Is Black Market Exchange Rate a Good Indicator of Equilibrium Exchange Rate? A Simple Test With Evidence From South Asia

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Abstract

The black market exchange rate premium is widely used in the empirical literature as an indictor of trade and exchange rate distortions. This paper presents a simple test of the null hypothesis that the black market exchange rate is a reliable indicator of the equilibrium exchange rate. The evidence from India and Sri Lanka rejects the null, and raises serious doubts about the validity of the current empirical practice.

Keywords: Black market exchange rate, equilibrium exchange rate, India, Sri Lanka

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Introduction

The black market exchange rate premium has been widely used in the empirical literature as an indicator of the distortions in the trade and exchange rate regime. It has been found to be an important explanatory variable in empirical growth regressions[2] and savings functions (see, for example, Fry (1997)), among other things. The implicit assumption that underlies these studies is that the black market exchange rate reflects the equilibrium exchange rate reasonably well. In a regression context this implies that the movements in black market exchange rate closely track the unobserved equilibrium exchange rate that would prevail in the absence of trade and exchange rate distortions, both across countries and within a country over time. There is, however, no theoretical reason to expect a tight relationship between the black market exchange rate and the equilibrium exchange rate. In fact, as shown by Lizondo (1987), the black market rate can be either below or above the equilibrium exchange rate. It seems rather curious that black market premium has been accorded such a prominent place in empirical literature even though there is no theoretical basis for using it as an index of trade and exchange rate distortions. It is probably more surprising that there is no formal test in the literature of the proposition that black market exchange rate is a reliable indicator of equilibrium exchange rate. The objective of this paper is to present a simple (formal) test of this proposition and provide some evidence from two South Asian countries, India (1952-1999) and Sri Lanka (1960-1995). The empirical results show that the black market exchange rate is NOT a reliable indicator of equilibrium exchange rate, thus vindicating the theoretical results that the relationship between black and equilibrium exchange rate is tenuous at best, and may not be even monotonic. This conclusion is extremely important, as the validity and the interpretation of a diverse body of recent empirical literature is at stake.

1. A Simple Test of Black Market Exchange Rate as Equilibrium Exchange Rate

The test developed in this paper utilizes the sufficient statistic property of equilibrium prices and income for consumer optimization in a competitive equilibrium. In particular, it exploits the testable implications of the null hypothesis that black market exchange rate is

[2] Durlauf and Quah (1999) cite six studies that used black market premium in growth regressions.

the equilibrium exchange rate for the specification of an aggregate import demand function. The basic insight is that if the import price evaluated at black market exchange rate is the equilibrium price, then prices and income constitute a set of sufficient statistics for the determination of import demand; any variable representing foreign exchange constraint should have no explanatory power. If black market exchange rate is a good proxy for the equilibrium exchange rate then the *scarcity premium* on imports should be approximately zero when the foreign currency import prices are converted into the domestic prices by using the black market exchange rate. This leads to a simple test where one can check if the scarcity premium is, in fact, approximately zero when black market exchange rate is used instead of the official exchange rate. However, the scarcity premium is unobservable to the econometrician as there is no data on the actual transactions prices of imports. For implementation of the test, one thus needs to parameterize the unobserved scarcity premium using some observed variables. Since the scarcity premium on imports is, *ceteris paribus*, a negative function of the amount of foreign exchange available, a variable representing foreign exchange availability (henceforth denoted as F) is a good candidate for the parameterization of the scarcity premium on imports.[3] This, however, is not the only theoretically consistent parameterization that can be used. As shown below, an alternative parameterization of the scarcity premium on imports can be obtained by using the ratio of the total domestic expenditure to the amount of foreign exchange available (henceforth denoted as Z).

Parameterization of the Scarcity Premium on Imports

The representative agent consumes two composite goods: a home good (H_t) and an imported good (M_t). Let P_t denote the relative price of imports; A_t, assets; $\tilde{Y}_t$, labor income; F_t, amount of foreign exchange available; and r, the constant real interest rate. We take home goods as the numeraire and all the variables above are expressed in terms of it. The representative agent discounts the future by the subjective rate of time preference δ. The optimization problem of the representative agent is as follows:

[3] Foreign exchange availability is defined in this paper as the sum of export earnings, remittances, and disbursed foreign aid.

$$\begin{aligned} Max_{[H_t,M_t,A_t]}V &= E\int_{t=0}^{\infty} e^{-\delta t}U(H_t,M_t)dt \\ subject \quad to \quad \dot{A} &= rA_t + \tilde{Y}_t - H_t - P_tM_t \qquad (1) \\ P_tM_t &\leq F_t \qquad (2) \end{aligned}$$

where a dot on a variable denotes a time derivative, i.e., $\dot{A} = \frac{dA_t}{dt}$. If constraint (2) is binding then the volume of imports is equal to the foreign exchange available. The current value Hamiltonian of the representative consumer's optimization problem can be written as:

$$L = U(H_t, M_t) + \lambda_t[rA_t + \tilde{Y}_t - H_t - P_tM_t] + \mu_t[F_t - P_tM_t]$$

where λ_t is the costate variable and μ_t is the Lagrange multiplier associated with the foreign exchange constraint. Following Clarida (1994), we assume that $U(.)$ is an addilog utility function:

$$U(H_t, M_t) = C_t\frac{H_t^{1-\alpha}}{1-\alpha} + B_t\frac{M_t^{1-\eta}}{1-\eta}$$

where C_t and B_t are random, strictly stationary shocks to preference. With the above utility function, the first order conditions can be rewritten as:

$$C_tH_t^{-\alpha} = \lambda_t \quad ; \quad B_tM_t^{-\eta} = P_t\lambda_t(1+\mu_t^*) = \lambda_tP_t^*$$

where $\mu_t^* = \frac{\mu_t}{\lambda_t} = \frac{\mu_t}{U_H}$ is the scarcity premia, and P_t^* is the equilibrium price or scarcity price at which transactions occur at the shop floor in the black or parallel market. Using the first order conditions and taking logarithm we get the following equation:

$$b_t - \eta m_t = c_t + p_t - \alpha h_t + \ln(1+\mu_t^*) \qquad (3)$$

where the lower case letters denote natural logarithm of the corresponding upper case letters.

In order to derive the long -run import demand relationship, we impose the steady state conditions that $\dot{A} = \dot{\lambda} = 0$. Also, the steady state is characterized by the equilibrium price relations implying $P_t = P_t^*$. The corresponding total household income including both labor and asset income evaluated at the equilibrium price vector is denoted by Y_t^*. The steady state solution implies that $Y^* = H + P^*M$. Using the steady state condition and taking logarithm, we get $h_t = \ln(Y_t^* - P_t^* M_t) \equiv \ln(Y_t - P_t M_t)$, where $Y_t = (Y_t^* - \mu_t^* P_t M_t)$ is the observed income in a foreign exchange constrained regime and P_t the observed price. Now substitute for h_t in equation (3) and solve for m_t:

$$m_t = \frac{\alpha}{\eta}\ln(Y_t - P_t M_t) - \frac{1}{\eta}p_t - \frac{1}{\eta}\ln(1+\mu_t^*) + \xi_t \quad (4)$$

where $\xi_t = \frac{1}{\eta}(b_t - c_t)$ is the composite preference shock. Observe that Y_t is the total expenditure by domestic consumers on both domestically produced goods and imports. The scale variable $\ln(Y_t - P_t M_t)$ in the right hand side of equation (4) can thus be defined as GDP minus exports. When the foreign exchange constraint is binding, the Kuhn-Tucker theorem requires that $\mu_t > 0$, and hence $\mu_t^* > 0$.

Proposition 1

The scarcity premium on imports μ_t^* is, ceteris paribus, a negative function of the amount of foreign exchange available (F_t) and a positive function of the ratio of the domestic expenditure to the foreign exchange available (Z_t).

Proof

If the foreign exchange constraint (equation (2) in the text) is binding, then $P_t M_t = F_t$. Using this to substitute for $P_t M_t$ and m_t in the equation (4) we get:

$$\ln(1+\mu_t^*) = \alpha\ln(Y_t - F_t) - \eta f_t - (1-\eta)p_t + (b_t - c_t) \quad (5)$$

From equation (5), it immediately follows that $\frac{\partial \ln(1+\mu_t^*)}{\partial F_t} < 0 \Rightarrow \frac{\partial \mu_t^*}{\partial F_t} < 0$. To derive $\frac{\partial \mu_t^*}{\partial Z_t} > 0$, observe that from equation (5), $\frac{\partial \ln(1+\mu_t^*)}{\partial Y_t} > 0 \Rightarrow \frac{\partial \mu_t^*}{\partial Y_t} > 0$ and that $\frac{\partial \mu_t^*}{\partial Z_t} = \frac{\partial \mu_t^*}{\partial F_t}\frac{\partial F_t}{\partial Z_t} + \frac{\partial \mu_t^*}{\partial Y_t}\frac{\partial Y_t}{\partial Z_t}$. The proof then follows from the facts that $\frac{\partial F_t}{\partial Z_t} < 0$,and $\frac{\partial Y_t}{\partial Z_t} > 0$. Q.E.D.

For empirical implementation, we use two alternative functional forms of $\mu_t^*(.)$. The first specification implies that F_t and Z_t enter linearly into the import function and the second specification implies that they enter in log-linear form:

$$\mu_t^*(Z_t) = e^{\theta_1 Z_t} - 1 \; ; \; \theta_1 \geq 0 \; ; \; \mu_t^*(F_t) = e^{-\theta_2 F_t} - 1 \; ; \; \theta_2 \geq 0 \tag{6}$$

$$\mu_t^*(Z_t) = Z_t^{\theta_3} - 1 \; ; \; \theta_3 \geq 0 \quad ; \quad \mu_t^*(F_t) = F_t^{-\theta_4} - 1 \; ; \; \theta_4 \geq 0 \tag{7}$$

Using equations (6) and (7) we get the following equations for an aggregate import demand function:

$$m_t = \pi_1 \ln(Y_t - P_t M_t) + \pi_2 p_t + \pi_i X_{it} + \xi_t, \qquad i = 3, ..., 6 \tag{8}$$

where $X_{3t} = Z_t$, $X_{4t} = F_t$, $X_{5t} = z_t$ and $X_{6t} = f_t$ and $\pi_1 = \frac{\alpha}{\eta}$, $\pi_2 = -\frac{1}{\eta}$, $\pi_3 = -\frac{\theta_1}{\eta}$, $\pi_4 = \frac{\theta_2}{\eta}$, $\pi_5 = -\frac{\theta_3}{\eta}$, $\pi_6 = \frac{\theta_4}{\eta}$. As before, the lower case letters denote the logarithm of their corresponding upper case letters.

The null hypothesis that the black market exchange rate is a reliable indicator of equilibrium exchange rate implies that if $P_t = P_t^b$ *then* $\pi_3 = \pi_4 = \pi_5 = \pi_6 = 0$ *where* P_t^b *is the import price index evaluated at the black market exchange rate. On the other hand, if black market exchange rate is not a good proxy for equilibrium exchange rate we expect* $\pi_3, \pi_5 < 0$ *and* $\pi_4, \pi_6 > 0$.

2. Empirical Analysis

Since the variables in the import model are cointegrated under the assumption that the preference shocks b_t and c_t are strictly stationary, we employ cointegration approach to estimate the four different specifications of import function in equation (8) and to test the validity of the exclusionary restrictions implied by the null hypothesis that the black market exchange rate is a reliable indicator of the equilibrium exchange rate. The results from bounds 'F' test due to Pesaran, Shin and Smith (2001) and the bounds 't' test proposed by Banerjee et. al (1998) show that the null of no cointegration among the variables of all different specifications are rejected at 5 percent significance level. Given our focus on the exclusionary restrictions on the coefficients of the parameterizations of the scarcity premium, we omit the details of the bounds tests. The cointegrating vector is estimated and the relevant exclusionary restrictions are tested using the ARDL approach to cointegration (Pesaran and Shin, 1999).[4] The results

[4]The specification of the ARDL models is chosen on the basis of SBC and the modified F test for autocorre-

are similar if we use the Stock-Watson (1993) DOLS method instead. For the sake of brevity, we report only the results from the ARDL approach.

(2.1) Results

The results from the test of the exclusionary restrictions implied by the null hypothesis that the black market exchange rate is an adequate proxy for the equilibrium exchange rate are reported in table 1. We report two sets of results: one set includes a dummy variable for the trade and economic liberalization implemented in India (1991) and Sri Lanka (1977). All the regressions for Sri Lanka also include a dummy for the devastating civil war (1983-89). The results of the Wald tests (F statistic) show that the null is rejected at zero percent level in 9 cases out of a total of 16 cases, at 1 percent level for 2 cases, at 5 percent level for 3 cases, and at 10 percent level for 2 cases.[5] The results are robust across alternative formulations of the scarcity premium function, and hold irrespective of whether or not a dummy for economic liberalization is included in the regression. Moreover, the results from the estimation of the different import models show that the sign restrictions implied by the hypothesis that the foreign exchange constraint remains binding even under the black market exchange rate are satisfied in all the different specifications (i.e., $\pi_3, \pi_5 < 0$ and $\pi_4, \pi_6 > 0$).[6] So the evidence, for both India and Sri Lanka, clearly demonstrates that the black market exchange rate is NOT an adequate indicator of the unobserved equilibrium exchange rate. Thus the black market premium is not likely to be a reliable index of distortions due to trade and exchange rate interventions. This finding is important as it raises questions regarding the appropriate interpretations of a significant effect of the black market exchange rate premium often found in the current empirical literature, for example, in growth regressions.

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lation. As shown in Pesaran and Shin (1999), a two-step procedure where the ARDL model is selected by SBC and then estimated by OLS has desirable small sample properties. It also effectively corrects for endogeneity of regressors.

[5] The results from alternative tests like LM or LR are strikingly similar and not reported.

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Table 1: Tests of Exclusionary Restrictions

	Sri Lanka		**India**	
	Wald Test		Wald Test	
	F -statistic	P-value	F -statistic	P-value
Level formulation of Scarcity Premium				
Included Policy Shift Dummy				
H_0:[π_3=0]	3.68	[0.066]	3.84	[0.058]
H_0:[π_4=0]	24.09	[0.000]	7.21	[0.011]
Excluded Policy Shift Dummy				
H_0:[π_3=0]	8.94	[0.006]	6.02	[0.019]
H_0:[π_4=0]	22.15	[0.000]	10.98	[0.002]
Log formulation of Scarcity Premium				
Included Policy Shift Dummy				
H_0:[π_5=0]	5.88	[0.020]	4.54	[0.040]
H_0:[π_6=0]	15.22	[0.001]	8.39	[0.006]
Excluded Policy Shift Dummy				
H_0:[π_5=0]	12.21	[0.002]	7.04	[0.012]
H_0:[π_6=0]	17.46	[0.000]	11.23	[0.002]