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Zangeneh, Hamid

Widener University

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Hamid Zangeneh[1]

Introduction

Even though there is no agreement among researchers about what constitutes underground economic activities,[1] their existence is not generally disputed. Therefore, we need to know their magnitude for many reasons. The knowledge is, first and foremost, of considerable interest to policy makers who must decide on public subsidies and assistances that they are providing to low income and indigent people. The existence of such activities also points to a more fundamental issue. Policy makers may not need to do as much if these activities are pervasive and significant. The aggregate data such as income,[2] unemployment, inflation, and the magnitude of the tax base might be significantly distorted.

Over the past twenty-five years many studies have suggested the existence of an underground economy in Iran that is, at least, as large if not larger than the formal economy. However, hard evidence has not been provided to support this suspicion. In this study an estimate of Iran's underground economy will be attempted. Section I of this paper provides reasons for the existence of underground or unofficial economies. Section II discusses difficulties associated with definition and estimation. Section III will provide the estimation methods. Section IV is used for data analysis. Section V is used for a brief discussion of theoretical formulation of demand for money and modifications made for the particular Iranian case. In section VI empirical results are presented. Section VII will be used for summary and implications.

I—Why Do Underground Activities Exist?

In general, on an individual level, the most important reason for engaging in the underground economy is to earn a living or to enhance ones disposable income. On institutional levels, participation in the underground economies stems from the extent of government regulations and perception of government's legitimacy. If regulations become too overbearing, people would try to avoid them by joining the underground economy and hide their infractions. Also, if people perceive the government as corrupt and unrepresentative, they would do whatever possible to avoid taxes. Therefore, black market activities exist in all countries at any time in various degrees mainly to evade taxes or to maintain public support such as unemployment insurance benefits, food stamps, and other welfare payments at any time. However, the practice seems to be less severe in countries where tax payment is more acceptable (tax moral[3] is high) than in

[1] Author is a Professor of Economics, Widener University, Chester, PA 19013, hzangeneh@mail.widener.edu. Telephone 610-499-1140 and fax 610-499-4614. The author would like to thank Professors Kamran Dadkhah of Northeastern and Nader Habibi of Brandies Universities for his comments. However, he is solely responsible for any remaining shortcoming. This paper is to be published in Jamshid Assadi, ed., Market and Democracy, 2010.

those countries where tax evasion for political and/or religious reasons is the norm. In advanced countries well established people more readily comply with their tax obligations than do newcomers. New immigrants, in general, tend to engage in underground activities to avoid taxes, a habit learned in their old countries. Also because of the tendency of new immigrants to interact with each other within the "community" more than they do with "outsiders," they tend to be more discrete.

A third factor that is very relevant for the existence of an underground economy in the US and in Iran is the large number of "illegal aliens" in the country. Iran has been a recipient of a large number of immigrants (refugees) in the last two decades from Iraq and Afghanistan for obvious reasons. Almost all of them engage in some sort of illegal activities, in either what is considered legal or illegal activities in nature, to earn a living. The United Nations reported that there existed over three millions of refugees in Iran. Finally, revolution created uncertainty and in the uncertain post-revolutionary era when lawlessness and confiscations were common, being liquid has added to the need to be "unobservable."

II— What Constitutes Underground Activities and How Can They Be Detected?

Activities that lend themselves more to this practice could be legal or illegal. Activities that are legal in nature could be divided into tax avoidance, which is legal (e.g., employee discounts and fringe benefits) and tax evasion, which are illegal such as unreported self-employment income. Activities that are illegal in nature could be either monetary or non monetary such as trade in stolen goods, drugs, prostitution, and gambling. What constitutes underground activities, therefore, depends on one's perception. Tanzi (1980, 1983) and Tucker defined underground economic activities as all legal activities that go unmeasured. Feige (1979, 1985) defined underground economic activities as all those which go unmeasured, legal or illegal.

III— Estimation Methods

In order to estimate the magnitudes of underground economies, one could either resort to surveys of the public or use already collected and published data sources. Each has its own difficulties and shortcomings. In conducting surveys one should contend with their associated costs and more importantly, the veracity of the responses. After all, we would be relying on the "cheaters" to tell us how and how much they "cheat."[4] The difficulty of using the officially collected data on economic activities is the "tentative nature" of the relationship between the observed data and unobserved data about underground economy.

The officially observed and measured economic activities of any country are presented in National Income Statistics. Since we estimate Gross Domestic Product (GDP), in two different ways, it would potentially be a way of detecting the magnitude of the underground economy. That is, if we compare the GDP estimated by expenditures method[5] to that of income method[6] and if there is a discrepancy, the discrepancy point to the existence of underground activities. That is, if people are spending more than their income, one could argue that the discrepancy is due to additional income that they earn from the underground activities. However, it is possible that the two sides do agree despite the existence of a significant underground economy. If people receive income under the table and spend it in markets that are also beyond the reaches of the official

system, there would be no discrepancy while both incomes and expenditures remain unobserved and unreported.

Another alternative would be to look at variables that should be similar in different countries and if they are dissimilar, the dissimilarity might be due to the existence of the underground economies. For example, one could consider labor participation in similar countries and assume it must be equal. If one is significantly smaller, one could infer that a significant number of people are earning a living through underground activities.

Finally, the monetary approach, the method that is used for this study, depends on the assumption that using money is the most viable and safest method of concealing transactions on either side of the ledger, on the income side or on the expenditures side. This is based on the assumption that the demand for money is stable, which has been found to be the case for Iran (**Amir Kia**, **Ali F. Darratt**, 2007). In this approach, one should look for any anomalous jump in the money ratios relative to their "historical levels." If there are jumps that could not be explained by changes in other economic variables, these could allude to an increase in underground activities.[7]

IV—The data[8]

Can we see underground activities in the quantity of money in circulation? Figure 1 shows the real and nominal currency per capita for Iran between 1959 and 2004. Per capita currency holding increased from 92.72 in 1338 (1959) to a high of 2196.8 in 1358 (1979, the first post revolution year) and after a period of ups and downs, it climbed to 2587.82 in1383 (2004). Presuming that technological advances in banking should have lowered the need for real balances, these increases might reflect underground activities.

Figure 1
nominal and real per capita currency
1959-2004
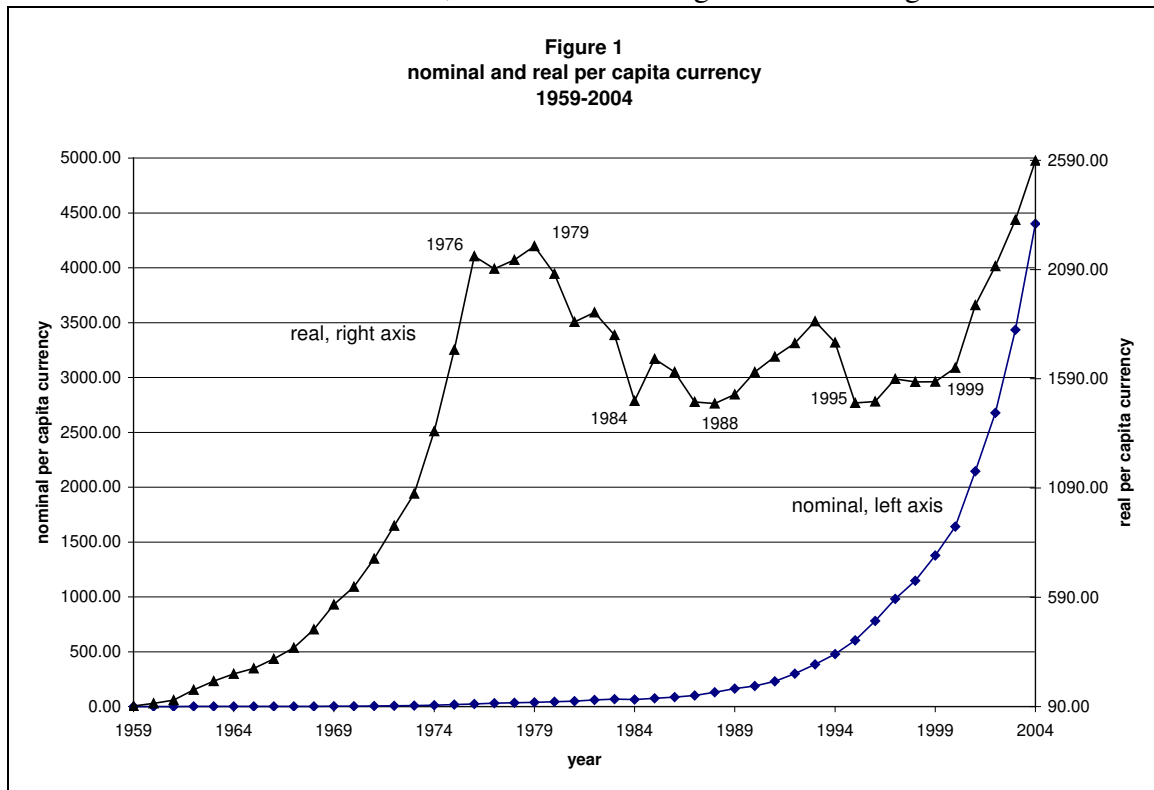
V—The Demand for Real Balances

The following model or a variation of it has universally been accepted:

(1) $m_t^i = m_t^i (y_t, R_t)$ $\quad\quad\quad$ $\delta\, m_t^i/\delta y\,>0,\;\; \delta\, m_t^i/\delta R\,<0$

Where:

$\quad m_t^i\;$ = real balances (cu, m_1 or m_2)

$\quad y_t\;\;$ = real income.

$\quad R_t\;\;$ = a nominal interest rate.

The disturbance term is assumed to be a white noise, $E(\varepsilon_t)=0$, and constant variance, σ^2. In this closed economy model,[9] it is assumed that all adjustments between the desired and actual real balances take place in one period. If there is an assumption of partial adjustment, a stock adjustment process is assumed and the lagged dependent variable, m_{t-1}, is added to the equation.[10] So the estimated equation would become:

(2) $m_t^i =\; m_t^i (y_t, R_t, m_{t-1})$ $\quad$ $\delta\, m_t^i/\delta y\,>0,\;\; \delta\, m_t^i/\delta R\,<0\,,\; \delta\, m_t^i/\delta\, m_{t-1}^i\,>0$

On a priori basis one would expect that an increase in income would lead to increases in both assets and transaction demand for money. Since we are interested in estimating the demand for currency for transaction purposes, we use disposable income rather than gross income. Therefore, the income coefficient is expected to be positive. Also, if all adjustments do not take place in one period, one would expect the coefficient of the lagged real balances to be positive also. However, holding money has an associated opportunity cost. Economic agents tend to minimize this cost. Therefore, when there is high (low) cost, they hold smaller (larger) real balances. As a result, the coefficient of the interest rate is expected to be negative.

The Iranian Case

In this study our equations are modified to reflect the Iranian experience. That is, rather than including a nominal or real rate of interest, log of consumer price index is included as a proxy for the opportunity cost of holding money. This will solve the problem of inadequate to nonexistent data on the nominal and/or real rates of interest as well as their artificiality in the Iranian economy. Therefore, log of CPI would be a much more reliable and acceptable proxy for the cost of holding money in Iran because of the common custom of conducting transactions, for the most part, in cash. It is also justifiable to do so because of a lack of a sophisticated financial market in Iran to provide a historically consistent measure of opportunity cost of holding money that could be used in the estimation of the demand for the real balances.

After the revolution of 1979, people did not adjust their consumption levels despite a prolonged and precipitous decline in real officially observed and measured

income. This must have happened either through underground activities or by selling their real assets. Therefore, rather than including real income, we include the ratio of real consumption to real income as a scale variable.

 Finally, we incorporated two dummy variables for the tax law change in 1348 (1969) and for the 1979 revolution.   Therefore the modified equation that is used for this study is:

(3) $cu_t = cu\,(c_t/y_t,\ \pi_t,\ \tau_t,\ dtl,\ dr)$ $\delta cu/\delta y >0$, $\delta cu/\delta \pi <0$, $\delta cu/\delta \tau >0$, $\delta cu/\delta dtl>0$, $\delta cu/\delta r>0$

Where:
   cu_t = log of real per capita currency
   c_t/y_t = ratio of log of real consumption to log of real income
   π_t = log of CPI_t
   τ_t= log of direct per capita taxes
   dtl, dr = Dummy variables for tax law change, and revolution

VI—Empirical Results

a—The data
  As is the case for all of the macroeconomic variables, our time series are subject to stationarity problem. Table 1 below shows the D-F test statistics for the variables used in this study.

Table 1: Augmented Dickey-Fuller (H_0: there is a unit root)				
	Levels		**First difference**	
Variable	Intercept/ no trend	Intercept and trend	Intercept/ no trend	Intercept and trend
CU_t = per capita currency	-1.15	-1.76	-4.07	-4.02
c_t/y_t	-2.11	-2.21	-6.93	-6.93
π_t = lncpi	-2.53	-3.56	-7.27	-7.25
τ= direct taxes	0.54	-1.96	-6.99	-7.05
All of the first differences are at least significant at 5% level.				

b—Regression results

Table 2: OLS Results. $cu_t = cu$ $(c_t/y_t, \pi_t, \tau_t, dtl, dr)$				
	Coefficient	Std. Error	t-Statistic	Prob.
c_t/y_t	5.743090	0.105303	54.53877	0.0000
π_t	-1.090126	0.132711	-8.214270	0.0000
τ_t	1.004718	0.113678	8.838300	0.0000
dtl	0.523885	0.195275	2.682807	0.0106
dr	0.611959	0.146349	4.181499	0.0002
R-squared	0.934191	Mean dependent var		6.896000
Adjusted R-squared	0.927610	S.D. dependent var		0.933647
S.E. of regression	0.251201	Akaike info criterion		0.179310
Sum squared resid	2.524070	Schwarz criterion		0.380050
Log likelihood	0.965536	Hannan-Quinn criter.		0.254143
Durbin-Watson stat	0.962218			

Using Eviews 6, an OLS regression was estimated. All of the variables have the expected signs and all are statistically significant. The opportunity costs coefficient is negative and significant. This implies that people try to reduce their real balances in the face of higher opportunity cost. Ratio of consumption to income has positive coefficients and is significant. Higher taxes lead to higher cash economy. Finally, revolution resulted in a larger cash economy as well.

High R-squared and low D-W statistic, however, might indicate a potentially spurious equation. To deal with this suspicion, a Johansen cointegration test was conducted. In order for an OLS model to be valid rather than spurious, at least one integrating equation must be present. The results in Table 3 show that under any specification, i. e., with/without intercept or trend, at least one cointegrating equation exists at 5% level.

Table 3: Johansen test summary					
Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	1	2	3	2	2
Max-Eig	2	1	1	2	2
Critical values based on MacKinnon - Haug - Michelis (1999).					

Table 4 shows a normalized unrestricted cointegrating equation. This means that a single

equation for the long run demand for per capita real currency is appropriate and a valid process.

Table 4: normalized unrestricted cointegrating equation			
CU_t	c_t/y_t	π_t	τ_t
1.00	1004.31	-42.47	30.55
	(229.58)	(8.63)	(7.37)

A final step is to estimate an error correction model. Below is the error correction model for the data.

ΔCU_t = - 0.005 CU_{t-1}+ 1004.31 c_{t-1}/y_{t-1} - 42.47 π_{t-1} + 30.54 τ_{t-1} - 1006.57
    [-3.58]   [4.37]   [-4.92]   [4.14234]

- .099 ΔCU_{t-1} - 0.064 ΔCU_{t-2} - 0.41 ΔCU_{t-3} + 1.00 $\Delta c_{t-1}/y_{t-1}$ - 1.01 $\Delta c_{t-2}/y_{t-2}$
 [-0.528]   [-0.34]   [-2.24]   [-2.24]   [-0.71]

- 2.34 $\Delta c_{t-3}/y_{t-3}$ - 0.73 $\Delta\pi_{t-1}$ + 0.55 $\Delta\pi_{t-2}$ - 0.64 $\Delta\pi_{t-3}$ + 0.064 $\Delta\tau_{t-1}$ - 0.11 $\Delta\tau_{t-2}$
 [-1.718]   [-3.034]   [2.033]   [-2.63]   [1.149]   [-2.00]

- 0.20 $\Delta\tau_{t-3}$ + 0.24 + 0.150 dtl - 0.206 dr
 [-3.49]   [3.85]   [3.32] [-3.58]

Summary Statistics for the Error Correction Model

R-squared	0.811791	Determinant resid covariance (dof adj.)	1.30E-11
Adj. R-squared	0.698865	Determinant resid covariance	1.79E-12
Sum sq. resids	0.092485	Log likelihood	321.7535
S.E. equation	0.060823	Akaike information criterion	-12.37822
F-statistic	7.188724	Schwarz criterion	-9.536197
Log likelihood	66.75625		
Akaike AIC	-2.475915		
Schwarz SC	-1.807204		
Mean dependent	0.064146		
S.D. dependent	0.110837		

Numbers in brackets under the error correction model representation are student t statistics.

The first term, the cointegrating term, is negative and significant, which means the regression converges toward its long term path after a disturbance. Variables c_t/y_t, π_t, and τ_t as well as dummy variables dtl and dr have correct signs and are significant.

Estimate of Iran's Underground Economy

Using our error correction model, we are now set to estimate Iran's underground economy. In order to do so, we calculate currency holdings under two regimes, a regime assuming the existence of taxes and tax law change and a regime without the existence of taxes and tax law changes. In order to change the calculations from logs to levels, we add to each equation $\ln(CU_{t-1}) + \Delta\ln(cpi) + \Delta\ln(population)$. The two equations, therefore are:

### A—Regime With Taxes.

In this case currency holding would be:

$CU_{tax} = \exp(- 0.005\ CU_{t-1} + 1004.31\ c_{t-1}/y_{t-1} - 42.47\ \pi_{t-1} + 30.54\ \tau_{t-1} - 1006.57 - .099\ \Delta CU_{t-1} - 0.064\ \Delta CU_{t-2} - 0.41\ \Delta CU_{t-3} + 1.00\ \Delta c_{t-1}/y_{t-1} - 1.01\ \Delta c_{t-2}/y_{t-2} - 2.34\ \Delta c_{t-3}/y_{t-3} - 0.73\ \Delta\pi_{t-1} + 0.55\ \Delta\pi_{t-2} - 0.64\ \Delta\pi_{t-3} + 0.064\ \Delta\tau_{t-1} - 0.11\ \Delta\tau_{t-2} - 0.20\ \Delta\tau_{t-3} + 0.24 + 0.150\ dtl - 0.206\ dr + \ln(CU_{t-1}) + \Delta\ln(cpi) + \Delta\ln(population))$

B—Regime Without Taxes:

In this case currency holdings would be:

$CU_{notax} = \exp(- 0.005\ CU_{t-1} + 1004.31\ c_{t-1}/y_{t-1} - 42.47\ \pi_{t-1} + 30.54\ \tau_{t-1} - 1006.57 - .099\ \Delta CU_{t-1} - 0.064\ \Delta CU_{t-2} - 0.41\ \Delta CU_{t-3} + 1.00\ \Delta c_{t-1}/y_{t-1} - 1.01\ \Delta c_{t-2}/y_{t-2} - 2.34\ \Delta c_{t-3}/y_{t-3} - 0.73\ \Delta\pi_{t-1}$
$+ 0.55\ \Delta\pi_{t-2} - 0.64\ \Delta\pi_{t-3} + 0.24 - 0.206\ dr + \ln(CU_{t-1}) + \Delta\ln(cpi) + \Delta\ln(population))$

Within the second regime, i.e., a regime in the absence of taxes, the public would hold much less than otherwise. In order to obtain an estimate of "illegal currency" holdings of the public we subtract CU_{notax} from CU_{tax} $[CU_{notax} - CU_{tax}]$.

C—Income Estimate

Assuming that income velocities of money in official and unofficial economies are similar,[11] we could multiply the amount of "illegal currency in the hands of public" by the official income velocity of money to estimate the income levels of the underground economy. The following graph shows these magnitudes.

Figure 2: underground economy as a percentage of the GDP
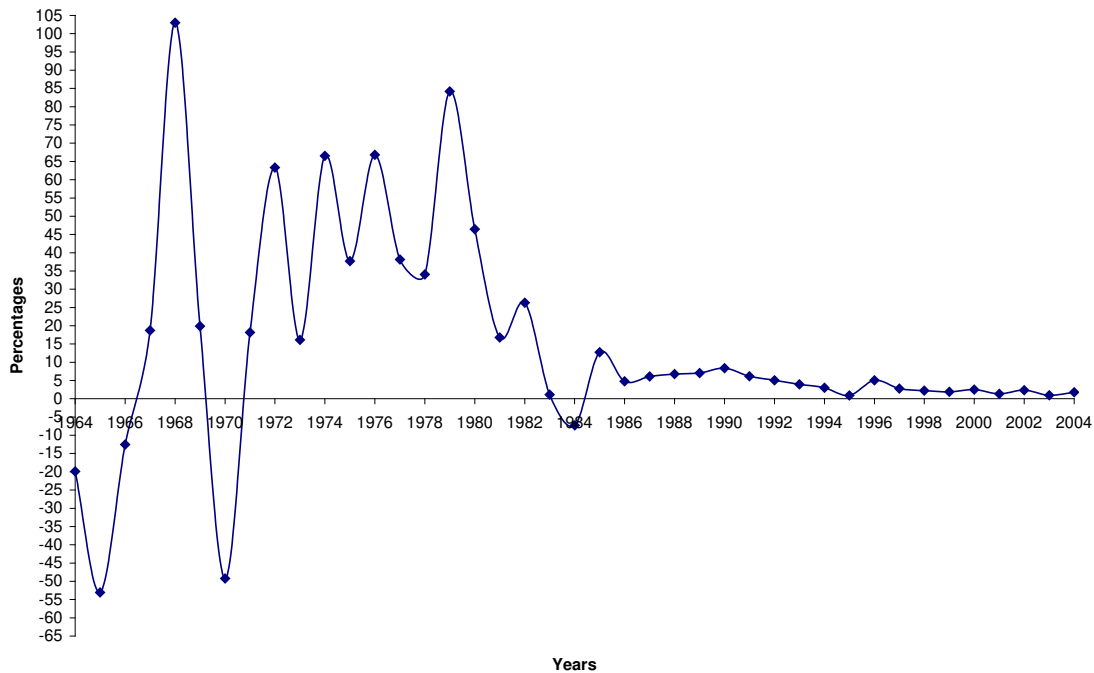
Surprisingly, despite the current understanding, the underground economy today, at least relative to the pre-revolutionary era, is almost non-existent. It appears that the unofficial economy was much more pronounced and significantly larger than during the post revolution. One possible explanation is that the official data already accounts for such activities now compared to the pre-revolutionary years. It is also possible that those who engage in these activities today are more in tune with the regime and therefore support it in every way possible, including paying taxes. Finally, it is possible that people were more liquid because of the extraordinary hustle and bustle of the early 70s when, all of sudden, an enormous amount of money was put into circulation due to higher oil prices and revenues.

VII—Summary and Conclusion

The perception that Iranian economy has stagnated after the revolution and there is rampant unemployment/underemployment might be illusory if there is a large underground economy. This study shows that so-called underground economy; besides and beyond what is reported by the Central Bank data that support millions of youths cannot be substantiated.

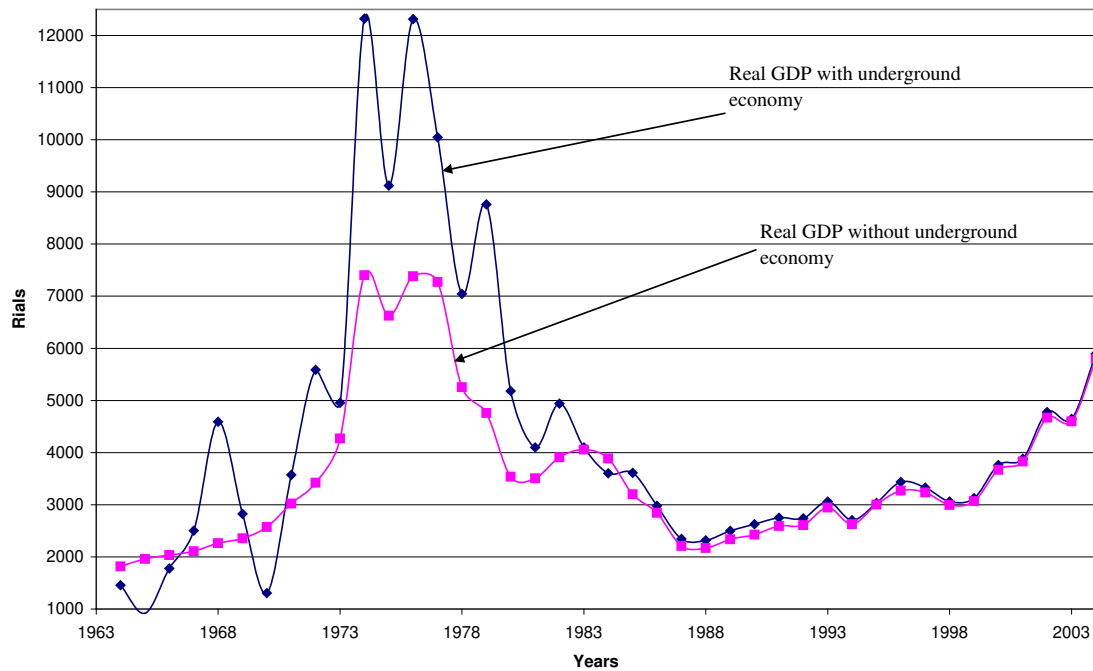**Figure 3: Real GDP Per Capital With and Without the Underground Economy**

Figure 3 shows the real GDP per capita of Iran with and without the adjustments for the underground economy. It implies that the economy before the revolution was much larger than it has been previously thought. A striking implication of this study is the fact that the per capita income has not reached anywhere close to its pre-revolutionary era. This study shows that per capita income in 2004 (5897 rials) was less than half of its peak in 1974 (12323 rials).

Again, it is important to note that in rationalizing the low GDP, there are those who believe that the officially reported GDP is only a part of the total actual real GDP. That is, some believe that a large part of Iranian economy is not reported. Therefore, there is a great deal of underground (unreported) economic activities in Iran that are not included in the reported data. Even though one cannot deny the existence of this unofficial underground economy, it cannot be shown that they are not included in the official data reported by the Central Bank of Iran. Therefore, we can safely assume that, by all approximations, the official data to be a good representative of actual real Iranian economy and the proposition of much larger economy due to the existence of a large underground economy beyond and in addition to the officially published data is, more or less, an exaggeration. This lack of unreported economy implies that economic cost of the revolution and consequent internal and external policies have had a more serious and lasting impact than previously thought because what is reported is all there is and no

more. Therefore, the argument that the economy is much larger in reality than what is reported and therefore people are not as worse-off as the data show does not hold water.

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Endnotes

[1]. Many terms are used to refer to underground economic activities. These include, among others, black, gray, cash, informal, invisible, irregular, and under the table. In this study we simply use underground activities.

[2]. The potential distortions are through moonlighting, nondisclosures of cash income, nondisclosures of employment by welfare recipients and unemployed, failure to disclose interest income, and barter. See Christopher Bajada, December 1999.

[3]. Tax moral is an index, which is supposed to measure people's attitudes toward the government. For more details see Bruno Frey and Hannelore Weck.

[4]. According to Frey, 1983, the Italian Statistical Office successfully used this method.

[5]. Total expenditures are equal to household (private consumption) expenditures, private business investment, government expenditures, and net exports.

[6]. Total incomes received by factors of production as wages and salaries, net interest income, rent, profits, and adjusting for depreciation and indirect business taxes should be equal to the GDP.

[7]. One needs to be attentive to the potential pitfalls of the monetary approach method. It generally assumes unchanged benchmark ratios (historical levels); and the underground economy uses solely currency as medium of exchange; each dollar supports a given level of income in both the regular and underground economies, i.e., a dollar equally supports a dollar of manufactured product as well as a dollar of services in the market, legal and illegal.

[8]. The choice of data period is dictated by availability. Consistent data on national income and accounts goes only back to 1953. There are data on currency prior to 1959 but not for other national income variables. All of the data used in this study are extracted from the IMF's International Financial Statistics electronic database except for the GDP deflator, which was partially derived from Bank Markazi Iran's web site.

[9]. See Gregory Falls and Hamid Zangenehzadeh for a discussion of an open economy approach to the demand for money.

[10]. See Bajada, 1999 Goldfed, 1973, 1976, Chow, 1966)

[11]. There is not much one could do to improve upon this seemingly bold assumption.