Bidimensional Decomposition of Welfare Distribution in Iran

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Abstract

After Hamilton (2001) and Costa (2001) many empirical and analytical studies (Gong and Meng (2007), Barrett and Brzozowski (2008), …) have manipulated and extended Engel's law to estimate CPI bias and regional price differences. However, there is not yet any study on Iran in which the biases in spatial prices or price indices are discriminated.

In this study we suggest that bidimensional social welfare perspectives may contribute very well to policy implications intending to protect Iranian households. To do so, first, we use Hamilton's approach to estimate a Spatial Price Index (SPI) helping us to have a better household welfare criterion. Second, using a developed version of Gini bidimensional decomposition, we find the contribution of rural and urban areas to inequality. Our decomposition method is an improved version of Mussard (2004) bidimensional decomposition method.

Our results indicate that while Iranian authorities repeatedly have claimed that income inequalities have improved after the targeted cutting of subsidies in 2011, the above improvement is due to a bias in regional price indices.

Keywords: bidimensional decomposition, welfare distribution, Iran.

JEL: D12, D31, D33, D63, E31, R12.

1. Introduction

Measures of income distributions are seen as one of the most important standards of welfare by most policy makers and economists. But income and welfare measures are not fully consistent with each other. One of the problems of the distribution of income as a measure of welfare is regional differences. E.g. prices may be different in different regions and therefore with the same amount of money we may reach different levels of welfare. This problem can also exist because of heterogeneous qualities and habits. Consumers' habits could be significantly very different among different groups and populations while their income levels are the same. The purpose of this study is twofold: first, we investigate a suitable measure for analyzing spatial distribution of welfare in Iran. Second, using an improved version of bidimensional decomposition method, we decompose our welfare measure among regional and income groups to trace the sources of inequality.

Hamilton (2001) and Costa (2001), separately, used Engel's law to estimate the bias in the US consumer price index. Their analyses are based on the idea that if the CPI is an accurate measure of the cost of living then CPI-deflated Engel curves (food-share equations expressed as a function of real expenditure) estimated at different points in time should not be significantly different. Hamilton (2001) recommends that the Engel's curve approach may also be extended to estimate movement in a true cost-of-living index for different races, age groups, geographic areas, and so on for developing countries with adequate household survey data.

We add another interpretation to the Hamilton's CPI bias. If income or expenditures were suitable measures for welfare, in an Engel's curve two hypothetical persons with the same share of food expenditure living in two different cities with the same levels of prices should have had the same level of income or total expenditure as well; otherwise, there is a bias in amount of expenditures. In Hamilton's approach we accrue this bias to CPI and estimate a multiplier correct for this bias. In other words, the hypothetical two persons we defined should have the same levels of welfare because they are spending the same share of their income on food.

Therefore the structure of this study will be like this: First, we estimate food Engel curves for Iran using the Household and Income Expenditure Survey (HIES) of the period 2008 -2012. We then employ them to estimate the spatial bias in the price indices to get a new measure for measuring welfare. Finally, we decompose welfare distributions with respect to inequality sources.

2. Model

Our analysis will happen in two steps. First, we use Hamilton's approach to estimate a Spatial Price Index (SPI) helping us to have a better household welfare criterion. Then, using a developed version of Gini bidimensional decomposition, we find the contribution of different sources, e.g., rural and urban areas[1], to inequality. Our decomposition method is an improved version of Mussard (2004)

[1] This decomposition may be conducted with respect to other sources as well. E.g. we may decompose the contribution of food and non-food expenses to inequality.

bidimensional decomposition method. In continue we elaborate on each of the above steps.

2.1 Capturing spatial price index

Consider the following Almost Ideal Demand System of food expenditures by Deaton and Muellbauer's (1980):

(1) $\omega_{ijt} = \phi + \gamma\left(ln\, P_{jt}^{f} - ln\, P_{jt}^{n}\right) + \beta\left(ln\, Y_{ijt} - ln\, P_{jt}\right) + \sum_x \theta_x X_{ijt} + \mu_{ijt}$

In which $\mathrm{Y_{ijt}}$ is the income level (or total expenditure) of family i living in province j at period t. $\mathrm{P_{jt}}$, $\mathrm{P_{jt}^{f}}$, and $\mathrm{P_{jt}^{n}}$ are the true but unobserved price indices of all goods, food and nonfood goods in province j at period t.

Hamilton (2001), Costa (2001), Gong and Meng (2007), Barrett and Brzozowski (2008), and many others have clarified that, using Engel's law, we may estimate the error in the administrative price indices $\mathrm{P_{jt}^{*}}$ for region j at time t. This error may be defined as:

(2) $$\ln\left(1 + \mathrm{E_{jt}}\right) = \ln \mathrm{P_{jt}^{*}} - \ln \mathrm{P}_{jt}$$

Inserting the above definitions in equation (1) we see the role of errors. Since we are interested in dynamic and spatial biases, we add time and province dummy variables to capture $\mathrm{E_{jt}}$:

(3) $$\omega_{ijt} = \phi + \gamma\left(ln\, P_{jt}^{f*} - ln\, P_{jt}^{n*}\right) + \beta\left(ln\, Y_{ijt} - ln\, P_{jt}^{*}\right) + \sum_x \theta_x X_{ijt} + \sum_t \delta_t D_t + \sum_j \delta_j D_j + \mu_{ijt}$$

Then we may write:

(4) $$\ln\left(1 + \mathrm{E_{jt}}\right) = \frac{-\delta_t - \delta_j}{\beta}.$$

If we do not use the data of different years, equation (*3*) may not be directly estimated because the dummy variables and the intercept are not independent. To solve this problem we use pooled data of different years.[2] Another fact is the nominal regional price differences that one may add to estimate the errors[3]:

(5) $$\ln\left(1 + \mathrm{E_{jt}}\right) = \frac{-\delta_t - \delta_j + \gamma\left(\ln \mathrm{P_{jt}^{f*}} - \ln \mathrm{P_{jt}^{n*}}\right)}{\beta}.$$

[2] So we do not have the spatial price indices for each year but the average for a period. This issue made us to devise two scenarios. First, we consider just one period (i.e. 2008 to 2013); second, we depart the period: before cutting subsidies (2008 to 2010) and after that (20011 to 2012).

[3] See equation 9 in Hamilton 2001 for more information on this.

However, we abstract from the effect of price differences between food and non-food goods in this study. Having these errors estimated we can multiply all expenses by that. Therefore, inequality analysis may be based on this new measure, i.e income times the following expression:

(6) $$SPI_{t,j} = EXP(\frac{-\delta_t - \delta_j}{\beta}).$$

According to Gini coefficient's properties, the time's elements will have no effect on the inequality's indices, so we ignore them in our calculation.

(7) $$SPI_j = EXP(\frac{-\delta_j}{\beta}).$$

2.2 Decomposition method

Starting from Mussard (2004), we know that we can decompose Gini coefficient according to regions and income sources simultaneously:

(8) $$G = \sum_{m=1}^{q} \left(\frac{\sum_{j=1}^{k} \left(\sum_{i=1}^{n_j} \sum_{r=1}^{n_j} \left(x_{j,i}^{m} + x_{j,r}^{m} - 2x_{j,ir}^{*m} \right) \right)}{2\mu n^2} \right) + \sum_{m=1}^{q} \left(\frac{2\sum_{j=2}^{k} \sum_{h=1}^{j=1} \left(\sum_{i=1}^{n_j} \sum_{h=1}^{n_h} \left(x_{j,i}^{m} + x_{h,r}^{m} - 2x_{jh,ir}^{*m} \right) \right)}{2\mu n^2} \right).$$

In above and following equations we employ the following notations:

K: number of subgroups.

q: number of income sources.

n : Total population.

μ : Total income (Cost) mean.

G : Total Gini coefficient.

G_w : Within group Gini coefficient.

G_b : Between group Gini coefficient.

n_r : Population of rth group.

G_r : Gini coefficient of rth group.

$P_r = \frac{n_r}{n}$: Population share of r^th group.

$S_r = \frac{n_r \mu_r}{n \mu}$: Income share of r^th group.

$\bar{x}_r$: Income (Cost) mean in r^th group.

x_{ri} : Income (Cost) of i^th person of r^th group.

x_{ri}^{m} : Income (Cost) of i^th person of rth group from m^th income source.

$\bar{x}_r^{m}$: Income (Cost) mean in r^th group from m^th income source.

G_r^{m} : Gini coefficient of r^th group in m^th income source.

G_{rh} : Gini coefficient between r^th group and h^th group.

G_{rh}^{m} : Gini coefficient between r^th group and h^th group from m^th income source.

$x_{j,i}^{m}$: Income (Cost) of i^th person of rth group from m^th income source.

$x_{j,ir}^{*m} = \min(x_{j,i}^{m}, x_{j,r}^{m})$

The first part of Equation (8) demonstrates the inequality within k groups, respect to q sources of income (cost). And second part is the inequality between groups. Obviously, no one can distinguish the Gini coefficient for each individual group for just one income source. And it is also sophisticated.

From this point, we try to introduce an improved version of Gini decomposition which is rather simple and one could obtain share of individual group and single source of income (cost) from total inequality. Bourguignon (1979) shows that one could decompose Gini coefficient to within and between group:

(9) $$G = G_w + G_b$$

where:

(10) $$G_w = \sum_{r=1}^{K} P_r S_r G_r$$

and

(11) $$G_r = \frac{\sum_{i=1}^{n_r} \sum_{j=1}^{n_r} \left| x_{ri} - x_{rj} \right|}{2 n_r^2 \bar{x}_r} .$$

Following Rao (1969) we reorder the income data in descending order to write equation (11) in the following more practical form:

(12) $$G_r = \frac{\sum_{i=1}^{n_r}\sum_{j\geq i}^{n_r}(x_{ri} - x_{rj})}{n_r^2 \bar{x}_r}.$$

To distinguish inequality sources, we may write:

$$\begin{aligned}
G_r &= \frac{\sum_{i=1}^{n_r}\sum_{j\geq i}^{n_r}(x_{ri} - x_{rj})}{n_r^2 \bar{x}_r} \\
&= \frac{\sum_{i=1}^{n_r}\sum_{j\geq i}^{n_r}(\sum_{m=1}^{M} x_{ri}^{m} - \sum_{m=1}^{M} x_{rj}^{m})}{n_r^2 \bar{x}_r} \\
&= \frac{\sum_{i=1}^{n_r}\sum_{j\geq i}^{n_r}\sum_{m=1}^{M}(x_{ri}^{m} - x_{rj}^{m})}{n_r^2 \bar{x}_r} \\
&= \sum_{m=1}^{M}\frac{\sum_{i=1}^{n_r}\sum_{j\geq i}^{n_r}(x_{ri}^{m} - x_{rj}^{m})}{n_r^2 \bar{x}_r} \\
&= \sum_{m=1}^{M}\frac{\bar{x}_r^{m}}{\bar{x}_r}\cdot\frac{\sum_{i=1}^{n_r}\sum_{j\geq i}^{n_r}(x_{ri}^{m} - x_{rj}^{m})}{n_r^2 \bar{x}_r^{m}}
\end{aligned}$$

i.e:

(13) $$= \sum_{m=1}^{M}\frac{\bar{x}_r^{m}}{\bar{x}_r}\cdot G_r^{m}$$

so:

(14) $$G_w = \sum_{r=1}^{K}\sum_{m=1}^{M}\frac{\bar{x}_r^{m}}{\bar{x}_r}P_r S_r G_r^{m}\ .$$

First part of Gini decomposition to income (cost) source was done. For the second part, we try to decompose G_b. According to Bhattacharya and Mahalanobis (1967), G_b defined as below:

(15) $$G_b = \sum_{r=2}^{k}\sum_{h=1}^{j-1}(p_r s_h + p_h s_r)G_{rh}$$

, in which

(16) $$G_{rh} = \frac{\sum_{i=1}^{n_r}\sum_{j=1}^{n_h}\left|x_{ri} - x_{hj}\right|}{n_r n_h\left(\bar{x}_r + \bar{x}_h\right)}.$$

Now we try to define a new function:

(17) $$F_{hj}^{ri} = \mathrm{sgn}(x_{ri} - x_{hj}).$$

Combining (16) and (17) yields:

(18) $$G_{rh} = \frac{\sum_{i=1}^{n_r}\sum_{j=1}^{n_h}F_{ri}^{hj}(x_{ri} - x_{hj})}{n_r n_h\left(\bar{x}_r + \bar{x}_h\right)}.$$

Adding the income source to (18), would read to:

(19) $$\begin{aligned} G_{rh} &= \frac{\sum_{i=1}^{n_r}\sum_{j=1}^{n_h}F_{ri}^{hj}(x_{ri} - x_{hj})}{n_r n_h\left(\bar{x}_r + \bar{x}_h\right)} \\ &= \frac{\sum_{i=1}^{n_r}\sum_{j=1}^{n_h}F_{ri}^{hj}\left(\sum_{m=1}^{M}x_{ri}^{m} - \sum_{m=1}^{M}x_{hj}^{m}\right)}{n_r n_h\left(\bar{x}_r + \bar{x}_h\right)} \\ &= \frac{\sum_{i=1}^{n_r}\sum_{j=1}^{n_h}\sum_{m=1}^{M}F_{ri}^{hj}(x_{ri}^{m} - x_{hj}^{m})}{n_r n_h\left(\bar{x}_r + \bar{x}_h\right)} \\ &= \sum_{m=1}^{M}\frac{\sum_{i=1}^{n_r}\sum_{j=1}^{n_h}F_{ri}^{hj}(x_{ri}^{m} - x_{hj}^{m})}{n_r n_h\left(\bar{x}_r + \bar{x}_h\right)} \\ &= \sum_{m=1}^{M}\frac{\bar{x}_r^{m} + \bar{x}_r^{m}}{\bar{x}_r + \bar{x}_h}\cdot\frac{\sum_{i=1}^{n_r}\sum_{j=1}^{n_h}F_{ri}^{hj}(x_{ri}^{m} - x_{hj}^{m})}{n_r n_h\left(\bar{x}_r^{m} + \bar{x}_r^{m}\right)} \end{aligned}$$

(20) $$= \sum_{m=1}^{M}\frac{\bar{x}_r^{m} + \bar{x}_r^{m}}{\bar{x}_r + \bar{x}_h}G_{rh}^{m}$$

According to (15) and (20) have:

(21) $$G_b = \sum_{r=2}^{k}\sum_{h=1}^{j-1}\sum_{m=1}^{M}\frac{\bar{x}_r^{m} + \bar{x}_r^{m}}{\bar{x}_r + \bar{x}_h}(p_r s_h + p_h s_r)G_{rh}^{m}$$

and using equations (9), (14) and (21), we achieve the final relation:

(22) $$G = \sum_{r=1}^{K}\sum_{m=1}^{M}\frac{\bar{x}_r^{m}}{\bar{x}_r}P_r S_r G_r^{m} + \sum_{r=2}^{k}\sum_{h=1}^{j-1}\sum_{m=1}^{M}\frac{\bar{x}_r^{m} + \bar{x}_h^{m}}{\bar{x}_r + \bar{x}_h}(p_r s_h + p_h s_r)G_{rh}^{m}$$

i.e. bidimensional decomposition. Now we may trace the sources of variations in Gini coefficients with respect to the Gini of each bidimensional subgroups/sources.

3. Results

We use Household Income and Expenditure Survey (HIES) by the Statistical Center of Iran (SCI). This data has been gathered since 1963, though its basic definitions are mostly compatible after 1974. We use the series from 2008 to 2012. Our distributive implications are based on household level data in urban and rural regions; however, we incorporate individuals' behavior in capturing the spatial price index.

In Figure 1 Gini coefficients of year 2008 to 2012 are calculated in three ways. First, based on the total costs of each family in HIES. Based on this trend, as Iranian authorities truly stated, the distributions after targeted cutting of subsidies in 2011 are clearly diminishing. Second, we have used the whole data from 2008 to 2012 to estimate one SPI for rural and urban areas of each province. These SPIs are depicted in Figure 2 and is called "SPI 1 part" in Figure 1. After multiplying all expenses by the corresponding SPI, surprisingly, the level of Gini coefficient has moved up. This is unexpected because normally provinces with the lower level of expenses are multiplied by a higher SPI. This is probably because distribution of expenses in these kinds of provinces is less equitable.[4]

Third, as is seen in regression results of table 1, we have estimated SPIs once before cutting subsidies (2008-2010), and once after this policy is implemented at 2011 (2011-2012). This SPI which is estimated separately based on the two period 2008-2010 and 2011-2012 is called "SPI 2 part". With this change Gini coefficients after and before conducting the policy at 2011 is at most unchanged.

[4] This may be shown by decomposing the Gini inequality index with respect to provinces; however, we postpone that to future researches.

Figure 1: Gini coefficient of the whole country diminishes after 2011 based on the data, while it does not after correcting for the SPI of after and before cutting subsidies (SPI 2 part)

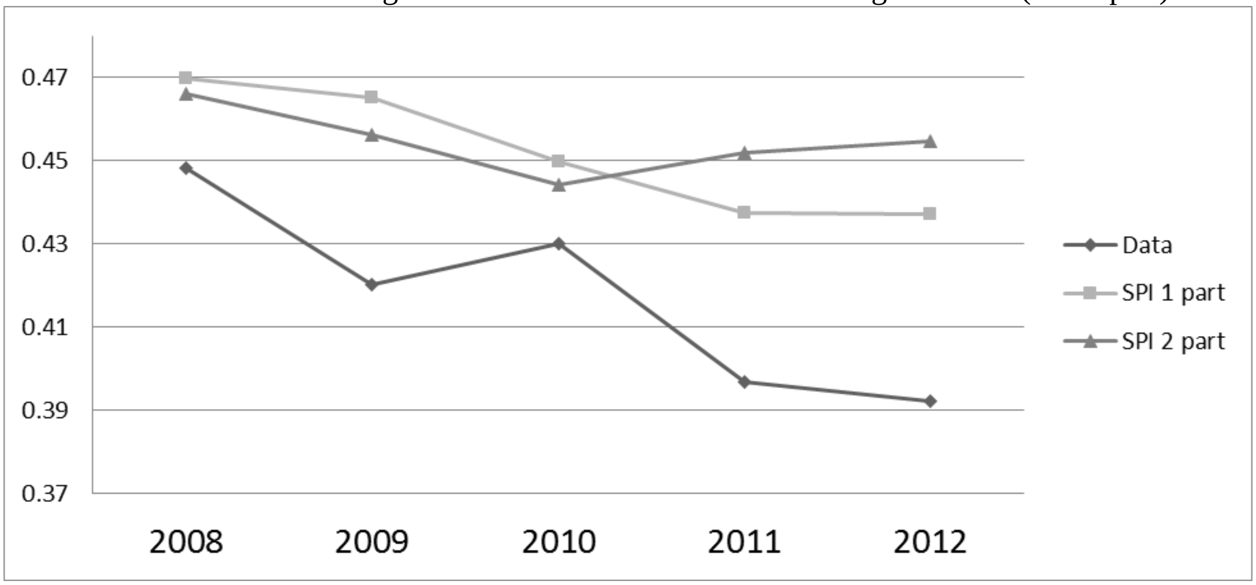


Figure 2: Calculated SPIs

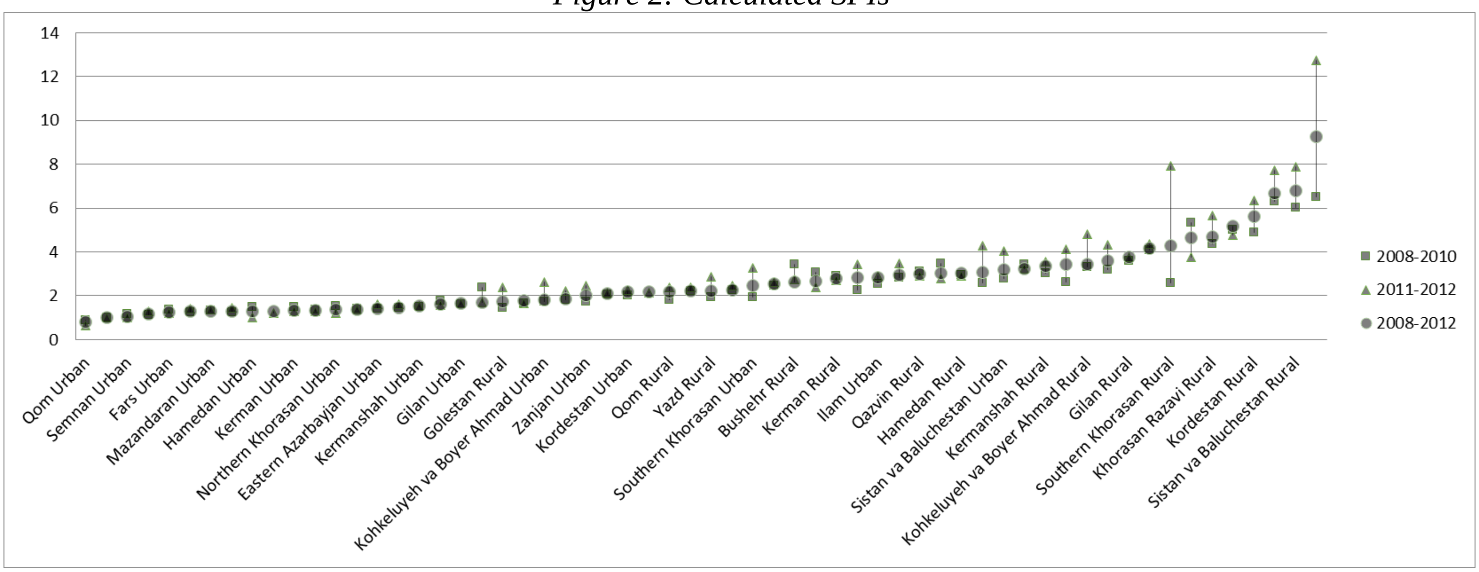


Figure 3: Gini coefficient of urban areas rapidly diminishes after 2011 based on the data, while it mostly remains unchanged after correcting for the SPI of after and before cutting subsidies

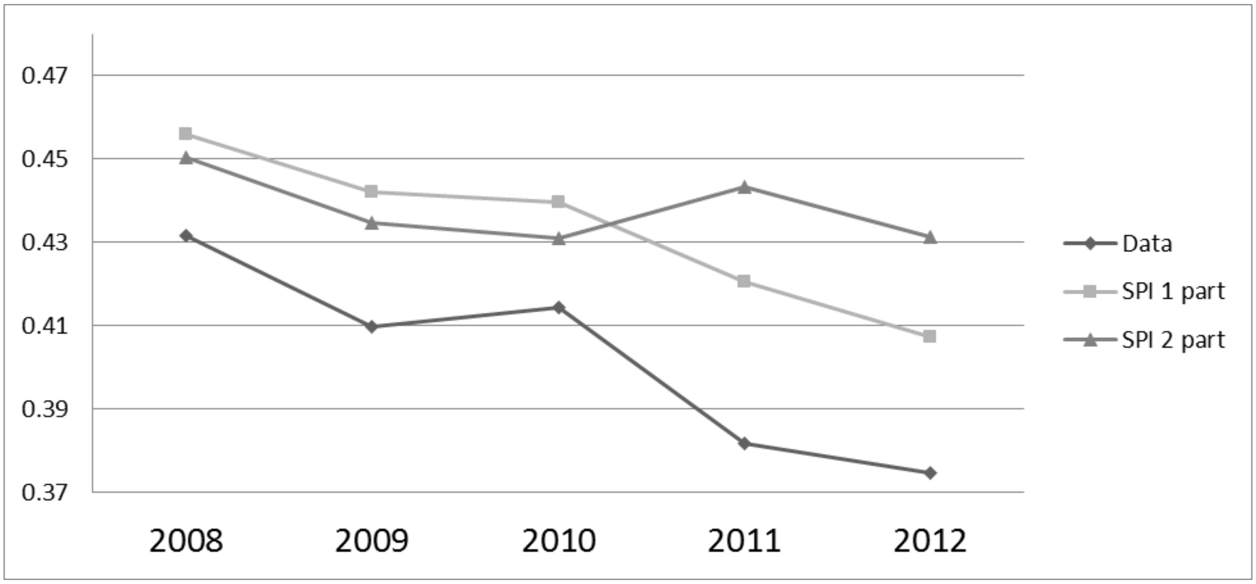


Figure 4: Gini coefficient of the whole country diminishes after 2011 based on the data, while it does not after correcting for the SPI of after and before cutting subsidies

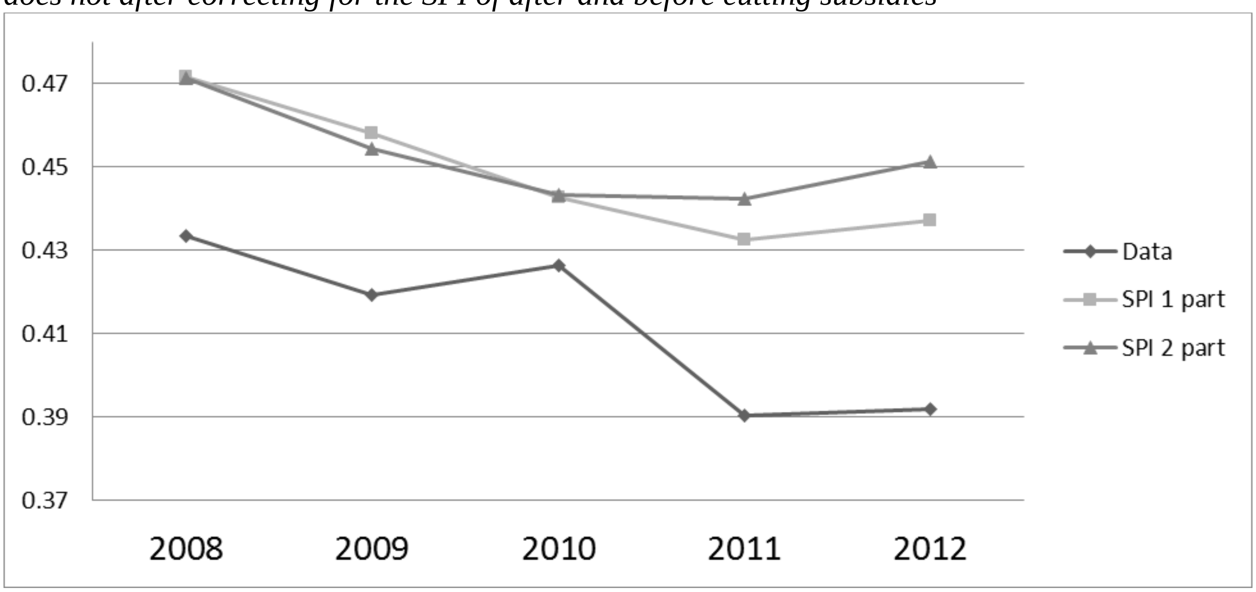
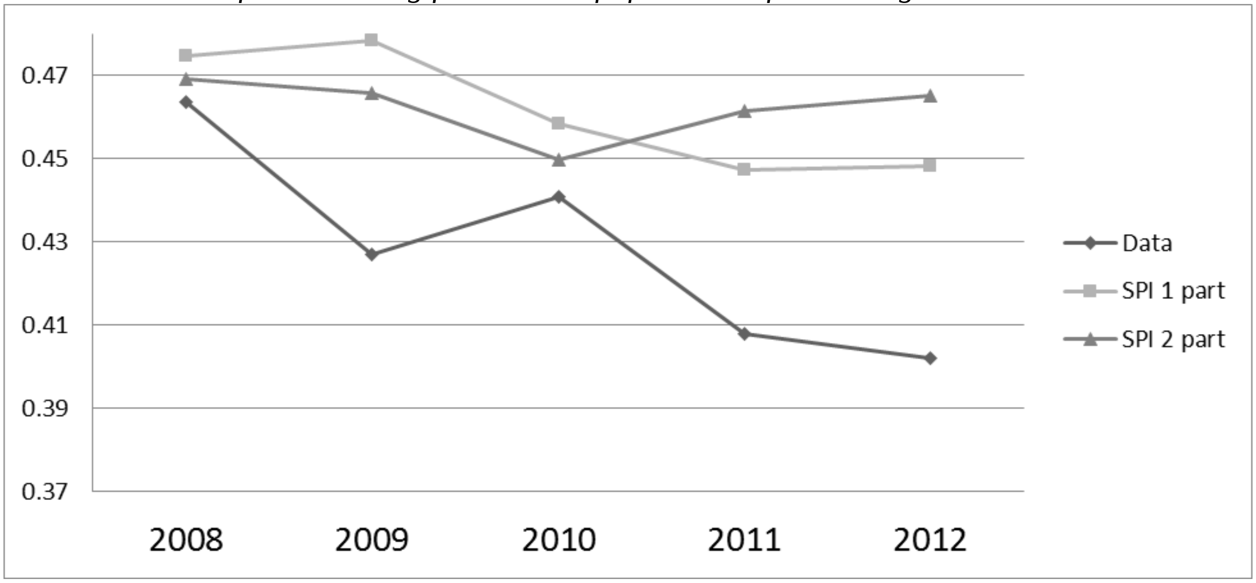


Figure 5: Inequality between rural and urban areas diminishes after 2011 based on the data, while it does not after correcting for the SPI of after and before cutting subsidies

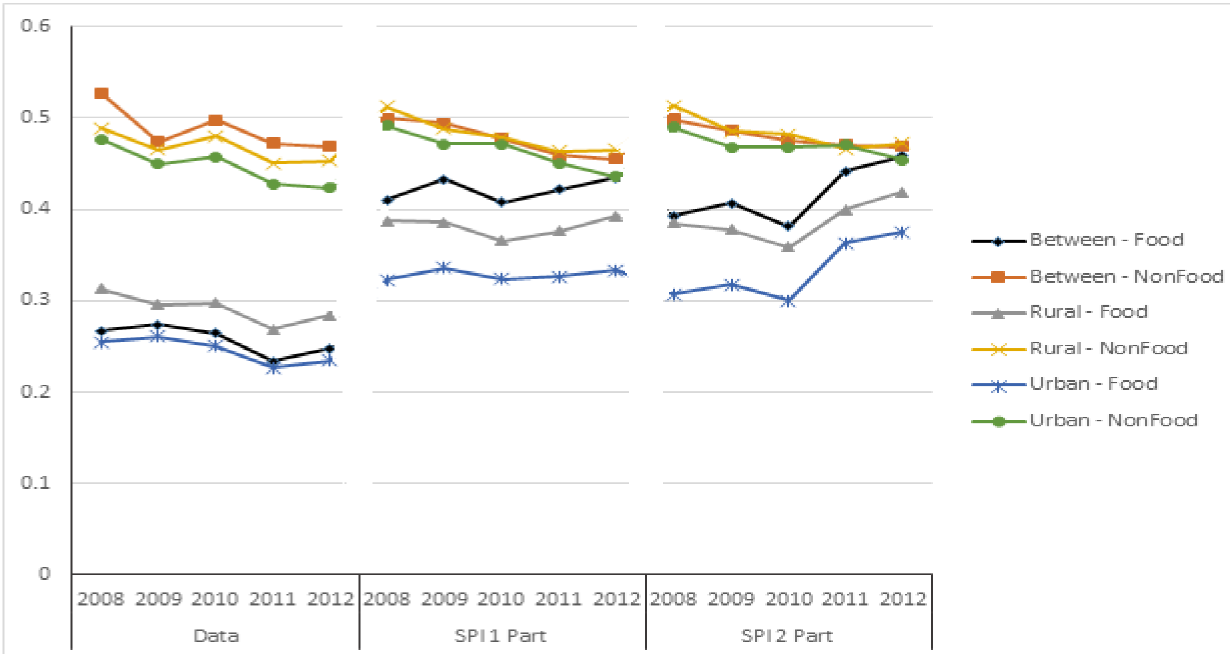


As is seen in Figure 3 and Figure 4 the Gini coefficient of urban areas and the whole country diminishes after 2011 based on the data, while after correcting based on the SPI we have calculated with respect to each period, Gini coefficient of the urban areas remains mostly unchanged and that of the whole country turns back upward. Our result about the inequality between urban and rural areas depicted in Figure 5 is showing an increase in inequality between rural and urban areas while it is reverse in data. More detailed results are shown in Table 4: Contribution of each dimension on Total inequalityTable 4.

In continue we analyze the results of the decomposition of inequality expenditures of food and nonfood expenditures within and between rural and urban areas which is depicted in Table 4 as well as in Figure 6. In data there is a considerable gap between food expenditure inequality and that of non-food. This gap shrinks when SPI is used.

The other difference is the direction of evolution. In the data, it is diminishing and based on SPI consideration the trend is increasing. Overall, we claim that there is a raise in the inequality of food expenditures yielding an increase in total inequality.

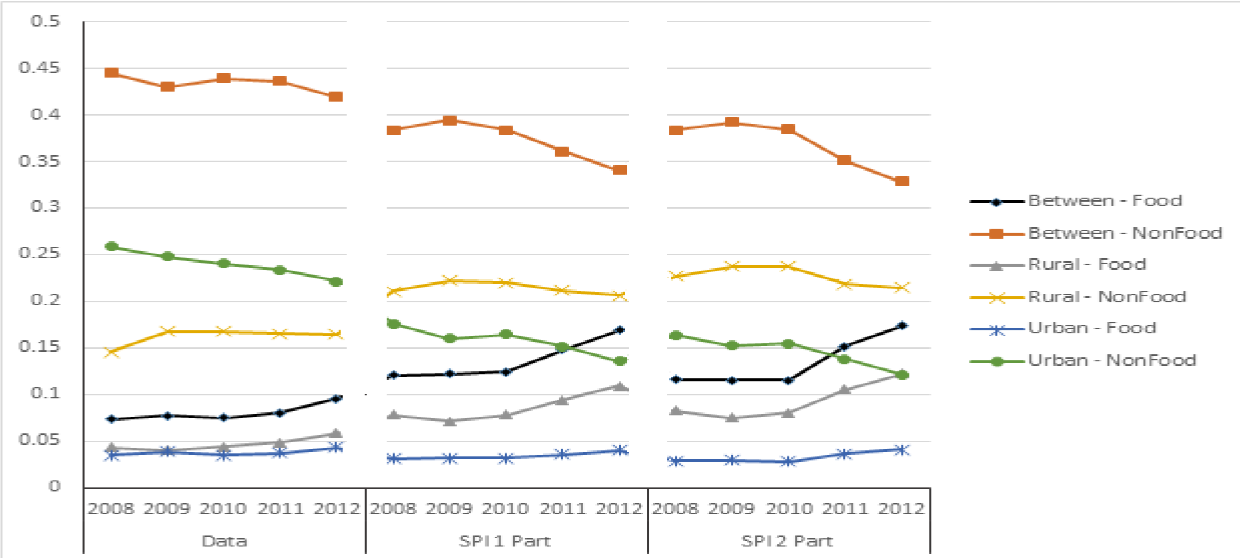
Figure 6: Inequalities of Food and Non Food Expenditures within and between Iranian rural and urban areas



In Table 4 as well as in Figure 7, we decompose contribution of distribution of food and nonfood expenditure in rural, urban areas and between them. Based on our results, the most influence on total inequality belongs to between-nonfood inequality. But this impact is decreasing in the time. However, the contribution of this source shrinks after using SPI. After using SPI, the contribution of between rural and urban areas in food expenditures has passed the contribution of rural and urban areas to inequality. This may be an alert for food problem in Iran.

Another interesting fact is that the contribution of rural areas and food expenditure to inequality is higher than we observe in data. However, this contribution is diminishing after 2011, while it does not change in data.

Figure 7: Inequality's contribution of Food and Non Food Expenditures in Urban, Rural areas and between groups For Iran income distribution.



4. Conclusion

In this study we used Hamilton's approach to estimate a Spatial Price Index (SPI). By this approach we estimate the bias in regional price indices and provide a better criterion for welfare variations. Using that we bidimensionally decomposed the contribution of rural versus urban areas and food versus non-food expenses to inequality in Iranian regions. While Iranian authorities repeatedly have claimed that income inequalities have improved after the targeted cutting of subsidies in 2011; our results indicate that the above improvement is due to a bias in regional price indices and controlling for that the inequality is at most unchanged. Moreover, considering SPIs we did not observe the much lower inequality in Iranian rural areas that is, based on the administrative data, widely accepted.

Based on our results the contribution of rural areas and food expenditure to inequality is higher than we observe in data. However, this contribution is diminishing after 2011, while it does not change in data. Overall, since considering these issues changes our understanding from the inequality map in Iran, our message is that policy makers should not be deceived by the good picture of income distribution that data depicts for them.

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Appendix:

Table 1: food share demand form corresponding to equation (1)

Variable	2011-2012	2008-2010	2008-2012
LCost	-0.09068	-0.083241	-0.08526
Gender	0.016825	0.025496	0.021803
Age	0.000687	0.000468	0.000552
HH	0.016597	0.015906	0.01602
F_H	-0.00163	0.001443	0.000234
W_H	0.008573	0.016496	0.012629
Education	-0.01956	-0.015417	-0.017334
Price difference	-0.0027	0.004602	0.117376
Y2009		-0.020723	-0.01968
Y2010		-0.003353	-0.007292
Y2011			0.011499
Y2012	0.116616		0.131363
Constant	1.280109	1.17824	1.189239
Reginal Dummies			
Markazi Urban	0.030244	0.021964	0.022812
Markazi Rural	0.081619	0.059173	0.065899
Gilan Urban	0.044711	0.040239	0.042959
Gilan Rural	0.12006	0.106386	0.112584
Mazandaran Urban	0.028103	0.024495	0.021997
Mazandaran Rural	0.08239	0.068058	0.069652
Eastern Azarbayjan Urban	0.044196	0.028816	0.029699
Eastern Azarbayjan Rural	0.113321	0.086587	0.091828
Western Azarbayjan Urban	0.043388	0.031682	0.032547
Western Azarbayjan Rural	0.106799	0.102402	0.100444
Kermanshah Urban	0.039836	0.032664	0.037192
Kermanshah Rural	0.11456	0.092326	0.103111
Khuzestan Urban	0.131634	0.07846	0.095575
Khuzestan Rural	0.18541	0.153172	0.161718
Fars Urban	0.017105	0.025208	0.01847
Fars Rural	0.039982	0.047586	0.040653
Kerman Urban	0.022663	0.032916	0.025151
Kerman Rural	0.090725	0.089205	0.087041
Khorasan Razavi Urban	0.072245	0.049427	0.052594
Khorasan Razavi Rural	0.15696	0.122934	0.131358
Isfahan Urban	0.031513	0.019563	0.020308
Isfahan Rural	0.078155	0.066708	0.067591
Sistan va Baluchestan Urban	0.126741	0.08516	0.098743
Sistan va Baluchestan Rural	0.187301	0.149732	0.163209
Kordestan Urban	0.073574	0.058842	0.065806
Kordestan Rural	0.167779	0.132099	0.147267

Hamedan Urban	0.001839	0.032748	0.022419
Hamedan Rural	0.097208	0.090502	0.095008
Chaharmahal va Bakhtiyari Urban	0.087136	0.074661	0.079152
Chaharmahal va Bakhtiyari Rural	0.119792	0.13916	0.130675
Lorestan Urban	0.045302	0.041985	0.048425
Lorestan Rural	0.128652	0.080866	0.10522
Ilam Urban	0.097251	0.078298	0.089084
Ilam Rural	0.141629	0.134139	0.140404
Kohkeluyeh va Boyer Ahmad Urban	0.087153	0.046463	0.051639
Kohkeluyeh va Boyer Ahmad Rural	0.142616	0.100079	0.105641
Bushehr Urban	0.048541	0.071727	0.045639
Bushehr Rural	0.091859	0.102721	0.081736
Zanjan Urban	0.082271	0.045845	0.059323
Zanjan Rural	0.133058	0.096305	0.109061
Semnan Urban	0.000645	0.011431	0.002982
Semnan Rural	0.093081	0.103435	0.094853
Yazd Urban	0.03327	0.019334	0.022048
Yazd Rural	0.096104	0.055626	0.068495
Hormozgan Urban	0.111662	0.068034	0.088045
Hormozgan Rural	0.230908	0.155914	0.189684
Tehran Urban			
Tehran Rural	0.023977	0.025912	0.025515
Ardebil Urban	0.069185	0.060864	0.062517
Ardebil Rural	0.133895	0.116842	0.121928
Qom Urban	-0.0413	-0.010811	-0.018077
Qom Rural	0.078404	0.050441	0.066389
Qazvin Urban	0.027255	0.029719	0.026812
Qazvin Rural	0.096752	0.094676	0.093504
Golestan Urban	0.022878	0.008632	0.011944
Golestan Rural	0.078569	0.030718	0.047641
Northern Khorasan Urban	0.017184	0.036164	0.025908
Northern Khorasan Rural	0.079026	0.093595	0.083673
Southern Khorasan Urban	0.107319	0.054701	0.076509
Southern Khorasan Rural	0.187944	0.079351	0.123625
Alborz Urban	0.016979		-0.002157
Alborz Rural	0.068483		0.052556
R-squared	0.4239	0.3373	0.3759
Rbar-squared	0.4234	0.3369	0.3756
Nvars	71	70	74
Nobs	75576	113940	189516

Dependent variable is food share. LCOST is logarithm of deflated total expenditure by official CPI. Gender is the genderof household’s head. HH is household size. F-His ratio of female in household, and W-H is ratio of workers in household. Education is 1 when head of family has some academic education and zero otherwise.PRICE DIFFERENCE represents the difference between CPI of food and non-food for each province. And Y20##s are time dummies. All coefficients are significant at 1% level.

Table 2: descriptive analysis

Condition	Year	Expenditures Average	Sample Size	Population Share
Total	87	79797964.294	39002.000	1.000
	88	87889381.512	36768.000	1.000
	89	101825760.950	38170.000	1.000
	90	116248878.135	38434.000	1.000
	91	142231948.349	38115.000	1.000
Urban	87	19914232.338	19335.000	0.496
	88	21094954.413	18606.000	0.506
	89	25175313.619	18644.000	0.488
	90	31676136.864	18695.000	0.486
	91	43051299.484	18502.000	0.485
Rural	87	19323119.400	19667.000	0.504
	88	20338833.226	18162.000	0.494
	89	24447903.451	19526.000	0.512
	90	31603538.280	19739.000	0.514
	91	42914402.040	19613.000	0.515

Table 3: Bidimensional Gini Coefficients

	Source:	Total Expenditures			Nonfood Expenditures			Food Expenditures		
Region	Year	Data	SPI 1 P	SPI 2 P	Data	SPI 1 P	SPI 2 P	Data	SPI 1 P	SPI 2 P
Total	2008	0.448	0.470	0.466	0.504	0.501	0.501	0.275	0.388	0.377
	2009	0.420	0.465	0.456	0.465	0.488	0.482	0.276	0.401	0.382
	2010	0.430	0.450	0.444	0.482	0.476	0.476	0.269	0.380	0.361
	2011	0.397	0.438	0.452	0.455	0.458	0.469	0.241	0.391	0.415
	2012	0.392	0.437	0.455	0.452	0.454	0.467	0.254	0.405	0.432
Urban	2008	0.432	0.456	0.450	0.476	0.491	0.490	0.255	0.323	0.307
	2009	0.410	0.442	0.435	0.449	0.472	0.468	0.260	0.336	0.317
	2010	0.414	0.439	0.431	0.457	0.472	0.468	0.250	0.323	0.300
	2011	0.382	0.421	0.443	0.428	0.451	0.470	0.227	0.327	0.363
	2012	0.375	0.407	0.431	0.424	0.435	0.454	0.234	0.333	0.375
Rural	2008	0.433	0.472	0.471	0.489	0.513	0.513	0.313	0.387	0.385
	2009	0.419	0.458	0.454	0.466	0.488	0.485	0.296	0.386	0.378
	2010	0.426	0.443	0.443	0.480	0.478	0.482	0.297	0.366	0.359
	2011	0.390	0.432	0.442	0.450	0.463	0.466	0.269	0.376	0.400
	2012	0.392	0.437	0.451	0.453	0.465	0.472	0.284	0.393	0.419
Between	2008	0.464	0.475	0.469	0.528	0.499	0.499	0.267	0.410	0.393
	2009	0.427	0.478	0.466	0.474	0.494	0.486	0.274	0.433	0.407
	2010	0.441	0.458	0.450	0.497	0.477	0.475	0.264	0.408	0.382
	2011	0.408	0.447	0.462	0.473	0.459	0.471	0.234	0.421	0.442

	2012	0.402	0.448	0.465	0.468	0.455	0.469	0.248	0.435	0.458

Table 4: Contribution of each dimension on Total inequality

	Source:	Total Expenditures			Nonfood Expenditures			Food Expenditures		
Region	Year	Data	SPI 1 P	SPI 2 P	Data	SPI 1 P	SPI 2 P	Data	SPI 1 P	SPI 2 P
Total	2008	1.000	1.000	1.000	0.899	0.842	0.844	0.124	0.174	0.174
	2009	1.000	1.000	1.000	0.874	0.820	0.825	0.137	0.188	0.184
	2010	1.000	1.000	1.000	0.889	0.829	0.836	0.130	0.184	0.178
	2011	1.000	1.000	1.000	0.883	0.794	0.777	0.140	0.217	0.231
	2012	1.000	1.000	1.000	0.855	0.752	0.731	0.167	0.256	0.274
Urban	2008	0.293	0.207	0.192	0.258	0.176	0.164	0.035	0.031	0.028
	2009	0.286	0.192	0.182	0.248	0.160	0.152	0.038	0.032	0.029
	2010	0.275	0.195	0.182	0.240	0.164	0.154	0.034	0.031	0.028
	2011	0.270	0.186	0.174	0.233	0.151	0.138	0.037	0.035	0.036
	2012	0.264	0.175	0.162	0.221	0.136	0.121	0.043	0.040	0.041
Rural	2008	0.188	0.289	0.309	0.145	0.211	0.227	0.043	0.078	0.083
	2009	0.207	0.293	0.312	0.167	0.222	0.237	0.040	0.071	0.074
	2010	0.211	0.297	0.318	0.168	0.220	0.238	0.043	0.078	0.080
	2011	0.213	0.305	0.324	0.165	0.211	0.219	0.049	0.094	0.105
	2012	0.222	0.315	0.336	0.164	0.206	0.214	0.058	0.109	0.122
Between	2008	0.518	0.505	0.499	0.445	0.384	0.383	0.073	0.121	0.116
	2009	0.507	0.516	0.507	0.430	0.394	0.392	0.077	0.122	0.115
	2010	0.514	0.507	0.500	0.439	0.383	0.385	0.075	0.124	0.115
	2011	0.516	0.508	0.502	0.436	0.361	0.351	0.080	0.147	0.152
	2012	0.515	0.509	0.502	0.419	0.340	0.329	0.095	0.169	0.173