Constructing Robust Poverty Trends in the Islamic Republic of Iran

2008–14

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Abstract

This paper constructs and tests the robustness of consistently measured poverty trends in the Islamic Republic of Iran after 2008, using international poverty lines based on U.S. dollars at 2011 purchasing power parity. The constructed estimates reveal three distinct periods of welfare in the Islamic Republic of Iran: increase in poverty and inequality between 2008 and 2009, decline in poverty and inequality between 2009 and 2012, and gradual deterioration of both indicators again after 2012. The results are robust regardless of the choice of welfare aggregate, inclusion or exclusion of different components, and spatial adjustment accounting for regional variation in food and housing prices.

Constructing Robust Poverty Trends in the Islamic Republic of Iran: 2008–14[1]

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1. Introduction

Accurate and timely welfare measurement is a necessary step for effective and informed policy making. Even though there are no official publicly available poverty estimates in the Islamic Republic of Iran, estimates of poverty trends exist in the academic literature. These are calculated either based on the authors' own assessment of an appropriate national line or according to international poverty lines based on US dollars. Examples of such estimates cover different periods between 1984 and 2009 and are available in Assadzadeh and Paul (2004), Salehi-Isfahani (2009), Mahmoudi (2011), and Maasoumi and Mahmoudi (2013).

According to Salehi-Isfahani (2009), the 1979 Revolution and the subsequent war disrupted economic growth, which contributed to a deterioration of welfare for Iranian households. Using the poverty lines defined in Assadzadeh and Paul (2004),[3] Salehi-Isfahani shows that poverty increased dramatically following the revolution from 29 percent in 1984 to 42 percent in 1989. After the end of the war in 1988, the period of reconstruction and reforms started. The poverty rate fell by more than 30 percentage points, declining from 42 percent in 1989 to 12 percent in 2005. Poverty gap and severity indicators improved as well which may suggest that welfare improved for the population close to the poverty line, but also for those at the bottom of the distribution (Salehi-Isfahani 2009).

The World Bank (2008) analyzed regional dimensions of poverty in the Islamic Republic of Iran in 1998-2005 using both the international poverty line ($2.9 in 2005 PPPs) and poverty lines in local currency units. Regardless of the choice of poverty line, poverty fell both in urban and rural areas and in most of the provinces. According to Maasoumi and Mahmoudi (2013), who decomposed poverty changes during the period 2000 to 2009 into growth and redistribution components, poverty declined between 2000 and 2004 and increased afterwards both in rural and urban areas. This is in line with findings in Mahmoudi (2011) who also reported an increase in poverty between 2004 and 2007.

There is, however, little knowledge about poverty trends in the Islamic Republic of Iran in the recent past, in particular after 2008, when the country's economy entered a turbulent period as a result of energy price reform, the tightening of international sanctions, and falling oil prices. The most recent international poverty estimates reported by the World Bank and based on the group data from the Household Expenditures and Income Survey (HEIS) contain only two data points, for 2009 and 2013.[4] According to this source, poverty fell between 2009 and 2013 regardless of the choice of poverty line. Inequality, measured by the Gini coefficient and based on expenditure per capita, also declined, from 42 to 37.4 percent. This limited empirical evidence should be treated with utmost caution because it is based on two points in time and could mask volatility in poverty rates especially given the shocks the Islamic Republic of Iran has experienced during this time. In particular, during this period the Islamic Republic of Iran went through sanctions, removal of energy subsidies and initiated the distribution of universal benefits through cash transfers. Therefore, constructing a consistent and reliable poverty trend by including all years is essential to better understand welfare changes in the Islamic Republic of Iran after 2008.

This working paper fills the existing knowledge gap by constructing welfare aggregates and measuring poverty rates in the Islamic Republic of Iran using publicly available data from the Household Expenditure

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[3] In particular, the rural daily poverty line in 2004 was set at 7,679 rials and the urban one at 10,886 rials.
[4] Datt (1998) discusses how group data can be used to calculate poverty rates.

and Income Survey (HEIS) that is conducted annually since 1963 in rural areas and 1968 in urban areas. Unit record data are available in an electronic format since 1984.This paper constructs the trend for the most recent 2008-2014 period. Besides the knowledge gap, this particular time period was chosen to minimize the risk of comparability between surveys due to changes in instruments and data collection process.[5] The paper explores different analytical approaches for constructing the components of the welfare aggregate as well as price adjustments, and conducts various robustness checks of poverty trends. This work may be helpful to inform discussions about establishing official poverty measurement methodology and necessary data requirements.

Poverty rates in this paper are measured using different international poverty lines expressed in USD at 2011 purchasing power parity (PPP). Using an international line helps to avoid arbitrariness and sensitivity of establishing a line in local currency units. In addition, selected international lines in this paper are used only for illustrative purposes.

This paper consists of seven sections. Section 2 briefly discusses main methodological issues in poverty measurement. Section 3 explains construction of different components of expenditure based welfare aggregate. Section 4 discusses the methodology for price adjustment. Section 5 presents robustness tests of expenditure based poverty and inequality measures. A brief robustness test of poverty trends by using income data is done in section 6. Section 7 concludes.

2. Methodological issues in poverty measurement

Measuring poverty requires two broad steps. The first step is to define an indicator to measure welfare or living standards. The second step requires setting a poverty line - the minimum welfare level below which a person is considered to be poor.

There are two most common welfare indicators for poverty measurement: consumption and income per capita derived from survey data. The choice between them is often made based on the social-economic conditions of the country chosen for the analysis and microdata collected. Income is usually used to measure welfare in rich and developed countries. For example, poverty in most of European Union countries is measured by income, but in most of the developing world consumption is deemed a better measure for poverty as income suffers from measurement error and tends to be underreported (Azzarri et al. 2010). Consumption includes both purchased goods, services and home production and is believed to be a better candidate to measure lifetime welfare in less developed countries. Consumption can be better measured than income in countries where agriculture and self-employment are important employment options. Consumption is also less subject to seasonal volatility in rural areas compared to income and is more likely to be representative of general welfare (Coudouel, Hentschel and Wodon 2012; Haughton and Khandker 2014). Using income for poverty measurement may have its benefits as well. For example, contributions to change in income poverty can be established by income sources and this information will be very useful and easy to use for policy recommendations. Indeed, a recent paper by Meyers and Sullivan (2009) argues

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[5] One caveat is that information on changes in sample frame in the selected period was not available in open sources. In order to test the robustness of obtained trend the team re-estimated poverty without survey weights. Results are qualitatively the same and available upon request.

that even for a developed country like the United States, consumption is a better measure especially for those at the lower end of the distribution.

In this paper we use expenditure as a basis for poverty and inequality measurement but also examine the income data and compare trends using both income and consumption measures.

Whatever welfare indicator is chosen, it is necessary to aggregate information provided at the household or individual level. The main guiding principle for the welfare aggregate is to make it as comprehensive as possible, but minimizing measurement errors through inclusion of components which may be noisy. For example, food consumption, typically, includes own production, transfers and food eaten outside home which pose challenges during the data collection phase. Nonfood consumption usually excludes lumpy infrequent expenditures (e.g. funerals, weddings), investment and items which are hard to estimate accurately (public goods). Durables require a special treatment because they are bought at a particular point in time, but consumed over a period of several years. Therefore, consumption should include only the annual use value of a durable rather than purchase value. The same principle should be applied to measure the value of housing services (Deaton and Zaidi 2002, Haughton and Khandker 2014).

There is no consensus in the literature on whether health and education expenditures should be included. One argument to exclude health expenditures is because they may reflect a regrettable necessity and do not contribute to welfare (e.g. expenditure to treat cancer). In contrast, preventive care expenditure clearly contributes to higher utility and welfare, but practically it is often difficult to distinguish between them. Education expenditures are another controversial item because they are associated with investment in the future rather than current consumption. Nevertheless, this component is often included in the welfare aggregate following standard national income accounting practice (Deaton and Zaidi 2002).

Having constructed the welfare aggregate, there is a need to make additional adjustments to facilitate ranking of individuals or households. One of the most important adjustments is spatial and inter-temporal deflation to account for temporal and spatial difference in prices faced by the population. The second important change is related to adjustment of the welfare aggregate for household composition. This can be done by simply dividing household consumption by total household size or by taking into account economy of scale and equivalence scale.

After adjusting the welfare aggregate as described above, the second step is construction of a poverty line which is intrinsically linked to the measure of welfare. The welfare aggregate and the poverty line should be coherently measured. Households whose consumption expenditures or income fall below this line are considered poor. Defining a national official poverty line is a long empirical process led by national authorities of the country. Broadly speaking, it requires many steps including defining an average nutritional requirement or multiple requirements depending on the method chosen, costs of meeting energy requirement and the nonfood component (Ravallion 1998).

For the purpose of international comparison, international poverty lines are often used. The most widely used poverty lines are 1.25 USD at 2005 PPP and its equivalent in 2011 PPP - 1.90 USD (Ferreira et al. 2015). They were established by the World Bank as averages of the national poverty lines of the 15 poorest developing countries expressed in PPP terms to monitor global extreme poverty (Chen and Ravallion 2010). Higher international poverty lines can be used by countries to measure wellbeing if necessary. In this report international poverty lines are used based on USD in 2011 PPPs.

In order to estimate poverty trends it is important to make sure that numbers are consistently measured across time (Haughton and Khandker 2014). Firstly, the sampling frame and survey instruments should not change during the period selected for the analysis. As shown in Beegle et al. (2010), changes in recall period and how consumption data are collected may result in significantly different poverty rates. Secondly, the welfare aggregate should be defined consistently across years. For example, excluding health expenditures in the first year and including them in the second will make poverty estimates between these years not comparable. Thirdly, the timing of survey work should be the same across years. This is especially important for the surveys without inter-temporal stratification within a year and with high seasonality in economic activities.

3. Expenditure-based welfare aggregate and its components

The Household Expenditure and Income Survey (HEIS) has been conducted annually by the Statistical Center of Iran (SCI) since 1963 in rural areas and 1968 in urban areas. The unit record data from 1984 onward are publicly available.[6] The survey is nationally representative and two-stage stratified. Strata information, however, is not publicly available for all years. Households are distributed randomly and evenly throughout the year, making one-twelfth of the sample interviewed each month. However, the month of interview information is publicly available only from 2008 onwards. Sample sizes vary over the years ranging from 5,759 households in 1986 to 39,856 households in 2014.

Gregorian notations for years are used in this report, but the actual survey period is left as it is shown in the HEIS: March to March. For example, year 2010 means the survey period between March 2010 and March 2011.

HEIS includes both demographic and income information but its main focus is on expenditures. Surveys collect expenditure information on more than 1,000 items. The recall period of expenditures for most items is the last month. For durables, some education expenses, insurance expenditures, investment in housing and farms, and income components, the recall period is the last 12 months. Like in most surveys of such type, income and expenditure data are self-reported. HEIS does not distinguish between how much is spent and how much is consumed and reports only expenditures on a particular item. For items, which were not purchased, an estimated value is provided.

The food component of the welfare aggregate includes purchases or the estimated value of all food products bought or received for free. Food expenditures in restaurants and dining facilities are also included in food. The non-food component aggregates the following groups of expenditures: tobacco, miscellaneous, hotel, leisure, communication, transport, furniture, housing, clothing, actual and estimated rent, education, and health insurance.

As discussed above, there are no clear rules on whether education and health expenditures should be included or excluded from the welfare aggregate and the decision depends mainly on the country context. Following Deaton and Zaidi (2012), the elasticity of education and health expenditures with respect to total expenditure per capita has been estimated to determine whether education and health expenditures are closely associated with wellbeing. The point is to keep expenditures with high elasticities to total expenditures. As is often observed in other countries, elasticity of education expenditures is higher than

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[6] Data points were downloaded in January 2016.

elasticity of health expenditures for the pooled sample during 2008-2014: 1.22 versus 0.98 respectively.[7] Given the difficulty of distinguishing between health expenditures that increase utility and those considered a regrettable necessity, the decision was to drop health expenditure as a whole. Health insurance is included as it is clearly related to preventive care and as a result associated with higher utility and welfare. Education expenditures are also included in the welfare aggregate.

The HEIS survey collects very limited information on stocks of durables. Information on their current prices, age or conditions is not available. This does not allow estimating the annualized flow of consumption and the decision was to exclude purchases of durables from the welfare aggregate.

Including or excluding health expenditures and durables results in parallel shifts in average expenditure per capita (figure 1), while impacts on poverty and inequality indicators are shown later in the text. Summing up, our preferred option is the welfare aggregate excluding durables and health, but including health insurance and education expenditure.

Figure 1. Average welfare aggregate by years excluding different components
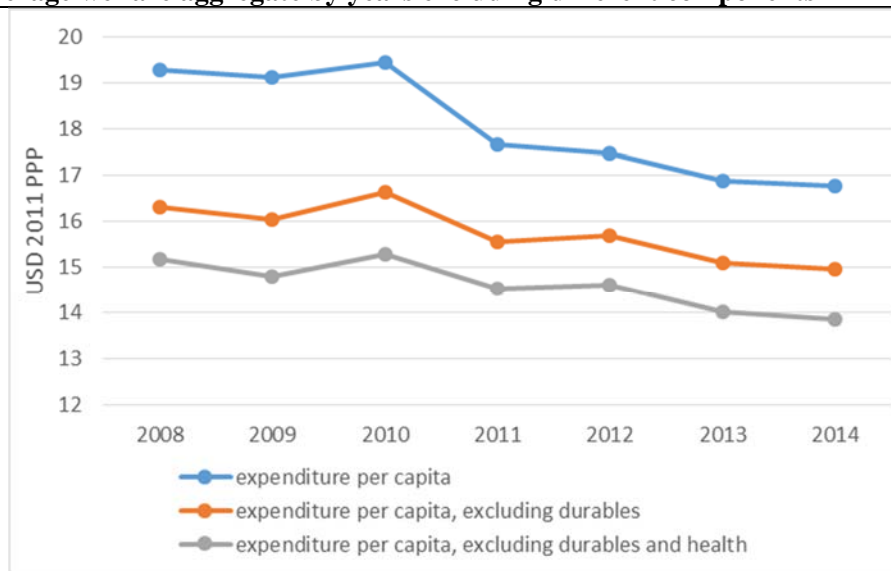
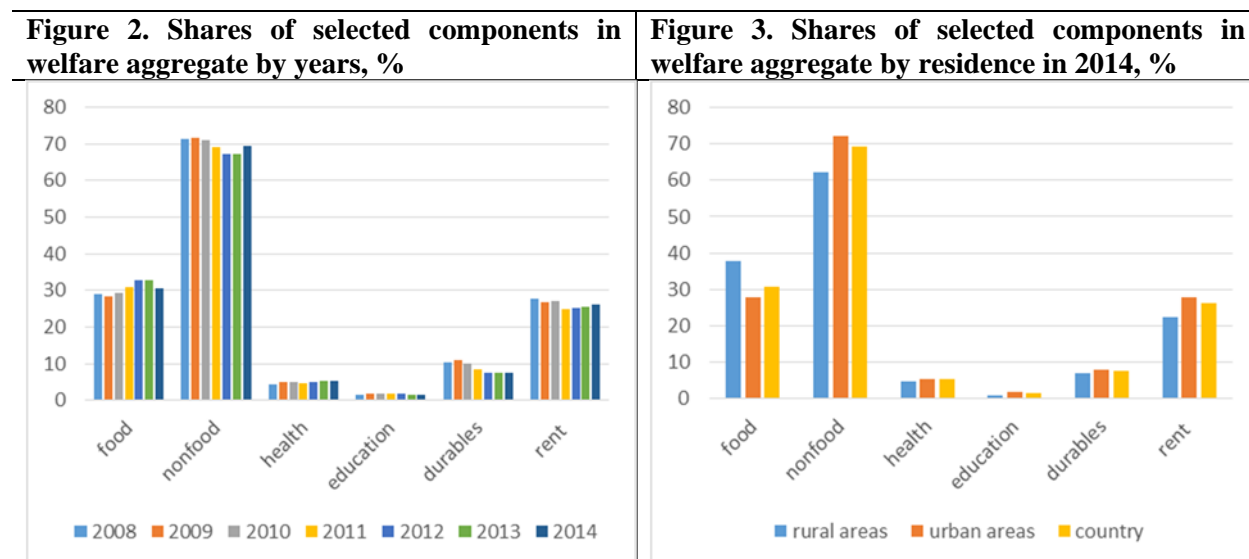Source: Authors' calculation using HEIS 2008-2014.
Note: Spatially adjusted welfare aggregate is used for calculation.

Shares of different components across place of residence and years are shown below. On average, households in the Islamic Republic of Iran spend about 31 percent of total expenditures on food and 69 percent on nonfood products and services. Actual and estimated rent expenditures is one of the largest single components accounting for about 26 percent of total expenditure on average between 2008 and 2014.[8] Shares are relatively stable across years with a slight increase in food expenditure shares during 2012 and 2013, consistent with negative economic shocks during this period. Unsurprisingly, food shares are higher

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[7] The regressions are run on welfare aggregates and its components after inter-temporal and spatial deflation. In order to keep zero expenditures on health and education, the inverse hyperbolic sine transformation was applied, which approximates the logarithm for large values (Burbidge, Magee, and Robb 1988). For education expenditure, the sample was limited to households with kids (6-22 age).
[8] Households in the HEIS are asked about their actual rent expenditures if they are renting their dwellings and the estimated rents if they own them.

in rural areas, while nonfood shares are higher in urban areas (mostly because of higher shares of rent expenditures) as shown in figure 3 using data from 2014.

Figure 2. Shares of selected components in welfare aggregate by years, %	**Figure 3. Shares of selected components in welfare aggregate by residence in 2014, %**

Source: Authors' calculation using HEIS 2008-2014.
Note: Spatially adjusted welfare aggregate including durables and health is used here for calculation.

4. Adjustments to the welfare aggregate

4.1 Sources of inflation data in the Islamic Republic of Iran

There are two sources of inflation data in the Islamic Republic of Iran. Price data are collected in urban and rural areas by the Statistical Centre of Iran, while the Central Bank collects price data in urban areas only. The decision was to use inflation collected by SCI given its coverage of rural and urban areas and observed differences in inflation rates across place of residence. Rural and urban population sizes from HEIS were used to construct a weighted inflation index for the whole country.[9] Figure 4 shows inflation rates (year on year) and figure 5 shows the inflation index with 2011 year as a base from SCI and CBI. As clearly seen, rural inflation was higher than urban inflation in 2010-2012 (figure 4) leading to a lower weighted CPI index (higher inflation compared to 2011) from SCI than CBI index before 2011 (figure 5). Applying the CBI price index will result in slightly higher poverty rates, but it does not change the trend as shown in the annex.

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[9] There are different options how weighted CPI can be constructed. Two approaches have been tested. The first one used shares of urban and rural population to get weighted CPI, while the second approach used expenditure shares of rural and urban population. The difference between the two estimates is minimal (results are available upon request). Population weighted CPI was chosen because it gives higher weight to rural inflation than expenditure based weighted CPI. Assigning higher weight to rural CPI seems to be important if one wants inflation rates to capture better prices the poor rural population face.
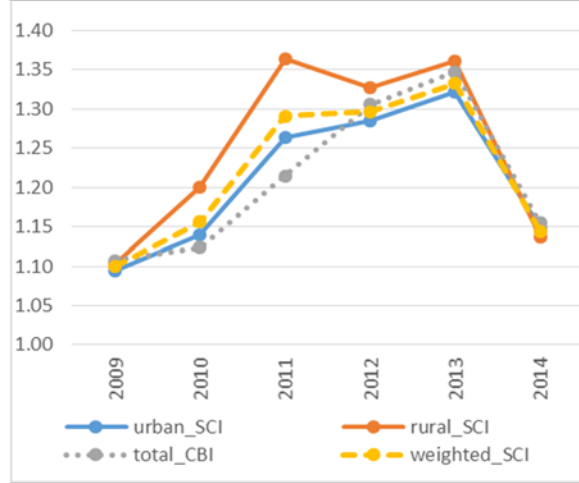
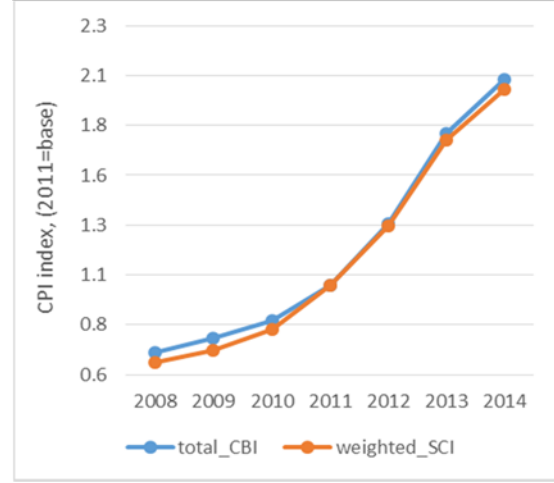| Figure 4. Inflation rates from different sources, yoy	Figure 5. CPI series from different sources, index with 2011 as a base

Source: SCI and CBI, authors' calculations.
Note: Population weights were used from HEIS 2008-2014 to calculate weighted inflation for the country using rural and urban inflation rates from SCI.

4.2 Inter-temporal deflation

The welfare aggregate should be adjusted for inter-temporal price variation within and across years. Within year deflation is important because data the collection period is spread over one year. In the case of high inflation within a year, households surveyed at the end of the year may have higher nominal expenditures than households surveyed at the beginning of the year simply because of inflation.

Monthly weighted prices from SCI were used for within-year temporal deflation. The goal is to make sure within each year prices are rebased to a particular point in time. Average yearly inflation index was used to rebase monthly CPI. This new index is used to convert all expenditures to average yearly prices. A simple example of CPI rebasing is shown in table 1.

Table 1. Example of rebasing CPI in 2005 to do within a year deflation

period	CPI	yearly average	CPI, rebased to average
2005:1	39.7		39.7/39.81 = 0.997
2005:2	39.4		0.989
2005:3	39.3		0.987
2005:4	39.0		0.981
2005:5	39.0		0.979
2005:6	39.1	**39.81**	0.982
2005:7	39.4		0.990
2005:8	39.8		1.000
2005:9	40.2		1.010
2005:10	40.5		1.018
2005:11	40.9		1.027
2005:12	41.5		1.043

Source: Authors' calculations.

Month of interview is known for each household in the survey. Given that for all expenditures (except durables) the recall period is last month, shifting the time of interview by one month gives the actual period of expenditures reported. Monthly rebased CPI is then applied to deflate the components of welfare aggregate within each year.

Across year deflation is done to keep welfare aggregates in similar prices. Given that expenditure per capita is transformed into USD in 2011 PPPs, welfare aggregates in each year are inflated or deflated to be in 2011 prices using SCI CPI.

4.3 Spatial deflation

Spatial deflation is another important step to make sure the welfare aggregate is corrected for differences in prices across space. Two different deflators were constructed for this purpose: food and rent. The food spatial deflator is constructed from unit values of purchased food products (excluding tobacco) and is based on Paashe price index following Deaton and Zaidi (2002). Paashe index is calculated using the formula below

$$P_P = \left(\sum_{k=1}^{K} w_{hk} * \frac{P_{0k}}{P_{hk}} \right)^{-1},$$

where w_{hk} is the share of household h's budget devoted to good k. P_0 is reference price vector. P_h is vector of prices household face. For spatial deflator, food unit prices are used to calculate household level deflators, which are then averaged to the regional level separately for urban and rural areas (called sub-regions further in the text). The whole process is described below.

Unit food prices are calculated by dividing inter-temporally (within-year) adjusted expenditures by purchased quantities. To make sure prices are calculated for consistent units, all quantities are transformed to kilograms. Products with zero or missing quantities are dropped. Products observed less than six times at the national level are dropped as well. Finally, outliers in unit prices at sub-regional level - lower or higher than 2.5 standard deviation from the mean – were identified and replaced by missing values. Missing values were replaced by median values at the lowest possible level starting from sub-regional level, followed by rural/urban and finally the national level. Households with zero expenditure were assigned imputed values using unit prices and quantities.

Household level deflators are constructed for each product by dividing household level prices over median prices at the national level. For each household average deflator is constructed using expenditure shares of different products as the weight. Thereafter, average deflators for each rural and urban area of seven regions are calculated and will be applied to each household for spatial adjustment.[10] Simple illustration of this procedure is shown in table 2.

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[10] Using sub-regional averages as deflators is easier for communication than having household specific deflators and is more robust to extreme values.

Table 2. Food deflator calculation: example

			1	2	3=1/2	4	5=3*4
Region	Household id	product	Household level price	country median price	Deflator, for each product and household	Expenditure shares	deflator at household level
Tehran	1	bread	6.1	6	1.02	0.8	
Tehran	1	milk	4.2	4	1.05	0.2	1.023
Tehran	2	bread	6.2	6	1.03	0.7	
Tehran	2	sugar	5.5	5	1.10	0.3	1.05
Tehran	3	bread	6.1	6	1.02	0.6	
Tehran	3	milk	4.1	4	1.03	0.4	1.02
average deflator applied for all households in Tehran area							1.03

The food-based spatial deflator is shown in figure 6. As expected, the highest food prices are observed in Tehran. Food prices there are on average 10 percent higher than the country average in selected years. The Caspian is another region where urban food prices are higher for all years except 2008 and 2009 than the country average. Consistently, in all regions except Southeast, urban food prices are higher than rural ones.

Figure 6. Spatial food deflator by rural and urban areas of different regions, index
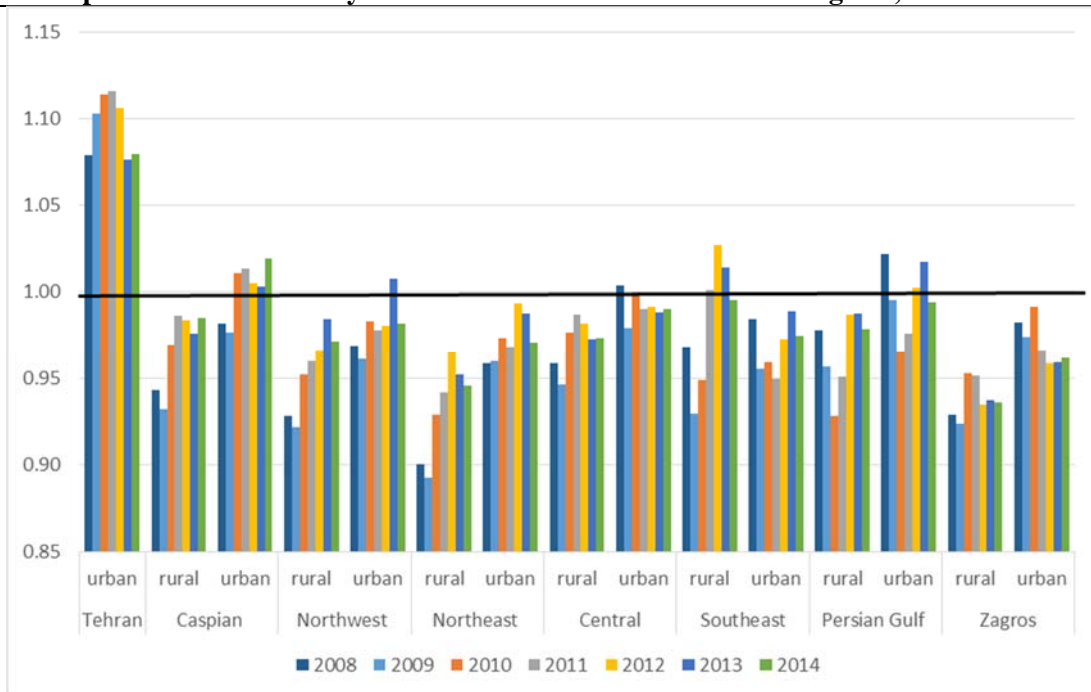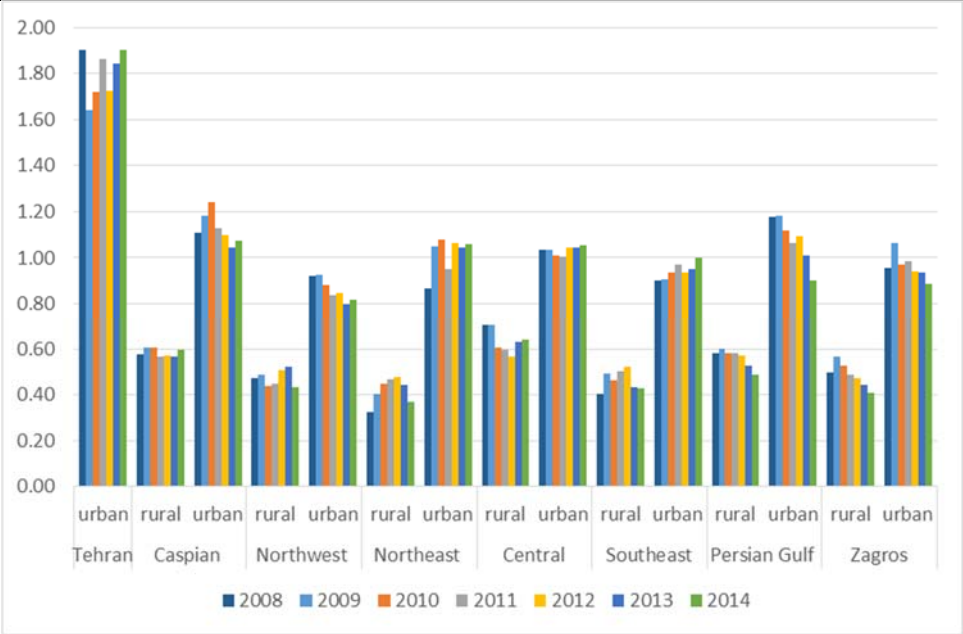

Source: Authors' calculation using HEIS 2008-2014.
Notes: Country average prices are used as the base.

Ideally, the nonfood part of the welfare aggregate should be adjusted by the regional nonfood deflator. However, unit prices for nonfood products do not exist in the survey, while ancillary data on non-food prices are not available. This will also require disaggregated CPI data by rural and urban areas for different regions. One possibility to overcome this limitation is to construct a rent deflator which would at least help to correct differences in housing prices across space.

A hedonic regression model is estimated based on actual and estimated rents to predict the average rent for 15 sub-regions and the country as a whole for a typical dwelling (coefficients from the regression based on 2014 year are shown in the annex for illustration). In particular, the most common dwelling selected has 4 rooms with a total area of 90 square meters in a building with bricks and metal frame with access to piped water, electricity, and natural gas. The dwelling also has a kitchen and a cooler. The results are shown in figure 7. As one would expect, rents in metropolitan areas of Tehran are substantially higher than the country average. In particular, rents in Tehran are higher on average by 80 percent. In all urban areas across different regions, rents are higher than in rural areas.

Figure 7. Spatial rent deflator by rural and urban areas of different regions, index

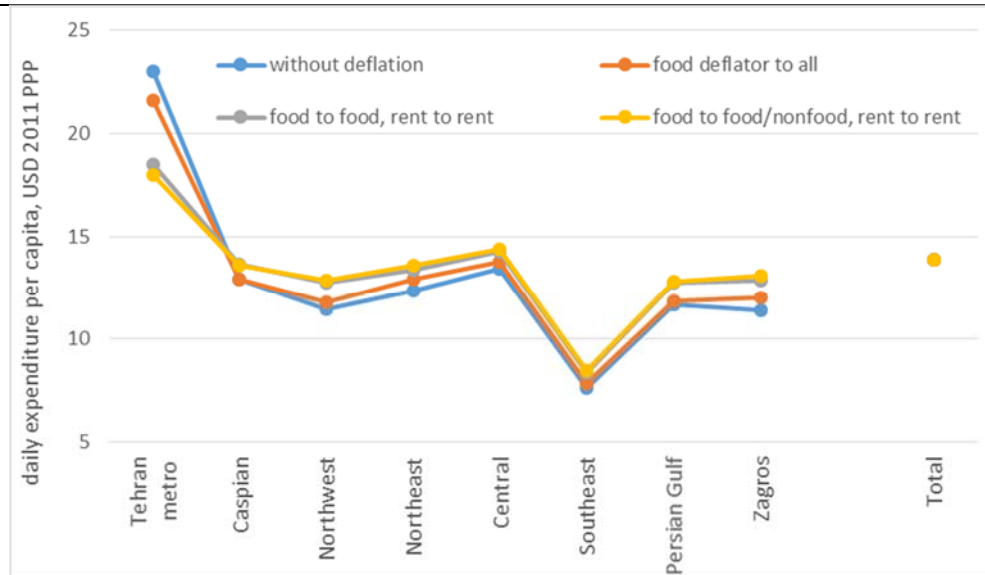Source: Authors' calculation using HEIS 2008-2014.
Notes: Country average prices are used as the base.

Having constructed food and rent deflators, spatial variation in prices can be addressed in several ways. The first option is to apply the food deflator to all components of the welfare aggregate. This will have the least strong impact on the aggregate because the differences in food prices are not high. The second option is to apply the food deflator to the food component, the rent deflator to the rent component and leave everything else without spatial adjustment. The third option is to apply the food deflator to the food component, the rent deflator to rent and the food deflator to the remaining nonfood expenditures. Importantly, the welfare aggregate and its components are normalized after spatial deflation to make sure the mean of nominal and spatially adjusted aggregates stay the same.[11] The third option was selected as a preferred one. Expenditures per capita in 2014 for seven regions are shown in figure 8, while robustness checks of poverty estimates to different choices is presented in the next section. After spatial deflation,

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[11] After spatial deflation, we need to make sure the mean of welfare aggregate does not change which is called normalization. It is simply a rescaling of spatially adjusted aggregate to have the same mean as it used to be before spatial adjustment. Normalized overall aggregate does not equal to sum of normalized components. If one needs normalized components to sum up to total aggregate, total aggregate should be reconstructed from normalized components. In our case, food, non-food and rent sub-components were used to reconstruct the total aggregate.

areas with high prices have lower expenditures (e.g. Tehran), while areas with low prices have higher expenditures (e.g. Northwest). As a result of spatial deflation, regional variation in wellbeing is reduced.

Figure 8. Expenditure per capita for different spatial adjustment by regions in 2014, USD 2011 PPP

Source: Authors' calculation using HEIS 2008-2014.
Notes: Welfare aggregate without durables and health is used for calculations.

5. Robustness checks of expenditure-based poverty and inequality estimates

As discussed above, the following options were selected for the preferred welfare aggregate. The welfare aggregate excludes expenditures on health and durables. Its food component is spatially deflated by the food deflator, its rent component by the rent deflator, and its nonfood expenditures by the food deflator. This section shows poverty and inequality rates for the preferred welfare aggregate and also compares them with estimates for other options to test for the robustness of the obtained results.

5.1 Choice of poverty line

Given that international poverty lines are used, there is flexibility in the choice of a particular line to measure poverty. Figure 7 shows poverty rates for four daily poverty lines: 4, 5.5, 8 and 10 USD in 2011 PPPs. Three distinct trends emerge regardless of the value of the poverty lines. Poverty increased between 2008 and 2009, then it fell during 2009-2012, and finally increased during 2012-2014. As shown in the annex, there are statistically significant differences in poverty rates between 2009, 2012 and 2014 years based on interval estimates and forming U-shape trend.

The headcount poverty rates for different poverty lines can be also expressed by constructing cumulative distribution functions (CDF). The CDF, for any selected level of expenditure per capita, gives the proportion of people who have expenditure per capita below that level. Evidently, there is first-order stochastic dominance of expenditure per capita distribution in 2008 over 2009, 2012 over 2009 and 2012 over 2014 for any point in the curves for expenditure per capita between 4 and 10 USD 2011 PPP. In other

words, the precise choice of poverty line is unimportant and does not affect the trend for this part of the distribution covering almost 60 percent of the population in the Islamic Republic of Iran. Hence trends in poverty are unaffected by the choice of the poverty line.
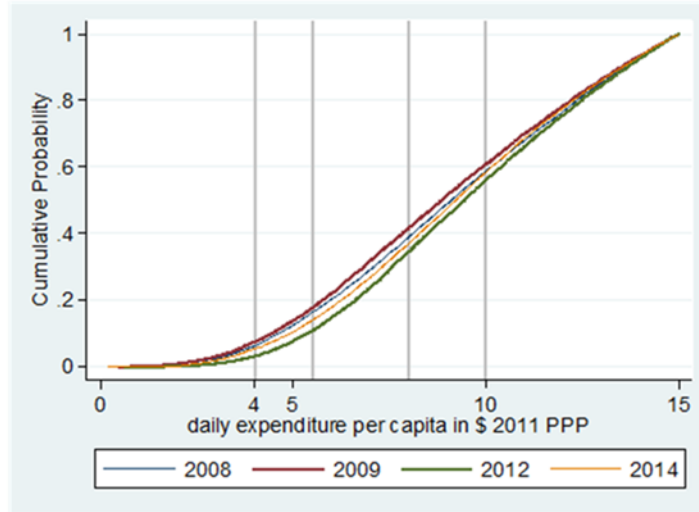
Figure 9. Poverty rates at different poverty lines in 2011 PPPs, %
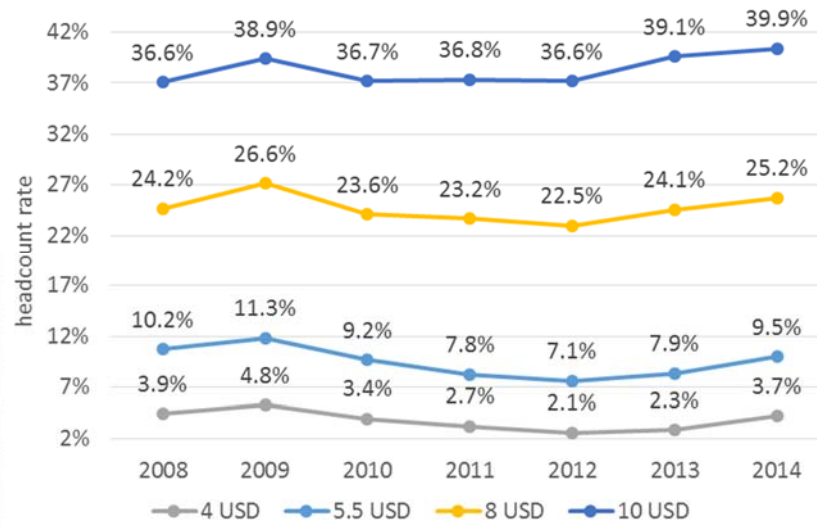
Source: Authors' calculation using HEIS 2008-2014.
Note: Spatially adjusted welfare aggregate without durables and health is used for calculations.

Figure 10. Cumulative Distribution Functions of welfare aggregate and different daily poverty lines in 2011 PPPs, %

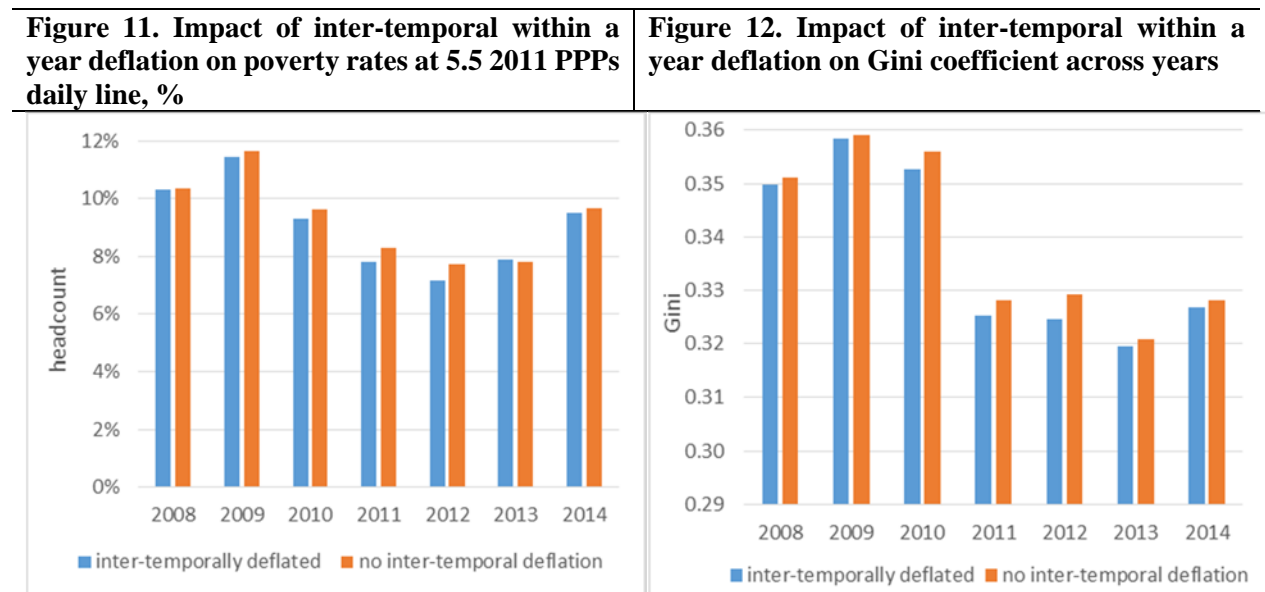Source: Authors' calculation using HEIS 2008-2014.
Note: Spatially adjusted welfare aggregate without durables and health is used for calculations.

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5.2 Impact of inter-temporal and spatial deflation

Figures 11 and 12 compare poverty rates at 5.5 USD 2011 PPP line and the Gini coefficient for the welfare aggregate adjusted for within-year inflation. As can be seen, inter-temporal deflation within a year does not have a large impact on inequality and poverty and does not change the observed trends.

The impact on poverty and inequality of different choices in spatial adjustments are shown in figures 13 and 14. In contrast to the inter-temporal within-year deflation, using food and rent deflators for spatial adjustment has a much stronger impact on the welfare aggregate, and as a result on poverty and inequality. In particular, poverty is on average one percentage point lower if the food deflator is applied to the welfare aggregate. Using the rent deflator has a stronger impact. Poverty on average is about three percentage points lower if the rent deflator is applied to the rent part of the welfare aggregate. Given that by construction spatial adjustment does not affect the mean of the welfare aggregate, the difference comes from changes in the distribution of the welfare aggregate.

| Figure 11. Impact of inter-temporal within a year deflation on poverty rates at 5.5 2011 PPPs daily line, %	Figure 12. Impact of inter-temporal within a year deflation on Gini coefficient across years

Source: Authors' calculation using HEIS 2008-2014.
Note: Welfare aggregate without durables and health is used for calculations.

Households from poor areas with low prices become richer after deflation, while households from rich metropolitan areas with high prices become poorer. Overall, spatial deflation narrows the regional gap in poverty rates. The level of inequality, measured by the Gini coefficient, becomes lower after accounting for spatial differences in food and rent prices. Importantly, spatial adjustment does not affect the trends, but rather the levels of poverty and inequality.[12]

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[12] Re-ranking of population after spatial adjustment was tested using the 2014 HEIS. The Spearmen coefficient for households ranked by two welfare aggregates (nominal and spatially adjusted using rent and food deflator) is about 0.97.
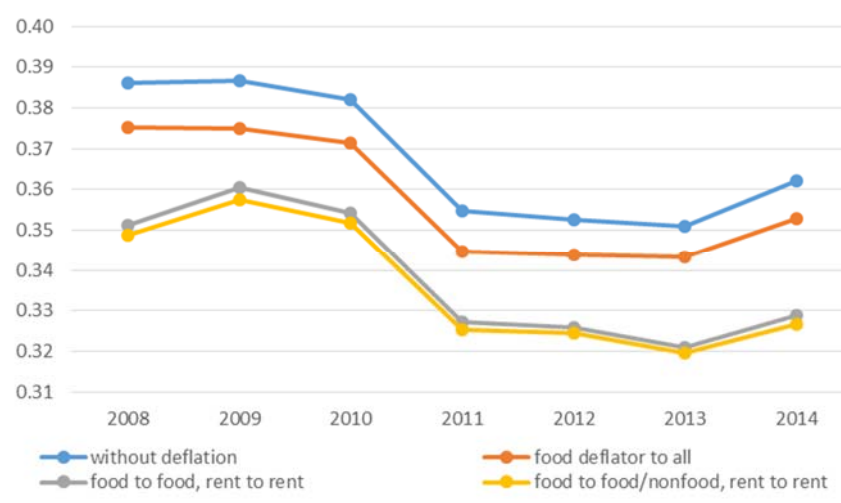
Figure 13. Impact of spatial adjustment on poverty rates at 5.5 USD in 2011 PPPs
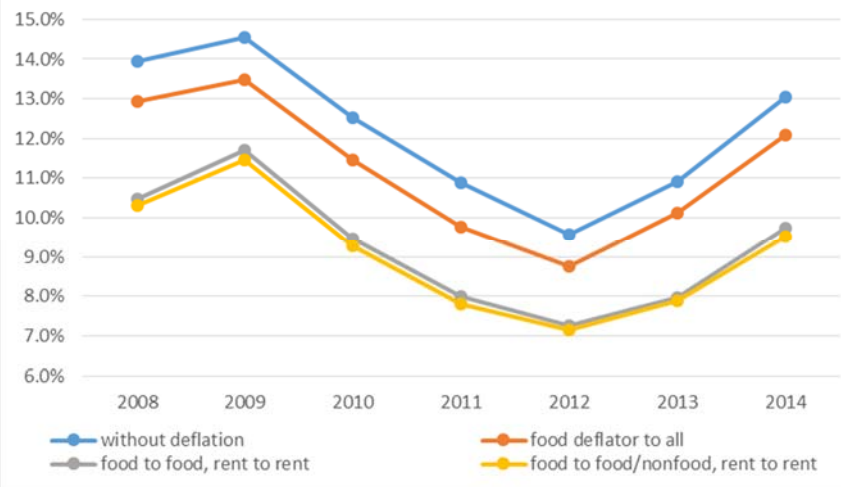
Source: Authors' calculation using HEIS 2008-2014.
Note: Welfare aggregate without durables and health is used for calculations.

Figure 14. Impact of spatial adjustment on Gini coefficient

Source: Authors' calculation using HEIS 2008-2014.
Note: Welfare aggregate without durables and health is used for calculations.

5.3 Impact of inclusion and exclusion of different components

As it was mentioned above, the preferred welfare aggregate excludes expenditures on health and durables. The impact of this decision on poverty and inequality is tested below. Exclusion of durables increases poverty by about one percentage point. The same happens if health expenditures are excluded as well. The impact on inequality is the reverse, with inequality falling if both durables and health expenditures are excluded. Trends in poverty and inequality remain the same, while exclusion of components impacts only the levels.

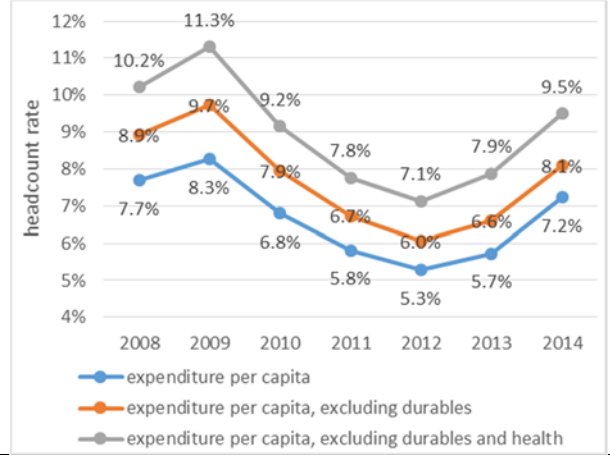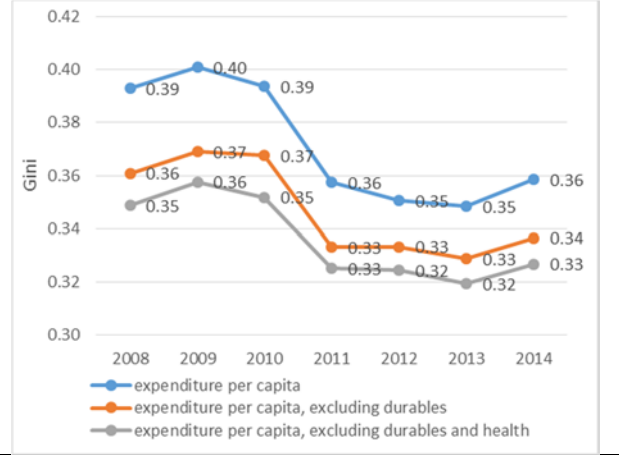| Figure 15. Exclusion components of welfare aggregate and poverty rates at 5.5 2011 PPPs daily line, %	Figure 16. Exclusion components of welfare aggregate and Gini coefficient

Source: Authors' calculation using HEIS 2008-2014.
Note: Spatially adjusted welfare aggregate is used for calculations.

5.4 Welfare aggregate and access to selected durables

One important requirement for the welfare aggregate is its ability to correctly sort out people along the wealth ladder. Possession of certain durables is often used as an important indicator of wealth. Figure 17 shows distribution of cars, computers and dishwashers among the population by expenditure per capita quintiles using the preferred spatially adjusted welfare aggregate without durables and health. Clearly, the poorest households are less likely to possess computers, cars and dishwashers compared to wealthier ones. For example, literally no one in the bottom quintile has a dishwasher compared to 67 percent owning one in the top quintile. The steep gradient in ownership of selected durables across quintiles corresponds well with expectations – as households become better-off they are more likely to own cars, computers and dishwashers. This can be viewed as supporting evidence that the constructed welfare aggregate appears to be sorting households in the way one expects.

Figure 17. Access to durables across expenditure per capita quintiles in 2013
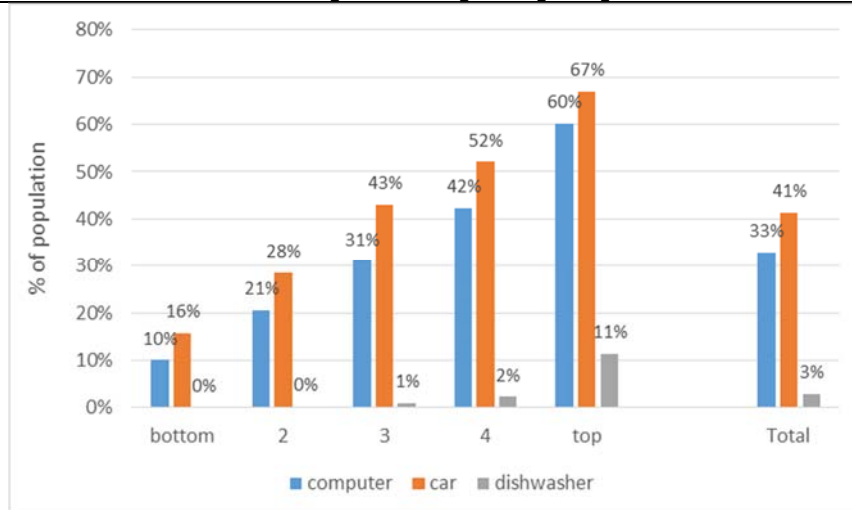
6. Robustness of poverty and inequality trends using income data

HEIS contains rich information on labor market indicators and income. Even though using consumption/expenditure data is preferable to measure poverty in developing countries, construction of income poverty estimates may help to check consistency and robustness of consumption based poverty trends. This section briefly discusses creation of the income welfare aggregate and compares poverty and inequality estimates for income and expenditure.

6.1 Income aggregate and its components

The proposed total income aggregate broadly consists of labor income, social assistance, transfers, pensions, property income (interests, capital, land, and rent) and income from products sold from home. Labor income includes net total income from wage and salaried jobs and self-employment during the last 12 months. Social assistance is a stand-alone component covering only cash transfers. Given the recall period of 12 months, intertemporal deflation within a year has not been done. In order to do spatial adjustment a weighted spatial deflator was constructed by combining rent and food deflators. Shares of rent in the total welfare aggregate were used to construct a weighted deflator for each household.

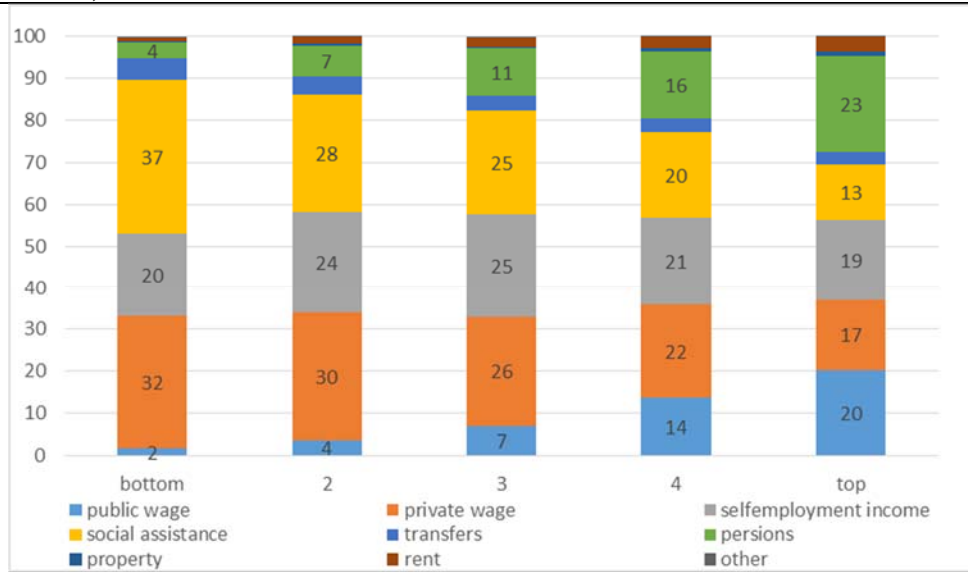**Figure 18. Shares of income components in income welfare aggregate across years, %**
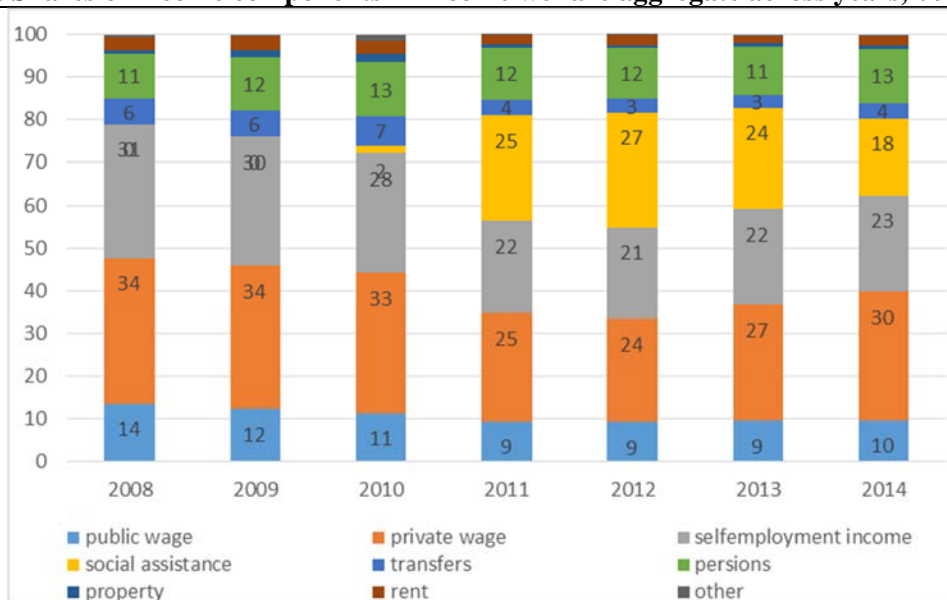
Source: Authors' calculation using HEIS 2008-2014.
Note: Spatially adjusted income aggregate. Households with zero total income were excluded from calculations.

Figure 18 shows the shares of different income components across years. Labor income is the largest component of the aggregate, accounting on average for 65 percent of total income. Self-employment income and private wages dominate labor earnings, while public wages play a less important role. The share of labor earnings has been gradually declining over time. The importance of self-employment income is

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associated with high employment rates in agriculture and high shares of self-employment. For example, about 19 percent of all employed in 2014 had primary employment in agriculture based on the HEIS. About 40 percent of all employed in 2014 reported their primary job being associated with self-employment. Social assistance started playing a very important role after 2010 accounting on average for 23 percent of total income aggregate.

Figure 19. Shares of income components in income welfare aggregate across expenditure per capita quintiles in 2011, %

Source: Authors' calculation using HEIS 2008-2014.
Note: Spatially adjusted income aggregate. Households with zero total income were excluded from calculations.

Different income components play different roles across the distribution. Figure 19 shows the shares of income sources by expenditure per capita quintiles in 2011. Social assistance and private wages play the most important role for the poorest bottom quintile. Self-employment income plays a more important role for the population in the middle of the distribution, while pensions and public wages are more important for the richest top quintile.

6.2 Income-based poverty and inequality

Poverty headcount rates for expenditure and income per capita welfare aggregates are shown in figure 20. Two poverty estimates are produced for the income aggregate for comparison: nominal and spatially adjusted. Income poverty rates are higher than the ones based on expenditure per capita and are more volatile. Inequality rates are also lower if expenditures are used. Spatial adjustment results in parallel downward shifts of both inequality and poverty measures. In spite of changes in the levels, trends in both indicators are more or less the same regardless of the choice of welfare aggregates. For example, for poverty one may distinguish three periods: increase (2008-2009), decline (2009-2012) and increase again (2012-2014). Two distinct periods can be identified for inequality: decline (2009-2012) and increase (2012-2014). Overall, poverty and inequality trends match for these two periods: 2009-2012 and 2012-2014.

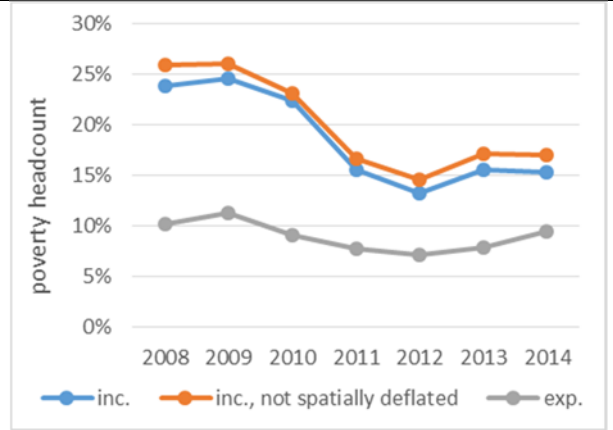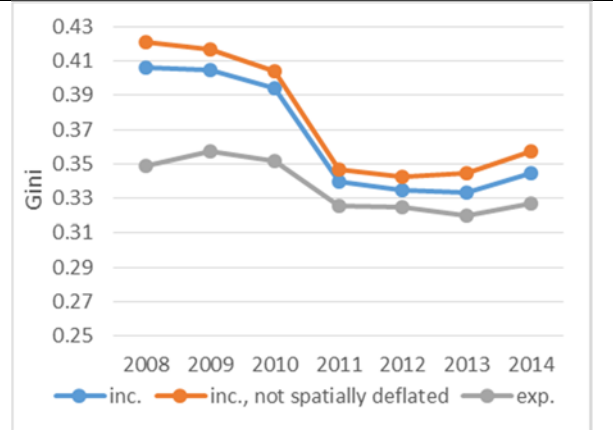| **Figure 20. Poverty rates by income and expenditure per capita aggregates across years, 5 USD 2011 PPP**	**Figure 21. Gini by income and expenditure per capita aggregates across years**

Source: Authors' calculation using HEIS 2008-2014.
Note: Spatially adjusted income per capita is used.

Income is on average lower than expenditures, but the gap is gradually falling with years. In spite of similar trends, levels of poverty in figure 20 are quite different depending on whether income or expenditures are used. Income based poverty is constantly higher, but the gap started to narrow after 2010 This happened because the difference between income and expenditure per capita average levels dropped from 28 to 15 percent between 2008 and 2014. This is clearly seen from figures 22 and 23 which show cumulative distribution functions for both aggregates.

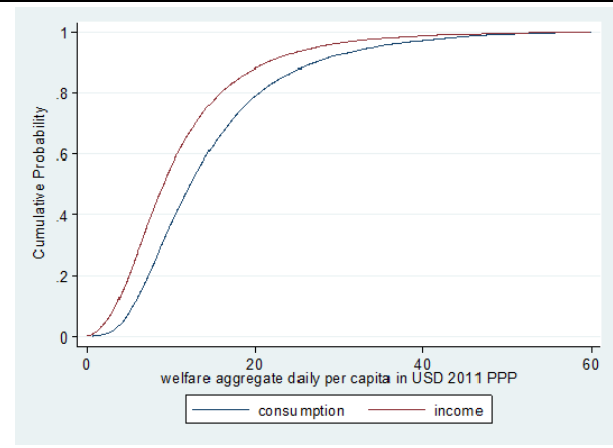| **Figure 22. Cumulative Distributive Functions using income and expenditure per capita in 2008**	**Figure 23. Cumulative Distributive Functions using income and expenditure per capita in 2014**
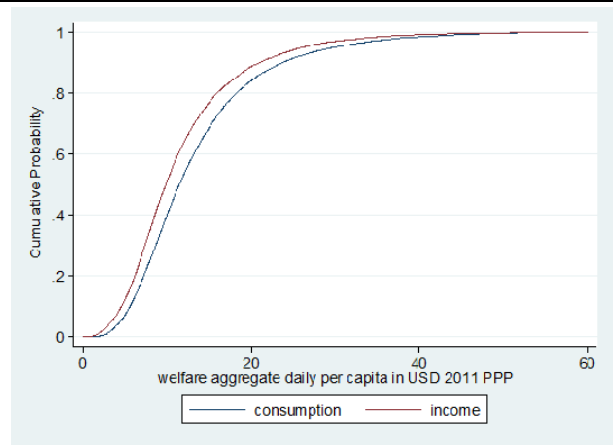
Source: Authors' calculation using HEIS 2008-2014.
Note: Spatially adjusted aggregates are used. Negative incomes are dropped.

Income underreporting is a common phenomenon in developing countries. Existing differences in reported income and consumption are well documented in the literature (Deaton 1997, Azzarri et al. 2010). Income is usually found to be under-reported in developing countries household budget surveys. For example, Azzarri et al. (2010) showed using rural household data that in most of the 17 developing and transition countries analyzed income is lower than consumption. In particular, the ratio of per capita income

to per capita consumption ranged from 0.3 to 0.8 in these countries. In Iran, this ratio is higher if rural areas are considered and it was increasing from 0.86 in 2008 to 0.98 in 2014. Income underreporting is more pronounced in urban areas and among households from the top deciles based on expenditure per capita (figures 24 and 25). Overall income and expenditure convergence is probably linked to the distribution of universal subsidies after 2010.
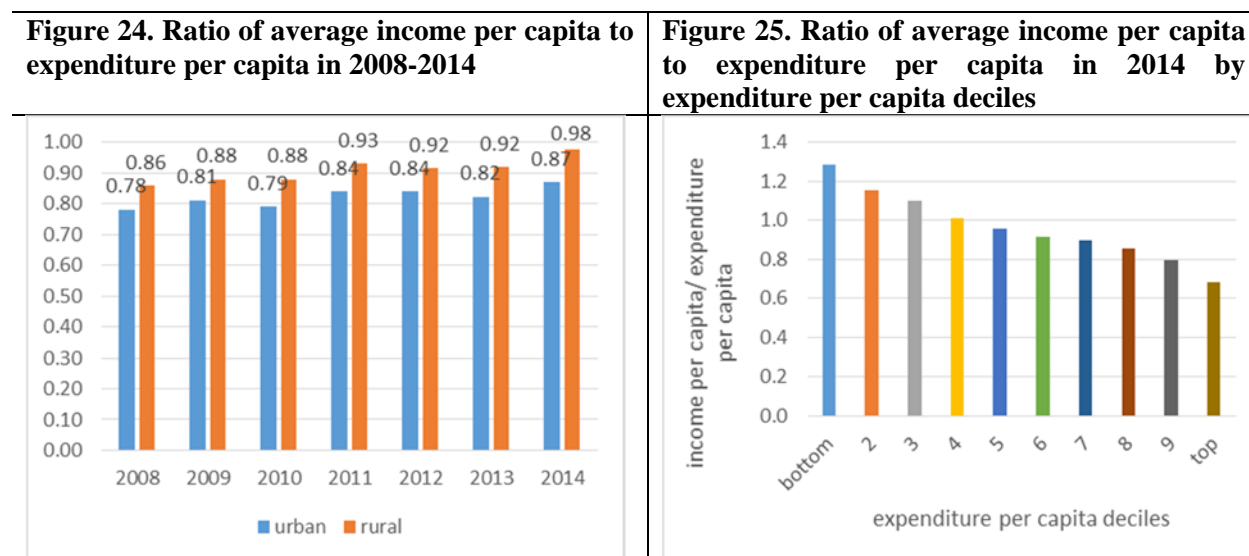
Figure 24. Ratio of average income per capita to expenditure per capita in 2008-2014	Figure 25. Ratio of average income per capita to expenditure per capita in 2014 by expenditure per capita deciles

Source: Authors' calculation using HEIS 2008-2014.
Note: Spatially adjusted income aggregate. Households with zero and negative income are included in the calculations.

In spite of changes in ranking among the population while using expenditure or income, most of it happens in the range of one or two deciles. Table 3 shows the percentages of the population who preserved or changed their ranking across deciles based on income and expenditure per capita using the 2008-2014 pooled sample. Thus, about 40 percent of the population from the poorest expenditure-based decile are also in the poorest income-based decile. In spite of the observed re-ranking, still 80 percent from the poorest expenditure-based decile concentrate in the three poorest income based deciles.

Table 3. Distribution of population by expenditure and income per capita quintiles in 2008-2014 pooled sample, %

		income per capita deciles									
		bottom	2	3	4	5	6	7	8	9	top
expenditure per capita deciles	bottom	40	24	14	8	5	3	2	1	1	0
	2	19	22	18	13	10	7	5	3	2	1
	3	12	16	18	15	12	10	8	5	3	2
	4	8	12	15	15	14	12	9	7	5	2
	5	7	9	12	14	14	14	12	10	6	3
	6	5	7	9	12	14	14	14	12	10	5
	7	3	4	6	9	12	14	15	15	13	8
	8	3	3	5	7	9	13	15	17	17	13
	9	2	2	2	4	7	9	13	18	22	21
	top	1	1	1	2	3	5	8	12	22	45

Source: Authors' calculation using HEIS 2008-2014.
Note: Spatially adjusted income aggregate. Households with zero and negative income are included in the calculations.

7. Conclusion

This working paper constructed poverty trends in the Islamic Republic of Iran during 2008-2014 using international poverty lines expressed in USD 2011 PPPs. The constructed estimates reveal three distinct periods regardless of the choice of poverty line (4-10 USD 2011 PPP daily), the way the welfare aggregate is constructed and adjusted, and whether income or expenditure is used. We distinguished three periods: The first period is between 2008 and 2009 when both poverty and inequality were increasing, the second period is between 2009 and 2012 when poverty and inequality were declining, and the third period spanning from 2012 to 2014 exhibited increasing poverty and inequality.

Proposed exclusion of durables and health components from welfare aggregate increases poverty rates measured at 5.5 USD 2011 PPP by 2-3 percentage points, but does not affect the trends. Correcting the welfare aggregate for spatial differences in food prices has a minimal impact on poverty rates. However, spatial adjustment for differences in nonfood prices substantially narrows the welfare gap between regions and rural and urban areas given the high share of nonfood expenditures and large variation in rents used to spatially deflate the rent component of the welfare aggregate.

Ownership of selected durables was constructed across the distribution of the preferred spatially adjusted welfare aggregate. The better-off households were naturally found to have better access to cars, computers and dishwashers, which can be viewed as supporting evidence that the constructed the welfare aggregate appears to be sorting households in the way one expects.

Finally, as an additional robustness check, income-based welfare measures were constructed. Income poverty is higher than expenditure poverty, probably because of underreporting. Nevertheless, trends in both series are qualitatively very similar.

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Figure A1. Impact of using CBI and SCI inflation on poverty rates at 5.5 USD 2011 PPP
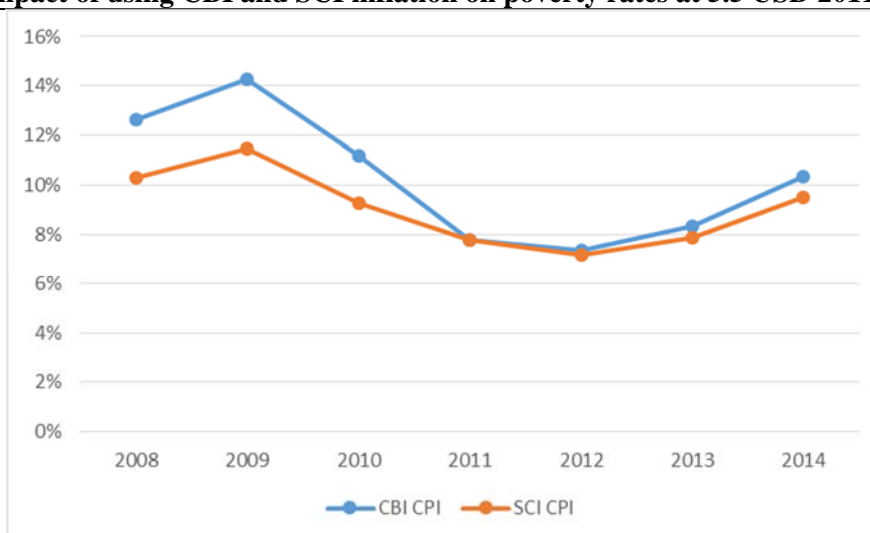
Source: Authors' calculation using HEIS 2008-2014.

Note: Welfare aggregate without durables and health is used for calculations.

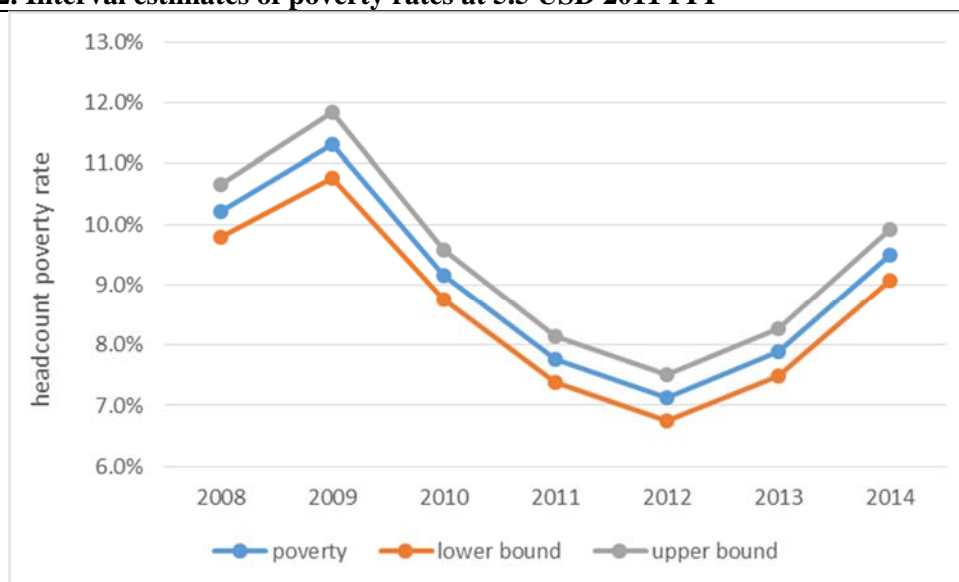**Table A1. Regression explaining differences in rent expenditure in 2014**

Variable	coefficient
Tehran	omitted
Caspian (rural)	-1.157***
Caspian (urban)	-0.569***
Northwest (rural)	-1.480***
Northwest (urban)	-0.846***
Northeast (rural)	-1.639***
Northeast (urban)	-0.586***
Central(rural)	-1.087***
Central(urban)	-0.589***
Southeast(rural)	-1.488***
Southeast(urban)	-0.643***
Persian Gulf (rural)	-1.360***
Persian Gulf (urban)	-0.744***
Zagros(rural)	-1.540***
Zagros(urban)	-0.760***
number of rooms	0.0700***
Area	0.00377***
Brick and steel or stone and steel	omitted
Brick and wood or stone and wood	-0.170***
Cement blocks	-0.0362**
Bricks only or stone and brick	-0.0202
Wood only	-0.121
Clay and wood	-0.273***
Clay and mud	-0.352***
Other	-0.0243
Metal	0.148***
Cement	0.134***

Piped water	0.0555**
Electricity	0.725***
Natural gas	0.257***
Kitchen	0.189***
Cooler	0.112***
Central AC	0.390***
Central heating	0.599***
Compact heating system	0.317***
Gas cooler	0.152***
Sewage	0.318***
Constant	13.44***
Observations	34,275
R-squared	0.615

Source: Authors' calculation using HEIS 2014.
Note: *** 1% level of significance, ** 5% and * 10% accordingly.

Figure A2. Interval estimates of poverty rates at 5.5 USD 2011 PPP

Source: Authors' calculation using HEIS 2008-2014.
Note: Welfare aggregate without durables and health is used for calculations.