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Abbas Valadkhani
University of Wollongong, abbas@uow.edu.au

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Abstract

The Iranian rial has been depreciated on average about 13 per cent per annum against the U.S dollar during the last four decades. This paper examines the long- and short-run determinants of the black market exchange rate employing the cointegration techniques and the annual time series data from 1960 to 2002. Consistent with previous studies and the monetary approach to the exchange-rate determination, it is found that the black market exchange rate is cointegrated with the relative consumer price indices in Iran and the U.S., real GDP and the relative import prices. However, in the short run only the rising relative prices and a meagre real GDP growth have been responsible for the depreciation of Iranian currency.

Keywords

Black market, exchange rate, Iran, Cointegration

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AN EMPIRICAL ANALYSIS OF THE BLACK MARKET EXCHANGE RATE IN IRAN

ABBAS VALADKHANI
Queensland University of Technology

ABSTRACT The Iranian rial has been depreciated on average about 13 per cent per annum against the U.S dollar during the last four decades. This paper examines the long- and short-run determinants of the black market exchange rate employing the cointegration techniques and the annual time series data from 1960 to 2002. Consistent with previous studies and the monetary approach to the exchange-rate determination, it is found that the black market exchange rate is cointegrated with the relative consumer price indices in Iran and the U.S., real GDP and the relative import prices. However, in the short run only the rising relative prices and a meagre real GDP growth have been responsible for the depreciation of Iranian currency.

1. Introduction

A volatile and constantly depreciating exchange rate can adversely affect a number of key macroeconomic variables such as private investment, GDP growth, and the demand for money. In fact, the black market exchange rate in Iran can be considered as a proxy measure of general public confidence to the performance of economy (Valadkhani, 2003). This market forms a very important Iranian institution that operates in specific streets of Tehran and other large cities and in varied shops! One set of actors in this market may be overseas visitors, Iranians returning from trips abroad, Iranians now resident in other countries and visiting family and friends, etc. who have various quantities of a most valuable commodity, *viz.* other countries' currencies. Another set of actors comprise what can be termed "the real buyers" of these scarce commodities. This set includes businesspersons involved in international trade, particularly importers, Iranians about to travel overseas for any purposes, *e.g.* business trips, the provision of medical services, visiting relatives resident abroad, etc.

However, these "real buyers" will not physically undertake transactions with suppliers of other currencies on the streets. This market is characterised by middlepersons or agents, who close the link between buyers and sellers. These agents will be typically unemployed or underemployed Iranians who may well be frontpersons for wealthy opportunistic entrepreneurs who have recognised that a government policy for the price of other countries' currencies is a non-market clearing price. As the difference between the market price and the government-determined price for these commodities increased in 1995, a third set of actors, the police, entered the stage!

In both the pre- and post-revolution periods, Iran has operated a fixed exchange rate regime, albeit with periodic devaluations. Prior to the 1979 Islamic Revolution, the official exchange rate between the rial and the US$ was approximately 70 rials per dollar. At that time, the gap between the official and the black market exchange rate was about 7 rials. However, the gap between the black market and the official rate has widened through time.

It is very interesting to note that since 1989 a new source of government revenue originated from the sale of foreign currencies. The exchange rate was devalued by approximately 25 per cent over the 1989-1992 period, but in spite of such a devaluation, the black market for foreign currencies persisted. The government's exchange rate policy had the effect of making the government a beneficiary of its own policy. The gap between the black market and the official rates has rendered a windfall gain for both the government and some foreign currency dealers in the parallel market. For this reason, it is apparent that the substantial segment of "other revenue" in the government annual budget is attributable to the sale of foreign currencies by the Central Bank in the black market. The share of "other revenue" in the government budget increased from an average of 14 per cent in the revolutionary and war period (1978-1988) to 36.2 per cent in the four years following the end of the Iraqi war (*i.e.* 1989-1992). It should be noted that the Central Bank started its direct intervention in the black market in 1988 (Valadkhani, 1997).

Overestimation of government revenue and/or underestimation of expenditure, placed the Iranian government in a critical situation during the revolutionary and war period (1978-1988). On average the ratio of the budget deficit to total government expenditure trebled in this period compared to that of the oil boom period (1973-1977). In 1989 the budget deficit was so large as to represent an unprecedented rate of 51 per cent of total expenditure. This ratio was reduced to 6.7 per cent in 1993 (Nourbakhsh, 1993). It seems that the sale of foreign currencies by the Central Bank in the black market played a major role in this achievement!

It should also be mentioned that the black market for foreign currencies is linked very closely with the government's policies. In the 1980s the government experienced a substantial budget deficit and, as a result, government indebtedness to the Central Bank increased substantially. Under these circumstances soaring inflation was inevitable. This, in turn, amplified the gap between the official rate and the black market exchange rate for foreign currencies. For example, the gap between the official and black market exchange rates increased from an average of 175 rials per US dollar in the early 1980s to 1400 rials in 1989 (Valadkhani, 1997).

Because of this increasing gap between the official rate and the black market rate, the government devalued the rial to 1750 per US dollar in an attempt to restore an equilibrium in the foreign exchange market and foster non-oil exports. Notwithstanding the fact that Iran used a multiple-exchange-rate system in the allocation of scarce hard currency earnings, this system was not successful. According to Farzin (1995) at one time during the war the number of exchange rates applicable to various categories of imports and exports exceeded seven.

The main reason for the deterioration in the value of the rial is the monetisation of the enormous budget deficit during and after the war. It should be mentioned that, to some extent, psychological and socio-political factors have also played an undeniable role. The growing gap between the government official and black market exchange rates directed scarce resources to unproductive sectors. The profitability of the trade sector, particularly small-scale trade such as sidewalk and small vendors, stimulated rent-seeking activities at the expense of goods-producing sectors. The currency devaluation policies also coerced economic agents, particularly the government and semi-government enterprises, into having an enormous demand for money (Bahmani-Oskooee, 1996). In other words, while the purchasing power of the rial decreases, people, including the government and semi-government enterprises, demand more money to cover their transactions. It is also argued that the income elasticity of the demand for money has decreased since the 1979 revolution. This means "the same rate of expansion in private sector liquidity is likely to have more inflationary consequences after than before the revolution" (Pesaran, 1995, p.5). This decline in income elasticity is also a manifestation of an inefficient banking system.

Bahmani-Oskooee (1995a, p. 278) points out that in 1993 the black market exchange rate was 2400 rials to the US$, involving a 30-fold depreciation of the rial. In March 1993 the Iranian government embarked upon the exchange rate unification policy with consultation of the International Monetary Fund (IMF). The major objective of this recent policy was to unify the multiple exchange rate regime into a single equilibrium rate by the massive intervention of the Iranian Central Bank. However, this policy has not been successful on various grounds, *viz.* the lack of an appropriate government social safety net to support vulnerable strata, the incorrect initial exchange rate announced by the Central Bank, and the unsuitable timing of the unification. See Farzin (1995) for a detailed explanation of these reasons and the recent assessment of the foreign exchange reform in Iran.

Therefore, in late 1995 the Iranian authorities once again decided to administer, or implement, the existing regulations relating to the fixed exchange rate system and "cracked down" on the participants in the black market. The Iranian police, with powers to arrest both buyers and sellers, began to be active in trying to prevent transactions in this market. According to the Central Bank of Iran (2003) black market exchange rate was approximately 8314 rials to the US$ in 2003. More recently, the Banking system buys and sells foreign currencies from individuals at a rate marginally below the black market rate. Abstracting from political and social effects associated with this black market, the important question in this study is to determine the economic factors, which give rise to the prices in the black market for foreign currencies.

The structure of the paper is as follows. In Section 2 a theoretical model is postulated, which captures the long-run equation for the black market exchange rate using both the Johansen multivariate cointegration technique and the Engle-Granger representation theorem. Sources of the annual data employed as well as the unit-root results using the Augmented Dickey-Fuller (ADF) and the Kwiatskowski-Phillips-Schmidt-Shin (KPSS) tests are discussed in Section 3. This section also presents the empirical econometric results for the long- and short-run determinants of the black market exchange rate, as well as policy implications of the study. Section 4 provides some concluding remarks.

2. The Model

Bahmani-Oskooee (1995a and 1995b) has made an important empirical contribution by applying cointegration techniques in his econometric analysis of those factors that determine the black market exchange rate. According to his empirical results, not only the consumer price index is cointegrated with the nominal stock of money, real GDP, the black market exchange rate, and the world export price index (as a proxy for import prices), but also the black market exchange rate has a long-run relationship with the consumer price index, the nominal stock of money, the real GDP, and the world export price index. Bahmani-Oskooee's policy conclusion is that the black market exchange rate cannot be stabilised unless the Iranian government seriously curbs inflation. Consistent with the monetary approach to the exchange-rate determination approach, this conclusion is also supported by Figure 1, which shows the time series data on the relative consumer price indices in Iran (*P*) and the U.S. (P^*) and the black market exchange rate (*BE*) for the US dollar during the period 1960-2003. It seems that there exists a vicious cycle in which a high relative inflation devalues the rial and a negligibly valued rial aggravates inflation. There are some empirical studies which have elucidated this cycle, for example Dadkhah (1987) and Bahmani-Oskooee (1993).

[Figure 1 about here]

The central institutional mechanism which enables this trend to continue is the lack of independence of the Iranian Central Bank. According to Bahmani-Oskooee the independence of the Central Bank is a crucial institutional reform. In his analysis of the black market exchange rate, Pesaran (1992) also emphasises the interaction of inflation and the rates of inflation in Iran's major trading partners (measured by bilateral and multilateral real exchange rate indices). He shows that when Iranian prices increase more than do those of her trading partners, the black market exchange rate rises. Similar results have also obtained in the present study. Pesaran's analysis, as does that of Bahmani-Oskooee (1995b), points to the crucial factor of Iran's persistent inflation as one of the determinants of the rising price (in Iranian rials) for major international currencies. In this study the long-run equation for the black market exchange rate is specified as follows:

$$\ln(BE_t) = \beta_0 + \beta_1 \ln(P_t / P_t^*) + \beta_2 \ln(Y_t) + \beta_3 \ln(P_{mt} / P_{mt}^*) + e_t \qquad (1)$$

where *BE* is the black market exchange rate (the price of $US in Iranian rial); *P* and P^* denote the consumer price index (1982=1) in Iran and the U.S, respectively, the *Y* is Iran's real GDP (1982 prices); and P_m and P^*_m are the corresponding import price indices in Iran and the U.S (1990=1). For a concise review of the literature on black market exchange rates see Siddiki (2000).

It is important to note that this specification assumes that the impact of the nominal stock of money, as proposed by Bahmani-Oskooee (1995b), is captured by the consumer price index. It is expected that the Iranian currency can appreciate (*BE* declines in magnitude) as prices in Iran increase less than prices in the U.S, as GDP grows, and as the U.S import price index rises less than that of Iran. Therefore, it can be hypothesised that if GDP growth in Iran is negative or negligible and if price rises are higher than those in the U.S economy, then the price of dollar, in rials, will rise. Based on these theoretical postulations, it is then expected that $\beta_1>0$ and both β_2 and $\beta_3<0$.

In order to have a valid model for the black market exchange rate, there should be at least one cointegrating vector in the system. The Johansen (1991, 1995) multivariate cointegration technique is used in this paper to test the existence of a long-run equilibrium relationship among the variables specified in equation (1). A brief description of this technique is presented below.

Let us consider the following VAR of order q:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_q y_{t-q_t} + w_t \tag{2}$$

where y_t is a *k*-vector of I(1) variables (*e.g.* in this study k=4), and w_t is a vector of white noise residuals. Following Johansen (1991, 1995), equation (2) can also be rewritten as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{q-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t \tag{3}$$

where $\Pi = \sum_{i=1}^{q} A_i - I$, and $\Gamma_i = -\sum_{j=i+1}^{q} A_j$

The rank (*r*) of Π determines the number of cointegrating vectors. If Π has a reduced rank (*i.e.* *r*<*k*), then there exist $k \times r$ matrices α and β each with rank *r*, where

$\Pi = \alpha\beta'$ and $\beta' y_t$ is stationary. The elements of α represent the adjustment parameters and each column of β in the literature is referred to as the cointegrating vector. Thus the important issue is how to determine the number cointegrating vectors (or *r*). In this paper both the trace statistics and the maximum eigenvalue statistics will determine *r*. The trace statistics test the null hypothesis of *r* cointegrating relations against the alternative of *k* cointegrating equations. On the other hand, the maximum eigenvalue statistics test the null of *r* cointegrating vectors versus the alternative of *r*+1 cointegrating relations. For more details see Johansen (1991, 1995).

Let us assume that: a) all the variables in equation (1) are I(1); b) the resulting residuals are I(0); and c) there is only one cointegrating vector in the system . According to Engle and Granger (1987), it can then be stated that there exists a corresponding error-correction mechanism (ECM) model of the following form:

$$\begin{aligned}\Delta \ln\left(BE\right)_t = \gamma_0 + \sum_{i=0}^{q_1} \gamma_{1i} \Delta \ln(P/P^*)_{t-i} + \sum_{i=0}^{q_2} \gamma_{2i} \Delta \ln\left(Y\right)_{t-i} + \\ \sum_{i=0}^{q_3} \gamma_{3i} \Delta \ln\left(P_m / P_m^*\right)_{t-i} + \sum_{i=1}^{q4} \delta_i \Delta \ln\left(BE\right)_{t-i} + \theta ECM_{t-1} + \nu_t\end{aligned} \tag{4}$$

where γ_{ji} are the estimated short-term coefficients; θ represents the feedback effect or the speed of adjustment whereby short-term dynamics converge to the long-term equilibrium path indicated in equation (1); δ_i denotes for the estimated coefficients of the lagged dependent variable to ensure that v_t or the disturbance term is white noise; *ECM* (the estimated e_t) is obtained from equation (1), and Δ indicates the first-difference operator.

The general-to-specific methodology can be used to omit insignificant variables in equation (4) on the basis of a battery of maximum likelihood tests. In this method, joint zero restrictions are imposed on explanatory variables in the unrestricted (general) model to obtain the most parsimonious and robust equation in the estimation process.

3. Empirical Results and Policy Implications

The sources of data for variables shown in equation (1) are Tabibian *et al.* (2000), the Central Bank (2002, 2003) and the International Monetary Fund (2004) on-line IFS database. An important step before using the Johansen multivariate technique is to determine the time series properties of the data. This is an important issue since the use of non-stationary data in the absence of cointegration can result in spurious regression results. To this end, two unit root tests, *i.e* the ADF test, and the Kwiatskowski-Phillips-Schmidt-Shin (KPSS) test, have been adopted to examine the stationarity, or otherwise, of the time series data. In this paper the lowest value of the Akaike Information Criterion (AIC) has been used as a guide to determine the optimal lag length in the ADF regression. These lags augment the ADF regression to ensure that the error term is white noise and free of serial correlation. In addition to the ADF test, a KPSS test has been performed for all the variables. Unlike the ADF test, the KPSS test has the null of stationarity, and the alternative indicates the existence of a unit root.

Prior to undertaking an empirical investigation of the major long-run determinants of the black market exchange rate, it is essential to determine the time series properties of the data. In order to make robust conclusions about stationarity or otherwise of the data, the ADF and the KPSS tests are utilised. The empirical results of the ADF and KPSS tests are summarised in Table 1. According to the results of the ADF and KPSS tests, all the four variables of $ln(BE)$, $ln(P/P^{*})$, $ln(Y)$ and $ln(P_m/P^{*}m)$ are I(1), indicating that they become stationary after first differencing.

[Table 1 about here]

Since all the variables in equation (1) are I(1), the Johansen (1991, 1995) multivariate cointegration technique can now be used to test the existence of a long-run equilibrium relationship for *BE.* An unrestricted intercept and a linear trend in the variables but not in the cointegrating vectors enter the system. The first important step in this test is to determine the optimal lag length (q) in equation (3). Three lag selection criteria of the AIC, the Final prediction error and the sequential modified LR (likelihood ratio) test statistic have been employed to determine q. Based on these criteria (not reported here but available from the author upon request), the optimal lag length is q=2.

Table 2 reports the results of the Johansen multivariate cointegration test on the black market exchange rate as formulated in equation (1). According to both the trace and max-eigenvalue tests there is robust evidence of one cointegrating vector at the 5 per cent level. It should be noted that the eigenvalue associated with the first vector (0.54) is considerably higher than those corresponding to the other vectors, thereby validating that there exists a unique cointegrating vector in the system.

[Table 2 about here]

Given that there is only one cointegrating vector, one can also use the Engle-Granger two step procedure to determine the long- and short-run factors affecting the black market exchange rate. Using the ordinary least square (OLS) method, the estimated long-term model, equation (1), is presented below.

$$\begin{aligned}
&\ln(BE_t) = 8.24 + 2.52\ln(P_t / P_t^*) - 0.39\ln(Y_t) - 1.03\ln(P_{mt} / P_{mt}^*) \\
&t: \quad (7.3) \quad (13.0) \qquad\qquad (-3.0) \qquad\quad (-6.5) \qquad\qquad\qquad\qquad\qquad (5) \\
&\bar{R}^2 = 0.974 \qquad \text{Residuals (ECM): I(0)}
\end{aligned}$$

There are 43 annual observations in the sample period (1960-2002). As seen from the above model, all the estimated coefficients are statistically significant at least at the 1 per cent level, and have the expected theoretical signs. This equation also performs extremely well in terms of goodness-of-fit statistics. The adjusted R^2 is as high as 0.974 and the overall F test rejects the null hypothesis at the one per cent level. Based on these results, one can argue that in the long-term, one per cent increase in relative prices (P/P^*) can result in more than 2.5 per cent depreciation of the Iranian currency. In terms of the magnitude of the estimated GDP elasticity, the above results indicate that if real GDP increases say by 10 per cent, *BE* will appreciate by 3.9 per cent. It is also found that an increase in the relative import prices by 1 per cent, *ceteris paribus*, could strengthen the value of Iranian rial in the long-run by almost the same magnitude.

Since the estimated residuals from the long-term model are I(0), one can use the Engle and Granger representation theorem (1987) to estimate the short-term model, or equation (4). Table 3 presents the results for the vector error correction model, which captures the short-term dynamics of the black market exchange rate. The general-to-specific methodology have been adopted in estimating equation (4) by omitting insignificant lagged variables and undertaking a battery of maximum likelihood tests. Joint zero restrictions have been imposed on insignificant explanatory variables in the unrestricted (or general model) to obtain the most parsimonious and robust equation in the estimation process. The parsimonious short-term model of exchange rate includes all of the long-term determinants of the black market exchange rate except for $ln(P_m/P^*_m)$ or the relative import price indices.

In other words, the results reported in Table 3 indicate that the short-term sources of the continuous depreciation of Iranian rial are massive domestic price rises in Iran (compared to low rates of inflation in U.S) and the meager real growth of GDP. All the estimated coefficients are statistically significant at least at the 8 per cent level and have the expected signs. In terms of goodness-of-fit statistics, though expressed in

$\Delta ln(BE)$, with an R^2 of 0.37, this equation performs reasonably well. This equation also passes each and every diagnostic test. Table 3 also reveals that the feed-back coefficient (or adjustment speed) is as high as –0.20 meaning that in every year 20 per cent of the divergence between the short-term black market exchange-rate from its long-term path is eliminated.

[Table 3 about here]

4. Concluding Remarks

In this paper the short-term and the long-term drivers of the black market exchange rate in Iran have been examined by using annual time series data from 1960 to 2002. The Johansen multivariate cointegration technique and the Engle-Granger two-step procedure are employed to estimate and validate empirically the short- and long-term exchange rate models.

The empirical results are broadly consistent with previous studies and the monetary approach to the exchange-rate determination. It is found that in the long- and short-term policies aimed at curbing the rate of inflation and stimulating the real growth of GDP can restore and strengthen Iranian currency. It seems that relative import price changes have not exerted a sizable and significant impact on the black market exchange rate in the short run. In sum, if Iran is to continue financing her budget deficit through monetisation, inflation can further depreciate the domestic currency on a one-to-one basis. Therefore, given the magnitudes of the long-run elasticities for relative prices ($\beta 1$=2.52) and GDP (-0.39), curbing inflation should be the number one priority on the policy agenda of the Iranian government and this cannot be achieved unless the central bank of Iran operates independently.

Table 1. ADF and KPSS Test Results
(including both constant and trend)

Variable	ADF test		KPSS Statistics
	ADF statistics	Optimum lag	
ln(BE)	-2.12	0	0.174*
Δln(BE)	-5.17*	0	0.110
ln(P/P*)	-1.69	2	0.217*
Δln(P/P*)	-4.15*	1	0.101
Ln(Y)	-2.31	1	0.156*
Δln(Y)	-3.50*	0	0.107
ln(P_m/P^{*}m)	-0.51	1	0.223*
Δln(P_m/P^{*}m)	-39.18	0	0.111

Note: * indicates that the corresponding null hypothesis is rejected at the 5% significance level.

Table 2. Johansen Test for Cointegration

Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	5% critical value	Max. Eigenvalue statistic	5% critical value
None	0.54	60.35*	47.21	31.10*	27.07
At most 1	0.36	29.25	29.68	18.07	20.97
At most 2	0.24	11.19	15.41	11.04	14.07
At most 3	0.00	0.15	3.76	0.15	3.76

Note: * indicates that the corresponding null hypothesis is rejected at 5 % significance level.

Table 3. Results for the Short-Term Black Market Exchange Rate model, $\Delta ln(BE_t)$

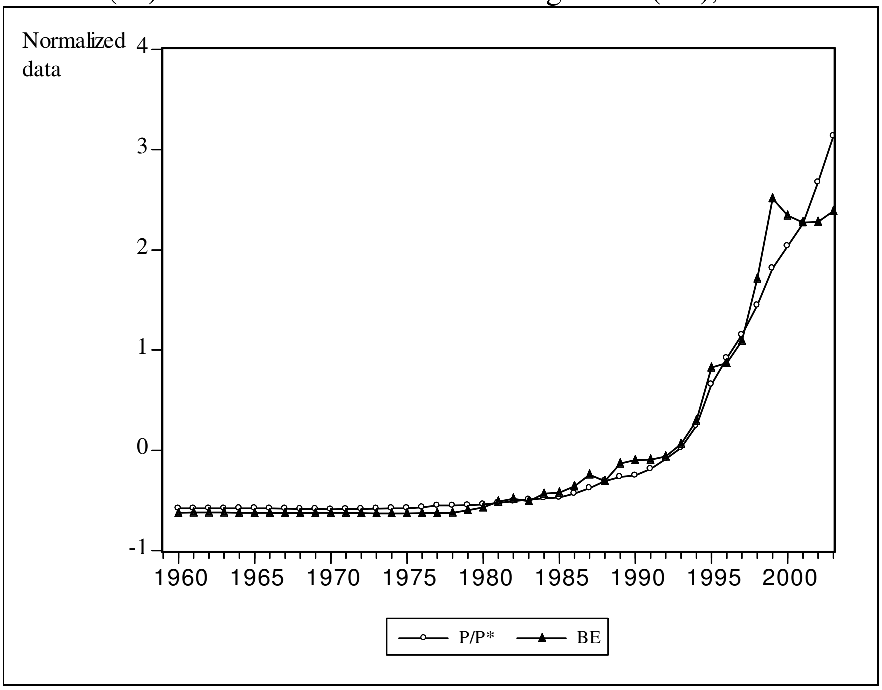
Independent Variables	Estimated elasticities	*t*-statistics*	Prob.	Expected signs
Intercept	0.090	1.9	[0.06]	
$\Delta ln(P/P^*)_t$	0.700	2.3	[0.03]	+
$\Delta ln(Y_{t-1})$	-0.824	-2.1	[0.05]	-
ECM_{t-1}	-0.196	-1.8	[0.08]	-

Order of integration of stochastic residuals: I(0)
Goodness-of-fit statistics:
R^2=0.371 Overall *F* statistic F=(3,38) =7.5

Diagnostic tests:		
DW	2.1	
AR 1-2	F (2, 36) = 0.105	[0.90]
ARCH 1	F (1, 36) = 1.96	[0.17]
Normality	χ^2 (2) = 1.26	[0.53]
White Heteroskedasticity	F (9, 28) = 1.93	[0.09]
RESET	F (1, 37) = 0.13	[0.71]

Notes: a) Figures in square brackets show the corresponding probabilities; b) the estimation method is OLS, the sample period is from 1960 to 2002.

Figure 1. The Relative Consumer Price Indices in Iran (*P*) and the U.S (P^*) and the Black Market Exchange Rate (*BE*), 1960-2003



Sources: Tabibian *et al.* (2000), the Central Bank (2002, 2003) and the International Monetary Fund (2004) on-line IFS database.

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