
Munich Personal RePEc Archive

Measurement and Evaluation of Equality of Opportunity: A Numerical Look at Education, Health, and Income Inequality

Haqiqi, Iman and Bahalou, Marziyeh and Hamidi, Razieh

University of Economic Sciences, University of Isfahan

2014

Online at https://mpra.ub.uni-muenchen.de/95866/
MPRA Paper No. 95866, posted 04 Sep 2019 18:34 UTC

Measurement and Evaluation of Equality of Opportunity: A Numerical Look at Education, Health, and Income Inequality

Iman Haqiqi, University of Economic Sciences, ihaqiqi@gmail.com
Marziyeh Bahalou Horeh, University of Isfahan, m.bahaloo.h@gmail.com
Razieh Hamidi, University of Economic Sciences, razieh.hamidi@yahoo.com

Abstract

Inequality in access to "opportunity" is one of the significant factors determining income inequality. The purpose of this paper is to analyze the economic effects of change in the initial allocation of resources and the redistribution of opportunity in terms of access to education and health. In this research we use a Computable General Equilibrium model, focusing on the initial distribution of educational opportunity and allocation of available resources. In our model, the difference among households is due to differences in opportunity, skill, and endowments of capital and labor. We introduce a method to quantify the opportunity premium. The model is calibrated based on Micro Consistent Matrix (MCM) of the Iranian economy. The results indicate that redistribution of opportunity and reallocations of educational resources can improve all equality indices. An important conclusion is that the income gap increases faster than the opportunity gap. Therefore, a reduction in income inequality is possible by small improvements in the equality of opportunity.

Keywords: equality of opportunity, social-choice theory, income distribution, education and inequality, equality of resources, general equilibrium

JEL code: D58, D63, I14, I24, J78.

1. Introduction

In the economics and social sciences literature, there are numerous discussions about equality, justice, and government actions. The main point is that meeting equality in a certain area may lead to inequality in other areas (Dworkin, 2000). For example, ideal income equality may require the inequality of welfare, resources, and opportunity. Because people with different levels of comfort, may experience different tastes, may have different preferences, and may benefit differently from resources and opportunity. In the meantime, some people believe in the necessity of equality of income and a number of people believe in the equality of opportunity. Many people got involved in the discussion after John Rawls's publication of the "Theory of justice". Amartya Sen (1980) believes that individual capabilities should be considered as a measure of welfare. On the other hand, some people like Arneson (1989), Cohen (1989), and Roemer (1993) are considered as pioneers of the theory of equality of opportunity. Other people like Dworkin believe in equality of resources.[1]

Some of these concepts are clear, although the others are not. For example, the meaning of equality of income is largely straightforward, even though the meaning of equality of opportunity is not so clear. Nevertheless, it may be said approximately that people should have equal opportunity to continue their own desirable life. So by this idea, the exogenous conditions which people are not involved to select should be equal.

Although inequality of income distribution depends on the individual's efforts, the external state has an important effect on income distribution too. In theory of equality of opportunity, the basic problem is providing equal opportunity to tailor the specific needs of everyone; people have different income levels because they are different in terms of talent, level of education, cultural backgrounds, and many other aspects which we call them endowments. In other words, the aim of equal opportunity is to prevent, eliminate, or reduce discrimination between individuals to generate efficient, motivating, and fair inequality.

Assigning a numerical value is one of the fundamental problems in measuring opportunity. The concept of opportunity has wide dimensions and it is related to discriminated training, education, gender, region, health services, environment, and so on. However, the various attempts have been made to quantify opportunity. Kranich (1996) did the first attempt by data simulation. After this, the great efforts were made to measure equality of opportunity such as [Arlegi(1999), Nieto (1999), Bossert (1999), Fluerbaey (1999 and Van de gaer (1999), and Ok (1997)].[2] Kranich (1996) approach to measure equality of opportunity is based on axioms. He assumed uncompetitive opportunity and thus outlined the features in terms of which equality of

---

[1)] for more information about the difference between these theories refer to Romer (1996), (1998) and (2000) as well as Dworkin (1981) and the references of equality in welfare and endowments.

[2] Summary of this literature can be found in the Pergini works (1999).

opportunity must be met. He designs an indicator base on the simple sum of parameters then measures each of these features. By comparison, the generalized Kranich index of inequality of opportunity is very similar to the Gini coefficient. However, the methods of weighting parameters are different. Indicators based on education inequality are another approach to the measurement of opportunity because access to educational opportunity can be heavily influenced by race, gender, region, and income. On the other hand, education is known to offset some of the discriminations and a tool for elimination of poverty. This approach is applied in the literature more than Kranich methods. In this approach, the benefit of individuals' education is limited because of their residence features. Thus, their right to receive an equal educational opportunity is overshadowed by another external opportunity. For example, a kid in a high-income area has better access to qualified education than a kid in low income regions.

In connecting equal opportunity to equal distribution, we concentrate on the impacts of opportunity redistribution on income distribution and welfare. The question is whether a more equal opportunity can lead to a more equal distribution of income and social welfare? To measure these impacts, we introduce a dynamic Computable General Equilibrium model. We assume heterogeneous urban and rural households with unequal primary resources and endowments. People will reach better skills through education which brings them more income. These assumptions will make relationships between education, the distribution of income, and welfare. The opportunity index is calculated by the calibration of the model based on the Iranian economy. Supposing that government can influence the equality of educational opportunity, we will examine the impact of different opportunity redistribution scenarios on income distribution and social welfare.

In the next section, we describe the theoretical framework, the effective factors which could affect urban and rural income and skilled labor supply to learn the potential impact of this redistribution on economic variables. In the third section, we introduce a General Equilibrium model. In the fourth section, based on the Micro Consistent data Matrix of 1999, the General Equilibrium model is calibrated. We analyze this matrix and show how the initial values of the wage index, equal opportunity, and "skill premium" are defined. In the fifth section, various scenarios of distribution of opportunity between rural and urban areas are introduced. Then we examine the effects of opportunity redistribution on economic variables. The last section discusses the results and concludes.

2. Methods

To analyze the effects of opportunity redistribution on the economy, it is necessary to clarify the mechanism of the effects. In this study, it is assumed that the opportunity available to a person affects his acquired skills. Therefore, with opportunity, unskilled labor becomes skilled labor. Although health, effort, and talent are also important in creating a skilled workforce, they are assumed to be homogeneous for simplicity. However, we can follow the same method for measuring them. The model is illustrated in the next section in more detail.

2.1 Income and opportunity

To analyze the impacts of redistribution of opportunity on income inequality, we need to identify the factors affecting income. In this study, we consider income inequality between regions. The same framework is applicable to inequality between different groups. In each region i, individuals' income consists of total labor income (LI) and capital income (KI):

$$I_i = LI_i + KI_i \quad (1)$$

If we show the stock of the capital resources in each region by K, and if r depicts the capital return, capital income in each region is:

$$KI_i = K_i . r_i \quad (2)$$

Let labor wage be displayed by w, then the total income of people of region i from labor is the sum of unskilled labor income and skilled labor income:

$$LI_i = SL_i w_s + UL_i w_u \quad (3)$$

where SL stands for skilled labor endowment and UL shows unskilled labor endowment. We show β as opportunity available to an individual in a given area during a specific period. Also, we assume the skilled labor supply (SL) in this region is determined according to the available opportunity (β), efforts and talent (φ) and the population of labor (L)[3].

$$SL_i = \min\{\varphi_i \beta_i L_i, L_i\}, \qquad \beta_i, \varphi_i \geq 0 \quad (4)$$

We assume that if health, talent, effort, and opportunity in one region are higher than another, the supply of skilled labor in that region is also higher. In other words, skilled labor supply is zero, if beta or φ is zero. However, with complete opportunity, only skilled labor will be supplied and unskilled work force will be zero. Thus, unskilled workers required in this area should be provided by other regions. According to these assumptions, we express the skilled and unskilled labor supply based on the population of the work force. Therefore labor income is determined by:

$$LI_i = \varphi_i \beta_i . L_i w_s + (1 - \varphi_i \beta_i) . L_i w_u \quad (5)$$

We also assume that the wage of skilled labor is determined proportionally to unskilled labor wage. By definition of opportunity or skill premium index (α), skilled labor wage is:

$$w_s = (1 + \alpha_i) w_u \quad (6)$$

[3] In complex models the supply labor is determined based on optimal choice between work and leisure.

In fact, the skill premium index represents the difference between skilled and unskilled workers' wage caused by accumulated opportunity premium. By substitution, labor income is determined by:

$$LI_i = \varphi_i \beta_i . L_i . (1+\alpha_i) w_u + (1-\varphi_i \beta_i) . L_i . w_u \quad (7)$$

$$LI_i = L_i . w_u \left[\varphi_i \beta_i . (1+\alpha_i) + (1-\varphi_i \beta_i) \right]$$

$$LI_i = L_i . w_u (1+\varphi_i \beta_i . \alpha_i) \quad (8)$$

Therefore, regional income is re-written as follows:

$$I_i = K_i . r_i + L_i . w_u (1+\varphi_i \beta_i . \alpha_i) \quad (9)$$

According to this equation, income in each area is a function of the population of labor, health, efforts, talent, available opportunity, wage of unskilled labor, skill premium, capital stock, and capital return. Knowing the values of these parameters, we can obtain the income level of each area and income inequality. This equation implies that:

1) If the available opportunity increase (ceteris paribus), the regional income will increase.
2) By increasing the skill premium index (ceteris paribus), the regional income will increase.
3) By increasing unskilled labor wage, the regional income will increase (ceteris paribus).
4) As well, by increasing the population of the workforce, the regional income will increase (ceteris paribus).

In reality, the analysis of this equation is very complicated. The main reason is that we are not able to keep other things as constant. For example, if the available opportunity increases, the skilled labor supply will increase. In a simple model, by increasing the skilled labor supply, the skilled labor wage and skill premium index will decrease, and as a result, it has a negative impact on income too. So, the first statement above is not always true. As well, by increasing the population of the workforce, wages of unskilled workers and income premium index will decrease which has a negative impact on income. So, the fourth statement is not always true. On the other hand, skill premium and income of workforce indicators are determined based on supply and demand mechanism and are endogenous. Considering the substitution between labor and capital in production technology, the complexity of the analysis is more obvious.

Facing these complexities, economists and scholars recommended using a General Equilibrium approach. General equilibrium models are appropriate tools as there consider various direct effects and indirect effects. This structure makes it possible to simulate complex changes of variables in a consistent framework. Here, we use a General Equilibrium model to analyze the impacts of redistribution of economic opportunity.

2.2 General Equilibrium Model

In the model, some economic variables are endogenous and determined by the interaction of economic agents while some others are exogenous. Main endogenous variables are household welfare, the income level for economic agents, the activity level of production sectors, demand, and supply level of goods and services. Furthermore, prices, wages, and capital return are determined endogenously through the interaction of supply and demand in markets. In this study, we determine the skill premium index as an endogenous variable. Modeling the redistribution of opportunity required that benchmark opportunity index, the population of workforces and capital stock are considered as exogenous.

We introduce the model as a mixed complementary problem following Rutherford (1995). Our model is a multi- sector, multi-region, multi-labor framework of a closed economy. Economic activities are classified according to labor intensity. This model consists of four production activities, four types of goods and services, urban and rural households, other institutions and final consumers, skilled and unskilled labor, and capital. In this model, there is a zero-profit condition for all of the production activities. There is a market-clearing condition for goods and services, capital, and labor. Income balance condition is assumed for households.

In the next section, only the main equations are introduced. The core part of the model is developed in a team of economists and is well-documented. This framework is applied in the assessment of the following policies: Cash Subsidy Transfer (Shahmoradi et al., 2011; Manzoor & Haqiqi, 2013); Access to Public Services (Mortazavi et al., 2013; Haqiqi & Mortazavi, 2012); Resources Boom (Manzoor et al. 2012a; Haqiqi & Bahador, 2015; Haqiqi & Bahalou, 2013); Generational Justice (Haqiqi, 2012; Haqiqi et al, 2013); Trade Barriers (Haqiqi & Bahalou, 2013) ; Labor Market Policies (Haqiqi & Bahalou, 2015; Manzoor and Bahaloo, 2015); Environmental Emissions (Manzoor and Haqiqi, 2012a); Energy Price Reform (Manzoor et al. 2010; Manzoor et al. 2012b; Manzoor & Haqiqi, 2012b; Sharifi et al., 2014) ; Energy Efficiency (Manzoor et al., 2011; Haqiqi et al., 2013) ; Energy Demand (Manzoor et al., 2012c; Manzoor & Haqiqi, 2013); Direct Investment (Manzoor et al. 2013). In this version, we focus on opportunity and income distribution.

2.3 Production structure

The products are made by unskilled and skilled workers, capital, and intermediate materials. In this study, nested constant elasticity of substitution (CES) is assumed. In this framework, the cost of the production is with a function of composite intermediate (M) and composite value added (KL). Considering production behavior in each activity as MCP (mixed complementarity problem), the zero profit function for each sector s is:

$$AL_s\left[\left(\omega_{KL,s}P_{KL,s}^{\,1-\gamma_s}+\omega_{M,s}P_{M,s}^{\,1-\gamma_s}\right)^{\frac{1}{1-\gamma_s}}-p_{j,s}\right]=0, \tag{10}$$

$$AL_s\geq 0,\ \underbrace{\left(\omega_{KL,s}P_{KL,s}^{\,1-\gamma_s}+\omega_{M,s}P_{M,s}^{\,1-\gamma_s}\right)^{\frac{1}{1-\gamma_s}}}_{\text{CES unit cost function}}\geq \underbrace{p_{j,s}}_{\text{unit revenue}}$$

$$P_{KL,s}=\left\{\omega_{L,s}P_{L,s}^{\,1-\rho_s}+\omega_{k,s}P_{k,s}^{\,1-\rho_s}\right\}^{\frac{1}{1-\rho_s}} \tag{11}$$

$$P_{L,s}=\left(\theta_{ul,s}p_{ul,s}^{\,1-\lambda_s}+\theta_{sl,s}p_{sl,s}^{\,1-\lambda_s}\right)^{\frac{1}{1-\lambda_s}} \tag{12}$$

$$P_{M,s}=\left(\sum_m \theta_{m,s}p_m^{\,1-\beta_s}\right)^{\frac{1}{1-\beta_s}} \tag{13}$$

Where P is the price level, ω shows the upper layer's share parameters, θ is the share parameter in the lower layers, λ denotes the elasticity of substitution between skilled and unskilled labor, β shows the elasticity of substitution between intermediate materials, and ρ is the elasticity of substitution between labor and capital. Furthermore, s is the manufacturing sector index, j is the index of commodities, l is the labor index, and k is the index of capital.

Costs of intermediate material composite or P_M is also a CES function of the price of all intermediate commodities (p_m). Price of value added composite or P_{KL} is reflecting the capital and labor cost index. It is CES combination of composite labor cost index (P_L) and capital returns (pk). Labor cost index is also a CES function of the wage of unskilled (p_{ul}) and skilled labor (p_{sl}).

2.4 Modeling the supply and demand of skilled and unskilled labor

Generally, the demand for skilled labor is a function of its wage (p_{sl}), the level of production activity (AL_s), simple labor wage (p_{ul}), the efficiency of capital (p_k) and other costs of production (P_M). Market clearance condition for the skilled labor market in MCP form is:

$$P_{sl}\left[\sum_i \varphi_i\beta_i L_i-\sum_s D_{sl,s}\right]=0,\ P_{sl}\geq 0,\ \sum_i \varphi_i\beta_i L_i\geq\sum_s D_{sl,s} \tag{14}$$

$$D_{sl,s}=\omega_{KL,s}\omega_{L,s}\theta_{sl,s}AL_s D^0{}_{sl,s}\left(\frac{P_{KLM}}{P_{KL,s}}\right)^{\gamma_s}\left(\frac{P_{KL,s}}{P_{L,s}}\right)^{\rho_s}\left(\frac{P_{L,s}}{P_{sl,s}}\right)^{\lambda_s} \tag{15}$$

$$P_{KLM}=\left(\omega_{KL,s}P_{KL,s}^{\,1-\gamma_s}+\omega_{M,s}P_{M,s}^{\,1-\gamma_s}\right)^{\frac{1}{1-\gamma_s}}$$

Where AL, D, and $D^{0,}$ are activity level, demand function, and the benchmark demand level respectively. This function implies that the demand for skilled labor increase as wage falls or the

activity level rises. Note that the elasticity of substitution amplifies the effects of change in relative prices. Similarly, the labor market in MCP form and in CES cost function is:

$$P_{ul}\left[\sum_i (1-\varphi_i \beta_i L_i) - \sum_s D_{ul,s}\right] = 0,\ P_{ul} \geq 0,\ \sum_i \varphi_i \beta_i L_i \geq \sum_s D_{ul,s} \tag{16}$$

$$D_{ul,s} = \omega_{KL,s}\omega_{L,s}\theta_{ul,s} A L_s \bar{D}_{ul,s} \left(\frac{P_{KLM}}{P_{KL,s}}\right)^{\gamma_s} \left(\frac{P_{KL,s}}{P_{L,s}}\right)^{\rho_s} \left(\frac{P_{L,s}}{P_{ul,s}}\right)^{\lambda_s} \tag{17}$$

The interaction of demand and supply of capital in MCP form is determined by:

$$P_k\left[\bar{S}_k - \sum_s D_{k,s}\right] = 0,\ P_k \geq 0,\ \bar{S}_k \geq \sum_s D_{k,s} \tag{18}$$

$$D_{k,s} = \omega_{KL,s}\omega_{k,s} A L_s \bar{D}_{k,s} \left(\frac{P_{KLM}}{P_{KL,s}}\right)^{\gamma_s} \left(\frac{P_{KL,s}}{P_{k,s}}\right)^{\rho_s} \tag{19}$$

Where capital supply is exogenous. The interaction of supply and demand in these equations endogenously determines the wage of skilled and unskilled labor as well as the rate of return of capital.

2.5 Calibration and data

The model is calibrated based on the 2001 Micro Consistent data Matrix for the Iranian economy. The model consists of six categories of variables. It includes (1) Activity levels, (2) Levels of supply and demand, (3) Share parameters, (4) Elasticity of substitution, (5) Price indices, and (6) Opportunity indices. We calculate the initial values of the endogenous variables and model parameters based on this dataset. But the figures in MCM are based on transactions value- there are neither price levels nor quantities. We have to use the Harberger (1969) method for extracting prices and quantities for our General Equilibrium model. The method assumes unity as the initial values of all price indexes, wages, rate of return, and level of activity on the base year. Hence, we can simply calculate the quantity variables such as the amount of supply and demand. Share parameters are also calculated based on the cost share in MCM. However, we need more information for calculation of opportunity difference. We calculate this index using the labor population and labor wage. Economic data often reflect the total income of skilled and unskilled labor in a region by which we can compute the wage index, opportunity index, and skill premium index according to the following equation.

$$\beta_i = \frac{SL_i}{L_i} \tag{20}$$

$$\alpha = \frac{w_s}{w_u} - 1 = \frac{IS_i / LS_i}{IU_i / LU_i} - 1 \qquad (21)$$

2.6 Micro Consistent Matrix

Micro Consistent data Matrix is a rectangular Social Accounting Matrix (SAM). In this modified SAM, each column represents the income (revenues) and expenses of an economic agent. On the other hand, each row shows supply and demand in a particular market. In this table, positive values are income or supply and negative values exhibit costs or demand. Table 1 shows the simplified version of the matrix used in this study. This table includes urban and rural households' income which is originated from labor and capital. It shows the contribution of labor and capital in the production of each activity. In addition, this matrix demonstrates the allocation of resources (capital and labor) among different sectors in the Iranian economy.

Table 1: 2001 Micro Consistent Matrix for the Iranian economy (Billions of Rls, domestic currency)

	Agriculture	Oil and Gas	Industry, mining	Services	Urban household	Rural household	Other Inst.
Agriculture	110,198	-178	-60,721	-5,223	-26,120	-24,335	6,379
Oil and Gas	0	111,679	-10,864	0	0	0	-100,815
Industry and Mining	-23,356	-2,206	249,867	-54,453	-137,606	-66,101	33,855
Services	-4,235	-650	-18,199	431,058	-116,846	-26,367	-264,760
Capital	-78,239	-106,578	-113,084	-271,382	195,667	89,227	284,388
Skilled labor, urban	-889	-1,534	-26,745	-77,759	106,927	0	0
Unskilled labor, urban	-54	-116	-4,475	-3,735	8,379	0	0
Skilled labor, rural	-3,202	-337	-11,494	-17,026	0	32,059	0
Unskilled labor, rural	-224	-81	-4,286	-1,480	0	6,070	0
Transfers	0	0	0	0	-30,400	-10,553	40,953

Source: Authors' calculations from the 2001 Input Output table and labor statistics from the Statistical Center of Iran.

As this table depicts, the rural household income out of unskilled and skilled labor are 6070 and 32059 billions of Rls respectively. While the total income of urban households out of unskilled and skilled labor are 8379 and 106927 billions of Rls respectively.

Table 2: information on population and labor income

		Income of labor*	Population**
Urban			
	Total urban workforce	115,306	14,047
	Unskilled workers in urban	8,379	2,847
	Skilled workers in urban	106,927	11,200
Rural			
	Total rural workforce	38,129	6,391
	Unskilled workers in rural	6,070	4,050
	Skilled workers in rural	32,059	2,341

***Source: micro consistent matrix (billions of Rls)**

****Source: Statistical Center of Iran (thousands of people)**

Table 2 shows the population of skilled and unskilled labor in urban and rural regions as well as their income. The information combined with mathematical equation 20 is used to compute the

opportunity index for rural and urban areas and to calculate the income out of opportunity. Table 3 shows the calculated indices based on this information. Our very early but very important finding is that the index of opportunity for urban households is much more than doubles of the opportunity for rural households. In other words, the opportunity is not distributed equally among rural and urban regions in Iran.

Table 3: opportunity index for urban and rural households

	Opportunity index in the base year	Income out of opportunity
Urban households	0.80	73964
Rural households	0.37	28550

Resource: research computing

3. Results

We assume complete redistribution of opportunity. Total opportunity endowment of the economy is distributed between urban and rural households. In the first scenario, the share of the urban household out of opportunity endowment is 10%, in the second scenario it is 20%, in the third scenario it is 30%, and so in the ninth scenario is 90%. On the other hand, the share of rural households in the first scenario is 90%, in the second scenario is 80%, in the third scenario is 70% and so in the ninth scenario is 10%. The question is how the inequality of income changes due to redistribution of opportunity in each scenario. Figure 1 shows the urban to rural income ratio as well as urban to rural opportunity ratio. The urban to rural income ratio is always more than one. In other words, the total income of urban is greater than the total income of rural as the urban area is more populated. To have a precise analysis we should compare the income on a per capita basis.

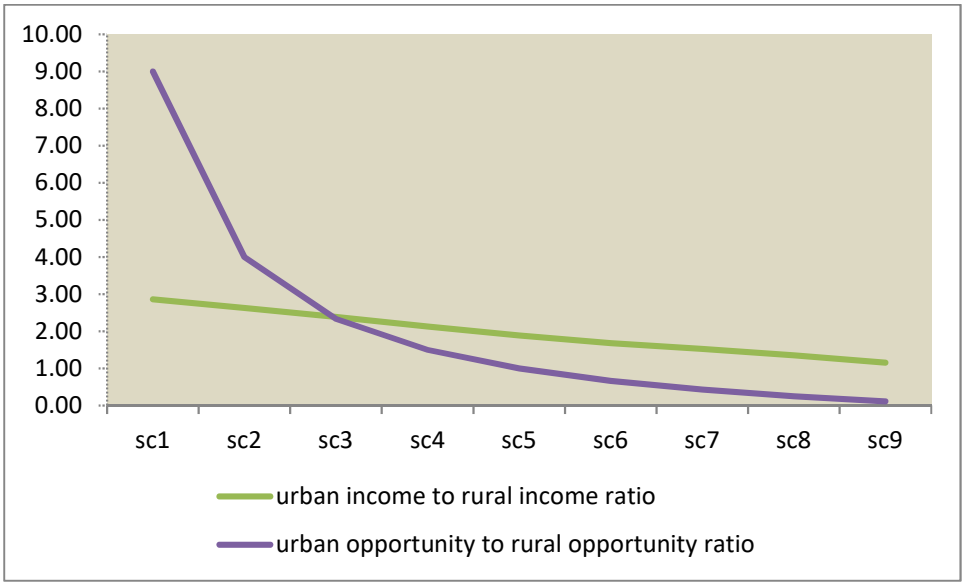

Figure 1. a comparison of income ratio with urban opportunity ratio to rural. This figure illustrates the total income of urban is higher than rural income.

Figure 2 shows urban to rural per capita income ratio. Using this figure, we find out the per capita income equality of urban and rural occurs somewhere between the third and fourth scenarios. There, the per capita income is almost the same for rural and urban households. In other words, the urban to rural per capita income ratio is between 0.97 and1.09, if the opportunity share of rural households is between 30% and 40%. So we can achieve equality of per capita income if the opportunity share of urban households is between 60% and 70%.

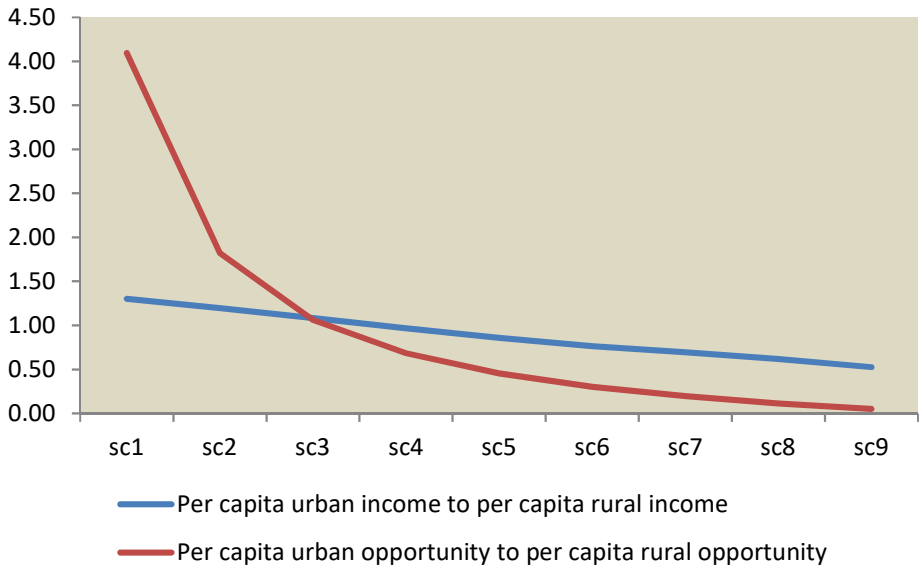

Figure 2. comparison of urban per capita income ratio to rural with urban per capita opportunity to rural. This figure illustrates the ratio of urban to rural per capita income.

Table 4 shows these figures. Look at two extreme cases. The ninth scenario illustrates that the per capita income of urban will be roughly one-half of per capita income of rural if rural households have 90% of opportunity. In contrast, If 90% opportunity is devoted to urban households, the per capita income of them will be nearly 1.3 of rural per capita income.

Table 4: income inequality in the distribution of opportunity for different scenarios

	sc1	sc2	sc3	sc4	sc5	sc6	sc7	sc8	sc9
Urban to rural per capita income	1.30	1.20	1.09	0.97	0.86	0.77	0.70	0.62	0.53
Urban to rural per capita opportunity	4.10	1.82	1.06	0.68	0.46	0.30	0.20	0.11	0.05
Urban to rural income	2.86	2.63	2.39	2.13	1.89	1.68	1.53	1.36	1.15
Urban to rural opportunity	9.00	4.00	2.33	1.50	1.00	0.67	0.43	0.25	0.11

Resource: computing of research

We find another interesting relationship. By increasing inequality of opportunity, inequality of income is growing faster and the income gap will be larger than the opportunity gap. This implied that we can enjoy further percentage reduction in income inequality by declining one percentage of opportunity inequality. In other words, we can see a further reduction in income inequality with a decline in inequality opportunity.

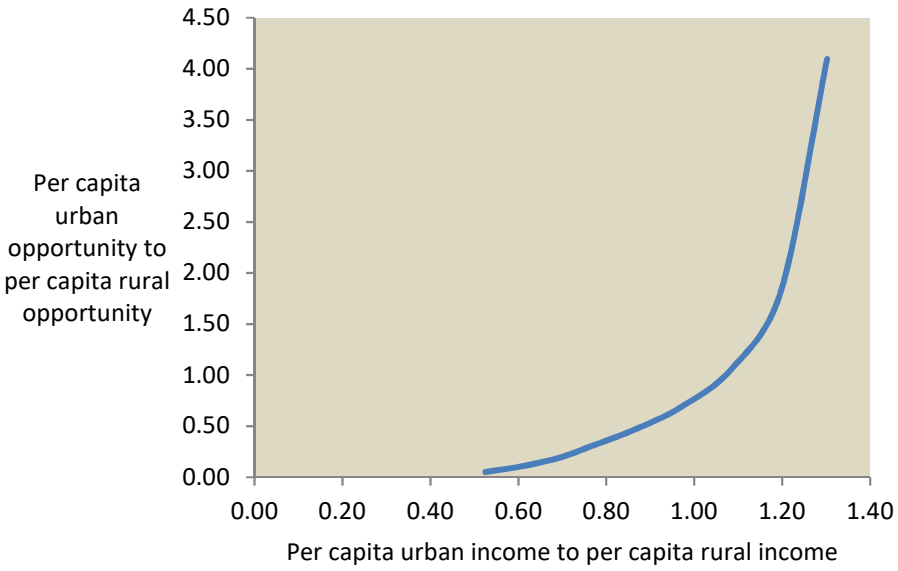

Figure 3. Change in per capita income, with change for the opportunity. This figure illustrates we can see a further reduction in income inequality with a decline in inequality in opportunity.

4. Summary and conclusions

One of the most important determinants of income distribution is how to allocate resources and opportunity in society. Therefore, individuals with more opportunity are able to achieve higher levels of income. In other words, equality of income requires equality in opportunity distribution. Although equal opportunity is necessary for income equality, it is not enough.

In this study, we analyzed the effects of redistribution of opportunity on income inequality and distribution in Iran in a general equilibrium model. This study proves that if per capita opportunity for urban and rural households are equal, we achieve income equality. In other words, equality of opportunity can be brought equality of per capita income.

The important achievement of this study is the relationship between the income gap and the opportunity gap. We found faster growth in per capita income gap by increasing opportunity gap. In the other words, the decrease in the inequality of income is higher than the decrease in inequality of opportunity that means by increasing the inequality of opportunity the inequality of income will be greater than the inequality of opportunity. As a result, we strongly recommend cutting the opportunity gap which leads to a further reduction in the income gap.

References

Arlegi, R., Nieto, J. (1999). Equality of opportunity: Cardinality-based criteria. In: de Swart H (ed) Logic, Game Theory and Social Choice.Tilburg University Press, Tilburg, pp. 458–481.

Arneson, R. (1989). Equity and Equality of Opportunity for Welfare. Philosophical Study 56.P 77–93

Bahador, A., & Haqiqi, I. (2015). Economic Effects of Petroleum Export Reduction in Iran: Financial Computable General Equilibrium Approach. Quarterly Journal of Monetary and Banking Researches, 8(24), 251–284.

Bennett, C., Both, C. & Yeadle, S. (2001). Mainstreaming equality in the committees of the Scottish parliament. University of strathclyde

Bosser, W., Fleurbaey, M., Van de gaer, D. (1999). Responsibility, talent, and compensation: A second-best analysis. Review of Economic Design 4.P 35–55.

Carnoy, M., & Levin, H. (1367). Dead end of training correction.

Cohen, G. A. (1989). On the Currency of Egalitarian Justice. Ethics 99. P 906–944.

Dworkin, R. Sovereign virtue. The theory and practice of equality. Cambridge, MA: Harvard University press 2000.

Dworkin, R. What is Equality? Part 1: Equality of Welfare, Philosophy and Public Affairs, Vol. 10 No. 3. (Summer, 1981a), pp. 185-246.

Dworkin, R. What is Equality? Part 2: Equality of Resources, Philosophy and Public Affairs, Vol.10, No. 4. (Autumn, 1981b), pp. 283-345

Haqiqi, I., & Bahador, A. (2015). Investigating Economic Effects of Oil Export Reduction: A Financial Computable General Equilibrium Approach, MPRA Paper 95784, University Library of Munich, Germany.

Haqiqi, I., & Bahaloo Horeh, M. (2013). Impacts of Cut in Oil Exports on Sectoral Employment of Skilled and Unskilled Labor: A CGE Approach International Iranian Economic Association Conference, IIEA, 2013, Istanbul, Turkey.

Haqiqi, I., & Bahaloo Horeh, M. (2014a). A CGE Model for Labor Migration Analysis Using Labor Micro Consistent Matrix, 22nd International Input-Output Conference & 4th Edition of the International School of I-O Analysis,14-18 July 2014, Lisbon, Portugal.

Haqiqi, I., & Bahaloo Horeh, M. (2014b). Dynamic CGE Modeling of Interest Rate Subsidies: An Application of Financial SAM, EcoMod2014, International Conference on Economic Modeling, Bali, Indonesia, July 16-18, 2014.

Haqiqi, I., & Bahalou Horeh, M. (2013). Macroeconomic Impacts of Export Barriers in a Dynamic CGE Model. Journal of Money and Economy, 8(3), 117–150.

Haqiqi, I., & Bahalou, M. (2015). A General Equilibrium Analysis of Unskilled Labor Entry and Skilled Labor Exit in Iran, MPRA Paper 95781, University Library of Munich, Germany.

Haqiqi, I., & Manzoor, D. (2012). Environmental Impacts of Phasing out Energy Subsidies, MPRA Paper 95688, University Library of Munich, Germany, revised 2016.

Haqiqi, I., & Mortazavi Kakhaki, M. (2012). The Impact of Redistribution of Opportunities on Income Inequality: A CGE Approach, MPRA Paper 95819, University Library of Munich, Germany.

Haqiqi, I., Aghanazari, H., & Sharzei, G. (2013). Natural Resources Revenue Allocation: A Dynamic General Equilibrium Approach, MPRA Paper 95785, University Library of Munich, Germany.

Haqiqi, I., Bahaloo Horeh, M. & Ghaedi, M. (2014). A CGE Analysis of Welfare and Sectoral Impacts of Removing Interest Rate Subsidies: A Model Based on Financial SAM and Flow of Fund Accounts, 22nd International Input-Output Conference & 4th Edition of the International School of I-O Analysis, 14-18 July 2014, Lisbon, Portugal.

Haqiqi, I., Manzoor, D., & Aghababaei, M. (2013). Impacts of Electricity Efficiency Improvements on Factors Market: A Computable General Equilibrium Approach, MPRA Paper 95825, University Library of Munich, Germany.

Haqiqi, I., Manzoor, D., & Aghababaei, M. E. (2013). Sectoral Economic Impacts of Electricity Efficiency Improvements: A Computable General Equilibrium Approach. Journal of Planning and Budgeting, 17(4), 25–44.

Haqiqi, I., & Mirian, N. (2015): A Financial General Equilibrium Model for Assessment of Financial Sector Policies in Developing Countries. MPRA Paper 95841, University Library of Munich, Germany.

Kranich, L. (1996). Equitable opportunity: An axiomatic approach. Journal of Economic Theory 71. P 131–147.

Manzoor, D., & Bahaloo Horeh, M. (2015). Analyzing the Impact of Increasing Minimum Wage on Skilled and Unskilled Labor in Iran: A CGE Approach. Journal of Quantitative Economics, Volume 12, 3 (46).

Manzoor, D., & Haqiqi, I. (2012). Impact of Energy Price Reform on Environmental Emissions; A Computable General Equilibrium Approach, MPRA Paper 95818, University Library of Munich, Germany.

Manzoor, D., & Haqiqi, I. (2013). Impacts of Energy Price Increase and Cash Subsidy Payments on Energy Demand. Journal of Trade Studies, 67(17), 101–124.

Manzoor, D., Aghababaei, M., & Haqiqi, I. (2011). Rebound Effects Analysis of Electricity Efficiency Improvements in Iran: A Computable General Equilibrium Approach, MPRA Paper 95810, University Library of Munich, Germany.

Manzoor, D., Haqiqi, I. & Aghababaei, M. (2012). Decomposing Electricity Demand Elasticity in Iran: Computable General Equilibrium Approach, MPRA Paper 95817, University Library of Munich, Germany.

Manzoor, D., Haqiqi, I., & Aghababaei, M. (2012). Modeling Dutch Disease in the Economy of Iran: A Computable General Equilibrium Approach, MPRA Paper 95821, University Library of Munich, Germany.

Manzoor, D., Haqiqi, I., & Aghababaei, M. (2013). Economic Impacts of Investment in the Electricity Industry: A CGE Comparison of Regulated and Free Markets, MPRA Paper 95823, University Library of Munich, Germany.

Manzoor, D., Shahmoradi, A., & Haqiqi, I. (2010). An Assessment of the Impact of Reducing Implicit and Explicit Energy Subsidies in Iran; Using a Computable General Equilibrium Model Based on a Modified Micro Consistent Matrix, MPRA Paper 95808, University Library of Munich, Germany.

Manzoor, D., Shahmoradi, A., & Haqiqi, I. (2012). An Analysis of Energy Price Reform: A CGE Approach. OPEC Energy Review, 36(1), 35–54. DOI: 10.1111/j.1753-0237.2011.00200.x

Manzoor, D., & Haqiqi, I. (2013). Impacts of Energy Price Increase and Cash Subsidy Payments on Energy Demand, MPRA Paper 95826, University Library of Munich, Germany.

Mortazavi Kakhaki, M., Haqiqi, I. & Mahdavi Adeli, M. (2013). Regional Equality of Opportunities and Income: A General Equilibrium Modeling for Iran , MPRA Paper 95822, University Library of Munich, Germany.

Nunez, J., Tartakowsky, A. (2007). Inequality of Outcomes vs. Inequality of Opportunity in a Developing Country An exploratory analysis for Chile, Estudios de Economia, Vol34-N 2,p 185-202.

Ok, E.A. (1997). On opportunity inequality measurement. Journal of Economic Theory 77. P 300–329.

Peragine, V. (1999). The distribution and redistribution of opportunity. Journal of Economic Surveys 13.P 37–70.

Robinson, S., & Roland-Holst, D. W. (1988). Macroeconomic structure and computable general equilibrium models. Journal of Policy Modeling, 10(3), 353-375.

Roemer, John E. (1996). Theories of Distributive Justice. Cambridge, MA: Harvard University Press.

Roemer, John E. (1998). Equality of Opportunity, Cambridge, MA: Harvard University Press.

Roemer, John E. (2000). Equality of Opportunity, in Meritocracy and Economic Inequality, Keneth Arrow , Samuel Bowles and Steven Durlauf, editors,Princeton University Press, New Jersey.

Roemer, John. Three Egalitarian Views and American Law, Law and Philosophy, Vol. 20, No. 4 (Jul., 2001), pp. 433-460.

Rutherford Thomas F. 1998, “Economic Equilibrium Modeling with GAMS, An Introduction to GAMS/MCP and GAMS/MPSGE”, University of Colorado.

Rutherford, T. F. (1995). Extensions of GAMS for complementarily problems arising in applied economics. Journal of Economic Dynamics and Control 19(8):1299–1324, 1995.

Rutherford,Thomas.f. (1994). Applied General Equilibrium Modeling with MPSGE as a GAMS Subsystem, Manuscript, Department of economics, University of Colorado, Boulder.

Sen, Amartya K. (1980). Equality of What? In S. McMurrin, ed., Tanner Lectures on Human Values,vol I. Cambridge, U.K.: Cambridge University Press.

Shahmoradi, A., Haqiqi, I., & Zahedi, R. (2011). Impact Analysis of Energy Price Reform and Cash Subsidy Payment in Iran: A CGE Approach, MPRA Paper 95809, University Library of Munich, Germany.

Sharifi, A., Khoshakhlagh, R., Bahaloo Horeh, M., & Sadeghi Hamedani, A. (2014). The Impact of Energy Price Increase on Employment: A CGE Approach. Journal of Economic Modeling Research, 4(16), 153-180.

Weymark, JA. (1981). Generalized Gini inequality indices. Mathematical Social Sciences 1: 409–430.