Dollarization in Egypt: Further Evidence

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ملخص

الدولرة فى مصر: دليل جديد

تهدف هذه الورقة إلى محاولة التمييز نظريا وعمليا بين دافع التنوع فى المحفظة المالية ودافع المعاملات لتفسير حيازة النقد الأجنبى فى مصر. وبتعديل منهج Cuddington's فى موازنة المحفظة المالية، وباستخدام نموذج تصحيح الأخطاء Error Correction Modeling، يتم اختبار طلب المصريين على النقود المحلية والأجنبية على مدى الفترة ١٩٨١-١٩٩٤.

وتظهر النتائج وجود علاقة عكسية (طردية) بين معدل العائد المتوقع على النقود الأجنبية والطلب على النقود المحلية (الأجنبية).

وتعطى هذه النتائج دليلاً إضافيا لذلك الذى وصل إليه المؤلف فيما قبل - على سيطرة دافع المحفظة المالية فى عملية الدولرة على دافع المعاملات (إحلال العملة) فى تفسير حيازة النقد الأجنبى فى مصر.

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1- Introduction

Egypt's underdeveloped financial markets do not permit easy purchases and sales of financial assets by individuals. In addition, the inflationary environment coupled with a depreciating currency and interest rate restrictions on domestic currency deposits will disable the store-of-value function of domestic money over time. Under these circumstances foreign currency denominated deposits (which is interest bearing) become a significant liquid investment for domestic residents to preserve wealth and to protect the purchasing power of money holdings(1).

This paper will argue that, in light of severely limited capital markets and exchange controls in Egypt during the period 1981: IV- 1994:I, the large increases in the share of foreign currency deposits in broad money is not what has been termed "currency substitution", that is, it is not substitution among medias of exchange. Rather, it is "dollarization", a systematic tendency of money holders to substitute different monies in their portfolios in response to their respective opportunity costs, to protect wealth.

We must suspect that the furnished evidence is evidence of portfolio shifts and not currency substitution. Therefore, the main aim of this paper is to distinguish theoretically and empirically between two different motives behind holding foreign money: medium of exchange, thus reflecting currency substitution, and store of value motivation for portfolio purposes to protect real wealth, thus reflecting dollarization.

To date, only two papers have examined the issue of currency substitution in Egypt, El- Erian (1988) and Elkhafif and Kubursi (1991)(2). These studies have claimed to find evidence on the existence of currency substitution in Egypt. In addition, these studies of currency substitution have been commonly plagued by implausible parameter estimates.

Given the importance of foreign currency denominated deposits in the Egyptian Economy, this distinction between the

different motives behind holding foreign money will determine whether these deposits should be included in the money supply. If foreign money is regarded by Egyptian residents simply as a store of value, these holdings should not be included in transactions oriented measures of the money supply when trying to assess the proper channels and instruments of monetary policy.

The format of the paper is as follows. Section 2 will develop a simple framework based on Cuddington's portfolio balance model (1983) that will consider explicitly the institutional set-up in Egypt. Section 3 will examine the time series properties of data. We test for stationarity using the Dickey and Fuller's F-statistics tests, and Perron's unit root tests in the presence of structural breaks. Section 4 will report cointegration results. We will utilize the Engle and Granger test, and the one suggested in Johansen and Jueslius (1990). Results of estimations of ECM are presented in section 5. The last section will summarize results and draw conclusions.

2-Distinguishing Asset Substitution From Currency Substitution

Alami (forthcoming) modified Cuddington's portfolio balance model and provided a formal framework that could distinguish between the store of value substitutability (asset substitution or dollarization) and the medium of exchange substitutability (currency substitution) in developing countries. In his model, Alami treated all different types of foreign currency denominated deposits as one financial asset.

However, in the specific case of Egypt, there are two types of foreign currency deposits in Egypt: demand and savings deposits. Both types of deposits earn competitive rates of return that are closely related to rates prevailing in international markets. In addition, Egypt's financial markets are underdeveloped. Thus, the volume and range of financial assets are limited, as the asset menu consists essentially of domestic money (M^d), domestic bonds (B^d), foreign currency demand

deposits $(eM1^f)$ and foreign currency savings deposits $(eM2^f)$.[3] The key question is whether these foreign currency deposits $(eM1^f)$ and $(eM2^f)$ are held primarily for transactions or portfolio purposes.

However, if domestic currency has low expected returns, as in high inflation countries, then foreign currency deposits become a significant liquid investment for domestic residents.

Using Cuddington's framework, this institutional set-up implies that, while only Egyptian's holdings of foreign currency demand deposits are part of Cuddington's foreign money (eM^f) that are held as a medium of exchange, foreign currency savings deposits are actually part of Cuddington's foreign assets (eB^f) that are held as a store of value rather than as part of foreign money.

According to Cuddington the domestic demand, for money, both domestic and foreign, rises with an increase in domestic income (PY). This is so since money in Cuddington's framework is held for transactions purposes. Foreign money is non-interest bearing, thus, it is dominated by other interest bearing assets (domestic and foreign) and, therefore, is held for transactions purposes. Applying this to Egypt, an increase in the domestic value of output (PY) raises the demand for both domestic money (M^d) and foreign currency demand deposits $(eM1^f)$ and lowers the demand for other assets, including foreign currency savings deposits $(eM2^f)$. This reflects the assumption that investors hold domestic money and foreign currency demand deposits for transaction purposes, while they hold other assets, including foreign currency savings deposits as a store of value. Therefore, the question whether foreign currency deposits $(eM1^f + eM2^f)$ are better regarded as a close substitute for domestic money as a medium of exchange or as a store of wealth is an empirical one.

Since data on interest rate on foreign currency demand deposits (eM^f) is not available. We then need to aggregate foreign currency demand and savings deposits. The total foreign currency deposits, then, is defined as follows:

$$EM^f = eM1^f + eM2^f = eM^f\ (i, i_1^* + x^e, i_2^* + x^e, PY, W)$$

where (i) is the rate of return on domestic bonds, (x^e) is expected depreciation of the domestic currency, $(i_1^* + x^e)$ is the rate of return on foreign currency demand deposits when expressed in terms of domestic currency and $(i_2^* + x^e)$ is the rate of return on foreign currency savings deposits.

In this case the asset menu consists of three variables, domestic money (M^d), total foreign currency deposits (eM^f) and domestic bonds (B^d). Assuming gross substitutability, the wealth constraint ensures that the effect of a rate of return variable on total asset demand must sum to zero.

In addition, since rates of return on both foreign currency demand deposits (i_1^*) and foreign currency savings deposits (i_2^*) are set competitively and are closely related to interest rates prevailing in international markets,(4) we expect a high correlation between these two rates $(i_1^*$ and $i_2^*)$. In this case $\Delta\ (i_1^* + x_e) = \Delta\ (i_2^* + x^e)$ and correlation between $(i_1^* + x^e)$ *and* $(i_2^* + x^e) \longrightarrow 1$.

If $\Delta\ (i_1^* + x^e) = \Delta\ (i_2^* + x^e)$ then the Egyptian domestic demand for the four assets, equal:

$$M^d = M^d\ (i, i_2^* + x^e, PY, W) \quad (1)$$
$$eM^f = eM^f\ (i, i_2^* + x^e, PY, W) \quad (2)$$
$$B^d = B^d\ (i, i_2^* + x^e, PY, W) \quad (3)$$

where in this case changes in $(i_2^* + x^e)$ approximate changes in both interest rates $(i_1^* + x^e)$ and $(i_2^* + x^e)$. The specified signs of the effects of the rate-of-return variables (i and $i^* + x^e$) and the effect of the scale variable (PY) on the demand for different assets depend on whether currency substitution or portfolio substitution dominates.

With respect to expected depreciation effects (x^e), the fact that the different types of foreign currency deposits earn competitive rates of return implies that expected depreciation is no longer considered the rate of return on foreign money as in Cuddington's framework. Expected depreciation exerts its effect indirectly through its effects on the rate of return on foreign currency deposits ($i_1^*+x^e$) and ($i_2^*+x^e$). Therefore, the direct effect of a change in expected depreciation--given ($i_2^*+x^e$)--on the demand for different assets is expected to be zero.

Given the wealth constraint and the assumption of gross substitutability among all assets, portfolio substitution exists if an increase in the rate of return on foreign currency savings deposits ($i_2^* + x^e$) results in an increase the demand for foreign currency savings deposits (given $i_1^*+x^e$) and a decrease in the demand for all other assets (including the demand for foreign currency demand deposits). Since (eM^f) is the summation of both demand and savings deposits denominated in foreign currency ($eM1^f+eM2^f$), thus the net effect of an increase in the rate of return on foreign currency savings deposits on the demand for different assets is:

$$\frac{\partial eM2^f}{\partial(i^*_2+x^e)}+\frac{\partial eM1^f}{\partial(i^*_2+x^e)}+\frac{\partial M^d}{\partial(i^*_2+x^e)}+\frac{\partial B^d}{\partial(i^*_2+x^*)}=0$$

this condition implies that:

$$\frac{\partial eM2^f}{\partial(i^*_2+x^e)}+\frac{\partial eM1^f}{\partial(i^*_2+x^e)}=-\frac{\partial M^d}{\partial(i^*_2+x^e)}+\frac{\partial B^d}{\partial(i^*_2+x^*)}=0$$

therefore:

$$\frac{\partial eM^f}{\partial(i^*_2+x^e)}\succ 0$$

However, since $\Delta(i^*_1 + x^e) = \Delta(i^*_2 + x^e)$, an increase in the rate of return on foreign currency savings deposits $(i^*_2 + x^e)$ will result in an increase in the rate of return on foreign currency demand deposits $(i^*_1 + x^e)$. Therefore, an increase in the rate of return on foreign currency savings deposits will result in an increase in the total demand for foreign currency deposits whether portfolio substitution exists or not.

In this framework, the effect of a change in the rate of return on foreign currency savings deposits on the demand for domestic money is to reduce the demand for domestic money, regardless to whether portfolio substitution exists or not.

Since our aggregate of foreign money (eM^f) includes both demand and savings deposits, and since holding demand deposits denominated in foreign currency already implies transactions motivations, the effect of the value of output (PY) on the demand for foreign money depends on whether portfolio considerations dominates transactions considerations or not. Currency substitution (holding foreign money for transactions purposes) occurs if the demand for foreign currency deposits (demand and savings deposits) increases with an increase in the transactions variable (PY). This reflects the assumption that foreign money is held for transactions purposes. However, if the demand for foreign money responds negatively to an increase in (PY), then portfolio considerations dominate transaction considerations, suggesting that residents hold foreign money primarily as a store of value rather than as a medium of exchange.

To determine if foreign money is held primary for portfolio or transactions purposes (currency substitution), the following two equations are estimated based on equations 1-3:

$$Log\left[\frac{M^d}{P}\right] = \beta_0 + \beta_1 \log y + \beta_2 i + \beta_3 (i^* + x^e) + \beta_4 x^e \qquad (4)$$

$$Log\left[\frac{eM^f}{P}\right] = \gamma_0 + \gamma_1 \log y + \gamma_2 i + \gamma_3 (i^* + x^e) + \gamma_4 x^e \qquad (5)$$

Equations 4 and 5 allow us to distinguish between portfolio diversification and currency substitution. We expect to find the coefficient on expected depreciation (x^e) to be insignificant, $\beta_4 = \gamma_4 = 0$. In addition, whether currency substitution is present or not the coefficient on the net return on foreign currency savings deposits (i^*+x^e) is expected to be significantly positive in equation (5), $\gamma_3 \succ 0$ and negative in equation (4), $\beta_3 < 0$.

In addition, the effect of an increase in domestic income is positive for the demand for assets that are held for transaction purposes and negative for all other assets. Therefore, we should expect that $\beta_1 \succ 0$ in equation (4). If domestic residents hold foreign money (eM^f) primarily for portfolio purposes, the coefficient on the scale variable γ_1, in equation (5) is expected to be negative. However, if foreign money is held to facilitate transactions (currency substitution) then we should expect $\gamma_1 \succ 0$ in equation (5).

Approximating the interest rate differential by expected depreciation has been a common practice in the econometric literature on currency substitution, by assuming uncovered interest parity. However, this approximation is questionable since it is not clear how these uncovered interest rates capture the opportunity cost of holding money, especially for countries with underdeveloped financial markets or has restrictions on capital mobility.

In the next section, quarterly data covering the period 1981 :IV-1994:I is used to analyze dollarization in more detail. All data (except on black market exchange rate) were taken from the international financial statistics of the International Monetary Fund. Data on black market exchange rate was taken from Pick's Currency Alert and International Currency Alert. Since quarterly data on Gross Domestic Product (GDP) which is used as a proxy for the transactions variable (PY) in equations 4 and 5 is not

available, quarterly data for GDP were interpolated from annual data using cubic spline function(5).

3. Unit Root Tests

The adoption of the economic reform and structural adjustment program in May 1991 may have resulted in permanent shifts. This policy change will be incorporated explicitly in the unit roots tests. Tests for known structural breaks have been proposed by Perron (1989).

Perron considered three different regression equations. The first is for series that are characterized by a major change in their level occurring after the break, the second is for series that are characterized by a change in the level, and by a change in the slope of the trend, and the third equation is for series that exhibits only a change in the slope of the trend function.

Plots of the series (not shown here) show that all variables in our study appear to have a change in the level that occurred after 1991:II, as well as, a change in the slope of the trend function after this date. While for the variables Real Ml and real M2 there was an increase in the slope of the trend function, all other variables (real income, foreign interest rate, domestic interest rate, depreciation and foreign currency denominated deposits held in domestic banks) are characterized by a trend function with a decreasing slope.

The following dummy variables were used: *Dp* represents a pulse dummy variable such that $Dp = 1$ at 1991:II and zero otherwise, D_L represents a level dummy variable such that $D_L = 1$ for all $t > 1991$:II and zero otherwise, and D_T represents a slope dummy such that $D_T = 1, 2, ..., 11$ (since the number of post break observations is 11) for all t beginning 1991:II and zero otherwise, if there is an increase in the slope of the trend, or D_T would take a decreasing number beginning at the break, $(D_T = 11, 8, ..., 1)$ if there is a decrease in the slope of the trend(6).

As shown in the Table 1, nonstationarity of each time series could not be rejected at the 5 percent significance level, indicating that these variables are I(1) processes[7]. In addition, the rate of change of the exchange rate (DEP) and the expected return on foreign money (PB VX), were found to be stationary processes, I(0)[8].

To assess the robustness of our findings on the order of integration of the series in the previous section, we used the Augmented Dickey-Fuller test. However, this test raises a problem related to the fact if the data contain an intercept and/or time trend. To determine whether the true data-generating process contain an intercept and/or time trend, Dickey and Fuller (1981) provide three F-statistics (called ϕ_1, ϕ_2, and ϕ_3,).

The results, for space considerations not shown here, confirm our findings in the previous section, where all the series (with the exception of expected depreciation, and expected rate of return on foreign money) were found to be nonstationary.

4- Cointegration

This section presents general results concerning the nature and stability of money demand in Egypt, the demand for domestic money *(Ml* and *M2)* and the demand for total foreign currency denominated deposits held in domestic banks *(FCD).* To test for cointegration we use first Engle-Granger (1987) procedure, and the Johansen-Juselius (1990) procedure.

Three versions of each equation of the demand for different assets (4-5) were estimated. We start first by estimating the full version of equation 4, including (PBVX) expected rate return on foreign currency deposits (i^*+x^e), and domestic interest rates (i), as suggested by Cuddington (1983). Since the domestic interest rate was fixed for most of the period of estimation, the second model excludes the domestic rate (i). Rather than using PBVX and the fixed domestic rate (i), the third model includes the interest rate differential PBV, $[((1+i^*+DEP)/(1+i)) - 1]$[9].

Finally, in line with results of stationarity tests, a time trend and a level dummy variable that captures the 1991 financial liberalization were also included in each regression(10).

While Tables 2a and 2b report results of estimating the demand for real domestic Ml and M2, Table 2c reports results for the demand for foreign money. The results presented in these tables represented the best fitting equations of the many variants tested. These include variations with respect to the appropriate measure of the opportunity cost variable(11) and with respect to the inclusion of the deterministic variables (the time trend and dummy variables).

The null hypothesis of no cointegration was rejected for all estimated equations. The results, presented in Tables 2a and 2b, imply that the significant trend (T) may be capturing the effects of other determinants of money demand, which are missing in these models. In addition, the May 1991 financial liberalization increased the rate of return on assets included in M2 relative to those rates on foreign money. This raised the share of domestic monetary assets and reduced the demand for foreign currency deposits in the portfolio allocation of wealth. The significance of the intercept dummy variable (D_L) reflects this change. As predicted by our modification of Cuddington's model, Tables 2a-2c, show no short-run currency substitution behavior. A negative (positive) expected depreciation, DEP, effect on the demand for Ml and M2 (FCD) could not be found. This implies that the rate of depreciation was found to play no role in determining the demand for monetary assets.

While the estimated income elasticity for Ml (table 2a) is 0.37, reflecting agent's economizing on holding cash balances, measured income elasticity for M2 was also less than unity, 0.55, mirroring the increase in the velocity of broad money. The interest rate differential in favor of foreign currency deposits might explain the downward trend in velocity.

To analyze cointegration of these series further, cointegration tests were once again performed on the same three different models, employing the Johansen-Juselis procedure[12].

The estimated eigenvalues, and eigenvectors for the demand for domestic real Ml, M2 and foreign money (FCD) are given in Table 3. The likelihood ratio test statistics are calculated and compared to the 95 percent quantiles of the appropriate distribution. The two versions of the test procedures are reported, λ_{trace} λ_{max}.

The results appear in Table 3 confirm the Engle-Granger results. The null hypothesis of no cointegration (r=0) was rejected by both statistics (trace and max.) in favor of the alternative (r=l) suggesting that there is at least one cointegrating vector in the six tested models[13].

The presence of cointegration suggests that the demand for domestic and foreign money should be represented in an error correction model. The existence of stable error correction models, based on the significance of the error term, was limited to only 6 out of the nine estimated equations for the three monetary aggregates (Ml, M2 and FCD). While Estimates of the demand by domestic residents for domestic Ml and M2 including the residuals lagged one period ε_{t-1}, representing deviations from the long run equilibrium relationship, are reported in Table 4 (as equations 1-4), the results for the demand for foreign currency deposits (FCD) appear in Table 4 as equations 5 and 6.

The existence of cointegration relationships is evidence of the existence of a long-run equilibrium relationship between economic variables as specified by each estimated cointegrating. In cases of departure from these equilibrium relationships, where satisfactory error correction models were obtained, approximately 0.29 to 0.39 percent of the shock is corrected within one quarter for domestic Ml, approximately 0.12 to 0.15 is corrected within one quarter for domestic M2 and approximately between 0.21 to 0.25 for total foreign currency deposits (FCD).

As predicted by our modification of Cuddington's framework Table 4, shows no short-run currency substitution behavior. The expected rate of depreciation variable, DEP,[14] was found insignificant implying that expected rate of depreciation was found to play no role in determining the demand for domestic money (Ml and M2) or the demand for foreign money (FCD).

However, as expected the expected rate of return on interest bearing foreign currency denominated deposits, PBVX ($i^* + x^e$) or its differential from the domestic rate of return (PBV), was found of crucial importance for both domestic money M2 (equations 3 and 4 in Table 4 and total foreign currency denominated deposits FCD (equations 5 and 6 in Table 4). This result implies that Egyptian residents adjust their portfolios and shift among the different alternative monetary assets in response to changes in the expected rate of return on foreign currency savings deposits rather than to changes in exchange rate.

The inclusion of the own rate of return variable (i), did not yield any satisfactory error correction model. This may be attributable to a lack of statistical power given that domestic interest rates have moved only once during the 1980s.

The results concerning the effect of change in real income on the demand for different monies turn out to be disappointing. In all the reported error correction models for domestic and foreign money the income coefficient was found to be significant but had the wrong sign. These results could be due to the fact that the Engle-Granger procedure suffers from a large degree of small sample bias, due to the omission of short-run dynamics when differencing the data.

5- Conclusions

In general, results reported in Table 4 show that the demand for different monies in Egypt respond to rates of returns rather than to expected depreciation. These results are in line

with the predictions of our modification of Cuddington's portfolio balance framework. The fact that Egyptian residents take expected rate of return on foreign currency denominated deposits when assessing the opportunity cost of money rather than expected depreciation suggests that portfolio considerations rather than transactions considerations is the dominant factor behind holding foreign money. Therefore, we conclude that foreign money is held primarily as a store of value (dollarization) rather than as a medium of exchange (currency substitution).

This result also contradicts existing results because the response of the demand for domestic money to variations in expected depreciation should be positive and significant under the conventional currency substitution hypothesis.

In interpreting the results, it is important to bear in mind the questionable quality of the data and the short period it covers. Despite these limitations, these findings are suggestive of the importance of the expected rate of return on foreign money, as part of the opportunity cost, in determining the demand for different monies denominated in different currencies in Egypt.

There are several arguments that justify this point. Ceilings on interest rates, high rates of inflation, as well as, exchange rate control, has resulted in a negative real rates of return on domestic financial assets. Moreover, Egypt's solvency has deteriorated dramatically due to massive external debt. Also, the government's reliance on inflation and financial repression taxes as sources of deficit finance has resulted in higher rates of inflation. This has induced residents to shift from domestic time and savings deposits into foreign currency deposits. In addition, the economic dominance of the public sector, which has contributed to the underdevelopment of the securities market, has resulted in a limited range of financial assets, which can serve as stores of value. These foreign holdings, therefore, reflect a form of holding wealth.

The empirical results presented here have implications on two levels. First, they shed light on the nature of money demand in Egypt. The results are consistent with the view that demand for foreign money is essentially a demand for a store of value. This view is supported by the role of the expected rate of return on foreign money or its differential from the domestic rate. The robustness of this result is supported by its minimal sensitivity to the choice of estimation techniques and specification of opportunity cost variables.

Second, the results also have policy implications, in connection with the formulation of monetary policy. The finding that foreign money in Egypt is held primarily to protect real wealth, rather than to facilitate transactions suggests that foreign money should not be included in transactions oriented measures of money supply that are used as targets in the conduct of monetary policy.

Table (1)
Perron's Unit Root Test in the Presence of Structural Breaks

Regression (11) $y_t = a_0 + \mu_1 D_p + \mu_2 D_L + \mu_3 D_T + a_2 t + \alpha Y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \varepsilon_t$

	p	λ	a_0	μ_1	μ_2	μ_3	a_2	α	S (ê)
M1	9	0.80	4.20	-0..03 (3.11)[a]	-0.19 (-0.34)	0.02 (-2.71)[b]	-0.08 (2.55)[b]	0.17 (-3.92)[a]	0.04 (0.64)
M2	6	0.80	2.73	-0.12 (3.34)[a]	0.003 (-1.95)[c]	0.03 (0.05	-0.02 (2.10)[a]	0.61 (-2.96)[a]	0.04 (3.95)[a]
FCD	0	0.80	1.11	0.05 (2.22)[b]	-0.26 (0.55)	0.02 (-2.94)[a]	0.03 (1.42)	0.73 (2.52)[b]	0.07 (5.94)[a]
Y	1	0.80	1.55	-0.02 (2.18)[b]	0.005 (-0.48)	0.005 (-0.17)	0.000 (0.95)	0.73 (0.25)	0.03 (6.02)
i^*	12	0.80	0.15	0.01 (3.15)[a]	-0.003 (1.13)	-0.005 (-0.56)	-0.42 (-2.78)[b]	0.005 (-0.93)	0.07 (1.13)
PBVX	4	0.80	0.28	-0.02 (3.11)[a]	-0.19 (-0.19)	0.02 (-2.07)[b]	-0.006 (1.22)	-1.13 (-0.87)	0.07 (-1.89)
DEP	4	0.80	0.08	-0.02 (1.86)[c]	-0.08 (-0.18)	0.009 (-1.23)	-0.002 (0.80)	-1. 16 (-0.23)	0.07 (-2.03)

Notes: Numbers in parenthesis denote t- statistics; a, b, and c denote statistcal significance at the 1%, 5%, and 10% level respectively.
M1, M2 = log of real domestic M1 and M2; FCD = total holding of foreign currency denominated deposits held in Egyptian banks; and Y = log of real income; i =3 months interest rate on foreign currency deposits proxied by the 3 Months London Interbank Offer Rate (LIBOR); Dep: expected depreciated of domestic currency; PBVX = net rate of return on foreign currency denominated deposits (I^* + DEP); D_p

represents a pulse dummy variable such that $D_p = 1$ at 1991: II and zero otherwise, D_L represents a level dummy variable such that $D_L = 1$ for all $t > 1991$: II and zero otherwise, and D_T represents a slope dummy such that $D_T = 1, 2, \ldots, 11$ for all t beginning 1991: 11 and zero otherwise, if there is an increase in the slope of the trend or D_T would take a decreasing number beginning at the break, ($D_T = 11, 8, \ldots 1$) if there is a decrease in the slope of the trend. (p) is the number of significant lags; s(e) is the standard error of regression.

To evaluate the significance of the t statistic on α, we used the critical value presented in Perron (1989, p. 1376) with a value of $\lambda = 0.80$.

Table (2a)
Estimated Cointegrated Vectors and Cointegration Test Results.
The Demand for Real Domestic M1

	(1)	(2)	(3)
C	3.40	2.86	2.65
	(2.82)[a]	(2.39)[b]	(1.98)[b]
T	-0.07	-0.07	-0.07
	(-14.70)[a]	(-15.85)[a]	(-13.24)[a]
Y	0.34	0.39	0.37
	(1.66)[c]	(1.90)[c]	(1.64)
i	-2.22		
	(-1.68)[c]		
PBV			-1.75
			(1.80)[c]
PBVX	-2.37	-2.67	
	(-2.97)[a]	(-3.35)[a]	
DEP	2.38	2.11	1.56
	(3.01)[a]	(3.38)[a]	(1.84)[c]
DUM_L	-0.21	-0.28	-0.27
	(-3.57)[a]	(-5.95)[a]	(-4.28)[a]
Unit Root rest on Residuals	3.00[a]	3.01[a]	2.06[b]

Table (2b)
Estimated Cointegrated Vectors and Cointegration Test Results.
The demand for real domestic M2

	(1)	(2)	(3)
C	2.01 (1.74)[c]	2.10 (1.41)	2.06 (1.62)[b]
T	-0.02 (-5.90)[a]	-0.03 (-6.47)[a]	-0.03 (-6.30)[a]
Y	0.71 (3.50)[a]	0.59 (2.26)[b]	0.55 (2.54)[a]
i	-4.51 (-5.07)[a]		
PBVX	-2.41 (-3.56)[a]	-1.83 (-2.00)[b]	
PBV			-1.99 (-2.34)[b]
DEP	2.44 (3.44)[a]	1.93 (2.13)[b]	1.81 (2.45)[b]
DUM_L	-0.17 (-3.07)[a]	-0.14 (-1.91)[c]	-0.28 (-4.73)[b]
DUM_T	0.03 (3.56)[a]	0.02 (2.50)[a]	0.06 (6.93)[a]
Unit Root test on Residuals	3.03[a]	2.86[a]	2.17[b]

Notes: Numbers in parenthesis denote t- statistics, a, b, and c denote statistical significance at the 1%, 5% and 10% level respectively, PBV = is the interest rate differential, $[(1+i^* + DEP) / (1+i) - 1]$.

Table (2c)
Estimated Cointegrated Vectors and Cointegration Test Results. The Demand for Total Foreign Currency Denominated Deposits Held in Egyptian Banks (FCD)

	(1)	(2)	(3)
C	6.65	7.63	7.87
	(2.25)[b]	(2.68)[b]	(2.60)[a]
T	0.10	0.10	0.10
	(8.49)[a]	(9.40)[a]	(8.22)[a]
Y	-0.58	-0.67	-0.64
	(-1.17)	(-1.36)	(-1.23)
i	3.91		
	(1.22)		
PBV			2.32
			(1.07)
PBVX	3.34	3.86	
	(1.72)[c]	(2.03)[b]	
DEP	-3.34	-3.85	-2.09
	(-1.74)[c]	(-2.04)[b]	(-1.10)
DUM_L	-0.15	-0.03	-0.05
	(-2.01)[b]	(-0.29)	(-2.28)[b]
Unit Root test			
On Residuals	3.07[a]	2.83[a]	2.06[b]

Notes: Numbers in parenthesis denote t- statistics; a, b, and c denote significance at the 99, 95, and 90 percent confidante level.

M1, M2 = log of real domestic M1 and M2; i = interest rate paid on domestic savings deposits; FCD = the demand for real total foreign currency denominated deposists held in Egyptian banks; y= real income; gross domestic product; DEP = expected exchange rate depreciation, log (E_t/ E_{t-1}), where E is the black market exchange rate; PBVX = rate of return on foreign currency denominated deposists expressed in terms of domestic currency (i^*+DEP); PBV = interest rate differential specified as [(1+ i + DEF) / (1 +i)-1]; T = trend; and DUM_L = a dummy variable, that captures the 1991 financial liberalization, taking a value of 0 prior and at 1991 : 1 and value I afterwards. D_T represents a slope dummy such that D_T = 1, 2, ..., 11 (Since the number of post break observations in 11) for all t beginning 1991: II and Zero otherwise, if there is an increase in the slope of the trend, or D_T would take a decreasing number beginning at the break, (D_T = 11, 8,.....,I) if there is a decrease in the slope of the trend.

The Augmented Dickey – Fuller unit root test was performed on each equation to test for cointegration.

Table (3)
The Johansen Procedure: VAR with Four Lags, Trend and a Dummy

$\lambda_{trace} = -T \Sigma \ln (1 - \lambda_i)$ $\lambda_{max} = -T \ln (1 - \lambda_{r+1})$

eigenvalue	H^*	λ_{trace}	λ_{trace} (0.95)	λ_{max}	λ_{max} (0.95)
1) M1 Y PBVX DEP					
λ_1 0.60916	$r \leq 0$	79.42*	47.18	41.34*	27.17
2) M1 Y PBV DEP					
λ_1 0.60319	$r \leq 0$	74.52*	47.18	40.67*	27.17
1) M2 Y PBVXDEP					
λ_1 0.57980	$r \leq 0$	71.04*	47.18	38.15*	27.17
2) M2 Y PBV DEP					
λ_1 0.57980	$r \leq 0$	76.67*	47.18	41.15*	27.17
1) FCD Y PBVX DEP					
λ_1 0.58641	$r \leq 0$	62.62*	47.18	38.84*	27.17
2) FCD Y PBVDEP					
λ_1 0.58662	$r \leq 0$	65.30*	47.18	39.87*	27.17

Notes (*) indicated that the null hypothesis has been rejected at the 5% significance level. The critical values reported for the trace and max. statistics are from Enders (1994).

M1, M2 + log of real domestic M1 and M2; FCD = Log of total real foreign currency denominated deposits (demand and savings) held in Egyptian banks; y = real income (GDP); DEP = expected exchange rate depreciation, log (E_t / E_{t-1}); PBVX = the expected rate of retun on foreign currency denominated deposits, $(i^* + DEP)$; PBV = interest rate differential specified as $[(1+ i^* + DEP)/(1 + i) - 1]$.

Table (4)
The Demand for Real Domestic Δ M1, Δ M2 and Δ FCD
(Error Correction Equations)

	The demand for Δ M1		The Demand for Δ M2		The Demand for Δ FCD	
	(1)	(2)	(3)	(4)	(5)	(6)
C	0.004	-0.008	0.02	0.003	-0.08	-0.01
	(1.18)	(-0.87)	(1.18)	(0.43)	(-1.57)	(-0.56)
DEP_{t-1}	0.06	0.05	-0.02	0.11	0.16	0.42
	(0.17)	(0.23)	(-0.20)	(0.72)	(0.20)	(0.84)
$PBVX_{t-1}$	-0.13		-0.18		0.40	
	(-0.40)		(-2.21)[b]		(2.03)[b]	
PBV_{t-1}		-0.13		-0.32		0.47
		(-0.73)		(-2.07)[b]		(2.20)[b]
Δy_{t-1}	-0.77	-0.78	-0.98	-0.90	(-0.17)	0.90
	(-2.43)[b]	(-2.45)[b]	(-2.90)[a]	(-2.50)[b]	(-0.44)	(2.00)
$\Delta M1_{t-1}$	0.31	0.30				
	(1.53)	(1.46)				
$\Delta M2_{t-1}$			0.71	0.57		
			(3.07)[a]	(2.22)[b]		
ΔFCD_{t-1}					0.22	0.12
					(1.16)	(0.69)
ε_{t-1}	-0.39	-0.29	-0.12	-0.15	-0.25	-0.21
	(-2.27)[b]	(-2.07)[b]	(-1.84)[c]	(-1.70)[c]	(-2.14)[b]	(-1.95)[c]
R-sq	0.11	0.09	0.33	0.36	0.34	0.35
D-W	2.16	2.16	2.39	2.09	1.81	1.85
S.E.R	0.05	0.05	0.04	0.04	0.08	0.08

Notes: See table (1).

ENDNOTES:

1- For more on the Egyptian financial system see Alami (1999).

2- Recent studies on currency substitution, that have failed to distinguish currency Substitution from dollarization, include Celements and Schwartz (1992) and Melvin and Fenske (1992) in Bolivia, Darrat and Al-Mutawa (1996) in the United Arab Emirates, Rogers (1992) in Mexico, Rojas-Suarez (1992) in Peru and Selcuk (1994) in Turkey.

3- In his original model Alami (forthcoming) the asset menu consists of domestic money(M^d), domestic bonds (B^d), and foreign currency denominated deposits (eM^f).

4- This information was obtained by an official (Ms. Ragaa Khalil) at the Central Bank of Egypt over the phone.

5- Multiplying the value of GDP at time (t) by the forth root of the ratio of GDP at time (t+1) to GDP at time (t).

6- According to Perron, the null hypothesis of a unit root imposes the following restrictions on the parameters of the estimated equation, as it appears in Table (1),
$a_2 = \mu_2 = \mu_3 = 0$, $\alpha = 1$ The alternative hypothesis of a trend stationary process, the restrictions are $\mu_1, = 0, \alpha < 1$.

7- For M2 and FCD The unit root hypothesis was rejected implying that these series might be stationary around a deterministic trend with a change in the slope after 1991:II. However, since the plots of these series suggest a change in level and in the slope of the trend, we expect that both the intercept dummy D_L and the slope dummy D_T to be significant, but we found for M2 that the intercept dummy is insignificant and for the FCD the slope dummy is insignificant. Therefore, we reject this finding and consider these series as nonstationary.

8- The nonstationarity of PBVX was rejected based on the insignificance of the constant term, a_o, and the break dummy, μ_1, coefficients. As indicated by Perron (1989), acceptance of the null hypothesis of a unit root implies that, a_o=0 and μ_1, =0.

9- PBV was found nonstationary with a one-time jump in the intercept, indicating that it is I(0) process.

10- For M2 equations a slope dummy was also included, where as indicated by our results from Perron's stationarity tests, and plots

of M2, it appears that not only a change in the level occurred after 1991 but there was also an increase in the slope of the trend function after this date.

11- No cointegration could be found when we add supplementary variables such as inflation or the deviation of the black market exchange rate from the official rate. One reason for the absence of cointegration is that they add no new information to that provided by expected rate of depreciation.

12- The same equation, for the demand for Ml, M2 and FCD, were tested again without the deterministic variables. The results indicated that, the significance of both statistics drops significantly when we exclude the time trend of the shift dummy. In addition, excluding these two variables produces only one cointegrating vector. These results, suggest that cointegration requires the inclusion of the time trend and the dummy variable.

13- Three versions of the two different specifications of money demand equations.

14- This finding held even when we used $\log(P_{t+1}/P_t)$ as a proxy for expected depreciation, instead of $\log (P_t/P_{t-1})$.

References

Alami, T., "Currency Substitution Versus Dollarization: A Portfolio Balance Model" Journal of Policy Modeling (forthcoming, in press).

Alami, T., "The Dernand for Foreign Money in Egypt: Critical Review and Extension," Arab Economic Journal, Vol.14, (Winter 1998), pp.3-I 8.

Clements, B. and G. Schwartz (1992): "Currency Substitution: The Recent Experience of Bolivia, IMF Working Paper, 92/65, International Monetary Fund

Cuddington, J. (1983): "Currency Substitutability, Capital Mobility and Money Demand" Journal of International Money and Finance, 2, pp. 111-133.

Darrat, A.F. and A. AI-Muttawa (1 996): "Modeling Money Demand in the United Arab Emirates" The Quarterly Review of Economics and Finance, Vol.36, No.1

Dickey, David and Wayne A. Fuller, "Likelihood Ration for Autoregressive Time Series with a unit Root." Econometric a 49 (July 1981), 1057-72.

EI-Erian, M., "Currency Substitution in Egypt and the Yemen Arab Republic: A Comparative Quantitative Analysis," International Monetary Fund Staff papers 35(1) (1988), pp.85-103.

Elkhafif M.A. and A.A. Kubursi, "Currency Substitution and Exchange Rate Instability: Which Comes First?," McMaster University, QSEP research report No.277 (1991).

Engle, R.E. and C.J. Granger: "Cointegration and Error-Correction: Representation, Estimation and Testing" Econometric a 55 (March 1987), pp.251-76

Johansen, Soren, "Statistical Analysis of Cointegration Vectors." Journal of Economic Dynamics and Control 12 (June-September. 1988), 231-54.

Johansen, Soren and Katerina Juselius, "Maximum Likelihood Estimation and Inference on Cointegration with Application to the Demand for Money." Oxford Bulletin of Economics and Statistics 52 (1990), 169-209.

Melvin, M. and F. Fenske (1992): "Coca Dollars and the Reform: Evidence from the Cochabamba of Bolivia," Revista de Analisis Economico 7(1), pp.125-138.

Perron, Pierre, "The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis." Econometrica 57 (Nov. 1989), 1361-1401.

Rogers, J.H. (1992): "Convertibility Risk and Dollarization in Mexico: a Vectorautoregressive Analysis," Journal of Interational Money and Finance 11, pp. 188-207

Rojas-Suarez, L. (1992):"Currency Substitution and Inflation in Peru" Revista de Analisis Economico 7(1) pp. 153-176

Selcuk, F. (1994): "Currency Substitution in Turkey," Applied Economics, Vol.26, pp.509-518.