

Measuring Health Inequalities and its Importance in Total Inequities in Iran

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ABSTRACT

Introduction: Health care costs, is one of the household expenditures that for unpredictable and staggering nature, is particular importance. Health insurance payments of household is one of the best ways to health care finance that for income redistribute in society and justice is very important.

Methods: In this paper inequities in household health costs and insurance payment compared with total household costs, in 2004-2010, by use of Gini Index, Theil Index and Lorenz curves and also with calculate of Kakwani Index as the most plausible way to measurement of justice in the financing of the health sector and therefore the fairness of the payments in rural and urban areas has been analyzed.

Finding: The results show that inequalities in the health sector have been stronger than total inequalities. Kakwani index for the studied period is exponentially. Average Kakwani index for rural and urban areas respectively is 0/1053 and 0/1385. Also about insurance payment, the results show that higher income deciles spend most of the lower income deciles in total cost compared to the cost of health insurance payments. Average Kakwani index for rural and urban areas respectively is -0.0376 and -0.0464 According to Descending of Kakwani index, unfair distribution of costs is in different deciles during the period under review.

Conclusion: According to the exponential Kakwani index and its trend over the period, Can be said that the financing of the health sector was fair and improve the look of Kakwani index in the studied period. But in insurance payment, according to the unfair payments for health insurance, costs of the health insurance payments for higher income deciles, Leads to redistribution of wealth from the health sector, and resulting in improved public health most people will benefit from the health services in the community.

KEYWORDS: Lorenz Curve, Gini Index, Theil Index, Kakwani Index.

JEL: D63, I30, R20

1. INTRODUCTION

One of the most developed approaches of justice is ability approach, in which, unlike resource and utility approaches, the advantage of each person is assessed according to the ability of doing the tasks he knows them worthy. The advantage of a person, according to the opportunities, is assessed lower for the person with lower ability, meant that have lower actual opportunities for doing worthy tasks. This approach shows freedom domain of the person to determine his demands (Sen, 2010).

By this way, providing justice in health sector, regarding to its direct relationship with individuals' abilities, has more importance than other sectors of the economy, and necessity of attention and examination of its dimensions indicates the importance. Justice in health can be defined as accessibility according to the need and payment according to the ability. International association of justice in health defines this concept as follow: equality of health means the lack of soluble systematic and potential differences in one or more aspects of health in a population and economic, social, demography, and geographical subsets. (Getzen, 2008)

In all fields, justice is impossible to be realized without a will for administration of the principle of equality. Social justice includes creating equal opportunities for everybody and removing the obstacles for all in an equitable manner. Therefore, justice is a result of equality and equity. (Asadinejad, 2012)

Extension of classes' gap, imbalanced distribution of income and wealth, increase of population under poverty line, etc. are all signs of damaging social welfare. Existing ideas about socioeconomic inequality and health from the view of welfare economics are very important. Health is by self a component of welfare. Thus, if we accept that

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health is influenced by socioeconomic inequalities, then taxation tools, subsidy and transmitting policies affect on income distribution, will be effective. Even if these inequalities do not have direct impact on health, redistribution of income for poorer persons will promote average rate of health rather than wealthy persons. Seeing welfare such that considers inequalities and health will indicate more extended differences between poor and wealthy.

Inequality the income level occur both in developing and developed countries. Therefore, it is logics if poverty is viewed as important problem for humankind because plausible consequences by poverty give threat toward the sustainability of social stability in human life. (Mardiyo, 2012)

2. LITERATURE REVIEW

There are several discussions about financing methods of health systems. Most of discussions about modifications of health sector emphasize on financing system and justice in financing.

In fact, analysis of justice in financing health services starts with this issue that payments for the health should be related the ability to pay of the people instead of received treatments. Here, the purpose of payment for treatments is personal payments by consumers of the treatments. The reasons that health system policy makers consider fair financing related to ability to pay regarding to social justice principle is that: 1) as Culyer said, policy makers are interested in the issue that payments for health treatments shouldn't be an effective factor for seeking health services. This belief is resulted from distribution of health services consumption and thus health itself. 2) Payments for health services reduce the ability to pay for other goods and services (like food) and policy makers are interested in distribution of these services like health services, and are not eager to participate in payments for health treatments instead of consumption services. They are relatively willing to ensure that these payments have not excess impacts on tenable income distribution. While knows it fair with other costs including leisure and entertainment costs and others, The reason is that policy makers consider payments for health treatments as an undesirable and unwanted costs which are induced by unpredictable shocks. So, these costs are presented to achieve lost health. This underlies the attitude that all people should be responsible for the imposed costs in order to prevent health distribution and tenable income from being worse. (Wagstaff and Van Doorslaer, 2004)

In recent years, we observe development of analytical tools for measuring and examining socioeconomic inequalities in health sector. Today, health concentration on income is one of the most popular methods of assessing relative health inequality related to income. Analysis methods based on regression are used in different spectrum of configuration and population. Recent study of Bommier and Stecklov suggest that concentration index present more proper measurement for inequality index derived from a social welfare function (Jones and Nicolas, 2004).

From early in 1980, socioeconomic differences in health and fatality as well as accessibility of health treatment system have become a great problem of Western Europe and all other countries. Most of studies have been done to measure these inequalities. Despite of all these works, not a complete image of these differences size has been developed in the West. One of important reasons is that there is not set of national data which can be used for study and assessment of inequality in health and fatality of many countries such as Holland. The second reason is that, even in cases of available national data, analysis according to that data is done for using social and economic information for a level of congestion, and it causes to create incomplete image. (Smits et al, 2005)

Doctors pay attention to the need, in treatment decisions. This standpoint considers every decision as a response to the technical question about needed services for proper treatment of a disease. This need-oriented standpoint pays attention to the existing differences of the people's health and neglect the role of price and income for allocating scarce resources. Doctors try not to deal with economic issues by neglecting payer and receiver to concentrate on the needs of the patients.(Getzen, 2008)

3. Measurement of inequality in economic and health section

Generally, measurement methods of inequality in health sector can be divided into 2 groups of simple and complex methods. A- Simple methods: out of pocket, catastrophic expenditures, medical impoverishment. B- Complex methods: kakwani index, fairness in financial contribution index, Suits progressivity.

3.1. Fairness in financial contribution index (FFC)

Fairness in financial contribution index aims to measure fairness of financial cost distribution of treatment expenditures. By this index, health system is financed fairly when total share of contribution in financing is the same as families' ability to pay and independent of health situation of the families. Thus, fairness is equality of contributions form families' ability to pay. This index in fact indicates equal distribution of contribution regarding to the ability to pay of the families. Ability to pay of a family is defined as effective income minus minimum subsistence, and is showed as follow:

$$HFC_i = \frac{HE_i}{ENSY_i}$$

HFC_i : Health system Financing Contribution of the household, HE_i : Per capita Expenditure on Health of household, $ENSY_i$: Per capita Effective income Minus Subsistence Expenditure of Household

Fairness in financial contribution index indicates distribution of HFC among families in one index, and weighted more to the families who pays more for health treatments from their income after deficit of minimum subsistence. Meant, it is most influenced by the families who are exposed to the risk of financial attenuation. The value of index is between 1 (maximum of fairness) and 0 (maximum of unfairness), and is obtained from the following relation:

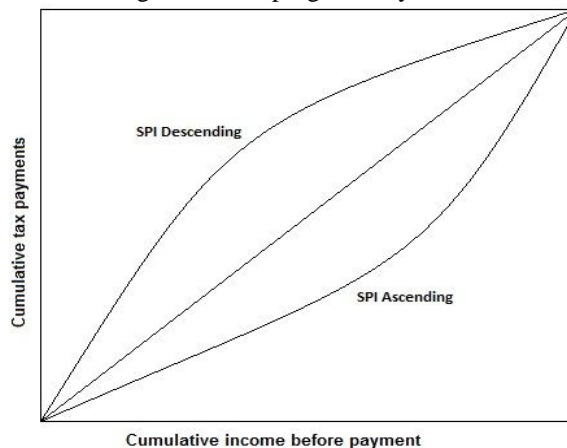
$$FFC = 1 - 4 \frac{\sum_{n=1}^H |HFC_n - \overline{HFC}|^3}{0.125H}$$

HFC_i : Health system Financing Contribution of the household, \overline{HFC} : mean of all HFSs, H: Number of households

3.2. Suits progressivity index (SPI)

This index shows Concentration curve of tax payments which indicate the relationship between income congestion percent before tax and tax payments congestion percent of the families when they are rated by pre-payment income. Graphically, this index is two times larger than area between 45 degree line (a position in which pre-payment income congestion percent is equal to tax payments congestion percent) and concentration curve of taxes. SPI domain varies within +1 and -1. SPI of 1 is the maximum of progressivity (a situation in which the richest person pays all taxes, SPI in this situation is in the bottom right of the graph) and SPI of -1 is the maximum resignation (SPI in this situation is in the up left of the graph). (Achdut, 2000):

Figure1: Suits progressivity index



3.3. Kakwani progressivity index:

Regarding to the criticism and fustigations from economists, health has been included in fairness in financial contribution index of WHO, another index originated from public economics courses and was accepted by the most is Kawanki index which indicates progressivity or resignation of economic system. Kawanki index indicates vertical unfairness. A value more than 1 is progressive financing and a value less than 0 is retrogressive financing method.(Andrew and Nicolas, 2004)

The index shows the value a taxation system (health) can be far away from relativity of payments, which is obtained from Gini coefficient difference of tax payments and Gini coefficient of pre-tax incomes.(Kakwani, 1997)

$$K_t = C_{tax} - G_x$$

K_t : Kakwani index, C_{tax} : concentration index of tax, G_x : Gini coefficient

To obtain tax concentration curve, the ratio of population ordered by pre-tax payment is indicated against the ratio of tax payments.

If the system is progressive, tax concentration curve will be under Lorenz curve. Tax concentration index indicates Gini coefficient of tax payments which is defined as two times minus area under tax concentration curve. For n persons in the population, we have:

$$C_{tax} = 1 - \left(\frac{2}{n^2 \bar{x}} \right) (t_1 x_1 + 2t_2 x_2 + \dots + nt_n x_n) + \frac{1}{n}$$

$$x_1 \geq x_2 \geq \dots \geq x_n$$

$$\bar{TX} = \frac{TX}{n}$$

$$TH = t_1x_1 + 2t_2x_2 + \dots + nt_nx_n$$

Gini index in this equation calculated as one minus twice the area under the Lorenz curve, Gini coefficient of earnings before-tax can be found as follows:

$$G_x = \left[\frac{(n^2 - 1)}{6n} \right] \left[\frac{b}{\bar{x}} \right]$$

\bar{x} : income before deduction of taxes, $b = \frac{cov(X,rx)}{var(rx)}$: Regress of x on rx, rx : Variable Rate for x.

According to $-1 \leq C_{tax} \leq 1$ and $0 \leq G_x \leq 1$, the least amount to K_T is -2: where the richest person, receive total income, and in this case, since G_x is one, the poorest person pays taxes.(Hajizadeh & Connelly, 2009)

Expansion of index to the financing system of health sector: there are 4 key sources to finance health sector: taxes, social insurances, private insurances, and direct payments. We can calculate Kakwani index for each one and calculate progressivity or resignation of total financing system by using weighted mean.

Redistributive effect of financing health sector: every society has mechanisms to redistribute income. Meanwhile, redistribution by providing health services is very important. Therefore, health systems should be considered as one of several mechanisms for income distribution. But it can be said that health systems distribute income have better performance for poor people in accessing to health services. Tax redistributive effect (income distribution tax) depends on progressivity of financing health treatments system, income relation used for financing health.

If we measure income inequalities by Gini coefficient, redistributive effect can be obtained simply from difference between Gini coefficient of pre-payment income G_{pre} and Gini coefficient of post-payment income G_{post} . Combination of distributive effects of Arnson and colleagues is indicated as follow:

$$RE = V - H - R$$

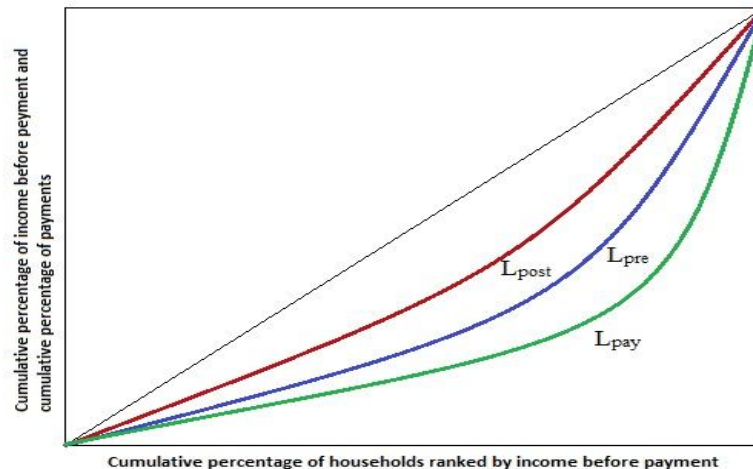
$$RE = \left(\frac{g}{1-g} \right) K - \alpha_x G_{F(x)} - (G_{x-p} - C_{x-t})$$

V: redistribution of vertical injustice, H: Average effect of redistribution of horizontal inequity, R: redistributive effects shows the Re-rating

General income redistribution: General income redistribution, V in above equation, indicates change of income inequality by health payments. If people in any income level, pay similar amount of money for health treatments before similar payment, V will depends on Kakwani progressive index and pre-payment income.

$$V = \left(\frac{g}{1-g} \right) K$$

The first General income redistribution combination V is Kakwani index, which is presented below and implies to the area between pre-payment Lorenz curve L_{pre} and concentration curve L_{pay} ; indeed, Kakwani index explain the difference between concentration index and Gini coefficient. If Kakwani index is positive, the structure is progressive, and if it is negative, structure is retrogressive. (Kakwani, 1997)



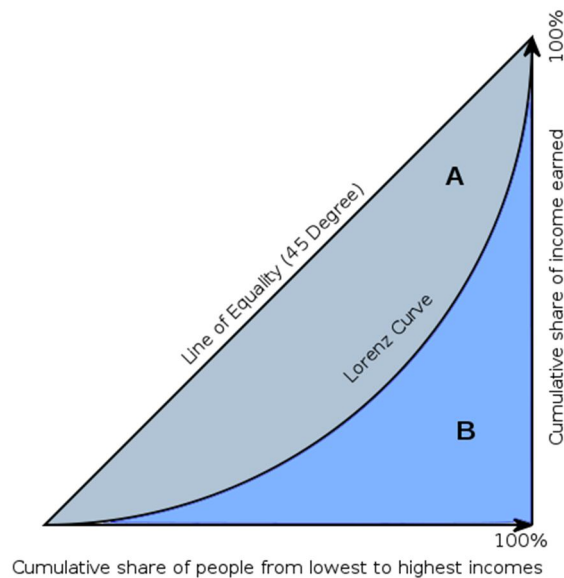
In progressive payments, Lorenz curve will be used for post-payment incomes at the top of Lorenz curve, and will have moderator effects on the pre-payment incomes. In contrast, in retrogressive payments, they will have unequal effects on pre-payment income, and Lorenz curve of post-pay income will be under Lorenz curve of pre-pays. Other part of V is related to g, which is indeed the share of pre-pay income of specified treatments. The more is the payment share of health treatments, will be more effective on income redistribution.

3.4. METHODOLOGY AND DATA

Data used in this article, is getting of annual household cost-income survey for 2004-2010 in Iran. That inequities in household health costs and insurance payment compared with total household costs by use of Gini Index, Theil Index and Lorenz curves and also with calculate of Kakwani Index as the most plausible way to measurement of justice in the financing of the health sector and therefore the fairness of the payments in rural and urban areas has been analyzed.

In fact, analysis of this article is based on Lorenz curves and its related Indicators. The Lorenz curve is a function of the cumulative proportion of ordered individuals mapped onto the corresponding cumulative proportion of their size.

The Gini index is defined as a ratio of the areas on the Lorenz curve diagram. If the area between the line of perfect equality and the Lorenz curve is A, and the area under the Lorenz curve is B, then the Gini index is $A / (A + B)$. Since $A + B = 0.5$, the Gini index is $G = 2 * A$ or $G = 1 - 2 B$.



While less commonly used than the Gini coefficient, the Theil-index of inequality has the advantage of being additive across different subgroups or regions in the country. The Theil index, however, does not have a straightforward representation and lacks the appealing interpretation of the Gini coefficient. The Theil index is part of a larger family of measures referred to as the General Entropy class. Kakwani Index is measured as the difference between the Gini coefficient of health sector and the Gini coefficient of whole economy.

Therefore, our research methodology is measure of inequality indices including Gini index, Theil and Kakwani index for urban and rural areas in different years. Also, in this paper compared the Lorenz curves for the health sector and the whole economy and evaluated these indicators over time.

4. RESULTS

Since Kakwani index is one of the most valuable existing indexes for assessing fairness of financing, it has been calculated in this article as well as Lorenz curves and Gini and Theil indexes, by using data from income-expenditure of Iranian families during 2004 to 2010. Lorenz curves have been shown in figure3 for indicating inequalities of total expenditures (T), and health treatment costs of families (H) separately for urban and rural

regions. Lorenz curve related to health expenditures are at the bottom of total expenditures, and it is true in all surveyed years.

Figure 3: Lorenz curves for total costs, total costs of health care and total costs without health sector(2010)

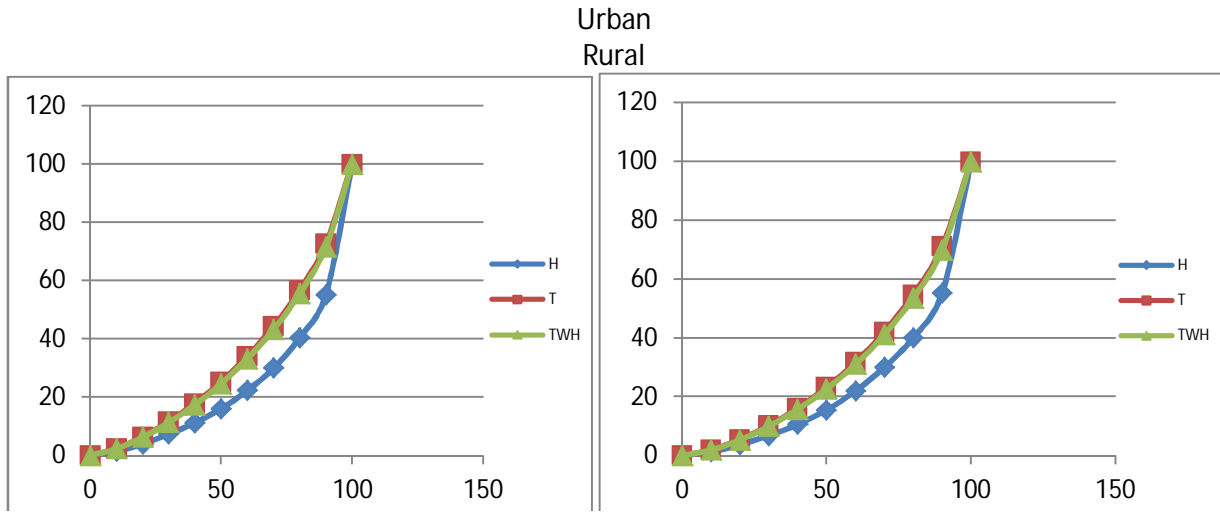
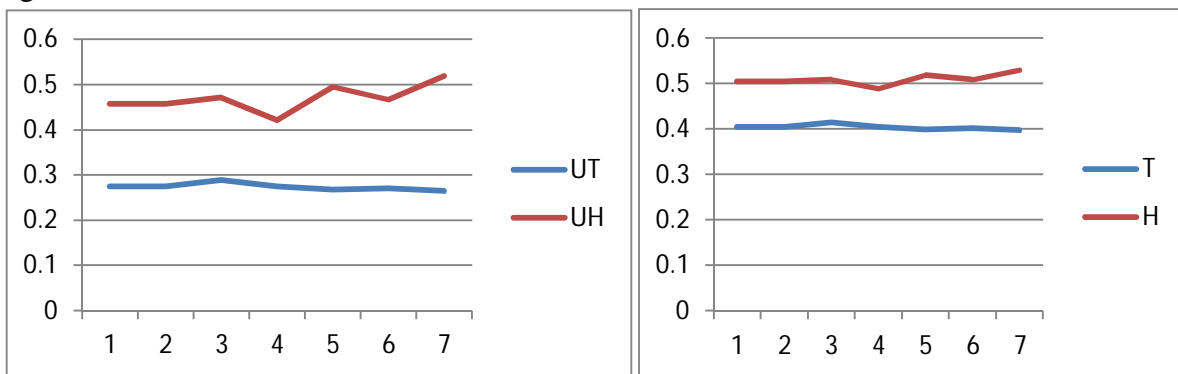


Table 1: inequality indices and Kakwani indicators for urban and rural(2004-2010)

year	Gini index of total costs		Gini index of health care costs		Theil index of total costs		Theil index of health care costs		Kakwani index	
	urban	rural	urban	rural	urban	rural	urban	rural	urban	rural
2004	0.4059	0.384	0.4839	0.356	0.2784	0.248	0.4004	0.216	0.078	-0,028
2005	0.4045	0.395	0.4502	0.36	0.2753	0.263	0.3371	0.217	0.0457	-0,035
2006	0.4141	0.4	0.3013	0.352	0.2895	0.269	0.1428	0.205	-0.1128	-0,049
2007	0.404	0.393	0.3304	0.343	0.2746	0.26	0.1722	0.195	-0.0736	-0,051
2008	0.3992	0.369	0.3085	0.307	0.2675	0.226	0.1497	0.158	-0.0907	-0,062
2009	0.4021	0.368	0.3254	0.319	0.2704	0.223	0.1668	0.167	-0.0767	-0,049
2010	0.3981	0.369	0.3649	0.317	0.2648	0.226	0.2118	0.164	-0.0332	-0,052

As it can be seen from the numbers of above table, inequalities of health sector are more than total expenditures. But these differences do not have similar trend. Meant that, decrease and increase of inequalities in health sector and total one are not undirected and it has been represented in figure3.

Figure 4: Gini coefficients of the total cost and health care cost for rural and urban households



In order to survey results from Gini coefficients with other inequality indexes, we can use one of the most important indexes of measuring inequality, Theil index. Theil introduced this index by using Entropy in theory of information about chaos and systemic dissimilarity. This theory contains 3 parts: set of events with specified happening, information function for measuring events according to possibilities, and entropy by means of

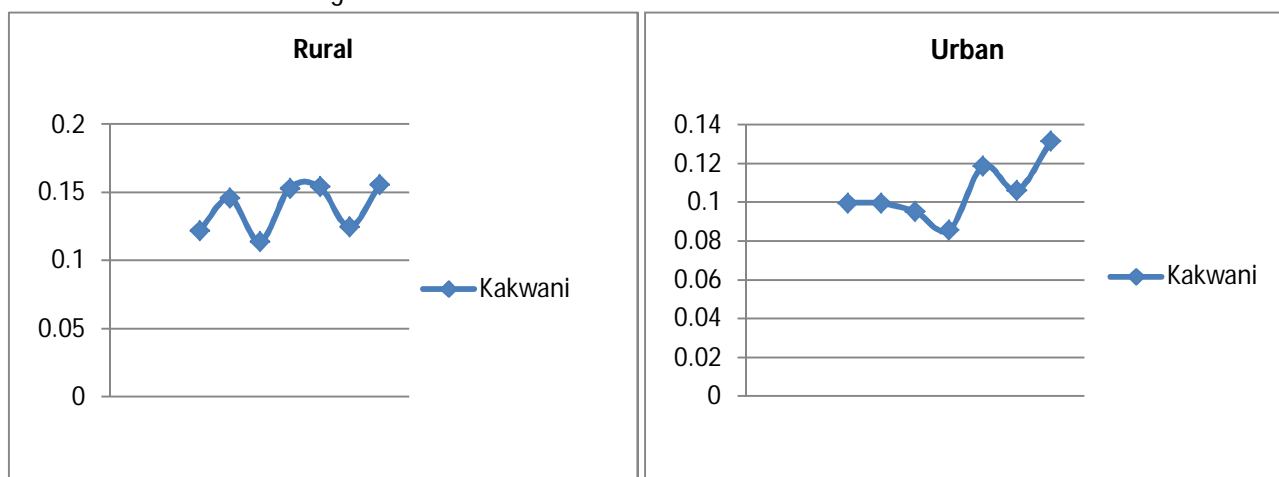
expectation information in distribution. In Theil index, income share is used to investigate inequality instead of event possibility. This index is from scarce indexes that are consistent with the basics of concepts such as dependence from income scale, dependence principle, and experimentation principle. (Theil, 1967)

In 6 to 9 columns of table1, inequalities of total expenditures and health expenditures have been represented by Theil index. According to the results of Theil index, existing inequalities of total expenditures are significantly different from urban and rural regions. As it was mentioned earlier, since health sector expenditures share from total expenditures is very low, difference between inequalities of total expenditures with and without health sector are not evident in the figures. So, to observe difference between these two values, tables 6 to 9 show the difference between inequalities of total expenditures and health expenditures by using both indexes of Gini and Theil index for urban and rural regions. The values of table show that a part of total inequalities in total expenditures of the family are related to the health sector. Since inequality of this sector is severe, it can be said that health sector reinforce the severity of total inequalities.

As it was mentioned in literature review, Kakwani index is among indexes that are originated from public economics courses and is accepted by the most of economists, and also shows progressivity and retrogressivity of economic system of health sector. If the value of Kakwani index is positive, there will be progressivity in contributions, and negative value indicates the retrogressive contributions. Therefore, in this section we measure Kakwani index for health expenditures within 2004 to 2010 in urban and rural regions. Calculations of Kakwani index for health payments of urban families are presented in table1 (columns 10 to 11). The trend of this index has been illustrated in figure4. As it can be seen from the results of table1, Kakwani index for both surveyed years is positive and health payments of the families have been progressive.

Whitin surveyed years, maximum and minimum values of this index are for 2010 and 2007, which are 0.1315 and 0.0857 respectively. This index in 2006, 2007, and 2008 had reduced but it has increasing trend during other years. Kakwani index value for health payments of rural families during this period is represented in table1. As it can be seen, the index is also progressive for rural regions. The least value of this index was in 2006 by 0.114 and maximum value was in 2010 by 0.1556. Kakwani index average for heath payments within this period can be obtained. Kakwani index average for urban and rural regions during this period has been respectively 0.1053 and 0.1385. It shows that despite of fluctuations in some years of the period, this index has been totally positive and increasing.

Figure 5: Trend of Kakwani Index in urban and rural areas



Inequalities indexes for insurance payments of families

In previous section we calculate and examine inequalities indexes for health payments. In this section we focus on an important health payments, that is insurance payments. And inequalities of these payments will be analyzed.

In 2004 and 2005, Lorenz curves of health insurance payments in lower deciles are placed under Lorenz curve of total expenditures, but there is no expenditure above it in higher deciles. It can be said that Lorenz curve of insurance payments is above Lorenz curve of total expenditures at the rest of the years. In the following graph, Gini curves for insurance payments and total expenditures in 2010 are represented separated by urban and rural regions.

For better investigation of results and data from inequality coefficients, related calculations are presented and analyzed by tables. In table1, inequalities of total expenditures and health insurance payments of families during surveyed years for urban and rural regions are presented by using Gini coefficient and Theil index and also Kakwani index. In urban regions, in 2004 and 2005, Gini coefficient of health insurance payments is higher than Gini coefficient of total expenditures; but from 2006 to 2010, the value of this coefficient for insurance payments have been lower than total expenditures. In urban regions, Gini coefficient of health insurance payments is lower than Gini coefficient of total expenditures.

Table 2: Inequality indices of total cost and health care insurance costs for rural and urban areas between

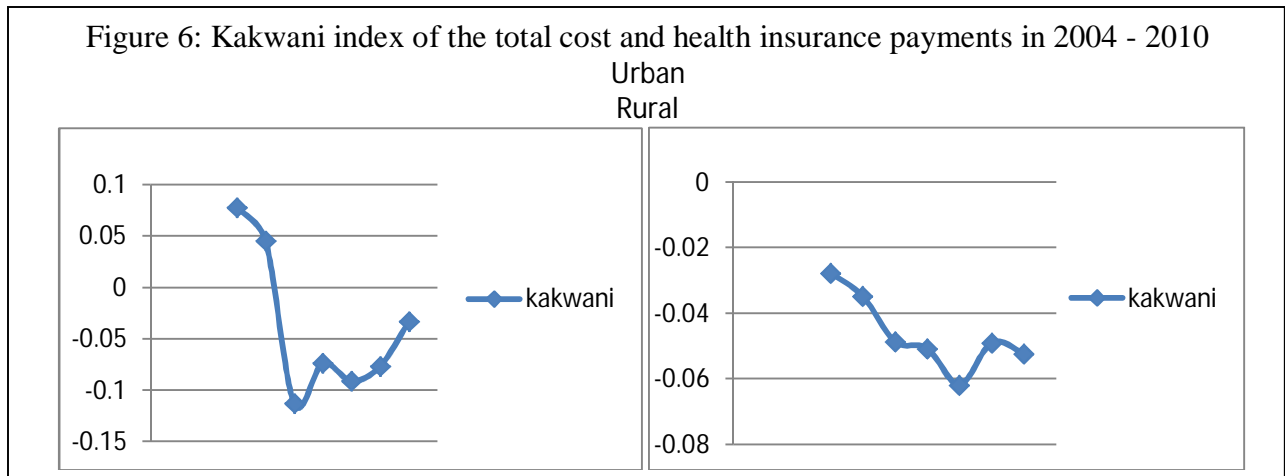
	Gini index of total costs		Gini index of health insurance payment		Theil index of total costs		Theil index of health insurance payment		Kakwani index	
	urban	rural	urban	rural	urban	rural	urban	rural	urban	rural
2004	0.4059	0.384	0.4839	0.356	0.2784	0.248	0.4004	0.216	0.078	-0,028
2005	0.4045	0.395	0.4502	0.36	0.2753	0.263	0.3371	0.217	0.0457	-0,035
2006	0.4141	0.4	0.3013	0.352	0.2895	0.269	0.1428	0.205	-0.1128	-0,049
2007	0.404	0.393	0.3304	0.343	0.2746	0.26	0.1722	0.195	-0.0736	-0,051
2008	0.3992	0.369	0.3085	0.307	0.2675	0.226	0.1497	0.158	-0.0907	-0,062
2009	0.4021	0.368	0.3254	0.319	0.2704	0.223	0.1668	0.167	-0.0767	-0,049
2010	0.3981	0.369	0.3649	0.317	0.2648	0.226	0.2118	0.164	-0.0332	-0,052

By investigating the trend of Gini coefficient of total expenditures and health insurance payments, it will be found that in urban regions, the value of this coefficient was the same for total expenditures. But there is a decreasing trend for health insurance expenditures. In rural regions, the values of these two coefficients have decreased the same.

Calculation of Kakwani index for health insurance payments of urban families are presented in the last column of table1. The trend of this index has been shown in figure2. As it can be seen from the results of table and graph, Kakwani index of surveyed period of 2004 and 2005 was positive, but it was negative for other years. Therefore, health insurance payments were retrogressive.

Within surveyed years, maximum and minimum values of this index are for 2004 and 2006, which are 0.0780 and 0.1128 respectively. This index had reduced in 2006 but it has increasing trend during other years. Kakwani index value for health payments of rural families was retrogressive. The least value of this index was in 2006 by -0.0618 and maximum value was in 2004 by -0.0276. Kakwani index average for heath payments within this period can be obtained. Kakwani index average for urban and rural regions during this period has been respectively -0.0376 and -0.0464. It shows that despite of fluctuations in some years of the period, this index has been totally negative and decreasing.

Therefore, the results show that first, high income deciles sustain more costs in total costs rather than health insurance costs. Second, unfair distribution in different deciles of this period has been investigated regarding to retrogressivity of Kakwani index.



5. CONCLUSION

In this article, importance of inequalities in health expenditures has been investigated in comparison to total expenditures of families. Next, related literature and also empirical works were reviewed. Then, Lorenz curves related to inequalities in total expenditures and health expenditures were extracted and the results showed that inequalities of health sector is severe than total inequalities and leads to inequalities of total expenditures. Numbers related to inequalities of these two sectors and also total expenditures without health expenditures are extracted and presented in tables by using both Gini and Theil coefficients.

Since Kakwani index is acceptable to explain fairness in financing health sector, it is calculated within surveyed period and its trend as well as mean index of entire period were extracted. Results show the fairness of this sector due to the progressivity of this index during all given years. This result is true for both rural and urban regions. Regarding to the trend of Kakwani index during this period, although it was somehow decreasing, totally it has been increasing. It results from the average index within surveyed period.

In this article, inequalities of health insurance payments have been investigated in comparison to total expenditures of households during 2004 to 2010 using Gini and Theil indexes. And fairness trend of these payments in rural and urban region has been analyzed by calculating Kakwani index as one of the most popular indexes indicating fairness quality in financing health sector.

Therefore, the results show that first, high income deciles sustain more costs in total costs rather than health insurance costs. Second, unfair distribution in different deciles of this period has been investigated regarding to retrogressively of Kakwani index.

There are several methods in economics to redistribute wealth in the society and reduce classes' gap, but recent studies show that using mechanisms of health sector to redistribute wealth in the society is more valuable than other methods promoting health level and utilization of people from health services in the country. Therefore, it is recommended that income redistribution in the society be performed by increase of health expenditure of high income deciles rather than low deciles. Since, health insurances are one of contribution paths to these expenditures and due to unfairness of health insurance payments from Kakwani unfairness, cost of these payments should be increased for high income deciles, because this method is more useful than others.

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