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Opportunity Inequality and its Effects on Economic Growth and Per Capita GDP

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Abstract

Opportunity inequality and its relationship with economic growth is a concept to which not enough attention has been paid in the previous studies. This study attempts to investigate the effects of opportunity inequality index on economic growth in 15 developing and 15 developed countries over the years 1995-2015. Accordingly, the mean group (MG) estimator within the framework of panel data was used and a new index for opportunity inequality was created. Furthermore, the effects of opportunity inequality and its sub-indices on per capita GDP were compared with the results of the model when economic growth was a dependent variable. The results showed that inequality of opportunities and its sub-indices on economic growth and per capita GDP had different effects in the developed and developing countries.

1. Introduction

In recent years, the concept of equal opportunity has been frequently considered in economic literature. Researchers such as Arneson (1989), Cohen (1989) and Romer (1998) were pioneers in the area of opportunity inequality. Sen (1980) believed that goods and facilities were distributed almost equally at first and that any remaining inequality resulted from individual choices. Some scholars like Dworkin (2000) argued that all factors which can affect individual welfare but are out of his/her control, should be controlled by government.

The concept of equality is clear in some aspects but not entirely clear in some other aspects. For example, income equality is well defined but opportunity equality is not clearly defined. However, opportunity equality can be accurately described as the situation where individuals have the same opportunities for pursuing overall life objectives as other persons (Haqiqi and Mortazavikakhki, 2012). In this regard, therefore, the opportunity is an

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exogenous factor and individuals have no role in determining and selecting it (Nunes and Tartakowsky, 2007).

Advocators of the idea of opportunity equality believe that to achieve equality, discriminatory factors that are outside the control of individuals but effective in determining their social and economic statuses should be identified and prohibited. According to this idea, if individuals are provided with equal opportunities and everyone starts from the same point, the outcome will be fair (Dworkin, 2000).

It can be argued that equality of opportunity is a key measure of economic growth and development. Some believe that if economic development is equal to approaching distributive justice, it can be implied that a major part of income and opportunity inequality is dependent on the circumstances beyond individuals' control (Zhang and Eriksson, 2010). Therefore, policymakers should establish an environment which helps in promoting equal opportunities and create incentives for economic growth in this condition.

Opportunity is an issue with multiple dimensions (Haqiqi and Mortazavikakhki, 2012) and to measure it factors such as educational, gender, and regional discrimination should be considered. It is worth mentioning here that this issue provides the researcher with a set of indices each of which is concerned with one or more aspects of opportunity.

Previous studies have focused on only one aspect of opportunity inequality. Lefranc et al. (2008) examined income inequality in nine developed countries through the use of Gini index. Ferreira and Gignoux (2008) assessed inequality of receipts, income and consumption in six Latin American countries. They used parametric and non-parametric methods to measure these inequalities. Checchi and Peragine (2010) used the mean logarithmic deviation to study receipts inequality in Italy. Jusot et al. (2010) focused on health inequality and measured it through the use of variance index. Yalonetsky (2012) surveyed educational inequality in Peru and introduced two new indices to measure opportunity inequality. Bricard et al. (2013) used several methods to examine inequality of health in European countries.

Rougoor and Marrewijk (2015) argued that the level of global income inequality would reach its lowest point around 2027 and it would, then, rise again. This would be affected by both economic and demographic factors. By combining economic projections with demographic developments and by using GDP per worker instead of GDP per capita in projecting income levels, they emphasized the role of demographic factors in income inequality. Differences between countries, in different stages of development, in their population growth and structure have been shown to increase global income inequality especially in the long run (after 2030).

Hartmann et al. (2017), using multivariate regression analysis, observed that economic complexity was a significant and negative predictor of income inequality and that this relationship was robust by controlling aggregate measures of income, institutions, export concentration, and human capital.

Onofrio et al. (2017) investigated the impact of local banking development on income inequality and the role of socio-economic structure in this regard. They found that local banking development mitigated income inequality by affecting geographical mobility and urbanization.

Blau (2018), using a broad cross-sectional sample of countries, investigated whether stock market liquidity affected the level of income inequality. His results showed that liquidity in a country's stock market was negatively related to various measures of inequality. In addition, he found that this relationship did not exist in most of the developed countries. Instead, his results were strongly correlated with the underdeveloped and moderately developed countries.

Dietmar (2018) observed that increasing inequality was commonly associated with social unrest and conflict between social classes. Islam (2018) investigated the extent to which wealth inequality influenced economic freedom and whether democracy level had any significant effect on this relationship. Empirical results suggested that rise in wealth inequality significantly hampered overall economic freedom, property rights protection, freedom to trade, soundness of money and regulatory environment. Furthermore, the negative effects of wealth inequality were reinforced at lower levels of democracy.

Each of the aforementioned studies has used different methods to create indices for opportunity inequality. Perhaps the first attempt to construct an index for inequality in opportunities can be attributed to Kranich (1996). Kranich's approach was based on the features which could be achieved in conditions where there was equality of opportunities. He measured each of the features, sorted them, and constructed his index based on a simple sum of the features. It can be stated that the Kranich's opportunity equality index was very similar to the extended Gini coefficient. The only difference was in the way the indices were weighted (Weymark, 2003).

The present study is an attempt to consider possible dimensions of opportunity inequality. The study, then, uses panel data approach to measure opportunity inequality by constructing an index and to estimate the effect of the created index on economic growth and per capita income of two groups of countries.

Achieving a higher economic growth and improving the per capita income, which will increase social welfare and reduce poverty and inequality, are the common main economic objectives of all the developing and developed countries (Partovi et al., 2011). Inequality of opportunity can potentially impact economic growth. The results of some empirical studies have shown an ambiguous relationship between inequality and economic growth (Frank, 2009; Wroblowsky and Yin, 2016). The ambiguity corresponds to time dimensions in the inequality-growth relationship (Halter et al., 2014), quality and type of data (Panizza, 2002), contradictory nature of inequality measurement indices (Knowles, 2005), types of inequality indices (Székeli, 2003), econometric methods (Forbes, 2000), model specifications (Panizza, 2002), method of

income distribution (Voitchovsky, 2005) and level of development (Castell´o-Climent, 2010).

Considering this ambiguity, this study attempts to examine the impact of opportunity inequality on economic growth and per capita income in some selected developing and developed countries over the years 1995 to 2015 through the use of panel data approach. To this end, the mean group (MG) estimator within the framework of panel data will be used and a new index for inequality of opportunity is created. The study also shed lights on the effects of the opportunity inequality index on per capita income of the two groups of countries with different levels of development.

2. Methodology

To construct an index for opportunity inequality, gender, income, and life expectancy inequality indices were considered. The Gender inequality index (GII) is an index for measuring gender disparity which was first introduced by the United Nations Development Programme (UNDP). According to the UNDP, this index is a composite measure which captures loss of achievement within a country due to gender inequality. It uses three dimensions in doing so, namely reproductive health, empowerment, and labor market participation. The value of GII ranges from zero to one, with zero representing a 0% inequality indicating women fare equal to men fare, and one showing a 100% inequality, indicating lower women fare than men fare (Tahmasebi, 2012). For instance, the GII index for the year 2014 was 0.028 in Switzerland and 0.563 in India indicating a higher level of gender equality in Switzerland.

Income and life expectancy inequality indices were used in the present study to investigate income and life expectancy inequalities. Several indices, such as Gini index, Atkinson index, Theil index and inequality in income index introduced by the UNDP, represent income inequality. The present study has benefitted from income inequality index introduced by the UNDP. The range of this index values is from zero to one with values near one indicating higher levels of income inequality. Inequality in income distribution is based on data from household surveys obtained through the use of Atkinson inequality index (UNDP, 2016). In 2014, for instance, income inequality index was 10.2 % in Norway and it was 46.6% in Iran, indicating a higher level of income equality in Norway.

In addition, the index of life expectancy inequality was taken from the UNDP. Again, higher values of this index can indicate higher levels of life expectancy inequality. Inequality in distribution of life expectancy was based on the data from life tables obtained through the use of Atkinson inequality index (UNDP, 2016).

To construct an index of opportunity inequality, the geometric mean of gender inequality, income inequality, and inequality in life expectancy were calculated as follow:

$$IOI = \sqrt[3]{GII \times II \times ILE}$$

$$Inequality\ \ of\ \ oppotunity = \sqrt[3]{Gender\ \ inequality \times Income\ \ inequality \times Life\ \text{expectancy}\ \ inequality} \quad (1)$$

Therefore, this index was used as a measure of inequality in opportunity in different countries. The formula for opportunity inequality index is like the formula used by the UNDP for calculating human development index (HDI). HDI stands for the geometric mean of life expectancy index, education index, and expected years of schooling index (UNDP, 2017).

To study the effect of opportunity inequality on economic growth, the equation proposed by Marrero and Rodríguez (2013) was used:

$$\ln Y_{it} = \mu_i + \lambda \ln Y_{it-j} + \beta_1 Inq_{it-j} + \beta_{i+1} X_{it-j} + \varepsilon_{it} \quad (2)$$

where $\ln Y_{it} - \lambda \ln Y_{it-j}$ refers to the logarithm of growth rate in GDP per capita, μ_i to the intercept, Inq_{it-j} to opportunity inequality index, X_{it-j} to a group of control variables including the capital to labor ratio, human capital and trade openness, and ε_{it} to *i.i.d* error term.

Regarding Equation 2, the lagged dependent variable Y_{it-j} among the estimators represents the dynamic panel data model (Baltagi, 2005). In the simple dynamic model, heterogeneity is only as a result of individual intercept μ_i which changes according to changes in different sections. Mean Group (MG) and Pooled Mean Group (PMG) estimators consider a higher level of heterogeneity in panel data models. MG estimator calculates the long run relationship through averaging the parameters of Autoregressive Distributed Lag (ARDL) model. For example, in Equation 2, the long run parameter θ_i is calculated as the following (Asteriou and Hall, 2007):

$$\theta_i = \beta_i / 1 - \lambda \quad (3)$$

where λ is the estimated coefficient for the lagged dependent variable in Equation 2 and θ_i is the long run coefficient of country i. MG estimator for all panel data can be calculated as follows:

$$\hat{\theta} = \frac{1}{N} \sum_{i=1}^{N} \theta_i \quad (4)$$

$$\hat{\mu} = \frac{1}{N} \sum_{i=1}^{N} \mu_i \quad (5)$$

It can be seen that MG estimator with a large number of lags offers super-consistent estimates of long-run parameters (Pesaran et al., 1999). Pesaran and Smith (1995) showed that pooled dynamic heterogeneous models have inconsistence estimates, even in large samples, and a common dynamic specification test cannot be used for all countries. Nevertheless, long-run parameters may be identical. They suggested estimates made by pooling long-run parameters and estimating model parameters as a system. Pesaran et al.

(1999) named this method as PMG. Model specification for an ARDL system of equations is as follows:

$$lnY_{it} = \sum_{j=1}^{p} \lambda_{ij} lnY_{it-j} + \sum_{j=1}^{q} \delta_{ij}' X_{it-j} + \mu_i + \varepsilon_{it} \quad (6)$$

where $X_{i,t-j}$ refers to a $k \times 1$ vector of controlled variables in Equation 2 and μ_i stands for fixed effects. In order to estimate the model, we can express Model 6 as a Vector Error Correction Model (VECM):

$$\Delta lnY_{it} = \theta_i (lnY_{it-1} - \beta_i' X_{it-1}) + \sum_{j=1}^{p-1} \gamma_{ij} \Delta lnY_{it-j} + \sum_{j=1}^{q-1} \gamma_{ij}' \Delta X_{it-j} + \mu_i + \varepsilon_{it} \quad (7)$$

where β_i and θ_i are long-run and error correction parameters, respectively.

In the present study, Chow (1960) test was used to select between panel data or pooled regression approaches. In Chow test, the null hypothesis suggests equal intercept, i. e. the use of pooled data, while the alternative hypothesis proposes different intercepts, i. e. the use of panel data. In addition the Wooldridge's serial autocorrelation test (Wooldridge, 2002) was used so that the dynamics of regression model could be examined. Regarding this test, the null hypothesis suggests that there is no first-order serial correlation in error terms.

The data for conducting the present study was collected from several sources. Data on GDP, per capita GDP, trade openness and the capital to labor ratio was obtained from the World Bank. Human capital data was gathered from Penn World Tables and it is related to the average years of schooling and return to education. Data of inequality indices were obtained from the UNDP for the years 1995-2015. Due to some limitations, only 15 developing and 15 developed countries were selected to investigate the effects of opportunity inequality index and its sub-indices on economic growth and per capita- income. The developing countries were Egypt, Indonesia, Morocco, Rwanda, Malaysia, Philippines, Uganda, Swaziland, Armenia, China, India, Iran, Thailand, Turkey, and Pakistan. Furthermore, the developed countries were Albania, Australia, Austria, Canada, Norway, Denmark, Finland, France, Germany, Portugal, Ireland, Italy, Japan, Romania and the Netherlands. These countries were selected on the basis of the classification offered by the World Bank.

In addition, to simulate the values of some variables until 2015, Holt' (2004) and Winters' (1960) method were used. Statistical analysis and the estimation of model was done using *Stata13* and *Eviews7* software's.

3. Results

Descriptive statistics results of the examined variables have been shown in Table 1. Based on the findings, the mean values of all inequality indices in the selected developed countries have been less than their equivalents in the selected developing countries. Accordingly, the mean value of opportunity inequality has been lower in the selected developed countries. This result can indicate that the level of opportunity inequality in the developing countries is higher than that in the developed countries. . Furthermore, the range of inequality is greater in the selected developing countries.

Table 1. Descriptive statistics results of the examined variables (1995-2015)

Variables	Developed Countries			Developing Countries		
	Max	Min	Mean	Max	Min	Mean
GDP per capita (current US$)	102832.3	218.5	30595.1	27970.5	125.7	3090.3
Trade openness (percentage of GDP)	209.1	15.92	71.66	220.4	15.3	71.3
Human capital index	3.49	2.26	2.96	3.36	1.33	2.21
Capital to labor ratio	34452.9	677.7	14296.2	13563.4	14.5	1934.7
Inequality of opportunity index	0.69	0.06	0.40	0.90	0.20	0.62
Gender inequality index	0.67	0.04	0.38	0.89	0.17	0.62
Inequality of income index	0.71	0.06	0.48	0.93	0.21	0.60
Inequality of life expectancy index	0.69	0.09	0.34	0.89	0.24	0.63

Table 2 demonstrates the results of the model estimation tests for the two regression equations with different dependent variables. Based on Chow test, panel data approach can be used in both equations. In addition, the results of Wooldridge's serial autocorrelation test indicate that the null hypothesis of no first order serial correlation in error terms is rejected and that it is necessary to estimate regression models dynamically. Homogeneity of the long-run coefficients can be examined through Hausman test. This test is based on the assumption that there is no statistically significant difference between the coefficients estimated by MG and PMG approaches. In other words, the PMG estimator considers the limitation that the long-run coefficients between sections are the same. By accepting this limitation, PMG presents consistent estimates. However, if this hypothesis is rejected, PMG estimator will be inconsistent and MG estimator will be consistent in both equations. As Hausman test results reveals (Table 2), it can be concluded that the null hypothesis is rejected and that MG estimator should be used to estimate regression models in the two equations.

Table 2. The results of statistical tests for the developing countries

	Test type	Test statistics	Value of the test statistic	p-value
Dependent variable: Economic growth	Chow	F	20.81	0.00
	Wooldridge's Serial autocorrelation	F	208.32	0.00
	Hausman	χ^2	127.83	0.00
Dependent variable: Per capita GDP	Chow	F	24.97	0.00
	Wooldridge's Serial autocorrelation	F	332.79	0.00
	Hausman	χ^2	130.63	0.00

To avoid spurious regression, stationary tests, including Levin, Lin and Chu (2002), Breitung (2001) and Im, Pesaran and Shin (2003) were used and the degree of integration of variables were determined.

As Table 3 indicates, in all stationary tests, the null hypothesis, i. e. the existence of unit root, has been rejected in the developing countries, and thus the variables in the regression model are stationary.

Table 3. The results of stationary test for all the variables in the developing countries

Test type	Variables								
	Per capita GDP	Trade openness	Human capital	Capital to labor	Opportunity Inequality	GDP growth	Gender inequality	Income inequality	Life expectancy inequality
Levin, Lin and Chu	-8.92 (0.003)	-2.004 (0.02)	-6.39 (0.000)	-10.76 (0.000)	-4.02 (0.000)	-9.44 (0.001)	-3.90 (0.000)	-3.42 (0.002)	-4.09 (0.000)
Breitung	-5.43 (0.000)	-1.87 (0.03)	-5.47 (0.000)	-2.77 (0.002)	-4.10 (0.000)	-5.04 (0.000)	-1.63 (0.05)	-4.79 (0.000)	-4.05 (0.005)
Im, Pesaran, and Shin	-1.87 (0.04)	-2.27 (0.002)	-2.52 (0.01)	-2.33 (0.000)	-2.31 (0.000)	-4.13 (0.000)	-2.13 (0.006)	-2.42 (0.000)	-2.29 (0.000)

The results of estimating regression model by MG approach have been depicted in Table 4.

Table 4. The results of the regression model estimated by MG approach in the developing countries

Variables	Time period	Dep. Variable: Per capita income			
The capital to labor ratio	Long run	0.66***	0.65***	0.75***	1.16***
		(3.16)	(3.02)	(2.48)	(2.86)
	Short run	0.37***	0.36***	0.37***	0.33***
		(5.03)	(4.62)	(4.86)	(5.12)
Human capital	Long run	-189.97	-89.99	-363.02	-363.88
		(-0.97)	(-0.95)	(-0.99)	(-0.99)
	Short run	2.83	2.49	3.91	3.65
		(1.20)	(1.46)	(1.46)	(1.39)
Trade openness	Long run	0.53*	0.52	0.55*	0.62*
		(1.69)	(1.56)	(1.77)	(1.79)
	Short run	0.39	0.39	0.37*	0.38
		(1.33)	(1.24)	(1.66)	(1.07)
opportunity inequality index	Long run	-3.66*			
		(-1.92)			
	Short run	-0.64			
		(-0.94)			
Gender Inequality	Long run		-2.08*		
			(-1.68)		
	Short run		0.49		
			(0.69)		
income Inequality	Long run			-1.28**	
				(-2.97)	
	Short run			-0.64*	
				(-1.82)	
life expectancy Inequality	Long run				-8.30
					(-1.00)
	Short run				0.57
					(0.82)
Error correction term		-0.31***	-0.31***	-0.32***	-0.33***
		(-5.05)	(-5.20)	(-4.87)	(-5.47)
Intercept		3.58	3.05	4.12	3.39
		(1.02)	(0.99)	(3.63)	(0.93)

*Note: *, ** and *** are significance level at the 10%, 5% and 1% respectively, (t) statistics are in parenthesis*

Table 4 (Continued). The results of the regression model estimated by MG approach in the developing countries

Variables	Time period	Dep. Variable: Economic growth			
The capital to labor ratio	Long run	0.75*** (4.57)	0.86*** (4.83)	0.74*** (3.40)	1.14*** (3.59)
	Short run	0.36*** (4.94)	0.35*** (4.61)	0.36*** (4.82)	0.33*** (5.04)
Human capital	Long run	-30.37 (-0.83)	-15.98 (-0.81)	-46.61 (-0.89)	-46.74 (-0.89)
	Short run	1.11 (0.57)	1.19 (0.68)	2.17 (1.03)	1.71 (0.85)
Trade openness	Long run	0.41 (1.62)	0.22 (1.58)	0.19 (1.24)	0.11 (1.14)
	Short run	0.33* (1.85)	0.34 (1.46)	0.32* (1.71)	0.33 (1.48)
opportunity inequality index	Long run	-0.85 (-1.32)			
	Short run	0.37 (0.69)			
Gender Inequality	Long run		-0.89 (0.35)		
	Short run		0.30 (0.51)		
income Inequality	Long run			-0.35* (-1.90)	
	Short run			0.27 (0.45)	
life expectancy Inequality	Long run				-0.25 (-1.10)
	Short run				-0.44* (-1.81)
Error correction term		-0.33*** (-5.24)	-0.33*** (-5.29)	-0.34*** (-5.16)	-0.35*** (-5.60)
Intercept		1.49 (0.87)	0.93 (0.70)	2.22 (1.16)	1.12 (0.58)

*Note: *, ** and *** are significance level at the 10%, 5% and 1% respectively , (t) statistics are in parenthesis*

As it can be seen from Table 4, opportunity inequality has not any significant effect on economic growth and per capita GDP in developing countries in the short run. In the long run, however, inequality of opportunity has a negative and significant effect on per capita GDP and a negative but insignificant effect on economic growth. In other words, higher levels of opportunity inequality in the developing countries reduces economic growth and

per capita GDP. Opportunity inequality can affect long-run per capita income. Its effects, however, is insignificant in the short run. Ferreira et al. (2014) found a negative relationship between inequality of opportunity and economic growth. Furthermore, Weide and Milanovic (2014) confirmed this negative effect for poor countries in the long run. In fact, in developing countries higher inequalities would cause a low level of investment in human capital, and thus a decrease in economic growth (Fishman and Simhon, 2002). Nevertheless, in the short run, inequality can raise the number of resources which are deviated towards human capital accumulation activities; therefore, it can affect economic growth or per capita GDP (Rodríguez, 2000). Opportunity inequality can have a negative effect on per capita income and economic growth in the long run because it reduces the capacity for the use of human and physical resources of the community (Fishman and Simhon, 2002).

In addition, the results concerning the effects of sub-indices of opportunity inequality on economic growth and per capita income have been reported in Table 4. As it can be observed, gender, income, and life expectancy inequalities have different effects on economic growth and per capita income in the short and long run.

Gender inequality has a negative and statistically significant effect on per capita GDP in the long run. However, it has no statistically significant effect on per capita GDP in the short run. Additionally, it has not any significant effect on economic growth in the short or long run. Klasen and Lamanna (2009) showed that gender inequality imposes costs on GDP and decreases GDP growth in the long run. Furthermore, Kim et al. (2016) also showed that promoting gender equality could contribute significantly to economic growth and promote accumulation of human capital. Gender inequality may not tangibly increase economic growth or per capita income in the short run. In the long run, however, it can have a negative impact on per capita income or economic growth, by eliminating or reducing the role of an important part of active forces in the society. This effect may be the same or different for the developing or the developed countries.

Income inequality can have a negative and statistically significant effect on per capita GDP in the short and long run but its effects on economic growth can be significant only in the long run. Hakura et al. (2016) showed that income inequality is negatively associated with per capita GDP growth, especially in lower income countries. In such developing countries as Iran, short-run economic growth may be affected by various factors, for example as the rising prices of exported products such as oil and some raw materials, government, trade patterns, and labor market policies. Therefore, the impact of income inequality in the developing countries is invisible in the short run. In the long run, however, income inequality will have a negative impact on investment and, as a result, economic growth and per capita GDP will decrease.

Finally, life expectancy inequality index has a negative and significant effect on economic growth in the short run. Cervellati and Sunde (2009) claimed

that the effect of life expectancy on human capital and income per capita is not the same before and after demographic transition, but a sufficiently high life expectancy can ultimately trigger transition to sustained income growth. A higher life expectancy index in developing countries can lead to more labor productivity and increases economic growth. However, with an increase in life expectancy inequality index, there will be a decrease in economic growth, due to a negative impact on labor productivity.

Further results, as depicted in Table 4, indicate that capital to labor ratio has a positive and significant effect on economic growth and per capita GDP. Concerning the developing countries, an increase in this ratio will lead to an increase in per capita income and economic growth. Jajri and Ismail (2010) confirmed these results. They stated that capital-labor ratio plays an important role in determining labor productivity which, in return, has an important role in determining the rate of economic growth. Capital to labor ratio plays an important role in determining the productivity level of labor. Furthermore, some developing countries have difficulties in accumulating capital for financing infrastructure expenditures. Therefore, with an increase in this ratio, the rate of economic growth and and the level of per capita income are also expected to increase.

Human capital has no positive and significant effect on economic growth and per capita GDP in developing countries. The impact of human capital on economic growth and per capita income can also be linked to other important factors. For example, in a country with a great deal of human capital, but limited entrepreneurial opportunities, human capital is expected to play no role in economic growth. Concerning developing countries, failure to generate higher economic growth and to increase per capita income, through increasing human capital, was observed in the studies done by Mehrara and Musai (2013) and Hanushek (2013). In developing countries, human capital has not been accurately defined based on people's special talents. The reason is that sovereignty in these countries has not allowed the use of these talents for economic growth and development.

Trade openness has a positive effect on economic growth in the short run, but a positive and significant effect on per capita GDP in the long run. Foster (2008) showed that in the long run, countries with a low rate of economic growth could benefit more from trade. A review of the previous economic literature shows that trade can increase economic growth, per capita income and welfare of nations because it can improve allocation of resources and increase competition and efficiency.

As Table 4 demonstrates, error correction terms (ECT) have a negative and significant effect on the dependent variable in all equations. ECT show the speed at which equilibrium in the model will be established again. With regard to the first equation, therefore, it can be argued that to achieve long-run equilibrium, about 31% of short-run imbalances in per capita income are

corrected. In other words, it takes about three years for per capita income to return to its long-run equilibrium.

The results concerning model estimation tests for the developed countries have been provided in Table 5.

Table 5. The results of statistical tests for the developed countries

	Test type	Test statistics	Value of the test statistic	p-value
Dependent variable: Economic growth	Chow	F	15.74	0.00
	Wooldridge's Serial autocorrelation	F	185.61	0.00
	Hausman	χ^2	391.62	0.00
Dependent variable: Per capita GDP	Chow	F	18.21	0.00
	Wooldridge's Serial autocorrelation	F	975.27	0.00
	Hausman	χ^2	61.36	0.00

According to Chow test, panel data approach can be used to estimate the models in both equations. Moreover, based on Wooldridge's serial autocorrelation test, it is necessary to dynamically estimate the two regression models. The homogeneity of the long-run coefficients can be investigated through Hausman test. Based on the results of this test (Table 5), the null hypothesis is rejected and the MG estimator should be used to estimate the regression models in the two equations. The results of stationary test of variables for the developed countries have been reported in Table 6. The results of all stationary tests show that the null hypothesis, i. e. the existence of unit root, is rejected and that variables are stationary.

Table 6. The results of stationary tests for all the examined variables in the developed countries

Test type	Variables								
	Per capita GDP	Trade openness	Human capital	capital to labor	Opportunity inequality	GDP growth	Gender inequality	Inequality in income	Life expectancy inequality
Levin, Lin and Chu	-9.63 (0.000)	-10.84 (0.000)	-9.52 (0.000)	-8.73 (0.01)	-7.73 (0.000)	-10.19 (0.000)	-7.73 (0.000)	-7.81 (0.000)	-7.72 (0.000)
Breitung	-9.36 (0.000)	-2.33 (0.009)	-3.41 (0.000)	-5.26 (0.000)	-2.55 (0.005)	-2.12 (0.01)	-2.54 (0.005)	-3.05 (0.001)	-2.73 (0.003)
Im, Pesaran, and Shin	-1.92 (0.03)	-2.72 (0.000)	-3.18 (0.000)	-3.94 (0.000)	-2.69 (0.000)	-2.09 (0.007)	-2.22 (0.001)	-2.82 (0.000)	-2.83 (0.000)

Table 7 depicts the results concerning estimation of the regression models, obtained through the use of MG approach, for the developed countries. As it can be seen, the effects of opportunity inequality index on economic growth and per capita GDP in the developed countries are different from those effects in the developing countries.

Regarding the developed countries, opportunity inequality has had a negative and significant effect on per capita GDP in the short run but a statistically insignificant effect on per capita GDP and economic growth in the long run. However, opportunity inequality has not had any significant effect on economic growth of the developed countries in both the short and long run. Due to a better distribution of opportunities in the developed countries, an increase in inequality index can affect per capita GDP only in the short run. In the long run, however, despite its negative effect, opportunity inequality has not a significant effect on per capita GDP, due to automatic correction system which can diminish inequality.

Table 7. The results of regression model estimated by MG approach in developed countries

Variables	Time period	Dep. Variable: Per capita GDP			
The capital to labor ratio	Long run	1.064	1.065	1.29	1.27
		(0.76)	(0.76)	(0.91)	(0.89)
	Short run	0.697***	0.698***	0.694***	0.695***
		(5.53)	(5.55)	(5.49)	(5.50)
Human capital	Long run	3.84**	3.64*	3.04*	2.90*
		(2.42)	(1.95)	(1.87)	(1.96)
	Short run	3.56	3.80	3.26	3.25
		(1.13)	(1.18)	(1.05)	(1.05)
Trade openness	Long run	1.60*	1.66*	1.55*	1.56
		(1.87)	(1.90)	(1.73)	(1.14)
	Short run	0.41***	0.42***	0.39***	0.40*
		(3.06)	(3.16)	(3.01)	(2.02)
Inequality of opportunity index	Long run	-2.68			
		(-1.52)			
	Short run	-0.92*			
		(-1.75)			
Gender Inequality	Long run		-1.49		
			(-1.11)		
	Short run		0.86		
			(1.15)		
Income inequality	Long run			-2.11*	
				(-1.72)	
	Short run			0.86	
				(1.34)	
Life expectancy inequality	Long run				-2.98
					(-1.19)
	Short run				0.84
					(1.31)
Error correction term		-0.294***	-0.295***	-0.292***	-0.293***
		(-5.43)	(-5.49)	(-5.37)	(-5.37)
Intercept		0.05	0.17	-0.14	-0.07
		(0.02)	(0.06)	(-0.05)	(-0.03)

*Note: *, ** and *** are significance level at the 10%, 5% and 1% respectively, (t) statistics are in parenthesis*

Table 7(Continued). The results of regression model estimated by MG approach in developed countries

Variables	Time period	Dep. Variable: Economic growth			
The capital to labor ratio	Long run	1.670	1.672	1.75	1.73
		(0.92)	(0.92)	(0.96)	(0.95)
	Short run	0.643***	0.642***	0.641***	0.640***
		(4.83)	(4.83)	(4.80)	(4.79)
Human capital	Long run	2.01**	2.6*	2.01*	1.91
		(2.59)	(1.88)	(1.99)	(1.58)
	Short run	3.61	3.86	3.38	3.35
		(1.09)	(1.15)	(1.04)	(1.03)
Trade openness	Long run	2.09	2.13*	2.10*	2.11
		(1.28)	(1.90)	(1.88)	(1.28)
	Short run	0.36***	0.36**	0.34***	0.35*
		(2.9)	(2.24)	(2.85)	(1.86)
Inequality of opportunity index	Long run	-1.44			
		(-1.17)			
	Short run	1.03			
		(1.19)			
Gender Inequality	Long run		-1.21		
			(-1.16)		
	Short run		0.97		
			(1.51)		
Income inequality	Long run			-1.99*	
				(-1.68)	
	Short run			0.99	
				(1.51)	
Life expectancy inequality	Long run				-1.89
					(-1.21)
	Short run				-0.96*
					(-1.98)
Error correction term		-0.289***	-291***	-0.288***	-0.290***
		(-5.38)	(-5.42)	(-5.38)	(-5.39)
Intercept		-0.41	-0.28	-0.59	-0.55
		(-0.15)	(-0.1)	(-0.21)	(-0.19)

*Note: *, ** and *** are significance level at the 10%, 5% and 1% respectively, (t) statistics are in parenthesis*

Gender inequality index has not had any significant effect on economic growth and per capita income in the developed countries in the short and long run. The level of GII has nearly been similar in all the developed countries, probably due to the fact that gender inequality is not considerable in these countries.

Income inequality index has a negative and significant effect on economic growth and per capita income in the long run while it has no statistically significant effect on the two relevant variables in the short run. The effect of income inequality on economic growth and per capita income in the developed countries is similar to that in the developing countries because income inequality

can have a negative effect on investment decisions, and thus a negative effect on economic growth and per capita income. Finally, life expectancy inequality index has a negative effect on economic growth in the short run. In other words, with an increase in life expectancy inequality in the developed countries, there will be a decrease in economic growth in the short run. Life expectancy inequality can have a negative effect on economic growth of developed countries in the short run because it can diminish labor productivity. The same is true for the developing countries. Panizza (2002) examined the relationship between income inequality and economic growth in 48 states of the U.S over the years1940-1980 and found no positive relationship between income inequality and economic growth in the examined states. Partridge (2005) claimed that inequality can have different short-run and long-run effects on economic growth. For example, redistributive policies, which are imposed to reduce inequality, might impede short-run economic growth through higher taxes, but can promote economic growth in the long run, due to an increase in workforce productivity. Kennedy et al. (2015) found that income inequality negatively impacted per capita output in the larger states of Australia in the long run. Furthermore, in the short run, rising inequality had only a transitory positive effect on output growth in Victoria and Western Australia.

Considering Table 7, other results show that the capital to labor ratio has had a positive and significant effect on economic growth and per capita income in the short run, but no statistically significant effect on the two variable in the long run. In the developed countries, the ratio of capital to labor is higher than that in the developing countries, and there has been a relative abundance of capital. Naturally, therefore, in these groups of countries, capital efficiency is low and the effect of capital accumulation is insignificant in the long run. Moreover, human capital has had a positive and statistically significant effect on economic growth and per capita income in the long run. Effective utilization of human capital in the developed countries is an important reason behind its positive effect on economic growth and per capita income in the long run. Pelinescu (2015) has also confirmed this positive effect. Trade openness has had a positive effect on economic growth and per capita GDP in both the short and the long run. Irwin and Tervio (2002) and Frankel and Romer (1999) has further concluded that in countries with a higher proportion of trade in their GDP, there will be a higher level of income, even after controlling for the endogeneity of trade. Trade, as the engine of economic growth, plays an important role in increasing economic growth and per capita income, due to its role in efficient allocation of resources and in successful application of comparative advantage principle.

According to Table 7, ECT have had a negative and significant effect on both dependent variables in the developed countries. Therefore, it can be argued that to achieve long-run equilibrium, about 29% of short-run imbalances in per capita income and 28% of short-run imbalances of economic growth need to be corrected in each period. In other words, it takes about three years for per capita

income and economic growth to return to their long-run equilibrium. Comparing these with the results obtained for the developing countries, it can be observed that the speed at which long-run equilibrium can be achieved is almost the same for two groups of countries.

4. Conclusion

The effects of opportunity inequality on economic growth and per capita income have not been paid enough attention to in the previous studies. Therefore, the present study investigates the effects of opportunity inequality and its sub-indices, namely gender, income, and life expectancy inequalities on economic growth and per capita GDP through the use of dynamic panel data approach. Accordingly, the annual data of 15 developed and 15 developing countries over the years 1995-2015 was used and the short- and long-term coefficients of opportunity inequality, capital to labor ratio, human capital, trade openness and ECT were computed.

The results showed that in the developing countries, opportunity inequality could affect the long-run per capita income while in the short-run, its effects were insignificant. Additionally, gender inequality index had a negative and significant effect on per capita GDP in the long run while its effects in the short run were not significant. Income inequality index had a negative and significant effect on per capita GDP in the short and long run but its effects on economic growth were significant only in the long run. Finally, Life expectancy inequality had a negative and significant effect on economic growth in the short run.

In developed countries, opportunity inequality had a negative and significant effect on per capita GDP in the short run while its effects were insignificant in the long run. Gender inequality index of the developed countries had not any significant effect on economic growth and per capita income in the short and long run. In addition, income inequality index had a negative and significant effect on economic growth and per capita income in the long run while its effects in the short run was not significant. Finally, life expectancy inequality index had a negative effect on economic growth in the short run.

These results indicate that the effects of opportunity inequality index and its sub-indices on economic growth and per capita GDP are different in the two groups of countries.

Although opportunity equality could affect per capita GDP in the long run in the developing countries, it effected per capita GDP of developed countries only in the short run. This result shows a long-run commitment for improving opportunity equality in the developing countries. This way, the positive effects of opportunity equality on per capita GDP will be observed soon. In contrast, the developed countries have tried hard to establish opportunity equality and its different types; therefore, in the short run, these countries' efforts for achieving equal distribution of opportunities will result in higher GDP per capita.

In the developing countries, efforts for improving gender equality and also income justice and life expectancy have had a positive effect on improving GDP

per capita and lead to considerable economic growth. In the developed countries, there is a higher level of gender equality, and thus improving gender equality cannot affect economic growth and GDP per capita. Efforts for improving income justice by government in developed countries can positively affect the long-run economic growth and GDP per capita, while in the short run, improving life expectancy equality index can positively affect economic growth.

References

Arneson, R. (1989). Equity and equality of opportunity for welfare. *Journal of Philosophical studies*, 56(1): 77-93.

Asteriou, M., & Hall, S.G. (2007). *Applied econometrics: A modern approach*. Palgrave Hampshire, New York.

Baltagi, B. H. (2005). *Econometric analysis of panel data*. John Wiley and Sons, New York.

Blau, B. M. (2018). Income inequality, poverty, and the liquidity of stock markets. *Journal of Development Economics*, 130: 113-126.

Breitung, J. (2001). The local power of some unit root tests for panel data. *In Non-stationary panels, panel cointegration, and dynamic panels*, Emerald Publishing Limited. 161–177.

Bricard, D., Jusot, F., Trannoy, A., & Tubeuf, S. (2013). Inequality of opportunities in health and the principle of natural reward: Evidence from european countries. *Research of Economic Inequality*. 21: 335-370.

Castell´o-Climent, A. (2010). Inequality and growth in advanced economies: An empirical investigation. *Journal of Economic Inequality*. 8(3), 293–321.

Cervellati, M., & Sunde, U. (2009). Life expectancy and economic growth: The role of the demographic transition. *Discussion Paper* No. 4160.

Checchi, D., & Peragine, V. (2010). Inequality of opportunity in Italy. *Journal of Economic Inequality*. 8: 429–450.

Chow, G. C. (1960). Tests of equality between sets of the coefficient in two linear regressions. *Journal of Econometrica*. 28: 591–605.

Cohen, G.A. (1989). On the currency of egalitarian justice. *Ethics*. 99, 906–944.

Dietmar, F. (2018). Is increasing inequality harmful? Experimental evidence. *Games and Economic Behavior*, 107: 123-134.

Dworkin, R. (2000). *Sovereign virtue: The theory and practice of equality*. Harvard University, Cambridge.

Ferreira, F. H. G., & Gignoux, J. (2008). The measurement of inequality of opportunity: Theory and an application to Latin America. *World Bank Policy Research Working Paper* Number 4659.

Ferreira, F., Lakner, C., Lugo, M., & Ozler, B. (2014). Inequality of opportunity and economic growth: A cross-country analysis. *IZA Discussion Paper* No. 8243.

Fishman, A., & Simhon, A. (2002). The division of labor, inequality and growth. *Journal of Economic Growth*, 15, 117-136.

Forbes, K. (2000). A reassessment of the relationship between inequality and growth. *American Economic Review*, 90, 869–887.

Foster, N. (2008). The impact of trade liberalization on economic growth: Evidence from a quantile regression analysis. *Kyklos*, 61, 543-567.

Frank. M. W. (2009). Income inequality, human capital, and income growth: Evidence from a state-level VAR analysis. *Atlantic Economic Journal*, 37(2): 173–185.

Frankel, J. A., & Romer, D. (1999). Does trade cause growth? *American Economic Review*, 89, 379-399.

Ghani, G. M. (2011). The impact of trade liberalization on the economic performance of OIC member countries. *Journal of Economic Cooperation and Development*, 32(1): 1-18.

Hakura, D., Hussain, M., Newiak, M., Thakoor, V., & Yang, F. (2016). Inequality, gender gaps and economic growth: Comparative evidence for Sub-Saharan Africa. *IMF Working Paper*.

Halter, D., Oechslin, M., & Zweim¨uller, J. (2014). Inequality and growth: The neglected time dimension. *Journal of Economic Growth*, 19(1): 81–104.

Hanushek, E.A. (2013). Economic growth in developing countries: The role of human capital. *Economics of Education Review*, 37, 204-212.

Haqiqi, I., & Mortazavikakhki, M. (2012). The Impact of opportunities redistribution on income inequality: CGE approach. *Journal of Economic Modeling Research*, 7, 51-73.

Hartmann, Dominik, Miguel R. Guevara, Cristian Jara-Figueroa, Manuel Aristarán, & César A. Hidalgo. (2017). Linking economic complexity, institutions, and income inequality. *World Development*, 93: 75-93.

Holt, C. C. (2004). Forecasting seasonal and trends by exponentially weighted moving averages. *Journal of Forecasting*, 20, 5–10.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, 115: 53–74.

Irwin, D. A., & Tervio, M. (2002). Does trade raise income? Evidence from the twentieth century. *Journal of International Economics*, 58, 1-18.

Islam, M. R. (2018). Wealth inequality, democracy and economic freedom. *Journal of Comparative Economics*, In Press, Available online 12 January 2018.

Jajri, I., & Ismail, R. (2010). Impact of labor quality on labor productivity and economic growth. *African Journal of Business Management*, 4, 486-498.

Jusot, F., Tubeauf, S., & Trannoy, A. (2010). Effort or circumstances: Does the correlation matter for inequality of opportunity in health? *IRDES Working Papers* Number, 33.

Kennedy, T., Smyth, R., Valadkhani, A., & Chen, G. (2015). Long and short-run effects of income inequality on the per capita output of Australian states. *Discussion paper*, 55/15 .

Kim, J., Lee, J., & Shin, K. (2016). A model of gender inequality and economic growth. *ADB (Asian Development Bank) Economics Working Paper Series*, No, 475.

Klasen, S., & Lamanna, F. (2009). The impact of gender inequality in education and employment on economic growth: New evidence for a panel of countries. *Feminist Economics*, 15, 91-132.

Knowles, S. (2005). Inequality and economic growth: The empirical relationship reconsidered in the light of comparable data. *Journal of Development Studies*, 41, 135–159 .

Kranich, L. (1996). Equitable opportunities: An axiomatic approach. *Journal of Economic Theory*, 71, 131-147.

Lefranc, A., Pistolesi, N., & Trannoy, A. (2008). Inequality of opportunities vs. inequality of outcomes: Are western societies all alike? *Review of Income and Wealth*,54, 513–546.

Levin, A., Lin, C.F., & Chu, C-S. J. (2002). Unit root tests in panel data: Asymptotic and finite sample properties. *Journal of Econometrics*, 108, 1–22.

Marrero, G. A., & Rodriguez, J. G. (2013). Inequality of opportunity and growth. *Journal of Development Economics*, 104, 107–122.

Mehrara, M., & Musai, M. (2013). The relationship between economic growth and human capital in developing countries. *International Letters of Social and Humanistic Sciences*, 5, 55-62.

Nunes, J., & Tartakowsky, A. (2007). Inequality of outcomes vs. inequality of opportunities in a developing country an exploratory analysis for Chile. *Estudios de Economia*, 34, 185-202.

Onofrio, A., Raoul M., & Pierluigi M. (2017). Banking development, socioeconomic structure and income inequality. *Journal of Economic Behavior & Organization*.

Panizza, U. (2002). Income inequality and economic growth: Evidence from American data. *Journal of Economic Growth*, 7, 25–41.

Partovi, B., Amini, S., & Goudarzi, A. (2011). The effect of gender inequality on economic growth in Iran. *Quarterly Journal of Economic Modelling*, 3, 51-76.

Partridge, M. D. (2005). Does income distribution affect U.S. state economic growth? *Journal of Regional Science*, 45 (2), 363–394.

Pelinescu, E. (2015). The impact of human capital on economic growth. *Procedia Economics and Finance*, 22, 184 – 190.

Penn World Table, Version 8.1 (PWT 8.1). http://www.rug.nl/research/ggdc/data/pwt/pwt-8.1. Cited 2015.

Pesaran, M.H., & Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Economist Journal*, 68 (1), 79-113.

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *J. Am. Stat. Assoc*., 94, 621-634.

Rodríguez, F. (2000). Inequality, economic growth and economic performance. *A Background Note for the World Development Report*.

Roemer, J. E. (1998). *Equality of opportunity*. Harvard University, Cambridge.

Rougoor, W., & Marrewijk C. V. (2015). Demography, growth, and global income inequality. *World Development*,74: 220-232.

Sen, A. K. (1980). *Equality of what?*, Cambridge University, Cambridge.

Székeli, M. (2003). The 1990s in Latin America: Another decade of persistent inequality, but with somewhat lower poverty. *Journal of Applied Economics*, 1, 317–339.

Tahmasebi, j. (2012). *Human development index and position of Iran in the world*. Center for Strategic research, Iran.

United Nations Development Programme (UNDP). (2016). *Human developments reports*. http://hdr.undp.org/en/data. Cited 8 March 2016. http://hdr.undp.org/sites/default/files/2015_human_development_report.pdf

UNDP (2017). What is human development? Retrieved 27 October 2017.

Voitchovsky, S. (2005). Does the profile of income inequality matter for economic growth? *Journal of Economic Growth*, 10(3), 273–296.

Weide, R.V.D., & Milanovic, B. (2014). Inequality is bad for growth of the poor. *World Bank Policy Research Working Paper* Number 6963.

Weymark, J. A. (2003). Generalized Gini indices of equality of opportunity. *The Journal of Economic Inequality*, 1, 5-24.

Winters, P. R. (1960). Forecasting sales by exponentially weighted moving averages. *Management Sci*., 6, 324–342.

Wooldridge, J. M. (2002). *Econometric analysis of cross section and panel data*. Cambridge, MA: MIT Press.

World Bank. (2016). http://data.worldbank.org. Cited 14 October 2016.

Wroblowsky, T., & Yin, H. (2016). Income inequalities in China: Stylized facts vs. reality. *Perspectives in Science*, 7, 59-64.

Yalonetsky, G. (2012). A dissimilarity index of multidimensional inequality of opportunity. *Journal of Economic Inequality*, 10, 343-373.

Zhang, Y., & Eriksson, T. (2010). Inequality of opportunity and income inequality in nine Chinese provinces, 1989–2006. *Journal of China Economic Review*, 21, 607–616.