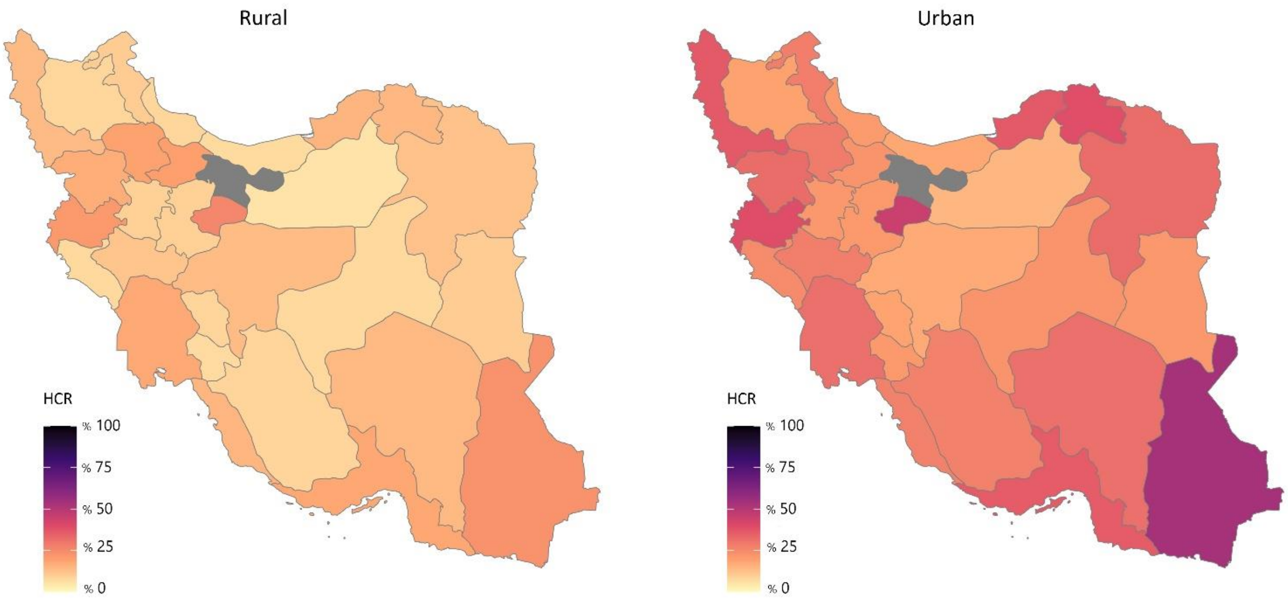
Map 3 - County-Level Poverty Headcount Ratios in Urban and Rural Areas



Map 4 – Provincial Poverty Headcount Ratios



Map 5 - Provincial Poverty Headcount Ratios in Urban and Rural Areas



5. Conclusion

This paper produced county-level poverty estimates for Iran in 2016 by combining the Household Expenditure and Income Survey with a 2 percent sample of the Population and Housing Census and applying a unit-level small-area estimation framework in the spirit of Elbers et al. (2003). Counties were first grouped into six relatively homogeneous urban–rural clusters using k-means; within each cluster, LASSO was used for variable selection and generalized least squares for estimation, and poverty measures were then obtained through Monte Carlo simulation of the Foster–Greer–Thorbecke indices.

The resulting poverty map reveals stark spatial disparities. At the county level, headcount poverty ranges from about 7 percent in places such as Osku, Badreh, and Taft to more than 80 percent in Sarbaz, Bashagard, and Qasre Qand. At the provincial level, Sistan & Baluchestan, Qom, and Kermanshah exhibit the highest poverty rates, whereas Semnan and Mazandaran record the lowest. Standard errors, typically between 0.03 and 0.13 for counties and 0.014 and 0.068 for provinces, indicate that the estimates are precise enough to support local decision-making. The associated maps show clearly that relying on provincial averages conceals substantial within-province heterogeneity and risks mis-targeting scarce resources.

These findings are directly usable at two policy levels. Nationally, they provide a basis for identifying disadvantaged counties, reallocating social protection budgets, and redesigning transfer and subsidy schemes toward areas with the highest incidence of poverty. Regionally, provincial authorities can use the intensity and spatial distribution of poverty across their counties to prioritize health, education, and economic empowerment programs, and to coordinate sectoral interventions in the most deprived localities rather than spreading funds thinly across entire provinces.

The analysis also highlights limitations in the current statistical infrastructure. The 2 percent census sample, once disaggregated to 429 counties, leaves some areas with thin samples that constrain model flexibility. Strengthening the household survey system—by revising questionnaires to include more detailed information on assets, employment, and access to basic services, and by increasing effective sample sizes at lower geographic levels—would improve the quality of small-area estimates. Likewise, greater geographic resolution in public-use census data would allow estimation below the county level and increase the precision of county-level indicators.

Finally, the framework developed here provides a starting point rather than an endpoint. Future work should (i) revisit and update poverty lines using methods that are less sensitive to housing-cost differentials across regions, (ii) extend the approach to repeated years to track spatial–temporal poverty dynamics under sanctions and macroeconomic shocks, (iii) incorporate richer geographic and spatial variables and, where feasible, machine-learning techniques to capture non-linearities, and (iv) move beyond income to estimate multidimensional poverty, integrating information on education, health, and living conditions. Together, these extensions would yield a more complete and dynamic picture of deprivation in Iran and further enhance the value of poverty maps for policy design.

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Annex A:

Due to the high sensitivity of poverty rates to housing costs and the absence of an appropriate housing expenditure variable in the census data, poverty in the provinces of Tehran and Alborz is overestimated because of the high cost of housing. Consequently, Table 6 does not report poverty rate results for the counties of these two provinces.

Table 6 - County-Level Poverty Rates and Their Standard Errors

province	code	county	HCR	Urban HCR	Rural HCR
Markazi	0001	arak	0.13 (0.05)	0.19 (0.07)	0.08 (0.05)
	0002	ashtian	0.17 (0.07)	0.22 (0.10)	0.11 (0.10)
	0003	tafresh	0.13 (0.05)	0.19 (0.09)	0.07 (0.05)
	0004	khomein	0.14 (0.05)	0.19 (0.07)	0.08 (0.05)
	0005	delijan	0.20 (0.07)	0.23 (0.08)	0.18 (0.12)
	0006	saveh	0.14 (0.05)	0.21 (0.07)	0.08 (0.05)
	0007	shazand	0.18 (0.05)	0.30 (0.09)	0.07 (0.04)
	0009	mahalat	0.19 (0.07)	0.22 (0.09)	0.16 (0.09)
	0010	zarandieh	0.24 (0.07)	0.30 (0.08)	0.19 (0.12)
	0011	komijan	0.33 (0.09)	0.42 (0.11)	0.23 (0.14)
	0012	khandab	0.29 (0.09)	0.37 (0.12)	0.20 (0.12)
	0013	Farahan	0.25 (0.08)	0.31 (0.11)	0.20 (0.11)
Gilan	0101	astara	0.12 (0.04)	0.18 (0.06)	0.07 (0.05)
	0102	astaneh	0.17 (0.05)	0.24 (0.08)	0.10 (0.07)
	0103	bandaran zali	0.13 (0.04)	0.19 (0.07)	0.07 (0.06)
	0104	talesh	0.22 (0.07)	0.30 (0.10)	0.15 (0.08)
	0105	rasht	0.14 (0.05)	0.21 (0.07)	0.08 (0.05)
	0106	roudbar	0.16 (0.05)	0.22 (0.09)	0.09 (0.06)
	0107	roudsar	0.16 (0.05)	0.22 (0.07)	0.10 (0.06)
	0108	somesara	0.17 (0.06)	0.25 (0.09)	0.10 (0.07)
	0109	fouman	0.16 (0.05)	0.23 (0.07)	0.09 (0.06)
	0110	langroud	0.14 (0.04)	0.21 (0.08)	0.07 (0.04)
	0111	lahijan	0.13 (0.04)	0.18 (0.06)	0.08 (0.06)
	0112	shaft	0.26 (0.09)	0.33 (0.12)	0.20 (0.13)
	0113	amlesh	0.14 (0.04)	0.22 (0.08)	0.07 (0.04)
	0114	rezvanshahr	0.13 (0.05)	0.18 (0.08)	0.07 (0.06)
	0115	siahkal	0.14 (0.05)	0.20 (0.08)	0.08 (0.06)
	0116	masal	0.14 (0.04)	0.20 (0.07)	0.08 (0.05)
Isfahan	1008	flowerjan	0.29 (0.08)	0.29 (0.10)	0.30 (0.13)
	1009	shahreza	0.12 (0.04)	0.14 (0.06)	0.09 (0.06)
	1010	kashan	0.25 (0.09)	0.19 (0.07)	0.30 (0.15)
	1011	golpaigan	0.19 (0.06)	0.28 (0.09)	0.10 (0.06)
	1012	lenjan	0.12 (0.05)	0.14 (0.07)	0.10 (0.06)
	1013	nain	0.23 (0.07)	0.22 (0.08)	0.24 (0.12)
	1014	najafabad	0.12 (0.04)	0.15 (0.06)	0.09 (0.05)
	1015	natanz	0.10 (0.04)	0.12 (0.06)	0.08 (0.05)
	1016	shahinshahr	0.11 (0.04)	0.13 (0.06)	0.09 (0.06)
	1017	mobarakeh	0.11 (0.05)	0.13 (0.07)	0.08 (0.05)
	1018	aran	0.29 (0.08)	0.29 (0.10)	0.29 (0.13)
	1019	tiran	0.25 (0.08)	0.24 (0.08)	0.26 (0.12)
	1020	chadegan	0.14 (0.06)	0.20 (0.10)	0.09 (0.06)
	1021	dehaghan	0.29 (0.08)	0.31 (0.09)	0.27 (0.13)
	1022	barkhar	0.29 (0.08)	0.28 (0.09)	0.30 (0.13)
	1023	khor	0.18 (0.05)	0.30 (0.08)	0.07 (0.05)
	1024	boen	0.28 (0.08)	0.29 (0.11)	0.28 (0.13)
Sistan va Balochestan	1101	iranshahr	0.46 (0.06)	0.61 (0.08)	0.30 (0.09)
	1102	chahbahar	0.45 (0.07)	0.61 (0.08)	0.30 (0.10)
	1103	khash	0.30 (0.05)	0.52 (0.09)	0.08 (0.05)
	1104	zabol	0.27 (0.07)	0.40 (0.12)	0.14 (0.06)
	1105	zahedan	0.33 (0.06)	0.45 (0.10)	0.20 (0.07)
	1106	saravan	0.50 (0.06)	0.78 (0.06)	0.23 (0.09)
	1107	nikshahr	0.58 (0.06)	0.81 (0.06)	0.35 (0.11)
	1108	sarbaz	0.83 (0.05)	0.93 (0.03)	0.72 (0.09)
	1109	konarak	0.54 (0.07)	0.65 (0.09)	0.42 (0.10)
	1110	zahak	0.48 (0.06)	0.71 (0.07)	0.25 (0.09)
	1111	hirmand	0.48 (0.07)	0.68 (0.10)	0.28 (0.10)

province	code	county	HCR	Urban HCR	Rural HCR
Mazandaran	0201	amol	0.11 (0.03)	0.16 (0.06)	0.06 (0.04)
Mazandaran	0202	babol	0.12 (0.05)	0.18 (0.07)	0.07 (0.05)
Mazandaran	0204	behshahr	0.14 (0.04)	0.20 (0.07)	0.07 (0.05)
Mazandaran	0205	tonekabon	0.11 (0.04)	0.16 (0.07)	0.07 (0.05)
Mazandaran	0206	ramsar	0.15 (0.05)	0.21 (0.08)	0.08 (0.06)
Mazandaran	0207	sari	0.09 (0.03)	0.13 (0.06)	0.05 (0.03)
Mazandaran	0208	savadkooh	0.24 (0.06)	0.40 (0.10)	0.09 (0.06)
Mazandaran	0210	ghaemshahr	0.12 (0.04)	0.17 (0.06)	0.07 (0.05)
Mazandaran	0214	nour	0.12 (0.04)	0.18 (0.07)	0.06 (0.04)
Mazandaran	0215	noshahr	0.10 (0.03)	0.15 (0.05)	0.05 (0.04)
Mazandaran	0216	babolsar	0.12 (0.05)	0.17 (0.08)	0.07 (0.05)
Mazandaran	0218	mahmoud abad	0.11 (0.04)	0.17 (0.07)	0.05 (0.04)
Mazandaran	0219	neka	0.12 (0.05)	0.18 (0.08)	0.06 (0.04)
Mazandaran	0220	chalous	0.12 (0.04)	0.16 (0.07)	0.07 (0.05)
Mazandaran	0221	joibar	0.26 (0.07)	0.30 (0.09)	0.21 (0.12)
Mazandaran	0222	galoogah	0.23 (0.05)	0.38 (0.09)	0.09 (0.06)
Mazandaran	0223	fereydoon kenar	0.29 (0.08)	0.34 (0.09)	0.24 (0.13)
Mazandaran	0224	abasabad	0.28 (0.08)	0.31 (0.11)	0.24 (0.12)
Mazandaran	0225	miandorood	0.23 (0.06)	0.38 (0.11)	0.07 (0.06)
Mazandaran	0226	Simorgh *	0.29 (0.10)	0.35 (0.12)	0.23 (0.15)
Mazandaran	0227	Nsavadkoh	0.28 (0.07)	0.40 (0.11)	0.16 (0.09)
Mazandaran	0228	kalardasht	0.11 (0.05)	0.16 (0.08)	0.06 (0.05)
E.Azarbaijan	0302	ahar	0.20 (0.05)	0.29 (0.08)	0.11 (0.06)
E.Azarbaijan	0303	tabriz	0.12 (0.04)	0.19 (0.07)	0.05 (0.04)
E.Azarbaijan	0305	sarab	0.19 (0.06)	0.20 (0.08)	0.18 (0.10)
E.Azarbaijan	0306	maragheh	0.11 (0.04)	0.16 (0.06)	0.07 (0.04)
E.Azarbaijan	0307	marand	0.23 (0.07)	0.26 (0.09)	0.20 (0.10)
E.Azarbaijan	0310	mianeh	0.16 (0.05)	0.27 (0.08)	0.05 (0.04)
E.Azarbaijan	0311	hashtroud	0.09 (0.04)	0.13 (0.06)	0.05 (0.04)
E.Azarbaijan	0312	bonab	0.20 (0.07)	0.21 (0.08)	0.18 (0.11)
E.Azarbaijan	0313	bostanabad	0.22 (0.07)	0.23 (0.08)	0.20 (0.12)
E.Azarbaijan	0314	shabestar	0.19 (0.06)	0.20 (0.07)	0.17 (0.09)
E.Azarbaijan	0315	kalibar	0.15 (0.06)	0.15 (0.08)	0.16 (0.09)
E.Azarbaijan	0316	haris	0.25 (0.07)	0.27 (0.10)	0.23 (0.12)
E.Azarbaijan	0319	jolfa	0.10 (0.04)	0.14 (0.06)	0.06 (0.04)
	1112	delgan	0.59 (0.08)	0.79 (0.08)	0.38 (0.14)
	1113	mehrestan (zaboli)	0.54 (0.07)	0.81 (0.07)	0.27 (0.10)
	1114	sibsouran	0.55 (0.06)	0.78 (0.07)	0.32 (0.10)
	1115	nimroz	0.51 (0.08)	0.74 (0.11)	0.27 (0.13)
	1116	hamoon	0.47 (0.07)	0.71 (0.10)	0.22 (0.11)
	1117	mirjaveh	0.47 (0.07)	0.76 (0.10)	0.19 (0.10)
	1118	ghasrghand	0.60 (0.07)	0.81 (0.08)	0.39 (0.11)
	1119	fnoj	0.53 (0.06)	0.74 (0.08)	0.33 (0.10)
Kurdestan	1201	baneh	0.33 (0.08)	0.41 (0.10)	0.24 (0.13)
Kurdestan	1202	bijar	0.24 (0.06)	0.28 (0.08)	0.20 (0.10)
Kurdestan	1203	saghez	0.29 (0.08)	0.38 (0.10)	0.20 (0.11)
Kurdestan	1204	sanandaj	0.17 (0.05)	0.24 (0.07)	0.10 (0.05)
Kurdestan	1205	ghorveh	0.27 (0.07)	0.33 (0.09)	0.21 (0.11)
Kurdestan	1206	marivan	0.30 (0.07)	0.42 (0.11)	0.19 (0.08)
Kurdestan	1207	divandareh	0.29 (0.08)	0.36 (0.11)	0.22 (0.12)
Kurdestan	1208	kamiaran	0.28 (0.06)	0.37 (0.10)	0.19 (0.08)
Kurdestan	1209	sarvabad	0.37 (0.08)	0.54 (0.11)	0.21 (0.09)
Kurdestan	1210	dehgolan	0.30 (0.07)	0.39 (0.09)	0.22 (0.12)
Hamadan	1301	toiserkan	0.13 (0.04)	0.20 (0.07)	0.07 (0.05)
Hamadan	1302	malayer	0.14 (0.05)	0.20 (0.08)	0.08 (0.05)
Hamadan	1303	nahavand	0.16 (0.06)	0.23 (0.08)	0.10 (0.07)
Hamadan	1304	hamadan	0.14 (0.04)	0.20 (0.07)	0.08 (0.05)
Hamadan	1305	kabodarahang	0.28 (0.08)	0.34 (0.10)	0.21 (0.12)
Hamadan	1306	asadabad	0.26 (0.07)	0.31 (0.11)	0.21 (0.11)
Hamadan	1307	bahar	0.25 (0.08)	0.31 (0.10)	0.20 (0.12)
Hamadan	1308	razan	0.15 (0.05)	0.22 (0.08)	0.08 (0.05)
Hamadan	1309	famenin	0.22 (0.07)	0.28 (0.11)	0.17 (0.09)
Bakhtiari	1401	boroujen	0.17 (0.06)	0.16 (0.07)	0.18 (0.10)
Bakhtiari	1402	shahrkord	0.09 (0.04)	0.13 (0.05)	0.05 (0.04)
Bakhtiari	1403	farsan	0.17 (0.05)	0.25 (0.08)	0.09 (0.05)
Bakhtiari	1404	lordegan	0.24 (0.05)	0.42 (0.10)	0.05 (0.04)
Bakhtiari	1405	ardal	0.30 (0.06)	0.45 (0.11)	0.14 (0.07)
Bakhtiari	1406	koohrang	0.23 (0.09)	0.31 (0.13)	0.15 (0.12)
Bakhtiari	1407	Kiyar	0.14 (0.04)	0.20 (0.07)	0.08 (0.04)
Bakhtiari	1408	saman	0.09 (0.04)	0.14 (0.07)	0.04 (0.03)

province	code	county	HCR	Urban HCR	Rural HCR
	0320	malekan	0.18 (0.06)	0.21 (0.08)	0.15 (0.09)
	0321	azarshahr	0.20 (0.07)	0.22 (0.09)	0.18 (0.09)
	0322	osko	0.07 (0.04)	0.10 (0.06)	0.04 (0.03)
	0323	charoimagh	0.14 (0.05)	0.18 (0.08)	0.10 (0.07)
	0324	varzaghan	0.20 (0.06)	0.31 (0.11)	0.08 (0.07)
	0325	ajabshir	0.09 (0.04)	0.13 (0.06)	0.06 (0.05)
	0326	khodaafarin	0.18 (0.09)	0.29 (0.14)	0.07 (0.08)
W.Azarbaijan	0401	oromieh	0.16 (0.04)	0.26 (0.07)	0.07 (0.05)
	0402	piranshahr	0.43 (0.09)	0.61 (0.10)	0.25 (0.14)
	0403	khoi	0.25 (0.07)	0.34 (0.10)	0.17 (0.10)
	0404	sardasht	0.35 (0.08)	0.49 (0.11)	0.21 (0.11)
	0405	salmas	0.27 (0.07)	0.38 (0.10)	0.17 (0.10)
	0406	maku	0.27 (0.07)	0.36 (0.09)	0.19 (0.09)
	0407	mahabad	0.33 (0.07)	0.44 (0.09)	0.22 (0.11)
	0408	miandoab	0.22 (0.06)	0.38 (0.11)	0.06 (0.04)
	0409	naghadeh	0.30 (0.08)	0.42 (0.10)	0.18 (0.10)
	0410	boukan	0.34 (0.09)	0.46 (0.11)	0.21 (0.11)
	0411	shahindezh	0.28 (0.07)	0.39 (0.09)	0.18 (0.10)
	0412	takab	0.34 (0.09)	0.48 (0.12)	0.20 (0.12)
	0413	oshnavieh	0.36 (0.08)	0.51 (0.10)	0.22 (0.12)
	0414	chalderan	0.38 (0.08)	0.53 (0.10)	0.22 (0.12)
	0415	Poldasht	0.31 (0.08)	0.42 (0.12)	0.20 (0.12)
	0416	chaypareh	0.29 (0.08)	0.40 (0.12)	0.18 (0.11)
	0417	shout	0.34 (0.08)	0.47 (0.10)	0.21 (0.12)
Kermanshah	0501	eslamabad e qarb	0.33 (0.06)	0.42 (0.10)	0.25 (0.08)
	0502	kermanshah	0.27 (0.06)	0.37 (0.09)	0.18 (0.09)
	0503	paveh	0.37 (0.07)	0.47 (0.09)	0.27 (0.10)
	0504	sarpolzahab	0.33 (0.07)	0.40 (0.10)	0.25 (0.09)
	0505	songhor	0.26 (0.07)	0.37 (0.10)	0.16 (0.09)
	0506	ghasreshirin	0.42 (0.09)	0.50 (0.11)	0.34 (0.14)
	0507	kangavar	0.32 (0.06)	0.42 (0.09)	0.23 (0.08)
	0508	gilangharb	0.21 (0.07)	0.29 (0.11)	0.13 (0.07)
	0509	javanroud	0.50 (0.07)	0.51 (0.11)	0.48 (0.12)
	0510	sahneh	0.32 (0.07)	0.41 (0.10)	0.23 (0.08)
	0511	harsin	0.38 (0.07)	0.49 (0.09)	0.28 (0.09)
	1409	bon	0.16 (0.06)	0.24 (0.09)	0.09 (0.05)
Lorestan	1501	aligoudarz	0.19 (0.05)	0.27 (0.07)	0.11 (0.07)
	1502	boroujerd	0.18 (0.05)	0.26 (0.07)	0.10 (0.06)
	1503	khoramabad	0.15 (0.05)	0.23 (0.08)	0.08 (0.06)
	1504	delfan	0.34 (0.09)	0.45 (0.11)	0.22 (0.12)
	1505	doroud	0.21 (0.06)	0.28 (0.09)	0.14 (0.07)
	1506	koohdasht	0.34 (0.08)	0.44 (0.10)	0.24 (0.12)
	1507	azna	0.17 (0.05)	0.25 (0.08)	0.08 (0.06)
	1508	poldokhtar	0.25 (0.07)	0.32 (0.11)	0.17 (0.10)
	1509	selseleh	0.18 (0.06)	0.22 (0.09)	0.13 (0.08)
	1510	Dowreh *	0.37 (0.10)	0.49 (0.14)	0.26 (0.15)
	1511	romshkan	0.33 (0.09)	0.47 (0.13)	0.19 (0.11)
Ilam	1601	ilam	0.12 (0.04)	0.19 (0.07)	0.05 (0.03)
	1602	darehshahr	0.12 (0.04)	0.18 (0.06)	0.06 (0.06)
	1603	dehloran	0.10 (0.04)	0.17 (0.07)	0.04 (0.04)
	1604	shirvanoc herdavel	0.21 (0.07)	0.30 (0.11)	0.13 (0.10)
	1605	mehran	0.24 (0.06)	0.33 (0.08)	0.15 (0.08)
	1606	abdanan	0.31 (0.08)	0.49 (0.14)	0.13 (0.10)
	1607	ivan	0.24 (0.06)	0.33 (0.10)	0.15 (0.07)
	1608	malekshahi	0.33 (0.08)	0.51 (0.12)	0.14 (0.10)
	1609	Sirvan *	0.33 (0.11)	0.50 (0.17)	0.16 (0.14)
	1610	badreh	0.08 (0.05)	0.14 (0.09)	0.02 (0.03)
Kohkiloyeh	1701	boirahmad	0.11 (0.04)	0.17 (0.06)	0.06 (0.05)
	1702	kohkiloyeh	0.17 (0.06)	0.21 (0.07)	0.13 (0.09)
	1703	gachsaran	0.09 (0.03)	0.14 (0.06)	0.03 (0.03)
	1704	dena	0.12 (0.05)	0.19 (0.08)	0.04 (0.04)
	1705	bahmaei	0.21 (0.06)	0.29 (0.09)	0.13 (0.07)
	1706	charam	0.33 (0.08)	0.55 (0.12)	0.12 (0.09)
	1707	basht	0.29 (0.09)	0.45 (0.13)	0.14 (0.12)
	1708	landeh	0.35 (0.09)	0.57 (0.14)	0.13 (0.11)
Bushehr	1801	boushehr	0.15 (0.04)	0.20 (0.07)	0.10 (0.06)
	1802	tangestan	0.22 (0.07)	0.27 (0.09)	0.17 (0.10)
	1803	dashtestan	0.22 (0.07)	0.26 (0.08)	0.19 (0.10)
	1804	dashti	0.22 (0.06)	0.28 (0.09)	0.16 (0.09)
	1805	dayer	0.34 (0.08)	0.46 (0.11)	0.22 (0.13)

province	code	county	HCR	Urban HCR	Rural HCR
	0512	salas	0.60 (0.07)	0.70 (0.09)	0.49 (0.11)
	0513	dalahoo	0.37 (0.06)	0.47 (0.09)	0.26 (0.10)
	0514	ravansar	0.41 (0.07)	0.49 (0.11)	0.32 (0.10)
Khuzestan	0601	abadan	0.28 (0.08)	0.33 (0.10)	0.22 (0.11)
	0602	Andimeshk *	0.31 (0.10)	0.36 (0.10)	0.26 (0.16)
	0603	ahvaz	0.19 (0.06)	0.27 (0.09)	0.10 (0.07)
	0604	izeh	0.31 (0.09)	0.37 (0.12)	0.25 (0.12)
	0605	bandarmahshahr	0.29 (0.08)	0.35 (0.09)	0.22 (0.12)
	0606	behbahan	0.14 (0.05)	0.19 (0.07)	0.09 (0.05)
	0607	khoramshahr	0.27 (0.07)	0.33 (0.10)	0.22 (0.11)
	0608	dezfoul	0.23 (0.07)	0.24 (0.06)	0.22 (0.12)
	0609	dashtazadegan	0.30 (0.08)	0.39 (0.11)	0.21 (0.12)
	0610	ramhormoz	0.23 (0.08)	0.24 (0.08)	0.22 (0.15)
	0611	Shadegan	0.33 (0.08)	0.44 (0.11)	0.21 (0.13)
	0612	Shoushtar	0.28 (0.08)	0.32 (0.08)	0.24 (0.12)
	0613	Masjedsoleiman	0.30 (0.09)	0.36 (0.10)	0.23 (0.13)
	0614	Shoush	0.27 (0.08)	0.32 (0.09)	0.21 (0.12)
	0615	Baghmalek	0.31 (0.09)	0.40 (0.12)	0.22 (0.13)
	0616	Omidiyeh	0.30 (0.08)	0.39 (0.11)	0.21 (0.13)
	0617	Lali *	0.35 (0.10)	0.40 (0.10)	0.29 (0.15)
	0618	hendijan	0.35 (0.09)	0.43 (0.11)	0.27 (0.15)
	0619	ramshir	0.30 (0.08)	0.41 (0.11)	0.19 (0.11)
	0620	gotvand	0.28 (0.07)	0.35 (0.09)	0.22 (0.14)
	0621	Andika *	0.49 (0.12)	0.59 (0.14)	0.38 (0.18)
	0622	Haftgol *	0.29 (0.10)	0.35 (0.10)	0.24 (0.15)
	0623	hoveyzeh	0.28 (0.09)	0.37 (0.09)	0.20 (0.13)
	0624	Bavi *	0.43 (0.11)	0.58 (0.11)	0.28 (0.16)
	0625	hamidieh	0.38 (0.09)	0.51 (0.11)	0.24 (0.12)
	0626	aghajari	0.43 (0.07)	0.52 (0.10)	0.34 (0.12)
	0627	karon	0.42 (0.09)	0.55 (0.12)	0.29 (0.15)
Fars	0701	abadeh	0.13 (0.05)	0.17 (0.07)	0.10 (0.07)
	0702	estahban	0.21 (0.07)	0.27 (0.09)	0.14 (0.09)
	0703	eghlid	0.16 (0.05)	0.21 (0.07)	0.12 (0.08)
	0704	jahrom	0.17 (0.06)	0.22 (0.07)	0.12 (0.09)
	0705	darab	0.19 (0.07)	0.24 (0.08)	0.14 (0.10)

province	code	county	HCR	Urban HCR	Rural HCR
	1806	kangan	0.16 (0.05)	0.20 (0.07)	0.12 (0.07)
	1807	gonaveh	0.35 (0.07)	0.47 (0.09)	0.23 (0.10)
	1808	deilam	0.31 (0.09)	0.42 (0.11)	0.20 (0.12)
	1809	jam	0.12 (0.05)	0.17 (0.07)	0.08 (0.06)
	1810	asalooeh	0.38 (0.08)	0.52 (0.12)	0.24 (0.11)
Zanjan	1901	abhar	0.20 (0.06)	0.25 (0.08)	0.15 (0.08)
	1903	khodabandeh	0.46 (0.09)	0.51 (0.11)	0.40 (0.15)
	1904	zanjan	0.19 (0.05)	0.24 (0.07)	0.15 (0.06)
	1906	Ijroud *	0.42 (0.12)	0.50 (0.14)	0.35 (0.18)
	1907	khoramdareh	0.41 (0.08)	0.46 (0.11)	0.35 (0.14)
	1908	tarom	0.22 (0.08)	0.27 (0.12)	0.16 (0.11)
	1909	mahneshan	0.26 (0.07)	0.34 (0.11)	0.18 (0.11)
	1910	soltaneh	0.40 (0.09)	0.46 (0.11)	0.34 (0.14)
Semnan	2001	damghan	0.10 (0.04)	0.16 (0.06)	0.05 (0.03)
	2002	semnan	0.10 (0.03)	0.14 (0.05)	0.06 (0.04)
	2003	shahroud	0.10 (0.04)	0.16 (0.06)	0.05 (0.04)
	2004	garmsar	0.09 (0.03)	0.14 (0.06)	0.05 (0.04)
	2005	mehdishahr	0.09 (0.04)	0.13 (0.06)	0.05 (0.04)
	2006	ardan	0.22 (0.07)	0.25 (0.09)	0.18 (0.12)
	2007	meamy	0.29 (0.08)	0.38 (0.14)	0.19 (0.11)
	2008	sarkhe	0.10 (0.05)	0.14 (0.08)	0.06 (0.05)
Yazd	2101	ardakan	0.23 (0.06)	0.32 (0.09)	0.14 (0.09)
	2102	bafgh	0.28 (0.07)	0.40 (0.11)	0.16 (0.09)
	2103	taft	0.09 (0.04)	0.13 (0.06)	0.04 (0.04)
	2104	mehriz	0.24 (0.07)	0.33 (0.10)	0.14 (0.10)
	2105	yazd	0.11 (0.04)	0.17 (0.06)	0.05 (0.04)
	2106	meibod	0.25 (0.06)	0.35 (0.09)	0.15 (0.09)
	2107	abarkooh	0.21 (0.06)	0.31 (0.10)	0.12 (0.08)
	2108	sadough	0.18 (0.05)	0.32 (0.10)	0.04 (0.03)
	2109	khatam	0.26 (0.07)	0.36 (0.11)	0.17 (0.11)
	2111	tabas	0.19 (0.06)	0.33 (0.11)	0.05 (0.04)
Hormozgan	2201	aboumousa	0.12 (0.07)	0.16 (0.11)	0.09 (0.09)
	2202	bandarabas	0.21 (0.05)	0.27 (0.08)	0.16 (0.08)
	2203	bandarlengeh	0.23 (0.06)	0.31 (0.09)	0.16 (0.08)
	2204	gheshm	0.40 (0.09)	0.53 (0.10)	0.27 (0.14)

province	code	county	HCR	Urban HCR	Rural HCR	province	code	county	HCR	Urban HCR	Rural HCR
	0706	sepidan	0.24 (0.08)	0.31 (0.09)	0.17 (0.12)		2205	minab	0.45 (0.07)	0.64 (0.09)	0.25 (0.09)
	0707	shiraz	0.17 (0.04)	0.29 (0.08)	0.04 (0.03)		2206	jask	0.29 (0.07)	0.35 (0.10)	0.23 (0.10)
	0708	fasa	0.17 (0.06)	0.22 (0.08)	0.12 (0.08)		2207	roudan	0.45 (0.06)	0.66 (0.09)	0.24 (0.09)
	0709	firouzabad	0.18 (0.06)	0.23 (0.09)	0.12 (0.08)		2208	hajiabad	0.31 (0.08)	0.36 (0.10)	0.26 (0.12)
	0710	kazeroun	0.18 (0.06)	0.22 (0.08)	0.13 (0.08)		2209	bastak	0.33 (0.05)	0.54 (0.09)	0.11 (0.06)
	0711	larestan	0.17 (0.05)	0.23 (0.07)	0.11 (0.07)		2210	khamir	0.43 (0.07)	0.62 (0.09)	0.24 (0.10)
	0712	marvdasht	0.20 (0.06)	0.26 (0.09)	0.15 (0.09)		2211	parsian	0.22 (0.06)	0.28 (0.09)	0.15 (0.07)
	0713	mamasani	0.24 (0.07)	0.36 (0.12)	0.11 (0.07)		2212	sirik	0.45 (0.06)	0.71 (0.09)	0.20 (0.08)
	0714	neiriz	0.18 (0.06)	0.22 (0.09)	0.14 (0.09)		2213	Bashagard *	0.65 (0.13)	0.75 (0.15)	0.55 (0.20)
	0715	lamard	0.23 (0.07)	0.31 (0.10)	0.15 (0.09)	Tehran	2301	tehran	-	-	-
	0716	bovanat	0.22 (0.08)	0.30 (0.10)	0.14 (0.10)		2302	damavand	-	-	-
	0717	arsanjan	0.19 (0.06)	0.29 (0.10)	0.09 (0.07)		2303	rey	-	-	-
	0718	khorambid	0.18 (0.06)	0.25 (0.08)	0.11 (0.07)		2304	shemiranat	-	-	-
	0719	zarindasht	0.30 (0.07)	0.40 (0.10)	0.20 (0.11)		2306	varamin	-	-	-
	0720	ghirokarzin	0.26 (0.07)	0.35 (0.10)	0.17 (0.10)		2309	shahriar	-	-	-
	0721	mohr	0.25 (0.06)	0.38 (0.10)	0.13 (0.09)		2310	eslamshahr	-	-	-
	0722	farashband	0.21 (0.06)	0.29 (0.09)	0.12 (0.09)		2312	robatkarim	-	-	-
	0723	pasargad	0.19 (0.07)	0.26 (0.09)	0.13 (0.11)		2313	pakdasht	-	-	-
	0724	khonj	0.17 (0.05)	0.22 (0.07)	0.12 (0.07)		2314	firouzkooh	-	-	-
	0725	sarvestan	0.15 (0.05)	0.21 (0.07)	0.09 (0.06)		2316	Qods	-	-	-
	0726	rostam	0.18 (0.06)	0.24 (0.10)	0.12 (0.07)		2317	malard	-	-	-
	0727	gerash	0.16 (0.05)	0.21 (0.07)	0.11 (0.08)		2318	pishva	-	-	-
	0728	Koovar	0.24 (0.06)	0.32 (0.10)	0.16 (0.08)		2319	baharestan	-	-	-
	0729	khrameh	0.20 (0.06)	0.27 (0.08)	0.12 (0.09)		2320	pardis	-	-	-
Kerman	0801	baft	0.21 (0.06)	0.29 (0.08)	0.14 (0.08)		2321	ghrchak	-	-	-
	0802	bam	0.16 (0.05)	0.23 (0.08)	0.09 (0.06)	Ardebil	2401	ardabil	0.13 (0.04)	0.20 (0.07)	0.07 (0.05)
	0803	jiroft	0.38 (0.09)	0.53 (0.11)	0.23 (0.13)		2402	pilehsavar	0.26 (0.08)	0.33 (0.11)	0.20 (0.12)
	0804	rafsanjan	0.23 (0.06)	0.29 (0.08)	0.16 (0.09)		2403	khalkhal	0.30 (0.05)	0.47 (0.08)	0.12 (0.05)
	0805	zarand	0.20 (0.06)	0.27 (0.08)	0.13 (0.08)		2404	meshkinshahr	0.33 (0.06)	0.48 (0.10)	0.17 (0.08)
	0806	sirjan	0.19 (0.05)	0.26 (0.08)	0.11 (0.07)		2405	garmi	0.32 (0.08)	0.46 (0.13)	0.18 (0.10)
	0807	shahrbabak	0.17 (0.04)	0.24 (0.07)	0.10 (0.05)		2406	parsabad	0.28 (0.06)	0.40 (0.10)	0.16 (0.07)
	0808	kerman	0.17 (0.04)	0.24 (0.06)	0.10 (0.06)		2407	kowsar	0.35 (0.07)	0.52 (0.10)	0.17 (0.10)
	0809	kahnouj	0.39 (0.08)	0.52 (0.11)	0.26 (0.13)		2408	namin	0.14 (0.04)	0.21 (0.07)	0.08 (0.06)
	0810	bardsir	0.36 (0.08)	0.46 (0.10)	0.25 (0.13)		2409	nayer	0.31 (0.07)	0.45 (0.11)	0.16 (0.08)
	0811	ravar	0.32 (0.09)	0.41 (0.11)	0.24 (0.13)		2410	sarein	0.33 (0.10)	0.40 (0.14)	0.25 (0.16)

province	code	county	HCR	Urban HCR	Rural HCR
	0812	anbarabad	0.47 (0.08)	0.60 (0.11)	0.33 (0.13)
	0813	manoojan	0.54 (0.06)	0.68 (0.07)	0.41 (0.12)
	0814	koohbanan	0.32 (0.07)	0.51 (0.11)	0.13 (0.06)
	0815	roudbar jonoub *	0.50 (0.10)	0.64 (0.13)	0.35 (0.14)
	0816	ghale ganj	0.47 (0.06)	0.64 (0.09)	0.31 (0.10)
	0817	Reegan	0.56 (0.09)	0.72 (0.11)	0.40 (0.16)
	0818	rabar	0.20 (0.06)	0.30 (0.09)	0.10 (0.07)
	0819	Fahraj *	0.48 (0.12)	0.61 (0.14)	0.35 (0.17)
	0820	anar	0.24 (0.07)	0.32 (0.10)	0.16 (0.10)
	0821	normanshir	0.22 (0.08)	0.29 (0.11)	0.15 (0.12)
	0822	fariyab	0.47 (0.09)	0.66 (0.12)	0.28 (0.11)
	0823	Arzooiyeh *	0.38 (0.10)	0.50 (0.12)	0.25 (0.15)
R.Khorasan	0904	taibad	0.27 (0.06)	0.34 (0.10)	0.19 (0.08)
	0905	torbathey dariyeh	0.12 (0.05)	0.16 (0.07)	0.09 (0.05)
	0906	torbatjam	0.28 (0.08)	0.32 (0.10)	0.25 (0.13)
	0907	dargaz	0.14 (0.05)	0.16 (0.07)	0.11 (0.06)
	0908	sabzevar	0.12 (0.04)	0.15 (0.06)	0.08 (0.05)
	0913	ghouchan	0.14 (0.04)	0.17 (0.07)	0.11 (0.07)
	0914	kashmar	0.20 (0.07)	0.22 (0.08)	0.18 (0.11)
	0915	gonabad	0.10 (0.04)	0.12 (0.06)	0.08 (0.06)
	0916	mashhad	0.24 (0.05)	0.37 (0.09)	0.11 (0.06)
	0917	neishabour	0.22 (0.06)	0.23 (0.08)	0.20 (0.10)
	0918	chenaran	0.25 (0.07)	0.26 (0.09)	0.25 (0.11)
	0919	khaf	0.34 (0.07)	0.42 (0.11)	0.25 (0.08)
	0920	sarakhs	0.16 (0.06)	0.17 (0.08)	0.14 (0.08)
	0922	fariman	0.25 (0.08)	0.28 (0.11)	0.22 (0.12)
	0923	bardeskan	0.23 (0.08)	0.26 (0.10)	0.19 (0.11)
	0927	rashtkhar	0.28 (0.08)	0.33 (0.11)	0.22 (0.12)
	0928	kalat	0.39 (0.08)	0.48 (0.11)	0.29 (0.10)
	0929	khalilabad	0.25 (0.08)	0.28 (0.10)	0.21 (0.12)
	0930	mahvalat	0.20 (0.07)	0.21 (0.08)	0.19 (0.12)
	0931	bajestan	0.25 (0.06)	0.37 (0.09)	0.14 (0.07)
	0932	binalood	0.12 (0.04)	0.15 (0.06)	0.10 (0.06)

province	code	county	HCR	Urban HCR	Rural HCR
Qom	2501	qom	0.35 (0.07)	0.45 (0.10)	0.26 (0.11)
Qazvin	2601	boinzahra	0.29 (0.08)	0.30 (0.09)	0.27 (0.13)
	2602	takestan	0.29 (0.08)	0.31 (0.09)	0.28 (0.13)
	2603	qazvin	0.19 (0.07)	0.21 (0.08)	0.17 (0.09)
	2604	abiek	0.20 (0.07)	0.20 (0.09)	0.20 (0.10)
	2605	alborz	0.21 (0.07)	0.22 (0.09)	0.21 (0.11)
	2606	avog	0.22 (0.06)	0.22 (0.09)	0.21 (0.10)
Golestan	2701	bandargaz	0.35 (0.06)	0.54 (0.10)	0.16 (0.07)
	2702	torkaman	0.34 (0.09)	0.43 (0.11)	0.26 (0.13)
	2703	aliabad	0.32 (0.08)	0.40 (0.10)	0.24 (0.12)
	2704	kordkoy	0.31 (0.06)	0.53 (0.10)	0.10 (0.06)
	2705	gorgan	0.16 (0.05)	0.22 (0.08)	0.09 (0.05)
	2706	gonbadkavous	0.19 (0.05)	0.26 (0.07)	0.12 (0.07)
	2707	minoodasht	0.37 (0.09)	0.50 (0.12)	0.24 (0.13)
	2708	aghghala	0.30 (0.07)	0.44 (0.11)	0.17 (0.08)
	2709	kalaleh	0.43 (0.06)	0.61 (0.09)	0.24 (0.10)
	2710	azadshahr	0.40 (0.06)	0.59 (0.08)	0.21 (0.08)
	2711	ramian	0.42 (0.06)	0.62 (0.09)	0.23 (0.10)
	2712	maraveh tapeh	0.44 (0.09)	0.58 (0.12)	0.29 (0.12)
	2713	gamishan	0.49 (0.06)	0.70 (0.08)	0.29 (0.10)
	2714	galikesh	0.36 (0.09)	0.46 (0.10)	0.27 (0.14)
N.Khorasan	2801	esfarayen	0.39 (0.08)	0.58 (0.12)	0.19 (0.10)
	2802	bojnourd	0.18 (0.05)	0.28 (0.09)	0.08 (0.04)
	2803	jajarm	0.31 (0.08)	0.42 (0.11)	0.19 (0.11)
	2804	shirvan	0.32 (0.08)	0.43 (0.11)	0.21 (0.11)
	2805	Farouj *	0.40 (0.10)	0.56 (0.13)	0.24 (0.13)
	2806	maneh	0.36 (0.09)	0.50 (0.13)	0.23 (0.12)
	2807	garmeh	0.36 (0.09)	0.48 (0.12)	0.23 (0.14)
	2808	raz va jargalan	0.35 (0.07)	0.59 (0.11)	0.11 (0.08)
S.Khorasan	2901	birjand	0.14 (0.04)	0.18 (0.07)	0.10 (0.06)
	2902	darmian	0.37 (0.06)	0.59 (0.10)	0.15 (0.07)
	2903	sarbisheh	0.19 (0.07)	0.24 (0.09)	0.14 (0.09)
	2904	ghaenat	0.17 (0.05)	0.24 (0.09)	0.09 (0.06)

province	code	county	HCR	Urban HCR	Rural HCR	province	code	county	HCR	Urban HCR	Rural HCR
	0933	takht jolgeh	0.31 (0.09)	0.36 (0.12)	0.25 (0.13)		2905	nahbandan	0.16 (0.06)	0.20 (0.08)	0.13 (0.08)
	0934	jaqatay	0.11 (0.05)	0.14 (0.07)	0.08 (0.06)		2906	sarayan	0.25 (0.07)	0.32 (0.09)	0.18 (0.11)
	0935	zaveh	0.28 (0.08)	0.33 (0.12)	0.24 (0.13)		2907	ferdos	0.11 (0.04)	0.16 (0.06)	0.07 (0.05)
	0936	Joveyn	0.24 (0.08)	0.28 (0.11)	0.20 (0.13)		2908	basharooyeh	0.25 (0.06)	0.40 (0.10)	0.10 (0.05)
	0937	bakherz	0.29 (0.07)	0.41 (0.12)	0.17 (0.09)		2909	zirkoh	0.30 (0.09)	0.41 (0.14)	0.18 (0.10)
	0938	Khooshab *	0.38 (0.12)	0.50 (0.14)	0.27 (0.16)		2910	khosf	0.23 (0.08)	0.32 (0.11)	0.14 (0.10)
	0939	davrzan	0.21 (0.09)	0.28 (0.13)	0.14 (0.11)		2911	tabas	0.10 (0.04)	0.13 (0.06)	0.06 (0.05)
Isfahan	1001	ardestan	0.18 (0.04)	0.24 (0.08)	0.11 (0.05)	Alborz	3001	karaj	-	-	-
	1002	isfahan	0.11 (0.04)	0.14 (0.06)	0.09 (0.06)		3002	savojbolagh	-	-	-
	1003	khomeinishahr	0.30 (0.09)	0.30 (0.09)	0.30 (0.14)		3003	nazarabad	-	-	-
	1004	khansar	0.18 (0.05)	0.27 (0.09)	0.10 (0.07)		3004	taleqan	-	-	-
	1005	samirom	0.21 (0.05)	0.30 (0.09)	0.12 (0.06)		3005	eshthard	-	-	-
	1006	faridan	0.27 (0.08)	0.28 (0.10)	0.26 (0.14)		3006	fardis	-	-	-
	1007	fereydoun shahr	0.30 (0.08)	0.30 (0.09)	0.29 (0.13)						

Note. 3 Counties with standard errors greater than 10 percent have been marked with(14 Counties)*

Annex B:

Summary of regression coefficients from Weighted Least Squares and Generalized Least Squares for Cluster 1 in the urban sector are presented in Tables 7 and 8, respectively.

Table 7 - Summary Statistics of Weighted Least Squares Regression

variables	estimate	std.error	statistic	p.value
(Intercept)	17.71	0.03	507.10	< 0.001
HouseArea	0.00	0.00	21.49	< 0.001
MembersCount	-0.16	0.00	-34.22	< 0.001
Ratio_Literate_to_Members	0.38	0.02	17.37	< 0.001
Num_University_Educated	0.14	0.01	17.23	< 0.001
Ratio_With_Income	0.39	0.03	12.68	< 0.001
prov_median_Prop_Age_0_6	-1.46	0.33	-4.45	< 0.001
prov_median_Ratio_Studying_to_Members	-0.77	0.07	-11.75	< 0.001
county_median_Prop_Age_7_14	-1.95	0.60	-3.23	< 0.01
Materials2	-0.12	0.02	-8.00	< 0.001
Materials3	-0.30	0.03	-9.67	< 0.001
Materials4	-0.25	0.03	-9.59	< 0.001
Materials5	-0.15	0.06	-2.53	0.011
Materials7	-0.34	0.06	-6.05	< 0.001
Materials8	-0.39	0.05	-7.95	< 0.001

Table 8 - Summary Statistics of Generalized Least Squares Regression

variables	estimate	std.error	statistic	p.value
(Intercept)	17.632	0.285	61.93	< 0.001
HouseArea	0.004	0.000	17.026	< 0.001
MembersCount	-0.164	0.006	-25.74	< 0.001
Ratio_Literate_to_Members	0.352	0.028	12.724	< 0.001
Num_University_Educated	0.141	0.010	13.422	< 0.001
Ratio_With_Income	0.346	0.041	8.539	< 0.001
prov_median_HouseArea	-0.004	0.001	-2.727	< 0.01
prov_median_Ratio_Studying_to_Members	-0.703	0.180	-3.899	< 0.001
county_median_Head_Age	0.009	0.006	1.447	0.148
county_median_Ratio_Studying_to_Members	-0.063	0.185	-0.343	0.731
county_median_Num_Literate_Members	0.019	0.035	0.549	0.583
county_median_Num_University_Educated	-0.199	0.078	-2.571	0.01
Materials2	-0.115	0.021	-5.342	< 0.001
Materials3	-0.263	0.032	-8.093	< 0.001
Materials4	-0.252	0.036	-6.942	< 0.001
Materials5	-0.139	0.085	-1.646	0.1
Materials7	-0.325	0.082	-3.992	< 0.001
Materials8	-0.305	0.062	-4.913	< 0.001

Annex C:

Figure 1 - Distribution of Residuals from Ordinary Least Squares Regression in the First Stage

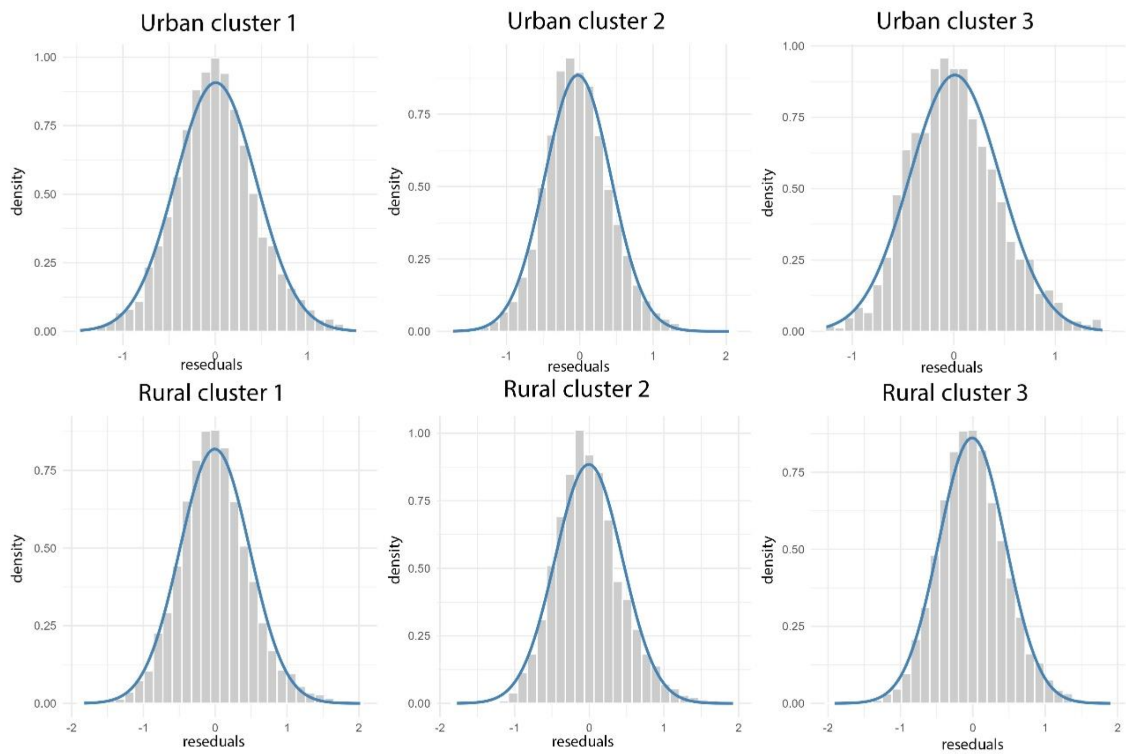

Figure 2 - Quantile–Quantile Plot for Each Urban and Rural Cluster