Poverty Maps of Iran

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Abstract

Poverty maps are shown to be of the best tools in economic policy design in poverty alleviation programs. This study uses small area estimation method to calculate the poverty headcount ratio for rural and urban areas of 397 counties of Iran. We use the "Household Expenditures and Income Survey" (HEIS) 2014 by "Statistical Center of Iran" (SCI), and 2011 Census (a 2% random sample), and some macro county- and province-level data to build models to estimate household per capita expenditures. 60 urban/rural provincial regions are divided into 13 clusters using k-means clustering method. For each of these clusters a model is built to estimate the expenditures. As usual in small area methods, we use survey data to estimate the model parameters and apply the model to census data to estimate the desired variable for each household. Regional poverty headcount ratio is then calculated for each of 794 urban/rural regions of counties.

Keywords: Small Area Estimation, Bayesian Variable Selection, Household Expenditures and Income Survey, Census Data

JEL classification: C11, I32, Y91

Introduction

In the last two decades there has formed a consensus among development economists that although economic growth is the necessary condition to decrease poverty, it is not enough. Based on this view, the basic needs of poor households should be provided by government programs so they can have the chance to contribute to the development process. Such government programs need identifying and targeting the poor (Coady, Growsh & Hoddinott 2004). International studies on welfare programs show that most of them use poverty maps in designing a well-targeted program (IMPS 2014).

Aggregate measures often conceal important differences among regions of a country. Thus studying poverty and factors affecting it, and any poverty-alleviating programs need to be done at smaller geographical areas. Measuring and displaying such information are known as poverty maps. Understanding the importance of poverty maps, the last two decades has seen important international efforts on this subject.

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The World Bank has been a pioneer in poverty map studies since 1992 (Alderman et al., 2000; Hentschel et al., 2000; Demombynes et al. 2002; Elbers, Lanjouw, & Lanjouw, 2003; Elbers et al., 2007; Elbers, Lanjouw, & Leite, 2008; Lanjouw, Marra, & Nguyen, 2013, …). Other important studies include the "Model-based Small Area Income & Poverty Estimates" (SAIPE)[3] project by the US Census Bureau, the "Europe Small Area Estimation" (EU SAE) and the "Advanced Methodology for European Laekan Indicators" (AMELI)[4], the "Small Area Methods for Poverty and Living Conditions Estimates" (SAMPLE)[5], and the "Territorial Dimension of Poverty and Social Exclusion in Europe" (TIMPSE) projects by the European Commission, European Union, and other European governing bodies.

This study uses small area estimation method to calculate the poverty headcount ratio for rural and urban areas of 397 counties of Iran. We use the "Household Expenditures and Income Survey" (HEIS) 2014 by "Statistical Center of Iran" (SCI), and 2011 Census (a 2% random sample), and some macro county- and province-level data to build models to estimate household per capita expenditures. 60 urban/rural provincial regions are divided into 13 clusters using k-means clustering method. For each of these clusters a model is built to estimate the expenditures. As usual in small area methods, we use survey data to estimate the model parameters and apply the model to census data to estimate the desired variable for each household. Regional poverty headcount ratio is then calculated for each of 794 urban/rural regions of counties.

As there are a lot of candidate variables for explaining the target variable, we use Bayesian Model Selection approach to identify the best variables for each 13 models.

Calculating a poverty headcount ratio needs a defined poverty line. We gather 1018 absolute poverty line numbers from 33 official reports and published papers, calculate comparable per capita numbers for our base year and use the median of calculated numbers as poverty lines. The calculated per capita values in 2011 prices for rural areas, urban areas except Tehran, and Tehran are 1.51, 2.48, and 3.62 million Rials respectively.

The rest of the paper is divided into four sections. We first introduce methods of poverty mapping. Next we calculate poverty lines for Iran. Then we introduce our method to calculate poverty maps and at the last section we overview the results of the study.

[3] http://www.census.gov/did/www/saipe/
[4] http://www.uni-trier.de/index.php?id=25157&L=2
[5] http://www.sample-project.eu/

Poverty Mapping

Different methods are used to prepare poverty maps. These methods differ in the measure calculated to show on a map. To name of few methods used in poverty mapping:

- Basic needs multivariate weighted index
- Combination of qualitative and quantitative information
- Direct computation based on household expenditures and income surveys
- Direct computation on census data
- Small Area Estimation

The first two methods do not use economic indicators of poverty, rather use other related indicators. The direct computation based on household surveys faces the problem of low number of observations in small geographical/administrative areas. The problem with direct computation on census is that most censuses over the world lack questions on expenditures and income. And if they do include questions on income, they lack reliability. Most economic poverty studies use the Small Area Estimation (SAE) method which uses both household surveys data and census data with statistical modeling.

In any survey, the target population is the population survey designed for. So direct estimates are valid for the target population but not for its subsets. These subsets can be any subset of population including geographical and administrative areas, socio-demographic groups (grouped by gender or age) or any other categorizing feature. We are usually not aware of the validity of direct estimates on small areas. Most estimates are invalid due to really small sample. The first best solution is to provide a sample as big as enough for validity of direct estimates on small areas. This is obviously a very costly solution. The second solution is to model target variable using survey data and estimate using census data known as SAE.

Small Area Estimation

The simplest SAE method is that of Fay & Herriot (1979) which is appropriate for linear estimates (average income, etc) and cannot be used for poverty headcount ratio. Newer methods include the World Bank method (Elbers, Lanjouw, & Lanjouw, 2003), SAMPLE project's M-Quantile method (Chambers & Tzavidis, 2006), Empirical Best/Bayes method (Molina & Rao 2010), and Hierarchical Bayes method (Molina, Nandram, & Rao, 2014). The difference between the World Bank method and newer methods is that the former assumes that the modeling clusters fit the small areas used for estimation. Newer methods relax this assumption.

In SAE methods we assume that we have two sets of data:

- A Household Expenditures and Income Survey
    - Including the target variable (per capita consumption, …) named y,
    - Including a vector of households' socio-economic variables named X,

  - Not enough observations in small areas
- A Census
  - Not including the target variable
  - Including the same vector of households' socio-economic variables named X,
  - Enough observations in small areas

Suppose there is a relation between y and X as:

$$y_1 = \alpha + \boldsymbol{\beta} X_1 + \varepsilon$$

Using the first dataset, the parameters of the regression are estimated ($\hat{\alpha}$ and $\widehat{\boldsymbol{\beta}}$) and in the next step, y is estimated for the second dataset using the estimated parameters.

$$\hat{y}_2 = \hat{\alpha} + \widehat{\boldsymbol{\beta}} X_2$$

Differences in SAE methods are about the assumptions about the error term ε.

Important issues regarding the choice of poverty mapping method are the goal of study, philosophy, availability of data, cost and processing capacity. For example the studies with economic view on poverty, use SAE methods, but studies regarding poverty as a social deprivation phenomenon, may use basic needs multivariate indices.

Various indices are used in poverty maps, which can be summarized into two categories: poverty indices and food insecurity indices. Poverty indices include economic indices such as Laeken indices (Eurostat, 2004), social indices such as quality and availability of education and health, demographic indices, and vulnerability indices. Food insecurity indices include direct consumption and calories intake, nutritunial status results such as micronutrients and anthropometry. Foster, Greer & Thorbecke (1984) indices are the most famous economic poverty indices:

$$Z(\alpha, t) = \frac{1}{N} \sum_{i=1}^{N} \left(\frac{t - y_i}{t} \right)^{\alpha} I(y_i \leq t)$$

Where t stands for the poverty line. $\alpha = 0$ gives the poverty headcount ratio (HCR), $\alpha = 1$ gives the povety gap (PG) index and $\alpha = 2$ gives the poverty severity index (Haughton & Khandker 2009, chapter 4).

Poverty Line in Iran

There are different methods to calculate a poverty line. For a developing country, the absolute poverty line is more appropriate which is calculated using necessary food (based on calorie needs) and other expenditures minimum. We do not calculate yet another poverty line for Iran, but use prior studies. 33 reports by official institutes such as the Statistical Center of Iran[6] (SCI), the Statistical Research and Training Center[7] (SRTC), the Central Bank of the Islamic Republic of Iran[8] (CBI), the Institute for Management and Planning Studies[9] (IMPS), the Ministry of Cooperatives, Labor, and Social Welfare[10] (MCLS), Sharif Institute for Economic and Industrial Studies[11] (SIEIS) and peer reviewed papers. 1018 absolute poverty line is gathered for different years, household sizes, and different geographical areas (Naderan & Gholami Nattaj Amiri, 2000; Pirasteh & Ranjbar, 2002; Mahmoodi, 2002; SCI, 2002; SRTC, 2004; Arzroumchilar, 2005; Mohtasham, 2006; Baqeri, Daneshparvar, & Kavand, 2007; Zibayi & Shushtarian, 2007; Mohammadi, MiriAli, & Gorji, 2007; Najm, 2007; Abunouri & Maleki 2008; Emami, 2007; Souri, 2009; Shahmiri Shourmasti, 2010; Foruzande, 2010; Kiani, Attar, & Habibi, 2010; Mohammadzade, Fallahi, & Hekmati Farid, 2010; Arshadi, Hasanzadeh, & Mostashari, 2010; Afqah & Qanavatifar, 2011; Zamanzadeh & Shahmoradi, 2012; Safarkhanlou & Mohammadinejad, 2011; Makian & Saadatkhah, 2011; Eftekhari, Karami, & Nouripour, 2012; Khodadad Kashi & Shahikitash, 2012; Heydari & Sami, 2012; Saadat & Qasemi, 2012; Ebrahimpour & Milaelmi, 2013; Grivani, Ahmadi Shadmehri, & Fallahi, 2012; Arshadi & Karimi, 2014; Negahdari, Pirayi, Keshavarz Haddad, & Haqiqat, 2014; Yadollahi, 2014).

The gathered poverty line values are then converted to 2011 fixed prices to be comparable.

Analyzing the calculated poverty line values shows that the per capita poverty line using old OECD method[12] for household equivalent size, is almost fixed for different household sizes. Thus we convert all gathered values to per capita equivalents using the old OECD method.

Several studies on different provinces of Iran (Ilam, Semnan, Isfahan, Mazandaran, …) shows that other than Tehran, other provinces do not have important differences in poverty line calculations (see Yadollahi, 2014). Thus we calculate 3 distinct lines for urban (excluding Tehran), rural, and Tehran urban areas. Table 1 shows the values.

[6] https://www.amar.org.ir/english
[7] http://www.srtc.ac.ir/en/Index.html
[8] http://cbi.ir/default_en.aspx
[9] http://en.imps.ac.ir/
[10] https://www.mcls.gov.ir/en/home
[11] http://sieis.sharif.ir/
[12] Household head =1, other adults=0.7 each, & children 0.5 each.

Table 1 Per capita Monthly Poverty Lines

Region	Value in 2011 Million Rials
Urban (excluding Tehran)	2.48
Rural	1.51
Tehran	3.62

As we will use the 2014 HEIS, the poverty line for each household is updated based on region and the CPI index for the month of information gathering.

Poverty Headcount Ratio for Urban and Rural areas of the Counties of Iran

Data

We use 3 sets of data for this SAE analysis. The administrative areas of Iran are constantly dividing to more counties. We use the country division of 2011 which are the basis for 2011 census and 2014 HEIS. Iran was divided to 31 provinces and 297 counties back in 2011. Thus we gather data for 794 rural and urban areas of counties.

Population and Housing Census, 2011

The last census in Iran is 2016 census, but the micro-data for this census is not yet published. We use the 2011 census which is also the basis for 2014 HEIS. 2011 census gathers data on about 21 million households (75 million people). Tehran is the most populated province with 12.18 million people in 3.73 million households. Ilam is the least populated province with 558 thousand people in 135 thousand households. The most and least populated counties are Tehran (8.29 million people in 2.63 million households) and Abu Musa (5263 people in 679 households) respectively.

The micro data for the census are not publicly available, but there is a 2 percent random subset. The subset is uniformly selected, so the number of household are less than 100 for 161 (of 794) regions.

The census questionnaire includes several questions on social characteristic of the household members and also data on the living place of the household. The census does not gather any economic information (income, expenditures, and asset values) on households.

Household Expenditures and Income Survey, 2014

The HEIS uses the census 2011 as a basis for the first time in 2013. The latest data available at the time of study was 2014 survey. The HIES provides data on social characteristics of household members and the living place, as well as data on income and detailed data on expenditures.

Geographical Macro-data

We gather information on county and provincial level. The population data, number of rural ICT centers, number of industrial firms, and employees of these firms, sport places available, hotel, apartment hotel, & motel rooms and beds available are provided on county level. Labor market statistics and data on available children's and adolescent intellectual centers are provided on provincial level. These data are transformed into per capita values.

Combined database

The data gathered can be categorized in the following groups which can explain the target variable.

- Target variable: gross equivalent per capita expenditures of the household
- Demographic indices:
  - Household head's age and it's second power
  - Household head's gender
  - Female ratio
  - …
- Human Capital
  - Household head's education
  - University level ratio
  - …
- Employment
  - Head's employment status
  - Number of earners in household
  - Dependency ratio
  - …
- Access (Household level)
  - Pipe water
  - Swage system
  - Piped gas
  - Electricity
  - Landline phone
  - Main fuel for cooking, heating, hot water
- Access (Macro level)
  - per capita number of beds/rooms of hotels/apartment hotels/motels (and their 2^{nd} power)
  - per capita number/area of land/area of building of children's and adolescent intellectual centers (and their 2^{nd} power)
  - per capita rural/urban sports area (and 2^{nd} power)
  - per capita number of 10-49/50+ employee industrial firms
  - per capita number of employees in these firms
- Geography
  - Population density
  - Population growth
  - Participation rate
  - Unemployment rate
  - Literacy rate
  - Internet penetration rate
- Assets

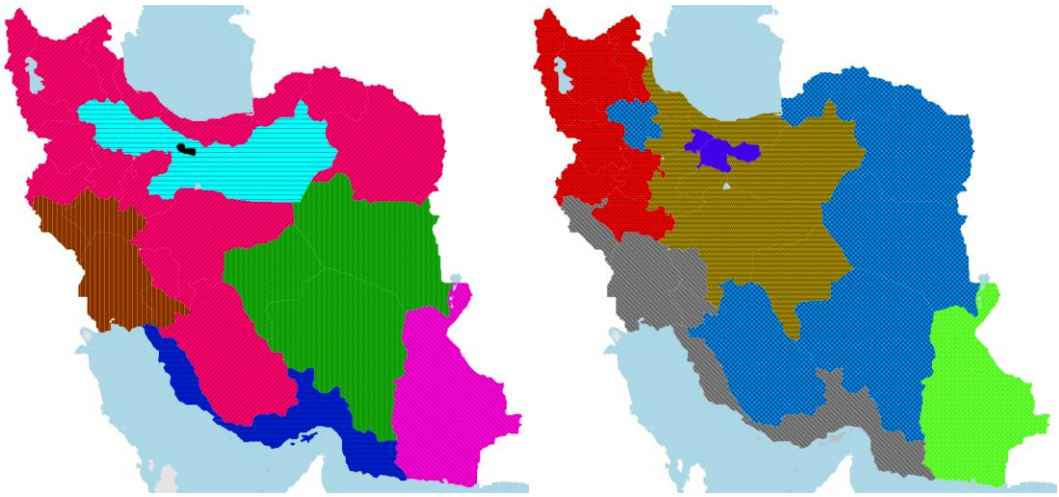
  - Living place occupation status (owning, renting, …)
  - Living place area
  - Number of rooms
  - Having a bathroom
  - Owning a car
  - Owning a motorbike
  - …
- Durable goods
  - TV
  - PC

Clustering Analysis Regions into Homogenous Areas

The aforementioned indices have different meanings in different regions. For example the area of living place, although directly related to welfare level in all areas, has different level in Tehran and other cities and villages. The average area of living place might be less than other places in Tehran, but this does not mean people in Tehran are poorer, because the house prices are much higher in Tehran.

This is also true for other indicators. Having a landline phone can be a useful indicator in Sistan & Baluchestan to tell non-poor from the poor, but it will not be helpful in cities of Tehran. Thus it will be more appropriate to have different models for different areas. On the other hand modeling for each province will decrease the accuracy of models.

We cluster 63 areas (31 rural areas of provinces, 31 urban areas of provinces excluding the county of Tehran, and the urban areas of the county of Tehran) based on the averages of indices introduced in the previous section, into 7 urban and 6 rural areas. Clustering is done using k-means method on normalized averages of features of households. The number of clusters are decided based on how much the sum of squared errors reduces by increasing the number of clusters (Hartigan & Wong, 1979). Figure 1 and Table 2 illustrate the results of this clustering.



Urban Clusters Rural Clusters

Figure 1 Clustering Urban and Rural Areas

Table 2 Clusters of Urban and Rural Areas

Cluster		Including	HCR (%)
	1	Urban areas of Sistan & Baluchestan province	46.3
	2	Urban areas of Markazi, Guilan, Mazandaran, East Azerbaijan, West Azerbaijan, Kermanshah, Fars, Razavi Khorasan, Isfahan, Kurdistan, Hamedan, Chaharmahal & Bakhtiari, Zanjan, Ardebil, Golestan, North Khorasan provinces	13.5
	3	Urban areas of Khuzestan, Luristan, Ilam, Kohgiluye & Boyer Ahmad provinces	16.0
	4	Urban areas of Tehran county	6.7
	5	Urban areas of Kerman, Yazd, and South Khorasan provinces	20.1
	6	Urban areas of Bushehr and Hormozgan provinces	12.0
	7	Urban areas of Tehran province excluding Tehran county; Urban areas of Semnan, Qom, Qazvin, and Alborz provinces	11.3
	8	Rural areas of Khuzestan, Chaharmahal & Bakhtiari, Ilam, Kohgiluye & Boyer Ahmad, Bushehr, and Hormozgan provinces	14.1
	9	Rural areas of Fars, Kerman, Razavi Khorasan, Zanjan, Golestan, North Khorasan, and South Khorasan provinces	29.4
	10	Rural areas of Sistan & Baluchestan province	76.9
	11	Rural areas of Tehran and Alborz provinces	7.6
	12	Rural areas of East Azerbaijan, West Azerbaijan, Kermanshah, Kurdistan, Hamedan, Luristan, and Ardebil provinces	17.7
	13	Rural areas of Markazi, Guilan, Mazandaran, Isfahan, Semnan, Yazd, Qom, and Qazvin provinces	12.5

Modeling Per Capita Consumption Based on Common Variables

We model per capita consumption instead of modeling discrete variables such as being poor. Census and HEIS share 123 variables for each household. Some variables are dropped in each cluster because of problems such as non-variability (such as access to electricity in some clusters), full collinearity

of some indices. In the end we have 65 to 116 variables available for modeling old OECD equivalent per capita consumption in each cluster. (Refer to Appendix 1 for the complete list of variables in each cluster).

It is not possible to include all variables in the models as it reduces the power of model. We should do a model selection. Most studies use (implicitly) arbitrary methods of model selection which leads to lower projection power. We use Bayesian model selection approach. Fernandez, Ley, & Steel (2001) use this method for the first time in economics literature to study the factors affecting economic growth. In Bayesian variable selection method, all variables have equal a priori inclusion probability. The algorithm searches through the model space using a random Markov Chain and with including and excluding variable, decides on the value of their inclusion, and the a posteriori inclusion probability is updated using the Bayes rule. In the end the algorithm converges to the best model. The best model is different for each cluster and explains per capita consumption using different variables. Table 3 lists the variables of the best model for each cluster.

Table 3 Variables used in the best models of each cluster

Cluster	Varibales #	Variable Names
1	8	Household head employed in public sector Landline phone Number of university graduates in the household Rental home Household size Living place area Using kerosene as the main fuel for heating water Owning a Car
2	13	Number of 0-6 children Household size Second power of population growth rate in the region Landline phone University graduates ratio in the household Having a bathroom Industrial firms with 50 or more workers in the region to population Share of literate members of the household Log of living place area Unemployment rate in the region Owning a personal computer Owning a car Household head employed in public sector
3	8	Number of rooms Second power of share of active members of the household Share of literate members of the household Number of literate members of the household Access to the sewage system network Owning a personal computer Household head employed in public sector Owning a car

4	6	Access to Internet Log of household size Access to the sewage system network Household head employed in public sector Log of living place area Owning a car
5	8	Second power of share of literate members of the household Number of university graduates Owning a motorbike Number of rooms Size of household Household head employed in public sector Population density in the region Owning a car
6	6	Population density in the region Number of literate members of the household Share of literate members of the household Number of hotel rooms in the region to population Owning a car Access to the internet
7	13	Area of sports places in the urban area to population and its second power Number of industrial firms with 50 and up workers to population and its second power Number of university graduates in the household Household head employed in public sector Number of motel rooms in the region to population Participation rate in the region Household size Household head's education level (high school and up) Log of living place area Access to sewage system Owning a car
8	13	Second power of the household head's age Having a bathroom Number of industrial firms with 50 and up workers to population Household size Log of living place area Personal computer Population density in area Access to internet Second power of share of university graduates Share of active member of the household Literacy rate in the region Unemployment rate in the region Owning a car
9	12	Household size Share of active members Log of living place area Having a bathroom Access to piped water network

			Main fuel for cooking is kerosene Having a landline phone Participation rate in the region Personal computer Owning a car
	10	6	Second power of active members Share of active members Living place area Household head employed in public sector Owning a car Main fuel for heating water is kerosene
	11	8	Log of household size Second power of per capita area of land of children's and adolescent intellectual centers in the region Share of literate members of the household Number of industrial firms with 10 to 49 workers to population Second power of living place area Household head employed in public sector Main fuel for heating home is liquid gas Owning a car
	12	11	Second power of per capita area of buildings of children's and adolescent intellectual centers in the region Share of active members in the household Number of literate members Log of living place area Personal computer Share of literate members in the household Internet penetration rate in the region Unemployment rate in the region Population density in the region Owning a car
	13	11	Number of active members Second power of number of industrial firms with 50 and up workers to population in the region Access to natural gas pipe network Share of active members of the household Number of industrial firms with 10 to 49 workers to population in the region Unemployment rate in the region Log of living place area Share of literate members of the household Owning a motorbike Owning a personal computer Owning a car

Models are qualified over all. The in sample performance (R^2) of the models are high. We check the out of sample performance of the model comparing the performance of models estimated using 70% of the survey data on the remaining 30% and comparing the projections with the real values. The correlation

of projected values and real values are high. We observe a heteroskedasticity in a few of the models but overcoming it does not affect the performance of the models.

Results: Poverty Maps of the Iran

Based on calculated results, the poorest regions of the country (with the highest poverty headcount ratios) are in order rural regions of Mehrestan (Zaboli), Chahbahar, Konarak, Zahedan and Nikshahr (all counties of Sistan & Baluchestan province). The calculated headcount poverty ratio for these regions are higher than %80. Rural regions of Khash and Sarbaz (counties of Sistan & Baluchestan), urban regions of Andika (county in Khouzestan), rural regions of Delgan, rural and urban regions of Hirmand, and urban regions of Sarbaz and Mehrestan (all counties of Sistan & Baluchestan) are the next poor regions of Iran.

The poverty HCR in rural and urban regions of a few counties are calculated to be zero. This can be because of small sample. The regions with poverty HCR less than 3.5% are urban regions of Mobarake (Isfahan), Alborz (Qazvin), Damghan (Semnan), and rural areas of Karaj (Alborz), Najaf Abad, Khoeminishahr, and Mobarake (Isfahan), Farsan (Chaharmahal & Bakhtiari), Alborz (Qazvin), Tiran and Karvan (Isfahan), Nazar Abad (Alborz), Shahr-e Kord (Chaharmahal & Bakhtiari), Pasargad (Fars), Falavarjan (Isfahan), Mahmood Abad, and Babolsar (Mazandaran).

Tables 4 & 5 represent the 20 urban and 20 rural regions with highest poverty headcount ratio. As this is obvious in these tables, Sistan & Baluchestan has the highest number of poor counties. Kerman and South Khorasan are following Sistan & Baluchestan. Tables 6 & 7 represent the 20 urban and 20 rural regions with the highest number of poor families, which does not necessarily equate the former tables.

Table 4 Top 20 counties with highest rural poverty HCR

#	Province	County	Poverty HCR
1	Sistan & Baluchestan	Mehrestan	90.3%
2	Sistan & Baluchestan	Chabahar	88.7%
3	Sistan & Baluchestan	Konarak	84.4%
4	Sistan & Baluchestan	Zahedan	84.0%
5	Sistan & Baluchestan	Nikshahr	83.2%
6	Sistan & Baluchestan	Khash	79.4%
7	Sistan & Baluchestan	Sarbaz	77.5%
8	Sistan & Baluchestan	Dalgan	75.0%
9	Sistan & Baluchestan	Hirmand	74.3%
10	Kerman	Reygan	68.6%
11	Kerman	Fahraj	67.8%
12	Sistan & Baluchestan	SiboSoran	65.3%
13	Sistan & Baluchestan	Iranshahr	65.2%
14	Sistan & Baluchestan	Zabol	65.0%
15	Sistan & Baluchestan	Saravan	64.6%
16	Sistan & Baluchestan	Zehak	63.1%
17	Kerman	Anbarabad	59.4%
18	Fars	Neyriz	59.3%
19	Kerman	Manujan	56.4%
20	South Khorasan	Nehbandan	56.0%

Table 5 Top 20 counties with highest urban poverty HCR

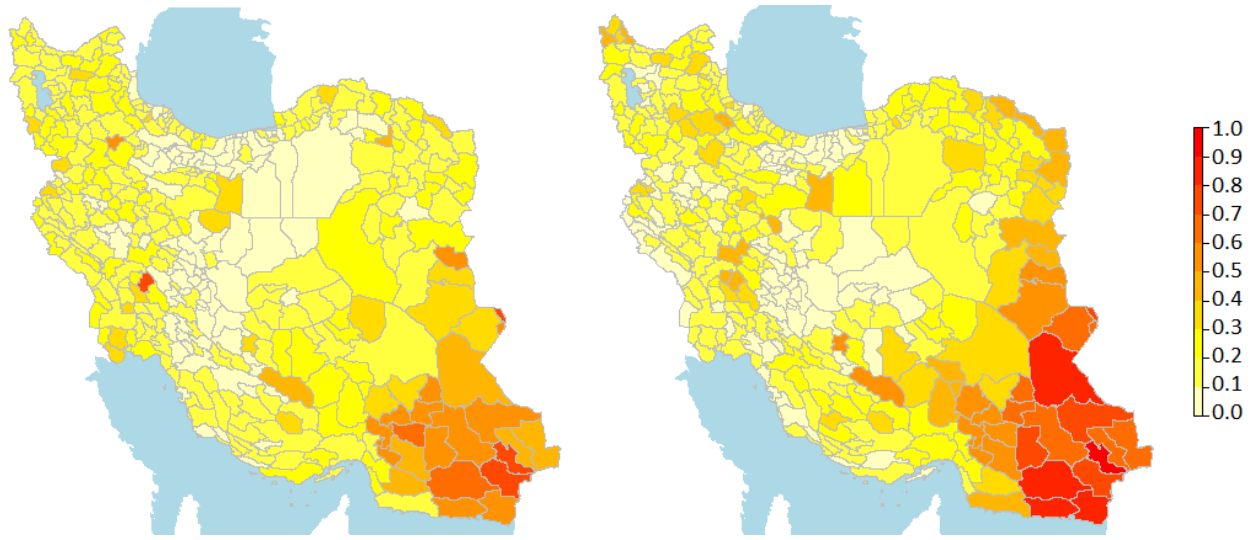
#	Province	County	Poverty HCR
1	Khuzestan	Andika	75.0%
2	Sistan & Baluchestan	Hirmand	72.7%
3	Sistan & Baluchestan	Sarbaz	71.4%
4	Sistan & Baluchestan	Mehrestan	71.1%
5	Sistan & Baluchestan	Nikshahr	65.1%
6	Kerman	Roudbar-e-Jonub	62.2%
7	Zanjan	Eejrud	60.0%
8	Kerman	Manujan	58.9%
9	Sistan & Baluchestan	Konarak	58.5%
10	Sistan & Baluchestan	Zehak	57.1%
11	Sistan & Baluchestan	Chabahar	56.8%
12	Kerman	Fahraj	56.1%
13	Sistan & Baluchestan	Khash	54.5%
14	Kerman	Kahnuj	53.6%
15	Sistan & Baluchestan	Iranshahr	53.5%
16	Sistan & Baluchestan	Dalgan	53.1%
17	Kerman	Anbarabad	52.9%
18	South Khorasan	Darmian	52.6%
19	Kerman	Reygan	51.4%
20	Kerman	Ghaleye-Ganj	49.1%

Table 6 Top 20 counties with highest number of poor households in rural regions

#	Province	County	Poor Households
1	Sistan & Baluchestan	Chabahar	30912
2	Sistan & Baluchestan	Nikshahr	23985
3	Razavi Khorasan	Mashhad	20389
4	Kerman	Jiroft	18345
5	Sistan & Baluchestan	Sarbaz	18031
6	Sistan & Baluchestan	Zahedan	15714
7	Sistan & Baluchestan	Khash	15638
8	Sistan & Baluchestan	Zabol	14653
9	Razavi Khorasan	Torbat-e-Jam	13396
10	Sistan & Baluchestan	Iranshahr	12327
11	West Azerbaijan	Urmia	12193
12	Razavi Khorasan	Nishapur	11842
13	South Khorasan	Qaen	9891
14	Sistan & Baluchestan	Saravan	9487
15	Kerman	Fahraj	9339
16	Sistan & Baluchestan	Mehrestan	9321
17	Golestan	Gonbad-e-Kavus	9250
18	North Khorasan	Bojnurd	9250
19	Hormozgan	Minab	8340
20	Zanjan	Khodabandeh	8246

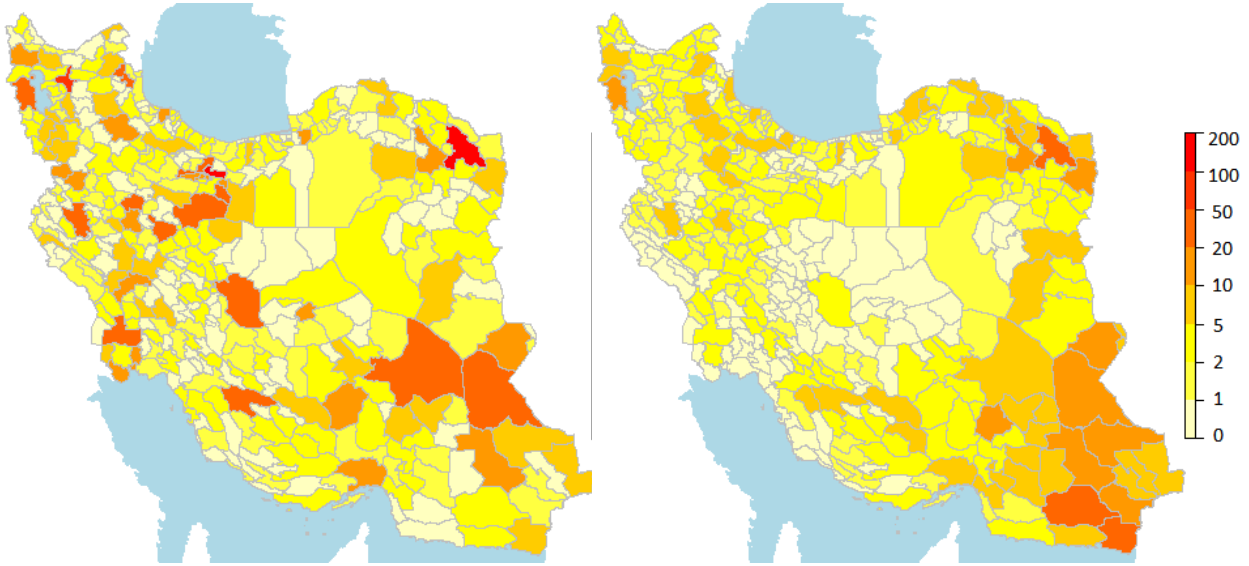
Table 7 Top 20 counties with highest number of poor households in urban regions

#	Province	County	Poor Households
1	Tehran	Tehran	169691
2	Razavi Khorasan	Mashhad	120846
3	East Azerbaijan	Tabriz	78644
4	Sistan & Baluchestan	Zahedan	47335
5	Isfahan	Isfahan	39691
6	Khuzestan	Ahvaz	37198
7	Qom	Qom	35884
8	Tehran	Baharestan	31947
9	Fars	Shiraz	30095
10	Kerman	Kerman	29778
11	Kermanshah	Kermanshah	28688
12	Hamadan	Hamadan	28687
13	Alborz	Karaj	24995
14	Tehran	Varamin	23042
15	WestAzerbaijan	Urmia	21998
16	Markazi	Arak	21934
17	Ardabil	Ardabil	20544
18	Tehran	Pakdasht	18689
19	Tehran	Shahriar	17996
20	Gilan	Rasht	17840



a) Urban b) Rural

Figure 2 Poverty Headcount Ratios



a) Urban b) Rural

Figure 3 Number of Poor Households (x1000)

References

Abounoouri, E., & Maleki, N. (2008). An Evaluation of Poverty in Semnan Province During the First, Second and Third Development Plans (1368-1383). *Journal of Economic Research and Policies*, *16*(45), 5–27. (in Persian). Retrieved from http://qjerp.ir/article-1-275-en.html

Afghah,M ., & Ghanavatifar,T . (2632). Poverty Line Estimation in Khuzestan Province (1997-2006). *Journal of Economy and Regional Development*, *18*(1). doi:10.22067/erd.v18i1.13680

Alderman, H., Babita, M., Lanjouw, J., Lanjouw, P., Makhatha, N., Mohamed, A., Ozler, B. & Qaba, O. (2000). Combining census and survey data to construct a poverty map of South Africa. *Measuring Poverty in South Africa*, 11-12.

Arshadi, A., Hassanzadeh, A., & Mostashari, F. (2010). Determination of Minimum Living of Urban and Rural Households in Province of Kermanshah with Linear Expenditure System. , 7(4), 1-23. (in Persian). doi: 10.22055/jqe.2010.10634

Arshadi, A., & Karimi, A. (2014). Analysis of poverty status in development plans after the war (1987-2009), *Economic Policy*, 3 (8), 131-164. (in Persian)

Arzroumchilar, N. (2005). *Different Aspects of Poverty in Iran.* Economic Studies Series No 27. Economic Policies and Research Office, Central Bank of the Islamic Republic of Iran. (in Persian). Retrieved from http://www.cbi.ir/page/4315.aspx

Chambers, R., & Tzavidis, N. (2006). M-quantile models for small area estimation. *Biometrika*, *93*(2), 255-268.

Coady, D., Growsh, M., & Hoddinott, J., (2004). *Targeting of Transfers in Developing Countries: Review of Lessons and Experience*, Social Safety Net Primer Series, Vol. 1. World Bank Publications.

Demombynes, G., Elbers, C., Lanjouw, J., Lanjouw, P., Mistiaen, J., & Özler, B. (2002). *Producing an improved geographic profile of poverty: methodology and evidence from three developing countries* (No. 2002/39). WIDER Discussion Papers/World Institute for Development Economics (UNU-WIDER).

Ebrahim Pour, S., & Elmi, Z. (2013). Determinants of Poverty in Iranian Urban Households in 2009: An Application of Panel Data Models with Limited Dependent Variable. *Economics Research*, 13(49), 101-116. (in Persian). Retrived from http://joer.atu.ac.ir/article_909_en.html

Eftekhari, S., Karami, A., Nooripoor, M. (2012). Study of poverty situation in rural areas of Kohgilouyeh va Boyerahmad province. *Agricultural Economics*, 6(1), 179-204. (in Persian). Retrieved from http://www.iranianjae.ir/article_9330_en.html

Elbers, C., Fujii, T., Lanjouw, P., Özler, B., & Yin, W. (2007). Poverty alleviation through geographic targeting: How much does disaggregation help? *Journal of Development Economics*, *83*(1), 198-213.

Elbers, C., Lanjouw, J. O., & Lanjouw, P. (2003). Micro–level estimation of poverty and inequality. *Econometrica*, *71*(1), 355-364.

Ebers, C., Lanjouw, P. F., & Leite, P. G. (2008). Brazil within Brazil: Testing the poverty map methodology in Minas Gerais. *World Bank Policy Research Working Paper Series.*

Emami, P. (2007). Poverty and poverty line in Yazd province, *Political-Economic Information,* 21 (7-8), 188-213. (in Persian).

Eurostat (2004). Common cross-sectional EU indicators based on EU-SILC; the gender pay gap. *EU-SILC 131-rev/04,* Unit D-2: Living conditions and social protection, Directoreate D: Single market, employment and social statistics, Eurostat, Luxembourg.

Baghery, F., Danesh Parvar, N., & Kavand, H. (2008). Poverty line and poverty indices trend in Iran based on 2300 calorie approach for the period of 1996-2006. *Iranian Journal of Official Statistics Studies*, *18*(2), 71–82. (in Persian). Retrieved from http://ijoss.srtc.ac.ir/article-1-126-en.html

Fay III, R. E., & Herriot, R. A. (1979). Estimates of income for small places: an application of James-Stein procedures to census data. *Journal of the American Statistical Association*, *74*(366a), 269-277.

Fernandez, C., Ley, E., & Steel, M. F. (2001). Model uncertainty in cross-country growth regressions. *Journal of applied Econometrics*, 16(5), 563-576.

Foruzande, A. (2010). Analysis of poverty line and inflation in urban and rural areas of Isfahan province during 1998-2006, *Proceedings of the "half a century with household economics" conference.* Tehran: Statistical Center of Iran. (in Persian).

Foster, J., Greer, J., & Thorbecke, E. (1984). A class of decomposable poverty measures. *Econometrica: Journal of the Econometric Society*, 761-766.

Grivani, F., Ahmadi Shadmehri, M, & Fallahi, M. (2012). Factors affecting the poverty of rural households in North Khorasan province. *Village and Development*, 16 (3), 125-145. (in Persian).

Hartigan, J. A., & Wong, M. A. (1979). Algorithm AS 136: A k-means clustering algorithm. *Journal of the Royal Statistical Society. Series C (Applied Statistics)*, 28(1), 100-108.

Haughton, J. H., & Khandker, S. R. (2009). *Handbook on poverty and inequality*. World Bank Publications.

Hentschel, J., Lanjouw, J. O., Lanjouw, P., & Poggi, J. (2000). Combining census and survey data to trace the spatial dimensions of poverty: A case study of Ecuador. *The World Bank Economic Review*, *14*(1), 147-165.

Kiani, M., Attar, K, & Habibi, J. (2010), Calculation and analysis of urban poverty (country and 30 provinces 2009), *Proceedings of the "half a century with household economics" conference.* Tehran: Statistical Center of Iran. (in Persian).

Khodadad Kashi, F., & Shahikitash, M. (2012). Measuring the intensity of poverty in iranian rural households: a comparison with urban households. *Village and Development*, 15 (3): 41-55. (in Persian).

Heydari, M., & Sami, A. (2012) Estimation of minimum livelihood (poverty line) of urban and rural households in Razavi Khorasan province using linear expenditure system with habit formation, *Applied Economics*, 10, 57-90. (in Persian).

Lanjouw, P., Marra, M., & Nguyen Viet, C. (2013). Vietnam's evolving poverty map: patterns and implications for policy. *World Bank Policy Research Working Paper*, (6355).

Molina, I., & Rao, J. N. K. (2010). Small area estimation of poverty indicators. *Canadian Journal of Statistics*, *38*(3), 369-385.

Pirasteh, H., & Ranjbar, H. (2002) Analysis of poverty line and the effect of some macroeconomic indicators on poverty in Iran 1979-1996, *Quarterly Journal Of Economic Research And Policies*, 10 (24), 3-28. (in Persian).

Saadat, R., Ghasemi, M. (2012). Supernumerary Expenditure in Urban and Rural areas of Kermanshah and the Country (1995-2007). *The Economic Research*, 12(2), 187-206. (in Persian). Retrieved from http://ecor.modares.ac.ir/article_2262_en.html

Safarkhanlou, A. & Mohammadinejad, A. (2011). Review of the Effects of Bread Wastes on Poverty Line and Food Security Index of the Rural and Urban Household of Iran During 2001- 2007, *Development and Agricultural Economics*, 19 (75), 53-77. (in Persian).

Shahmiri Shourmasti, M. (2010). Measuring poverty line, analysis of indicators (Mazandaran province case study), *Proceedings of the "half a century with household economics" conference.* Tehran: Statistical Center of Iran. (in Persian).

Souri, D. (2009) *Geographical distribution of poverty: a tool for targeting the subsidies.* Unpublished article. (in Persian).

SRTC (2004). *Calculating poverty line in Iran during 2001-2003*, Economic Statistics Research Group, Statistical Research and Training Center, Statistical Center of Iran. (in Persian).

Zamanzadeh, H., & Shahmoradi, A. (2012). Estimating the Poverty Lines in Iran Based on Household Scale. *Journal of Economic Modeling Research*, *2*(6), 1–18. (in Persian) Retrieved from http://jemr.khu.ac.ir/article-1-133-en.html

Zibayi, M., & Shushtarian, A. (2007). Dynamics of Poverty in Iran: Application of Panel Data in Urban and Rural Areas. *Iranian Journal of Economic research*, 9(32), 55-83. (in Persian). Retrieved from http://ijer.atu.ac.ir/article_3625_en.html