Natural Resources, Openness and Income Inequality in Iran

Hamideh Mohtashami Borzadaran[1]
Mehdi Behname[2]
Sayed Mahdi Mostafavi[3]

The aim of this paper is to survey the relationship among natural resource, income inequality and openness in Iran by using the Auto Regressive Distributed Lag (ARDL) model in the period 1980-2009. The stationary test reveals that our variables are both I(0) and I(1), so for that reason, we used the ARDL approach to estimate long run and the short run relations between the variables. The results show that, in the long-run and the short-run, the GDP per capita, Land, Openness and literacy rate have a negative effect on income equality; the total natural resource rents has a positive effect on income equality. The oil revenue has a negative effect on income inequality in the short run, and it has a positive effect on income equality in the long run.
Keywords: ARDL, Income inequality, Iran Natural Resources, Openness
JEL Classifications: O15; F41; C32; O53

[1]**Hamideh Mohtashami Borzadaran**, Department of Economics, Ferdowsi University of Mashhad (FUM), International Branch, Mashhad, Iran, hmb3028@gmail.com
[2] **Mehdi Behname**, Department of Economics, Ferdowsi University of Mashhad (FUM), Mashhad, Iran. mehdi_behname@yahoo.com m.behname@um.ac.ir
[3] **Sayed Mahdi Mostafavi**, Department of Economics, Ferdowsi University of Mashhad (FUM), Mashhad, Iran. mostafavimahdi@yahoo.co.uk

1. Introduction

There are great theories about the effects of natural resources in the economy. Leamer et al, (1999) indicates that economics well endowed with natural resources relative to the other factors of production have grown slower than other economies over the long term. This is one of the most surprising features of modern economic growth (Sachs and Warner, 1995). Natural resources were once considered a blessing; for example England's industrial revolution was because of the countries coal abundance (Blanco and Grier, 2012). Nowadays, natural resources that were once a key to economic growth are known as a curse. Although, this might not be entirely true because, there are many countries that managed to outgrow their dependence to natural resources (Gylfason, 2004) and this is what most economics with abundant resources are trying to do.

Generally, the countries that have a high level of natural resources are named the rich countries, but is that true? Are the people of these country rich too? Iran is a rich country in natural resources, mainly in gas and oil. Since the first oil shock (1973) most of the country's economic activities are related to the natural resources. More than 90% of Iran's foreign exchange revenues come from oil and gas exports (Farzanegan, 2011). According to IMF country report, (2010) in 2008/09 crude oil and gas exports earned Iran an estimated 74 percent of foreign exchange receipts (24 percent of GDP) and financed rapid growth of imports. At the same time, oil revenues provided 65 percent of all fiscal revenues (16 percent of GDP). Now the question is that; why is the country still involved with lower per capita growth and inequality in income? Can this mean that, the natural resources develop income inequality in Iran?

There are several factors that can explain the curse. Sachs and Warner (1997) argue that large natural resources affect the employment rate in the economy. They believe that, great natural resource endowments, lead the economy to demand for non-tradable

goods. Gylfason (2001) also believes that, oil brings risk as well as benefits for oil rich countries and that, nations without natural resources are less likely to make mistakes because they have a small margin for error.

Many studies show that natural resources rise income inequality. Buccellato (2009) argues that although natural resources are known as a positive factor for economic development but they can lead the economy to very unequal income distribution. On the other hand, many studies indicate that expenditures financed by natural resource projects can reduce poverty incidents (Warr et al, 2012). Natural resources can affect a countries income distribution through several channels like human capital and physical capital (Andersen, 2002). Physical capital and human capital are the main factors for production and every country has a different combination of them in their production function. Some countries are known for their abundance in labor and scarcity in capital like Latin American countries (Leamer et al, 1999) others might be known for their abundance in physical capital and scarcity in workers.

By knowing all of these, we aim to investigate the effects of resources economics on income inequality for Iran. We try to show how natural resource factors can affect income inequality individually and how can they affect it as a whole. In the end, we will explain, how governments can use the resources to avoid high inequality in the country.

In the below we represent these sections: 1) literature review; this section gives a brief review on the previews works on income inequality. 2) Natural resources, income inequality and openness; this section gives us a brief explanation about changes in income inequality, natural resources and openness in Iran between the years of 1980-2009. 3) Methodology; presents the data, model and methods that formulizes our assumption. 4) Empirical results; shows the estimation of our equation and our empirical results and 5) conclusion.

2. Literature review

Through the years there have been several studies that include income inequality and natural resources. The impact of natural resources on income inequality depends on the economic structure of the economy. That is why the natural resources are introduced differently in each country. The literature on natural resources and inequality is summarized in the table below.

The literature review introduces different studies of natural resources, openness and income inequality. Most of these studies agree that investment on human capital can lead to income inequality Birchenall (2001), Leamer (1999), Prete (2013). But there are also many studies that explain, human capital investment will lead to inequality in the income Spilimbergo (1999), Bakare (2012).

Generally the studies on income inequality and openness predict increase in income equality when openness increases Spilimbergo (1991), Jalil (2011). These studies indicate that change in the structure of the economy will lead to changes in the affect of market access on income inequality. The studies of Leamer (1999) and Spilimbergo (1999) explain that land abundance will lead to unequal income distribution but each of these studies has a different opinion about the effect of capital on income inequality. The relationship between GDP per capita and income inequality is studied by Birchenall (2001) and Shin (2012). They both explain that these two factors are negatively related, which shows that increase in GDP per capita will decrease income inequality.

Thus, the current study introduces Iran's natural resources in a new frame work, using openness. The reason we selected Iran is that it is a country, rich with resources especially oil and gas. These natural resources have led the country to economic openness and increase in trade. In this paper we tend to examine the effect of natural resources and openness on income inequality in Iran between the years of 1980-2009.

3. Income inequality, Natural resources and openness

This section focuses on the theoretical relationship among income distribution, the prices of the factors of production and factors of production that include economic resources and natural resources. The frame work is drawn from the spilimbergo, londono and szekely (1999).

There are several factors of production in the economy. If E represents the total endowments of factors of the economy and Q represents the total output of the economy, than:

$$Q=F(E) \qquad (3.1)$$

This shows that the production factors are used to produce the outputs in the economy. If the final goods are in a competitive market, than the price of every factor (W) is equal to its marginal product in every sector.

$$W=P*F'(E) \qquad (3.2)$$

The price of every factor depends on factor endowments and the prices of final goods.

$$W=W(P,E)$$

The price of final goods depends on the final outputs. (3.4)

By plugging equation (3.1) and equation (3.4) and putting them in to (3.3), we will have:

$$W=W(E) \qquad (3.5)$$

By knowing that the economy is open we will have to add international prices to the model. The factor prices in an open economy are determined by the prices of the international goods.

$$W=W(P^*) \quad (3.6)$$

And;

$$W=W(E,P^*) \quad (3.7)$$

International prices are determined by the world endowments.

$$P^*=P(E^*) \quad (3.8)$$

By substituting equations (3.6), (3.7) and (3.8) we will have;

$$W=W(E,E^*) \quad (3.9)$$

The factor price is a function of international and national endowments. The link between income distribution and factor endowments is that each individual gets her income from several production factors, so the total income of each individual is the sum of her income from all sectors.

This shows that income distribution can be explained by factor endowments and degree of openness. Since one of the most important indicators of income distribution is the gini coefficient, our model will be:

$$Gini=g(E^*,E) \quad (3.10)$$

Where E presents factor endowments of the country in year t and E^* presents the world factor endowments in year t and includes the degree of openness.

Many studies explain that countries endowed with factors like natural resources are more unequal. The production of natural resource is usually capital intensive rather than labor intensive. This means that these countries will require more skilled workers and biased on the demand for labor the wags of skilled workers will be higher than unskilled workers.

Figure 1

Gini coefficient[4]: 1980-2009

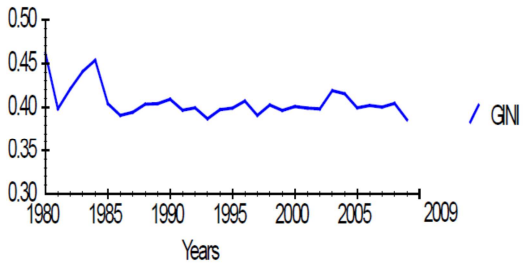
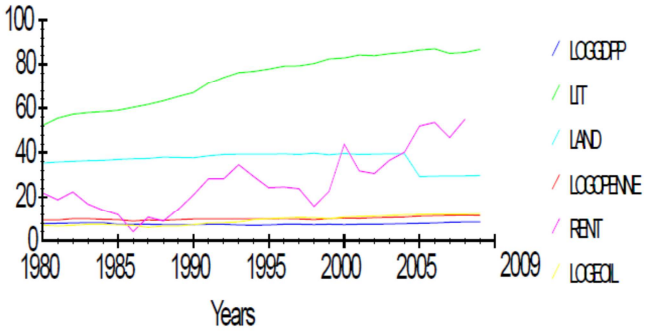


Figure 2

Factor endowments, openness and Natural resources[5]: 1980-2009



Now the main question is that, how do natural resources in Iran change the gini coefficient? Figure 1 shows the Gini coefficient for Iran between the years of 1980 to 2009. The figure reveals many

[4] The data are from Iran Central Bank.
[5] The data are from WDI, Iran Central Bank and the United Nations Database.

changes trough the years. Between the years of 1980 to 1988 (Iran-Iraq war) we can distinguish an increase in the Gini coefficient. Looking at the graph we notice that, after 1986 the fluctuations decrease and the country is experiencing a more steady change in the gini coefficient.

Fig.2. illustrates changes in natural resources as individuals[6]. The figure shows that all of the factors introduced as natural resources are increasing steadily. Changes in land are steady but after 2004 it decreases to a lower stage. The trade openness and the GDP per capita display significant changes especially between the years of 1980 to 1988 (Iran-Iraq war). After 2001 trade openness and GDP per capita are increasing. Figure 2 also shows that, the total natural resource rent decreases in 1986, to its lowest point, but after that, the resource rents increase significantly. The oil revenue is also increasing steadily in this period.

The recent empirical studies imply that, changes in the economic growth will lead to changes in income inequality. Most of the studies about wealth and income inequality rest on the Kuznets hypothesis. The Kuznets hypothesis is about an inverted U relationship among economic growth and income inequality. By using the Kuznets curve hypothesis we aim to examine the relationship between economic resources and income inequality in Iran. The Kuznets curve explains the relationship between the stage of economic growth and income inequality (Kuznets 1955). Hear we include GDP per capita to the model biased on the Kuznets hypothesis

[6] Figure 2 presents the logarithm of oil revenue, openness and GDP per capita with literacy rate, land and natural resource rent so we would be able to present them all in one graph.

In this paper we aim to explain the relationship between income inequality, openness and natural resources by using the study of Spilimbergo (1991) and Jalil (2011).

4. Methodology

To examine the effect of natural resources on income inequality we used five variables: literacy rate, GDP per capita, openness, total natural resource rents, oil revenue, share of land area that is arable and a dummy variable.

Agricultural lands are considered a production factor, we use agricultural land to total land area as a proxy for land. For the human capital we used literacy rate (Barro, 1990), this shows what percent of the population is educated. The oil revenue and the total natural resource rents are introduced as a proxy for natural resources, and we also include trade openness.

The measure of trade openness is the total trade in goods and services export in US dollars at current prices and current exchange rates. Finally we add GDP per capita to the right side of the regression. GDP per capita is the gross domestic product for each individual person, in the country the dummy variable will show us the effect of Iran and Iraq war on the gini coefficient. The data we used come from the World Bank[7], Iran's central bank[8] and Unctadstat[9].

We follow the empirical model of Jalil (2011) and Spilimbergo (1999) to test the affect of natural resources and openness on income inequality in Iran.

$$gini_t = \alpha_0 + \alpha_1 GDP\ per\ capita_t + \alpha_2 literacy\ rate_t + \alpha_3 openness_t + \alpha_4 land_t + \alpha_5 resource\ rent_t + \alpha_6 oil\ income_t + \alpha_7 dummy_t + U_t$$

[7] Worldbank.org
[8] tsd.cbi.ir
[9] Unctadstat.unctad.org

Where gini is the measure of income inequality, GDP per capita is the GDP for each individual, the literacy rate is the literacy rate for Iran, openness stands for the openness of total trade of goods and services in the export flow, land is the agricultural land to total land area, rent is the total natural resource rents, that is the sum of oil rents, natural gas rents, coal rents, mineral rents and forest rents, oil is the oil revenue and dummy is the dummy variable.

To estimate this model we used the ARDL model. The Auto Regressive Distributed Lag Model (ARDL) was populated by pesaran and pesaran (1997) and expanded by Pesaran and smith (1998) and Pesaran and Shin (1999). The ARDL model can be applied whether the variables are I (0) or I (1). The ARDL contains three steps (Pesaran and Pesaran 1997). The first step is testing the presence of cointegration among the variables. This test can identify the long run relationship with a dependent variable.

At this stage we calculate the F-statistic that will be compared with the critical value introduced by Pesaran et al. (2001). Our null hypothesis will be rejected if the calculated F-statistic is greater than the upper bound. If the computed F-statistic falls below the lower bound, than the null hypothesis of no cointegration cannot be rejected, if the F-statistic is between the lower and the upper bound, than the result is inconclusive, and we can apply the ECM model.

The second step is estimating the long run coefficient that is identified in the first step. Without having any information about the long run relationship between the gini coefficient and economic resources, we construct the following regression.

$$\Delta gini_{i} = \alpha_0 + \sum_{i=1}^{n} \beta_i \Delta \text{gini}_{t-i} + \sum_{i=1}^{n} \mu_i \Delta \text{gdpp}_{t-i} + \sum_{i=1}^{n} \delta_i \Delta \text{lit}_{t-i} + \sum_{i=1}^{n} \theta_i \Delta \text{land}_{t-i} + \sum_{i=1}^{n} \sigma_i \Delta \text{openness}_{t-i} + \sum_{i=1}^{n} \varphi_i \Delta \text{resource rent}_{t-i} + \sum_{i=1}^{n} \vartheta_i \Delta \text{oil income}_{t-i} + \sum_{i=1}^{n} \omega_i \Delta \text{dummy}_{t-i} + \gamma_1 \text{gini}_{t-1} + \gamma_2 \text{gdpp}_{t-1} + \gamma_3 \text{lit}_{t-1} + \gamma_4 \text{land}_{t-1} + \gamma_5 \text{openness}_{t-1} + \gamma_6 \text{resource rent}_{t-1} + \gamma_7 \text{oil income}_{t-1} + \gamma_8 \text{dummy}_{t-1} + \varepsilon_t$$

The $\beta, \mu, \delta, \theta, \sigma, \varphi, \omega, \vartheta$ represent the short run coefficient and $\gamma_i$represents the long run coefficients for our model. To find out the long run relationship, the null hypothesis and the alternative hypothesis will be:

$$\begin{cases} H_0: \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = \gamma_6 = \gamma_7 = \gamma_8 = 0 \\ H_1: \gamma_1 \neq 0 \gamma_2 \neq 0 \gamma_3 \neq 0 \gamma_4 \neq 0 \gamma_5 \neq 0 \gamma_6 \neq 0 \gamma_7 \neq 0 \, \gamma_8 \neq 0 \end{cases}$$

The null hypothesis shows that there is no long relationship between the variables. These hypotheses are tested by comparing the general F-statistics and comparing them with the critical values (Pesaran and Pesaran, 1997), (Pesaran and et al., 2001).

In the third step, we will estimate the error correction model which is known as our short run model. The ECM explains the speed of adjustment back to long run, after a short run shock.

$$\Delta gini_{i} = \alpha_0 + \sum_{i=1}^{n} \beta_i \Delta \text{gini}_{t-i} + \sum_{i=1}^{n} \mu_i \Delta \text{gdpp}_{t-i} + \sum_{i=1}^{n} \delta_i \Delta \text{lit}_{t-i} + \sum_{i=1}^{n} \theta_i \Delta \text{land}_{t-i} + \sum_{i=1}^{n} \sigma_i \Delta \text{openness}_{t-i} + \sum_{i=1}^{n} \varphi_i \Delta \text{resource rent}_{t-i} + \sum_{i=1}^{n} \vartheta_i \Delta \text{oil income}_{t-i} + \sum_{i=1}^{n} \omega_i \Delta \text{dummy}_{t-i} + \epsilon ECM_{t-1} + \varepsilon_t$$

To estimate the model we used the Schwartz Bayesian criteria (SBC) and based on the limited number of observations a maximum of 1 lags were used. In the end, we will take the beta test, using the STATA software. Standard coefficients (Beta), measures the changes in the criterion that is produced by a one standard deviation change in the predictor.
We must use the un standardized coefficients because the standard errors are calculated with reference to them not the standardized coefficients.
We will also test the structural stability using the cumulative sum (CUSUM) and cumulative sum squares (CUSUMSQ) technique. The CUSUM and CUSUMSQ statistics are plotted against the break points. If the plots stay within the critical bounds of 5% level of significance than the null hypothesis of all coefficients in the model are stable and cannot be rejected.

5. Empirical results

We begin the empirical analysis by understanding the situation of our variables, so for that we will start by taking the unit root test. The unit root test shows whether the series are stationary or not. Table 2 shows the augmented dickey fuller (Dickey and Fuller 1979) and Philips Perron (Phillips and Perron 1988) test for all the variables. The augmented dickey fuller (ADF) and the Philips Perron test are quite similar; they incorporate an automatic correction to the DF[10] procedure to allow for auto correlated residuals.

[10] Dickey-fuller

Table 2

Unit root tests

	I(0)		I(1)	
Variables	ADF	PP	ADF	PP
Gini coefficient (GINI)	-4.803641** (0.0006)	-5.115108** (0.0003)	-7.718478** (0.0000)	-19.38270** (0.0001)
Land (LAND)	-0.873459 (0.7821)	-0.917440 (0.7681)	-5.268403** (0.0002)	-5.268381** (0.0002)
Literacy rate (LIT)	-2.627434* (0.0992)	-2.249139 (0.1944)	-3.631262*** (0.0115)	-3.623155*** (0.0117)
GDP per capita (GDP)	-0.008996 (0.9502)	-0.008996 (0.9502)	-3.997342** (0.0047)	-3.925281** (0.0057)
Natural resource rent (RENT)	-1.669920 (0.4354)	-1.690733 (0.4252)	-5.424376** (0.0001)	-5.424376** (0.0001)
Openness (Open)	-0.891496 (0.7759)	0.560562 (0.9860)	-2.943846* (0.0530)	-2.987414*** (0.0484)
Oil income (OIL)	4.306730 (1.0000)	2.647809 (1.0000)	0.708361 (0.9893)	-3.208916*** (0.0301)

Note: ** 1% significant. *10% significant. ***5% significant.

The unit root test results show that our dependent variable, gini coefficient is stationary (I(0)), but the rest of the variables are all integrated of order 1, i.e. I(1). This shows that we will have to estimate our model with ARDL.

Figure 3

Cumulative Sum of Recursive Residuals

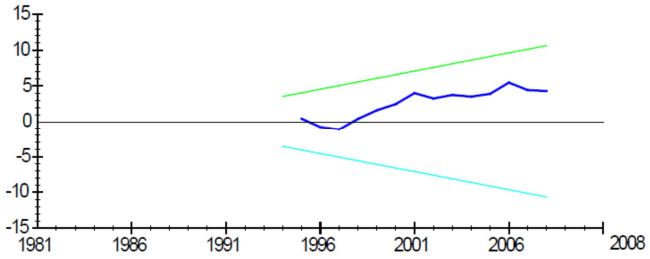


Figure 4

Cumulative Sum of Squared Recursive Residuals

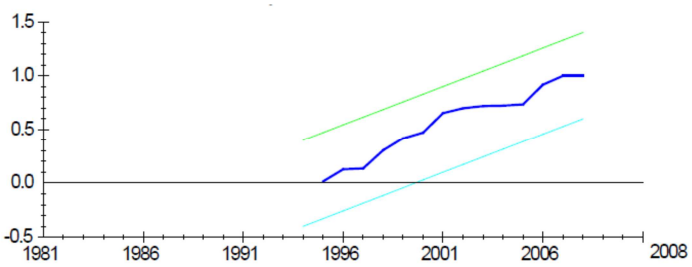


Figure 3 and figure 4 show the CUSUM and CUSUMSQ statistics. The plot of the stability test results for the ARDL model is given above. The CUSUM and CUSUMSQ plotted against the critical bound of the 5% significant level show that our model is stable.

Now the first step is the co-integration test. This test shows whether there is a long relationship between the variables. Table 4 presents the result based on the F-statistic for each stage. The F-statistic indicates that there is a co-integrating relationship between the variables in all the last three stages. The stage 1 presents the estimation of the gini coefficient, GDP per capita and the dummy variable and the stage 2 presents the estimation of all the variables in stage 1 and literacy rate. For these two stages the F-statistic is not specified. The F-statistic estimated for stage 3 is 1.1836, which is not significant in any level. In stages 4, 5 and 6 variables like land, natural resource rent and oil revenue are added. As we add these variables the F-statistic increases and becomes more and more significant. According to the results, the null hypothesis of no co-integration will not be rejected and we will have a long run relationship between the variables. The long run estimation table is presented in the table 3.

The long run estimation of the model is shown in Table 3. The results indicate that, 1 percent increase in the GDP per capita will increase the gini coefficient by 0.39 percent. This shows a negative relationship between GDP per capita and income equality. The economic openness has a smaller negative effect on income equality. 1 percent change in the openness will lead to 0.18 percent change in the gini coefficient.

The negative effect of land is a little smaller. One percent increase in the land will lead to 0.0057 percent increase in the gini coefficient. The results also show that the natural resource rent has a negative significant effect on the gini coefficient. The results also imply that there is a positive relation between oil revenue and income equality. One percent increase in the oil revenue will lead to 0.89 percent decrease in the gini coefficient, and one percent increase in the natural resource rent will lead to 0.0027percent decrease in income inequality.

Table 3

Estimated long run coefficients using the ARDL approach

Variables	(1)	(2)	(3)	(4)	(5)	**(6)**
GDPP	0.6143E-3 (0.27134)	-0.2605E-4 (-0.89218)	0.6065E-4 (3.7797)	0.3353E-4 (3.8812)	0.2822E-4 (3.5431)	0.3938E-4* (7.1690)
LIT	-	0.0054198 (7.2241)	0.0046726 (20.8873)	0.5833E-3 (0.67516)	-0.2483E-3 (-0.26347)	0.0019341* (2.5254)
OPENNESS	-	-	-0.3031E-5 (-4.3978)	-0.4606E-6 (-0.83638)	0.3399E-6 (0.64153)	0.1866E-5* (3.7870)
LAND	-	-	-	0.0078707 (4.8771)	0.0095377 (5.4358)	0.0057316* (4.0956)
RENT	-	-	-	-	-0.2494E-3 (-0.45549)	-0.0027579* (-4.9884)
OIL	-	-	-	-	-	-0.8922E-6* (-4.1242)
DUMMY	0.083134 (0.047393)	0.12821 (2.5060)	0.020730 (0.76490)	0.0088031 (0.60270)	0.0037822 (0.26922)	-0.0070993 (-0.81131)

Now based on the results of the co-integration test we estimate the relationships between the variables, by using the ARDL methodology and a maximum of 1 lags. Table 4 shows the impact of each variable in 6 stages. It is evident from the results that, by adding each variable, one at a time, the model develops and turns more significant. As we add the variables in each stage, we see that the $\bar{R}^2$ is increasing, which shoes that our model is turning significantly fitted.

Table 4

Autoregressive Distributed Lag Estimates based on Schwarz Bayesian Criterion

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Gini(-1)	1.0044* (46.9912)	0.84861 (8.4033)	0.57599* (5.6897)	0.34211* (3.4299)	0.24849* (2.1029)	0.15285 (1.5960)
GDPp	0.1630E-4* (2.4092)	0.1311E-4* (1.9078)	0.2571E-4* (3.6787)	0.2206E-4* (3.9546)	0.2121E-4* (3.7123)	0.2211E-4* (5.8471)
GDPp(-1)	-0.1902E-4* (-2.3967)	-0.1706E-4 (-2.1848)	-	-	-	0.1125E-4* (2.1263)
Lit	-	0.8205E-3 (1.5766)	0.0019812* (3.9069)	0.3838E-3 (0.67068)	-0.1866E-3 (-0.26149)	0.0051356* (2.3217)
Lit(-1)	-	-	-	-	-	-0.0034971 (1.7752)
Openness	-	-	-0.2509E-6 (-064213)	0.7161E-6 (1.8123)	0.2555E-6 (0.62468)	0.2486E-5* (5.2617)
Openness (-1)	-	-	-0.1034E-5 (-2.5242)	-0.1019E-5* (-3.1607)	-	0.9053E-6* (-2.4512)
Land	-	-	-	0.0051781* (3.8943)	0.0040704* (2.8470)	0.0027644* (2.6179)
Land(-1)	-	-	-	-	0.0030974 (1.9326)	0.0020910 (1.8441)
Rent	-	-	-	-	-0.1874E-3	-0.0023364*

					-0.45868	(-5.2054)
Oil	-	-	-	-	-	0.1076E-5* (5.2009)
Oil(-1)	-	-	-	-	-	-0.1832E-5* (-5.8759)
$\overline{R}^2$	-0.43267	-0.35231	0.031751	0.40080	0.36098	0.76164
D.W	1.8130	1.6813	1.6052	1.8307	1.8921	2.1279
F-statistics	NONE	NONE	1.1836 (0.348)	4.1215* (0.006)	3.1789* (0.020)	8.1897* (0.000)
Dummy	-0.3681E-3 (-0.047815)	0.019409 (1.3290)	0.0087898 (0.69707)	0.0057915 (0.58209)	0.0028424 (0.26581)	-0.0060141 (-0.82417)
Dummy(-1)	-	-	-	-	-	-
Diagnostic test						
LM**	0.83105 (0.362)	0.061744 (0.804)	0.093976 (0.759)	0.043628 (0.835)	0.10652 (0.744)	0.19420 (0.659)
RESET***	13.4114* (0.000)	12.1911* (0.000)	13.2782* (0.000)	6.8970* (0.009)	6.4904* (0.011)	6.9342* (0.008)
HTR****	14.7137* (0.000)	14.9996* (0.000)	1.7002 (0.192)	1.3403 (0.247)	0.83803 (0.360)	0.038308 (0.845)

Note: the calculated t-statistics are presented in the parenthesis. * 1% significant. **LM test for serial correlation. ***Ramsey's RESET test. ****Heteroskedasticity test.

It is evident from many articles that trade liberalization will reduce per capita income gap between rich and poor countries (Choi, 2007) and even rich and poor people. Openness in trade affects countries in different ways. In capital abundant countries, trade openness reduces inequality and in skill abundant countries trade openness will increase inequality (spilimbergo 1999). Our results show that trade openness will positively affect gini coefficient. One percent increase in trade openness and trade openness (-1) will increase income inequality by 0.24 percent and 0.90 percent.

Although, openness will increase inequality in Iran but our results show that investment in education and increase in the natural resource rent will lead to income equality. Natural resource rent is expected to

have an inverse relationship with the level of poverty. So we expect the natural resource rent to have a negative effect on the gini coefficient. The results on the literacy rate imply that, increase in the literacy rate will increase inequality. This is in contrast with the idea that; investment in public education and overall years of schooling is beneficial for other reasons than rising the human capital and economic growth (Sylwester, 2002). Investment in the public education will also raise the level of productivity (Bakare, 2012). This also means that countries can reduce inequality by promoting human capital (Zhang, 2005).

Many studies have revealed the answer to the effect of inequality on economic growth. They believe that higher inequality can retard growth in the early stage of economic development (Shin, 2012). (Birchenall, 2001) (Qin, 2009), (Barro, 2000), also believe in the opposite relation between economic growth and gini coefficient. Here we reveal that one unit increase in the GDP per capita and GDP per capita (-1) will increase the gini coefficient by 0.22 units and 0.11 units. In the 6 stage, after adding the oil revenue, the results show that, one percent increase in the oil revenue will increase income inequality, but one percent increase in the oil revenue (-1) will decrease income inequality by 0.18 percent.

Table 4 shows that until the fourth stage the gini coefficient is affected by not only GDP per capita but GDP per capita (-1) but after adding land the effect of GDP per capita(-1) disappears. The results also show a significant negative effect from changes in land and no significant effect from land (-1).

Looking at the Durbin-Watson stat (D.W), we can see that, by adding the variables to the model one at a time, the signs of correlation increases. Now the dummy variable has an insignificant effect on the model, so if we eliminate it from the model the signs of correlation will disappear. The estimation of the model without the dummy variable is shown in Appendix A.

Table 5

Autoregressive Distributed Lag Estimates for short run error correction model

Variables	(1)	(2)	(3)	(4)	(5)	(6)
dGDP per capita	0.1630E-4* (2.4092)	0.1311E-4* (1.9078)	0.2571E-4* (3.6787)	0.2206E-4* (3.9546)	0.2121E-4* (3.7123)	0.2211E-4* (5.8471)
dLit	-	0.8205E-3 (1.5766)	0.0019812* (3.9069)	0.3838E-3 (0.67068)	-0.1866E-3 (-0.26149)	0.0051356* (2.3217)
dOpenness	-	-	-0.2509E-6 (-0.64213)	0.7161E-6 (1.8123)	0.2555E-6 (0.62468)	0.2486E-5* (5.2617)
dLand	-	-	-	0.0051781* (3.8943)	0.0040704* (2.8470)	0.0027644* (2.6179)
dRent	-	-	-	-	-0.1874E-3 (-0.45868)	-0.0023364* (-5.2054)
dOil	-	-	-	-	-	0.1076E-5* (5.2009)
dDummy	-0.3681E-3 (-0.047815)	0.019409 (1.3290)	0.0087898 (0.69707)	0.0057915 (0.58209)	0.0028424 (0.26581)	-0.0060141 (-0.82417)
ECM	0.0044275 (0.20714)	-0.15139 (-1.4991)	-0.42401* (-4.1884)	-0.65789* (-6.5958)	-0.75151* (-6.3598)	-0.84715* (-8.8450)
$\bar{R}^2$	0.12512	0.17420	0.40872	0.63409	0.62265	0.85925
D.W	1.8130	1.6813	1.60	1.8307	1.9821	2.1279

* 5% significant.

The short run dynamic coefficients are also estimated in 6 stages. By adding each variable the model turns statistically significant. The results show a significant positive effect between the income inequality and GDP per capita, literacy rate, openness, land and the oil revenue and a significant negative affect between income inequality and natural resource rent. The short run results are generally consistent with the long run findings.

The results also show that, after the second stage, the ECM will turn significant. The error correction coefficient implies that disequilibria in

none of the gini's previous years shocks adjust back to the long run equilibrium in the current year.

Table 6

beta test

```
. regress gini gdpp openness land litracy rent oil, beta
```

Source	SS	df	MS		
Model	.005201297	6	.000866883	Number of obs =	30
Residual	.00392164	23	.000170506	F(6, 23) =	5.08
				Prob > F =	0.0019
Total	.009122937	29	.000314584	R-squared =	0.5701
				Adj R-squared =	0.4580
				Root MSE =	.01306

gini	Coef.	Std. Err.	t	P>|t|	Beta
gdpp	.0000157	5.88e-06	2.67	0.014	.9388677
openness	-7.17e-07	4.59e-07	-1.56	0.132	-1.167079
land	.0030032	.0019575	1.53	0.139	.5969409
litracy	-.0013526	.0006754	-2.00	0.057	-.8812464
rent	.0010147	.0003699	2.74	0.012	.771742
oil	1.93e-07	1.47e-07	1.31	0.202	.7394563
_cons	.3449987	.0614312	5.62	0.000	.

Table 6 shows the results for our standardized coefficients (beta test). This test explains the effect of independent variables on dependent variable according to their importance.

Looking at the results we can see that the GDP per capita is significantly effective on the gini coefficient. The beta results explain that if we increase the median of GDP per capita and natural resource rent by 1 standard deviation, the gini coefficient will increase by 0.93% and 0.77%. The beta results also imply that, by increasing the median of literacy rate the gini coefficient will decrease by 0.88%. Our other variables are not significantly effective but the beta results show that a 1 standard deviation increase in median of openness will decrease the gini coefficient by 1.16%, 1 standard deviation increase in median of land will increase gini coefficient by 0.59% and 1 standard deviation

increase in median of oil revenue will increase gini coefficient by 0.73%.

6. Conclusion

This paper explores the relationship between income distribution and factor endowment like natural resources. After defining economic resources and adding GDP per capita in Iran biased on the Kuznets curve framework, we take the unit root test that explains the situation of our variables. The results show that some variables are stationary and others are not so we use the Auto Regressive Distributed Lag (ARDL) methodology to see how each individual affects income inequality.

On the basis of our long run findings we see that, the variables, GDP per capita, literacy rate, openness and land will increase income inequality, but the natural resource rent and oil revenues, in Iran, will decrease the income inequality. The long run results also imply that the 8 year war between Iran and Iraq will have no significant effect on the gini coefficient.

The empirical results imply that the GDP per capita, GDP per capita (-1), literacy rate, openness, openness (-1) land and oil revenues have a significant negative effect on the gini coefficient but the natural resource rent and oil revenue (-1) has a positive impact on the gini coefficient. The results also show that the dummy variable has no significant impact on the gini coefficient. The short run results are generally consistent with our long run findings. These results suggest that Iranian government should pay more attention natural resources like oil revenues and natural resource rents. The findings imply that investment in natural resources will lead to equality in income especially in the long run period.

D:Based on the regression of squared residuals on squared fitted values

References

Angeles, L. (2007). "Income Inequality and Colonism". *Journal of European economic review*, 51: 1155-1170.

Bakare, A.S. (2012). "Measuring the Income Inequality in Nigeria: the Lorenz Curve and Gini Coefficient Approach". *American Journal of Economics,* 2(1): 47-52.

Barro, R.J. (1990). "Human capital and growth: theory and evidence". *Am. Econ. Rev. papers Proc*, 91(2): 12-17.

Barro, R.J. (2000). "Inequality and Growth in a Panel of Countries". *Journal of Economic Growth*, 5: 5-32.

Birchenall, J.A. (2001). "Income Distribution, Human Capital and Economic Growth in Colombia". *Journal of development economics*, 66: 271-287.

Blanco, L., R. Grier. (2012). "Natural Resource Dependence and the Accumulation of Physical and Human Capital in Latin America". *Journal of Resources Policy,* 37: 281-295.

Bucellato, T., M. Alessandrini. (2009). "Natural Resources: A Blessing or a Curse? The Role of Inequality". Discussion Paper 98. Center for Financial Management Studies.

Dickey, D.A., W.A. Fuller. (1979). "Distribution of the Estimators for an Autoregressive Time Series with a Unit Root". *Journal of the American statistical society,* 75: 427-431.

Eicher, S.T., G.C. Penalosa. (2001). "Inequality and Growth: the Dual Role of Human Capital in Development". *Journal of development economics,* 66: 173-197.

Farzanegan, M.R. (2011). "Oil Revenue Shocks and Government Spending Behavior in Iran". *Journal of Energy Economics,* 33: 1055-1069.

Goderis, B., W.S. Malone. (2011). "Natural Resource Boom and Inequality: Theory and Evidence". *The Scandinavian Journal of Economics,* 113(2): 388-417.

Gylfason , T. (2001). "Natural Resources, Education and Economic Development". *Journal of Economic Review,* 45: 847-859.
Gylfason, T. (2006). "Natural Resources and Economic Growth: from Dependence to Diversification". In H.G. Broadman, T. Pass, P.J.J. Welfens, *economic liberalization and integration policy options for Eastern Europe and Russia*: Springer Berlin Heidelberg.
Halmos, K. (2011). "The Effect of FDI, Exports and GDP on Income Inequality in 15 Eastern European Countries". *Acta Polytechnica Hungarica,* 8: 1.
IMF, (2010). "International Monetary Fund" *Islamic Republic of Iran: Selected Issue*, Country Report No: 10/76, Available at: http://www.imf.org/external/pubs/ft/scr/2010/cr1076.pdf
Jalil, A. (2012). "Modeling Income Inequality and Openness in the Frame Work of Kuznets Curve: New Evidence from China". *Journal of Economic Modeling,* 29: 309-315.
Leamer, E.E., H. Maul, S. Rodrigues, and K.P. Schott. (1999). "Dose Natural Resource Abundance Increase Latin American Income Inequality?". *Journal of Development Economies*, 59: 3-42.
Marcus Fum, R., R. Hodler. (2010). "Natural Resources and Income Inequality: The Role of Ethnic Division". *Journal of Economic Letters,* 107: 360-363.
Meschi, E., M. Vivarelli. (2009). "Trade and Income Inequality in Developing Countries". *Journal of World Development,* 37 (2): 287-302.
Pesaran, M.H., and B. Pesaran. (1997). *Working with Microfit 4.0: Interactive Economic Analysis*. Oxford University Press, Oxford.
Pesaran, M.H., and R.P. Smith. (1998). "Structural Analysis of Cointegrating VAR's". *Journal of Economic Survey*, 12: 471-505.
Pesaran, M.H., and Y. Shin. (1999). "An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis". In: Storm, S. (Ed.), *Econometrics and Economic Theory in 20th Century: The Ragnar Frisch Centennial Symposium*: Chapter 11, Cambridge University Press, Cambridge.

Pesaran, M.H., Y. Shin, and R.P. Smith. (2001). "Bounds Testing Approaches to the Analysis of Level Relationships". *Journal of Applied Econometrics,* 16: 289-326.
Peter, A.L. (2013). "Economic Literacy, Inequality and Financial Development". *Journal of Economic Letters,* 118: 74-76.
Philips, P.C.B., and P. Perron. (1988). "Testing for a Unit Root in Time Series Regressions. *Journal of Biometrica*, 75: 335-346.
Qin, D., M.A. Cagas, G. Ducanes, X. He., R. Liu, and S. Liu. (2009). "Effect of Income Inequality on China's Economic Growth". *Journal of Policy Modeling,* 31: 69-86.
Sachs, J.D., and M.A. Warner. (1997). "Natural Resource Abundance and Economic Growth". In Mayer J., B. Chambers and A. Farooq (eds.), *Development Policies in Natural Resource Economics*, Edward Elgar.
Shin, I. (2012). "Income Inequality and Economic Growth". *Journal of Economic Modeling,* 29: 2049-2057.
Spilimbergo, A., J.L., Londono, and M.Szekely. (1999). "Income Distribution, Factor Endowments and Trade Openness". *Journal of Development Economics*: 59, 77-101.
Sylwester, K. (2002). "Can Education Expenditures Reduce Income Inequality?". *Journal of Education Review*, 21: 43-52.
Zhang, J. (2005). "Income Ranking and Convergence with Physical and Human Capital and Income Inequality". *Journal of Economic Dynamics and Control* 29: 547-566.