

## Testing the Kuznets Hypothesis under Conditions of Societal Duress: Evidence from Post-Revolution Iran

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### Abstract

*My motivation for this study is to examine the growth-inequality relationship in a country experiencing marked episodes of societal duress. In doing so, I estimate a Kuznets model for Iran to test the hypothesized inverted-U-shaped relationship between growth and inequality. The empirical results provide no evidence for an inverted-U-shaped relationship between growth and inequality in Iran's post-revolution era. Data suggest that income per capita has diminished considerably because of persistent inflationary pressure and rapid population growth. Meanwhile, inequality in the distribution of income continued to be high, a pattern that has not changed much in more than three decades.*

**Key Words**– Kuznets Curve, Inverted-U Hypothesis, Economic Growth, Income Distribution, Inflation, Population Growth

### 1. Introduction

To Simon Kuznets (1955, 1963), economic development is an uneven process. In the inverted-U hypothesis, he asserts that in an early stage of development, the pattern of income distribution worsens, but it would improve in a later stage. Kuznets argues that transformation of an agrarian to an industrial economy requires a shift of labor from low-productivity to high-productivity sectors. This shift results in increased wage disparity between skilled and unskilled labor. However, the wage disparity tends to shrink as industrialization reduces the inter-sectoral differences in average income. Furthermore, as the economy advances, redistribution measures –progressive taxation and transfer payments –allow for benefits of growth to trickle-down and further reduce income disparity.

Still, empirical evidence to support the Kuznets assertion is mixed. By and large, studies lending support to the inverted-U hypothesis analyze the relationship between growth and inequality across countries [e.g., Adelman and Morris (1973); Ahluwalia, Carter, and Chenery (1979)]. However, studies applying time-series or panel data find no evidence to support the inverted-U pattern of income distribution [e.g., Saith (1983); Anand and Kanbur (1993); Barro (2000); Fields (2001)]. Moreover, Deininger and Squire (1998) argue that evidence supporting the hypothesis comes mostly from Latin America, a region with historically high degrees of income inequality. When they control for this regional variable, the U-shape of the curve disappears.

### 2. Research Motivation

The Iranian experience provides a curious case study for the relationship between growth and inequality. After all, the proclaimed merit of the 1979 Revolution was to achieve “equality and social justice” by way of income redistribution financed by the country's ever-growing stream of petrodollars. To achieve this objective, Iran relied on its strong foundation for growth as it is endowed with the world's second largest petroleum reserves, a young and educated labor force, and developed industrial and commercial infrastructure.

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<sup>1</sup>I am indebted to Dr. Djeto Assane of the University of Nevada, Las Vegas and Dr. Reza Ramazani of Saint Michael's College for their constructive review comments. I am also indebted to two anonymous journal referees.

Nonetheless, Iran's economy has not thrived yet. Growth has been volatile because of widely fluctuating petrodollars, factional feud over economic policy, and unyielding international sanctions [Maloney (2010)]. Meanwhile, income inequality -falling inearlier years of post-revolution - has increased mainly due to persistentinflation hurting workers earning less than the median income more than those earning above it [Salehi-Isfahani (2009)].

My motivation for this study is to examine the growth-inequality relationship in a country experiencing marked episodes of societal duress. In previous three decades, Iran has experienced a wide range of societal change, includinga violent revolution, a costly Iran-Iraq war, frequent oil price shocks, stiff economic sanctions, and continued socio-political upheaval. These changes have hampered job creation for a rapidly growing labor force and ignited double-digit inflation rates. My contribution to the literature is to examine validity of the Kuznets assertion in a country experiencing such radical changes and to examine the extent to which growth has affected distribution in the aftermath of a total revolution. The rest of the paper is organized as follows. In the following section, I will construct aKuznets model to estimate the relationship between growth and inequality. Next, I will present the empirical results. Finally, I will offer someconcluding remarks.

### 3. The Model

The basic form of the Kuznets model suggests a quadratic relationship between growth and inequality. The premise of this relationship is thatincome inequality increases with the level of per capita income, reaching a peak, and then finds a tendency to decline as per capita income continues to rise. This basic model specification formulated by Thornton (2001) is:

$$\text{INEQUALITY}_t = \beta_0 + \beta_1(\ln\text{INCOME}_t) + \beta_2 (\ln\text{INCOME}_t)^2 + \varepsilon_t$$

Over a time interval ( $t = 1, 2, \dots, n$ ),**INEQUALITY**is a measure of income inequality; **INCOME** denotes the real income per capita; and  $\varepsilon$ is a white-noise error term.The Kuznets assertion requires  $\beta_1 > 0$ and  $\beta_2 < 0$  provided that the entire inverted-Ucurve in captured.

To measure **INCOME**, I collected data on the Gross National Product (GNP) measured in market prices for the period of 1979-2011.<sup>2</sup>I then adjusted the nominal GNP for inflation and population. This adjustment substantially diminished the GNP.<sup>3</sup> Measured in thousands of rials and calculated in 1998 prices, the real GNP per capita widely fluctuated. It plunged from 6,476 in 1979 to 3,423 in 1989, but gradually climbed to 11,251 in 2008 before falling again to 7,081 in 2011. Consequently, growth was sluggish and volatile. The real GNP per capita grew at an average annual rate of only 0.8 percent with a standard deviation of 10.9 percent and a range of 46.6 percent. The average growth rate of real GNP per capita varied within a 95 percent confidence interval of -2.9to 4.6 percent.

The conventional measure of **INEQUALITY**is the Gini Index, which varies between zero for perfect equality and one for perfect inequality. Iran has a moderate degree of income inequality when compared internationally. According to *The World Factbook*, Iran's Gini Index ranks 45<sup>th</sup>among 136 countries. Yet, it is the highest in the Middle East and North Africa. In my database, Iran's Gini Index had a mean of 40.7 percent and a standard deviation of 1.8 percent. As an alternative **INEQUALITY**variable,I used the income ratio of the richest 10 percent to the poorest 10 percentof the population (hereafter, Disparity Ratio). Data indicate that, on average, income received by the richest 10 percent of Iran's population was 16.9 times greater than that of the poorest 10 percent. The Disparity Ratio had a standard deviation of 2.7 percent and a range of 13.1 percent.

Toaugment the Kuznets model, I add **EDUCATION**as a proxy for educational attainment:

$$\text{INEQUALITY}_t = \beta_0 + \beta_1(\ln\text{INCOME}_t) + \beta_2 (\ln\text{INCOME}_t)^2 + \beta_3 (\text{EDUCATION}_t) + \varepsilon_t$$

<sup>2</sup>Main sources of data for all variables in the model were the Central Bank of Iran and Statistical Center of Iran.

<sup>3</sup>In the post-revolution era, the rate of inflation had a mean of 20.5 percent and standard deviation of 8.1 percent. Iran's population, growing at an average annual rate of 2.3 percent, more than doubled from 36.4 in 1979 to 74.8 million in 2011. Growing at this rate, Iran's population will double again in three decades.

The effect of educational attainment on income inequality is unsettled. Research has examined the link between income inequality and various measures of education. Several studies found a negative correlation between income inequality and educational attainment [e.g., De Gregorio and Lee (2002); Park (1996)]. In contrast, Deininger and Squire (1996) have found a positive correlation between the two factors when wealth inequality is also included. Barro and Lee (2000), studying the effect of educational attainment on inequality, discovered a negative relationship for primary education, but a positive relationship for higher education.

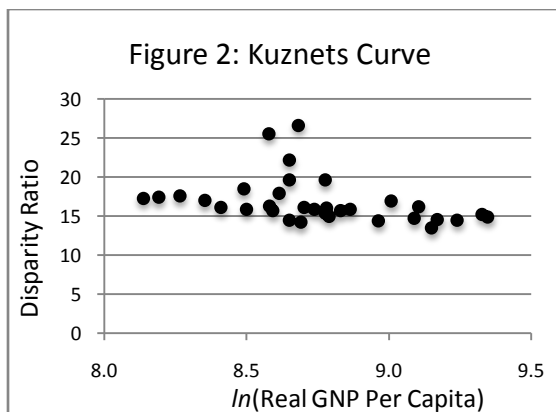
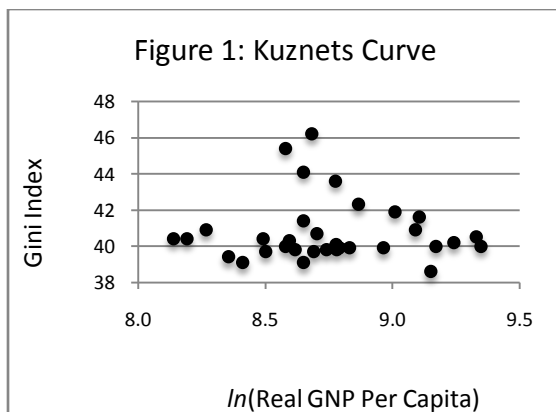
In this study, I use the rate of adult literacy as a proxy for educational attainment. I expect  $\beta_3 < 0$ , asserting that a greater rate of adult literacy would help reduce income inequality. The rationale for this assertion is that a nationwide effort to advance literacy would enhance labor productivity and earnings potential for the majority of population, thus helping improve income distribution in favor of unskilled labor. Between 1979 and 2011, Iran's adult literacy rate improved 37.3 percent from 50.8 to 88.1 percent. The country's rate of adult literacy averaged 73.8 percent with a standard deviation of 12.2 percent.

**4. Empirical Results**

To inspect the growth-inequality data, I looked at correlograms to observe that these series are stationary. As the number of lags increased from 1 to 16, the autocorrelation function dropped from 0.380 to -0.04 for the Gini Index; from 0.581 to -0.137 for the Disparity Ratio; and from 0.940 to -0.345 for the real GNP per capita. Shown in Table 1, the time series passed the Box-Ljung Q-test and Dickey-Fuller unit-root test. I also rejected the null hypothesis of no co-integration between alternative measures of inequality and the real GNP per capita at the one percent level.

**Table 1: Time-Series Test Results**

|  | Test Statistic | Significance Level | Decision Rule                                  |
|--|----------------|--------------------|--|
| <b>Box-Ljung Q Test:</b>               |                |                    |  |
| Real GDP Per Capita                    | 108.46         | 1%                 | Reject $H_0$ : non-stationary series           |
| Gini Index                             | 15.90          | 5%                 | Reject $H_0$ : non-stationary series           |
| Disparity Ratio                        | 43.88          | 1%                 | Reject $H_0$ : non-stationary series           |
| <b>Dickey-Fuller Unit-Root Test:</b>   |                |                    |  |
| Real GDP Per Capita                    | 6.41           | 10%                | Reject $H_0$ : Random Walk with Positive Drift |
| Gini Index                             | 13.5           | 1%                 | Reject $H_0$ : Random Walk with Positive Drift |
| Disparity Ratio                        | 9.1            | 5%                 | Reject $H_0$ : Random Walk with Positive Drift |
| <b>Co-Integration Test:</b>            |                |                    |  |
| Gini Index v. Real GNP Per Capita      | 0.96           | 1%                 | Reject $H_0$ : No co-integration               |
| Disparity Ratio v. Real GNP Per Capita | 1.14           | 1%                 | Reject $H_0$ : No co-integration               |



I estimated the Kuznets model with alternative measures of income inequality as the dependent variable for both basic and augmented specifications.

First, I performed the Chow test of structural shift due to soaring crude oil prices that began in 1999. In all unrestricted-restricted model estimations, computed values of the F-statistic fell short of their critical values. Hence, I failed to reject the null hypothesis of no structural shift with respect to rising oil prices. Next, I analyzed results of unrestricted model estimations to test validity of the Kuznets hypothesis. Test results, summarized in Table 2 along with scatter diagrams illustrated in Figures 1 and 2, provide no evidence for an inverted-U-shaped relationship between growth and inequality in Iran's post-revolution era.

In the basic model estimation, the OLS results produced low values of the Durbin-Watson statistic, indicating presence of positive serial correlation. When re-estimated the basic model with the Cochrane-Orcutt Procedure, Durbin-Watson tests indicated correction of first-degree serial correlation. Here, I found the coefficients of both  $(\ln \text{INCOME}_t)$  and  $(\ln \text{INCOME}_t)^2$ , while having the expected signs, to be statistically insignificant. I also found that values of the coefficient of determination were very low. In the augmented model estimation, Durbin-Watson tests indicated absence of serial correlation. Still, coefficients of both  $(\ln \text{INCOME}_t)$  and  $(\ln \text{INCOME}_t)^2$  remained statistically insignificant. However, I found coefficients of  $\text{EDUCATION}_t$  to have the expected negative signs and to be significant at the five percent level. I also observed that adding  $\text{EDUCATION}_t$  made considerable improvement in values of the coefficient of determination.

| INEQUALITY <sub>t</sub> measured by: | Gini Index       |                   | Disparity Ratio    |                    |
|--------------------------------------|------------------|-------------------|--------------------|--------------------|
|                                      | Basic Model      | Augmented Model   | Basic Model        | Augmented Model    |
| Constant                             | -0.93<br>(-0.35) | -1.46<br>(-0.83)  | -124.62<br>(-0.28) | -216.27<br>(-0.99) |
| $(\ln \text{INCOME}_t)$              | 0.31<br>(0.50)   | 0.42<br>(1.04)    | 35.18<br>(0.35)    | 54.48<br>(1.09)    |
| $(\ln \text{INCOME}_t)^2$            | -0.02<br>(-0.51) | -0.02<br>(-0.97)  | -2.17<br>(-0.38)   | -2.96<br>(-1.04)   |
| $\text{EDUCATION}_t$                 | -                | -0.01<br>(-3.73)* | -                  | -0.94<br>(-6.24)*  |
| R <sup>2</sup>                       | 0.05             | 0.35              | 0.05               | 0.64               |
| Durbin-Watson –OLS                   | 1.20             | 1.77              | 0.99               | 2.21               |
| Durbin-Watson –CORC                  | 1.75             | -                 | 2.01               | -                  |

#### 4. Conclusion

In this study, I found no evidence to support an inverted-U-shaped relationship between growth and inequality in the post-revolution era of the Iranian economy. Data analysis suggested sluggish and volatile patterns of the real income per capita coupled with high degrees of inequality in the distribution of income. I discovered that persistent inflationary pressure and hasty population growth substantially diminished real GNP per capita. Double-digit inflation corroded the buying power of income, while rapid population growth plummeted average income. In recent years, inflationary pressures have gained stronger momentum mainly due to increased import prices ignited by stiff economic sanctions, swift currency depreciation, financial mismanagement, and widespread corruption [Maloney (2010)].

Meanwhile, the political economy of redistribution in Iran has exerted profound effects on the inequality issue. Depending on presidential agenda, public policies have had variable distributional outcomes. For example, President Rafsanjani's (1989-1997) market-oriented policies of war reconstruction helped drop the mean Gini Index to 39.9 from 41.3 percent of the previous administration. During the ensuing reform era, President Khatami (1997-2005) did not directly tackle the inequality issue. Instead, he implemented a cautious array of modest economic initiatives like re-opening of private banks and insurance companies and unifying the foreign exchange rate [Maloney (2010)]. During his presidency, income inequality worsened as evident by a rise in the mean Gini Index to 40.4 percent. President Ahmadinejad's (since 2005) populist and free-wheeling spending policies, replacing government subsidies on food and energy with targeted cash assistance, have not improved the mean Gini Index of his predecessor.

In the post-revolution era, variable redistribution policies did not ignite a trickle-down effect to create an inverted-U-shaped pattern. In the context of a distributive economy such as Iran, Salehi-Isfahani (2006) suggests that wealth accumulation depends more on political access than labor productivity.

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