Analysis of Exchange Rate Fluctuations in Egypt: Application of Uncovered Interest-Rate Parity

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Abstract

This study extends uncovered interest-rate parity and the open macroeconomic model to analyze exchange rate fluctuations for Egypt and finds that the nominal exchange rate in Egypt is negatively associated with real M2, the foreign interest rate, the expected inflation rate and the relative price, and positively correlated with the expected exchange rate. The ratio of government deficit spending to GDP does not affect exchange rates significantly. Hence, monetary policy is effective. The authorities need to pursue price stability and contain inflation. The foreign interest rate plays an important role in exchange rate determination. Expectations about future exchange rates could affect the current exchange rate.

Keywords: UIRP, monetary and fiscal policies, foreign interest rates

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Introduction

During the 1990s, due to the adoption of a pegged exchange rate system, the Egyptian pound/US dollar exchange rate was relatively stable. After switching to a flexible exchange rate regime in 2000, the pound depreciated from 3.69 in 2000 to 6.13 in 2004, which made Egyptian products less expensive and might have benefited exports. In addition to domestic factors that are expected to affect exchange rates, some external factors that increased capital outflows, reduced tourism revenues, decreased dollar reserves include the Asian financial crisis, world stock market speculative bubbles, the 2000 second Palestinian intifadah, the 1998-99 world oil price fall, the Louxor terrorist attack, the 9/11 terrorist attacks, the Afghanistan War, and the Iraqi War. During July 2004 – March 2005, the new Cabinet pursued economic reforms to set up a foreign exchange inter-bank market and to increase trade liberalization by cutting tariffs and eliminating surcharges and fees for imports, and setting Qualified Industrial Zones (IMF, 2005a).

Panizza (2002) indicated that Egypt should pursue a more flexible exchange rate and inflation targeting to maintain independent monetary policy, make the policymaking process more transparent, and eliminate structural budget deficits. Cevik (2003) suggested that in adopting a floating exchange rate system, fiscal discipline is needed in order to avoid a potential devaluation and financial crisis. IMF (2005b) found that the switch from the peg to the flexible exchange rate regime resulted in an increase in the whole price index by as much as 46.1% and the consumer price index by as much as 13.6%.

This paper attempts to examine exchange rate fluctuations for Egypt based an extended open macroeconomic model and uncovered interest-rate parity and has several different aspects. First, a simultaneous model including three equations for the goods market, the money market, and

uncovered interest-rate parity (Romer, 2001; D'Amato and Pistoresi, 2001; Chinn and Meredith, 2005; Suliman, 2005) is considered so that the relationships among major relevant variables are examined. For example, not including the goods market in the exchange rate model may overlook potential impacts of government deficit spending on the exchange rate. Second, this paper investigates the role of the foreign interest rate in the real demand for money and uncovered interest-rate parity. Marquez (1987) and Bahmani-Oskooee and Ng (2002) showed that there may be two separate effects of a change in the foreign interest rate on real demand for money: the negative capital mobility effect and the positive cost of borrowing effect. Hence, the net impact of a change in the foreign interest rate on the exchange rate may need to be answered empirically. Third, comparative-static analysis is applied to analyze the impact of a change in one of the exogenous variables on the equilibrium exchange rate. Fourth, the Newey-West (1987) method is employed in empirical work to yield consistent estimates for standard errors and covariance when the forms of heteroskedasticity and autocorrelation are unknown.

The Model

Suppose that aggregate spending is determined by output, government spending, government tax, the real interest rate and the real exchange rate, that real demand for money is influenced by the nominal interest rate, real output and the foreign interest rate, and that the interest rate differential between Egypt and the foreign country is offset by the depreciation or appreciation of the exchange rate. The goods market equilibrium, the money market equilibrium, and uncovered interest-rate parity can be expressed as

$$Y = E[Y, G, T, R - \pi^{e}, e(P/P^{*}]] \quad (1)$$

$$M = L(R, Y, R^{f}) \quad (2)$$

$$R = R^{f} - e^{e} e^{-1} + 1 \quad (3)$$

where

Y = real GDP for Egypt,

E = aggregate expenditures,

G = real government spending,

T = real government tax revenues,

R = the nominal interest rate,

π^{e} = the expected inflation rate,

e = the nominal exchange rate (U.S. dollars per Egyptian pound),

P = the domestic price level,

P^{*} = the foreign price level,

M = real supply of money,

L = real demand for money,

R^{f} = the foreign interest rate, and

e^{e} = the expected exchange rate.

Uncovered interest-rate parity (UIRP) in equation (3) suggests that any interest rate differential between Egypt and a foreign country is offset by currency deprecation or appreciation. For example, if the domestic

interest rate is 5 percentage points greater than the foreign interest rate, then the exchange rate (U.S. dollars per Egyptian pound) is expected to depreciate by 5 percent. On the other hand, if the domestic interest rate is less than the foreign interest rate by 5 percentage points, UIRP would indicate that the exchange rate is expected to appreciate by 5 percent.

Solving for three unknowns, namely, real output, the nominal interest rate and the nominal exchange rate, we can write the equilibrium nominal exchange rate as

$$\bar{e} = \bar{e}(M, G, T, R^f, \pi^e, e^e, P/P^*) \qquad (4)$$

Suppose that aggregate spending has a positive relationship with real output and government spending and a negative relationship with government tax, the real interest rate, and the real exchange rate, that real demand for money has a negative relationship with the nominal interest rate, a positive relationship with real output, and a negative or positive relationship with the foreign interest rate, and that the nominal exchange rate has a positive relationship with the domestic interest rate and the expected exchange rate and a negative relationship with the foreign interest rate. These partial derivatives can be expressed mathematically as

$$E_Y > 0, E_G > 0, E_T < 0, E_{R-\pi^e} < 0, E_{e(P/P^*)} < 0,$$
$$L_R < 0, L_Y > 0, L_{R^f} > \upsilon \ < 0, e_R > 0, e_{R^f} < 0, e_{e^e} > 0.$$

The Jacobian can be written as

$$|J| = (1 - E_Y)L_R e^e e^{-2} + E_R L_Y e^e e^{-2} + E_e L_Y < 0. \qquad (5)$$

The respective effects of a change in real quantity of money, real government spending, and real government tax can be expressed as

$$\partial \bar{e} / \partial M = (1 - E_Y) / |J| < 0. \quad (6)$$

$$\partial \bar{e} / \partial G = -E_G L_Y / |J| > 0. \quad (7)$$

$$\partial \bar{e} / \partial T = -E_T L_Y / |J| > 0. \quad (8)$$

The impact of an increase in the foreign interest rate on the equilibrium nominal exchange rate in equation (9) will be negative if L_{R^f} is negative or if the negative capital mobility effect is greater than the positive cost of borrowing effect (Marquez, 1987; Bahmani-Oskooee and Ng, 2002). If L_{R^f} is positive or if the negative capital mobility effect is less than the positive cost of borrowing effect, the sign is unclear.

$$\partial \bar{e} / \partial R^f = [-(1 - E_Y) L_R - E_R L_Y - (1 - E_Y) L_{R^f}] / |J| < 0 \text{ if } L_{R^f} < 0. \quad (9)$$

Empirical Results

All the data were collected from the *International Financial Statistics* published by the International Monetary Fund. The nominal exchange rate is defined as U.S. dollars per Egyptian pound. Real M2 measured in million pounds is chosen to represent real quantity of money. The ratio of government deficit spending to nominal GDP defined as (G-T)/ Y*100 is employed to reduce a high degree of multicollinearity among time series variables. The 3-year U.S. Treasury bond yield is chosen to represent the foreign interest rate due to its worldwide influence. The

inflation rate is derived from percent change in the consumer price index (CPI). The average inflation rate of past three years is selected to represent the expected inflation rate. The relative price equals the CPI in Egypt divided by the CPI in the U.S. The expected exchange rate is the average exchange rate of past three years. The sample runs from 1981 to 2004. Consistent data for government deficits before 1981 are not available.

Unit root tests indicate that all the variables in levels have unit roots and that all the variables in first difference are stationary at the 5% level. The ADF cointegration test shows that the test statistic is estimated to be -4.10 with p = 1 compared with the critical values of -3.77, -.317, and -2.84 at the 1%, 5%, and 10% levels. The coefficients for Δu_{t-p} or the difference of lagged residuals when p > 1 are insignificant. Hence, these variables are cointegrated and have a long-term stable relationship. The level form is employed in empirical work because differencing of the data would obscure the long-term relationship (Greene, 2003).

Graph 1 shows exchange rate movements during the sample period. The Newey-West (1987) method is employed in empirical work to yield consistent estimates for standard errors and covariance. The results are presented in Table 1.[1] As shown, 94.6% of the variation in the exchange rate can be explained by the six right-hand side variables. All the coefficients are significant at the 1% or 5% level except that the coefficient for the government deficit spending/GDP ratio is insignificant at the 10% level. The nominal exchange rate has a negative relationship with real M2, the foreign interest rate, the expected inflation rate and the relative price, and a positive relationship with the expected exchange rate. When real government deficit spending replaces the ratio of government deficit spending to GDP in

the estimated regression, the coefficient is positive and insignificant at the 10% level.

Several comments can be made. Empirical results suggest that uncovered interest-rate parity is valid as evidenced by the negative, significant coefficient of the foreign interest rate and the positive, significant coefficient of the expected exchange rate. It suggests that a higher foreign interest rate would cause the nominal exchange rate to depreciate due to capital outflows and the decrease in the demand for the Egyptian pound. The insignificant coefficient for government deficit spending may indicate that relatively small ratios of budget deficits to nominal GDP of less than 3% due to fiscal prudence since 1993 have not affected exchange rates significantly. Because a higher inflation rate and a higher relative price would reduce the exchange rate, the authorities are expected to maintain price stability and contain inflation in order to have a stable exchange rate. The expected exchange rate plays an important role as the current exchange rate responds positively to a change in the expected exchange rate.

Summary and Conclusions

This study has examined the determinants of nominal exchange rate fluctuations for Egypt. Uncovered interest-rate parity is incorporated into the goods market equilibrium and the money market equilibrium so that the impacts of aggregate expenditures, real demand for money, and potential international capital mobility are simultaneously considered. The sample runs from 1981 to 2004. The Newey-West method is employed so that potential heteroskedasticity and autocorrelation in the time series can be considered and corrected simultaneously when the forms of heteroskedasticity and autocorrelation are unknown. Empirical results show that more quantity of M2 money, a higher foreign interest rate, a higher inflation rate, a higher relative price, and a lower expected

exchange rate would cause the nominal exchange rate to depreciate. The coefficient of the ratio of government deficit spending to GDP is positive but insignificant, suggesting that relatively small budget deficits in recent years due to fiscal discipline may not have a significant impact on the exchange rate.

There may be areas for further research. The results in this study should be regarded as preliminary. When more sample observations become available, the regression needs to be re-estimated to compare with the outcomes presented in this paper. The effective exchange rate may be estimated and considered based on the methodology developed by Bahmani-Oskooee (2001) and Bahmani-Oskooee and Mirzai (2000). More sophisticated methods may be employed to estimate the expected exchange rate and the expected inflation rate. Different foreign interest rates may be considered to determine whether they may affect the relationships that are characterized by uncovered interest-rate parity or the real demand for money. The exchange rate may be estimated by other models (Taylor, 1995; Cheung, Chinn, and Pascual, 2002; Sarno and Taylor, 2002).

Footnote

1. The model contains three equations with three unknowns. Ideally, all three equations need to be estimated. The estimation of the interest rate may pose difficulties due to lack of adequate sample observations for the government Treasury bill rate or active government involvement in determining the interest rate level. Empirical results for output and the interest rate will be available upon request.

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Graph 1. Exchange Rate Movements during 1981-2004

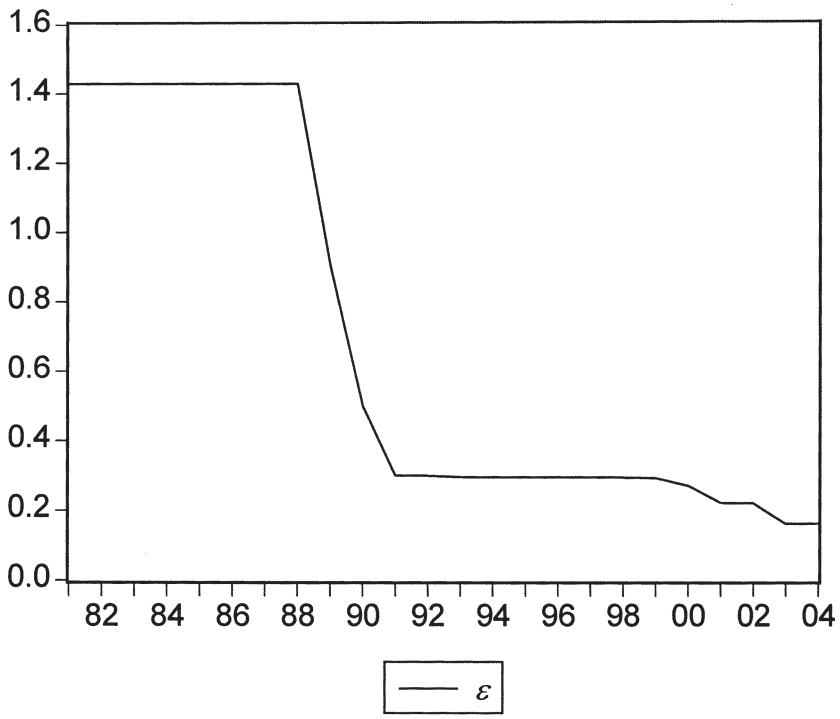

Table 1. The Estimated Nominal Exchange Rate for Egypt

Dependent Variable: e
Method: Least Squares
Sample (adjusted): 1981 - 2004
Included observations: 24 after adjustments
Newey-West HAC Standard Errors & Covariance (lag truncation=2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.471566	0.926262	2.668324	0.0162
M	-3.32E-06	1.59E-06	-2.083849	0.0526
DY	0.013611	0.008408	1.618858	0.1239
R^f	-0.060277	0.029577	-2.037969	0.0574
p^e	-0.039638	0.017004	-2.331160	0.0323
P/P^*	-0.970901	0.387000	-2.508791	0.0225
e^e	0.581720	0.190588	3.052244	0.0072
R-squared	0.946350	Mean dependent var		0.689332
Adjusted R-squared	0.927415	S.D. dependent var		0.552195
S.E. of regression	0.148770	Akaike info criterion		-0.734334
Sum squared resid	0.376254	Schwarz criterion		-0.390735
Log likelihood	15.81201	F-statistic		49.97823
Durbin-Watson stat	1.131034	Prob(F-statistic)		0.000000

Notes:

e is U.S. dollars per Egyptian pound.

M is real M2 money.

DY is the ratio of government deficit spending to GDP.

R^f is 3-year U.S. Treasury bond rate.

p^e is the expected inflation rate.

P/P^* is the relative price.

e^e is the expected exchange rate.