

Currency Substitution and the Demand for Money in the Arab Maghreb

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Abstract

The purpose of this paper is to estimate the demand for money for Al-Maghreb Al-Arabi countries by taking into account the currency substitution and rational expectation over the period 1964 to 1987. The results indicate that currency substitution exists in Morocco, Libya, and Mauritania; whereas it is absent from Algeria and Tunisia. The pooled data for the five countries indicate that currency substitution is not an important factor in determining money demand.

Introduction

A study of money demand empirically requires the use of a scale variable, an opportunity cost of holding money domestically, and rates of return of other alternative assets. For developed countries the opportunity cost of holding money is the rate of interest, however, for developing countries this is not the case. Since most developing countries lack the financial institutions available in the developed countries, thus making the rate of interest variable inappropriate. A more relevant variable is the inflation rate, which will be used in this study as an opportunity cost of holding money domestically.

Arize et al (1990) estimate the demand for money for several African countries including Mauritania, and Morocco. They incorporate the capital mobility hypothesis. Our purpose of this study, however, is to incorporate the currency substitution hypothesis, that is, the substitution of foreign currencies for domestic ones when the domestic currency is expected to depreciate.¹ Currency substitution has not been used on several developing countries including Algeria, Libya, Mauritania, Morocco, and Tunisia, known as Al-Maghreb Al-Arabi. The study covers the period from 1964 to 1987.

The Model

This study uses a semi-log demand for money function, which takes the form:

$$\text{Ln}M_t^* = a_0 + a_1 \text{Ln}y_t + a_2 E\pi_t + a_3 EX_t + V_t$$

where $\text{Ln}M_t^*$ is desired log real money balances; $\text{Ln}y_t$ is log real income; $E\pi_t = E(\text{Ln}P_t - \text{Ln}P_{t-1})$ is the expected

inflation rate; $EX_t = E(\text{Ln}e_t - \text{Ln}e_{t-1})$ is the expected change in the exchange rate; P_t is the price index; e_t is the exchange rate; and v_t is an error term.

It is assumed that money demand is directly related to real income, and inversely to expected inflation rate and expected change in the exchange rate, that is, a rapid depreciation of domestic currency is likely to lead domestic residents to substitute foreign money for domestic one. Domestic residents are assumed to hold four assets: domestic money balances, other domestic assets, foreign money balances, and other foreign assets. It is assumed that expectations of inflation and changes in the exchange rates are formed rationally based on all available past information, and that desired real money balances follow a partial real adjustment mechanism, that is, desired real money balances adjust toward actual real money balances with a lag. This partial adjustment coupled with equation 1, gives the final form of the money demand equation:

$$\text{Ln}M_t = b_0 + b_1 \text{Ln}y_t + b_2 E\pi_t + b_3 EX_t + b_4 \text{Ln}M_{t-1} + \varepsilon_t$$

where ε_t is an error term, and b_i 's are the short run elasticities or semi-elasticities of money demand with respect to the given variable.

Real money balances are defined as narrow money supply (M1). Exchange rates for each country are domestic currency per U.S. dollar. Price is the consumer price index. Income is real GDP. Data for the variables are taken from the International Financial Statistics; Currency Yearbook; and the 1988-1989 World Tables.

A two stage procedure is used to estimate the demand for money over the period 1964-1987. First, EX and $E\pi$ are estimated by regressing X and π on a constant, and two lags of: income, money, inflation rate, and changes in the exchange rates. An estimate of EX and $E\pi$ is then obtained by subtracting the residuals from X and π . Second, equation 2 is estimated by OLS techniques to get an estimate of the parameters.

Empirical Results

Table 1 shows the results of the money demand estimation for each country. The overall fit of each estimated money demand is good as indicated by the adjusted R² and SEE. The table indicated that most of the variables show the anticipated signs. The residuals from these regressions are serially independent as indicated by the Durbin-h statistics. Real log GDP and lagged real adjustment are important determinant of money demand in all countries. However, the expected changes in the exchange rates are, only, important in the case of Morocco, Libya, and Mauritania, indicating that the data support the currency substitution hypothesis in Morocco, Libya, and Mauritania.² Expected inflation rate is important determinant of the Moroccan, and Libyan money demand.

results of this regression are reported in table 3. This table shows that the overall fit of the estimated equations is good and the variables show the anticipated signs. The residuals are free from serial correlations as indicated by the Durbin-h statistics and the estimated equations are structurally stable as indicated by Chow test.

The data for the five countries are pooled to get an estimate of the money demand across the five countries. To pool the data, Crockett and Evans (1980) procedure is used: Real GDP and Money balances are converted into U.S. dollars to overcome the various currencies problem; to account for population differences, real GDP and money balances are divided by the population.

Table 4 shows the short-run and long-run real income elasticities. Long-run real income elasticity is calculated by dividing the short-run real income elasticity by the speed of adjustment. The long-run real income elasticity for Algeria, Libya, Mauritania, and Morocco supports the hypothesis that income is a luxury good; whereas for Tunisia it supports the economies of scale in cash management hypothesis.

Table 1
Regression Results of Money Demand Functions (Two Stage Least Squares)
Annual Data 1964-1987

Parameters	Country				
	Algeria	Libya	Mauritania	Morocco	Tunisia
Constant	-1.544 (-1.22)	-2.959 (-4.20)*	-2.265 (-0.85)	-1.381 (-2.82)*	-0.412 (-1.25)
Real GDP	0.413 (1.57)**	0.645 (6.32)*	0.305 (1.19)	0.227 (1.55)**	0.432 (2.93)*
Expected Inflation	-0.0077 (-0.85)	-0.0237 (-2.94)	-0.003 (-0.17)	-0.0118 (-3.68)*	-0.00024 (-0.04)
Expected Change in the Exchange Rate	-0.00051 (-0.18)	-0.0087 (-1.77)**	-0.0029 (-0.80)	-0.0031 (-2.37)*	0.00068 (0.71)
Lagged Partial Adjustment	0.714 (3.98)*	0.673 (8.18)*	0.907 (7.22)*	0.901 (7.35)*	0.551 (3.92)*
Summary Statistics:					
Adjusted R ²	0.982	0.978	0.841	0.993	0.985
S.E.	0.094	0.162	0.142	0.037	0.056
D.h	1.420	-0.549	0.203	1.490	0.798

The numbers in parentheses beneath the coefficients are absolute values of the t-statistics (one tail test): * indicates significance at the 5 percent level and ** indicates significance at the 10 percent level; D-h is the Durbin-h statistics.

Table 2 shows the F-statistics of structural stability test. This table indicates that at the assumed break point 1975, the estimated equations for Algeria, Morocco, and Tunisia are stable, but for Libya and Mauritania are unstable. Therefore, money demand equations for Libya and Mauritania are re-estimated for the full sample period by allowing the intercept to take different values in the two sub-periods: D=1 for 1963-1975, 0 otherwise; and D1 = 1 for 1976-1987, 0 otherwise. The

Table 5 shows the results of the pooled sample over 1963-1987. The table shows that the variables show the anticipated signs and the overall fit of the model is good. The table shows that each country has an important affect on money demand. Log GDP, expected inflation rate, and lagged partial adjustment are significant at the 5 percent level. The data do not support the currency substitution hypothesis across the five countries. This has several policy implications. A policy

implication is that a monetary unification might reduce the affect of foreign economic shocks on their economies.

Table 2
F-Statistics of Structural Stability Tests

Country	Chow Test
Algeria	0.664
Libya	6.51*
Mauritania	2.45**
Morocco	2.05
Tunisia	0.579

* Significant at the 01

** Significant at the 0.10

Conclusion

An estimate of money demand for five north African countries, known as Al-Maghreb Al-Arabi, incorporating the currency substitution hypothesis and rational expectations revealed that currency substitution exists in Morocco, Libya, and Mauritania; whereas it is absent from Algeria and Tunisia. Initial estimate of money demand for Libya and Mauritania revealed significant instability, which was attributed to an intercept shift rather than to slope coefficient changes. To account for

this instability, money demand equations for Libya and Mauritania were augmented with dummy variables. The estimated equations for Algeria, Morocco, Tunisia, and the augmented equations for Libya and Mauritania were structurally stable over the estimation period. Therefore, these estimated equations could be used to formulate domestic monetary policies.

After pooling the data, the results indicated that currency substitution is not an important factor in determining money demand in the five countries, implying that a monetary unification of these five north African countries would lead to stability and less vulnerability to external monetary influences. In the absence of this monetary unification, each country must pay attention to and take into consideration external monetary influences which may lead to the ineffectiveness or neutrality of domestic monetary policies.

Suggestions for Future Research

How should monetary policy be conducted in Morocco, Libya, and Mauritania compared to that of Algeria and Tunisia? Is capital mobility an important factor in determining money demand in these countries? These questions are beyond the scope of this paper and are topics for further research. A future research might study the effectiveness of monetary policy in these

Table 3
Regression Results of Money Demand Functions
(Two Stage Least Squares) Annual Data 1964-1987

Parameters	Country	
	Libya	Mauritania
Dummy 1	-2.732 (-4.72)*	-1.250 (-0.59)
Dummy 2	-2.459 (-4.13)*	-1.095 (-0.48)
Real GDP	0.71 (8.3)	0.341 (1.56)**
Expected Inflation	-.0207 (-3.1)*	-0.0201 (-1.23)
Expected Change in the Exchange rate	-.0104 (-2.56)*	-0.0075 (-2.17)*
Lagged Partial Adjustment	0.542 (6.95)*	0.754 (6.3)*
Summary Statistics:		
Adjusted R ²	0.985	0.884
S.E.	0.132	0.121
D.h	-0.679	-0.593
Chow test F(6,13)+	2.15	0.563

* Significant at the 0.05

** Significant at the 0.10

+ critical value of chow test F(6,13) at the 10 percent level is 2.23.

Table 4
Short-Run and Long-Run Real Income Elasticities

Country	Short-Run Elasticity	Long-Run Elasticity
Algeria	0.413	1.444
Libya	0.71	1.550
Mauritania	0.341	1.386
Morocco	0.227	2.293
Tunisia	0.432	0.962

Table 5
Regression Results of Money Demand Functions
(Two State Least Squares): Pooled Sample

Variable	Coefficient	T-Statistics
Libya	-2.2512	-19.75*
Tunisia	-2.0132	-22.21*
Morocco	-2.5286	-17.11*
Algeria	-2.4078	-15.48*
Mauritania	-3.7854	-17.21*
LOGGDP	1.0996	33.97*
Expected Inflation	-0.0197	-4.04*
Expected Change in the Exchange Rate	0.0026	0.78
Lagged Partial Adjustment	0.0578	2.00**
Summary Statistics:		
Adjusted R ²	0.997	
S.E.	0.166	
D.h	-0.72	

* Significant at the 0.01.

** Significant at the 0.05.

countries by incorporating a policy dummy variable in the money demand function.

Footnotes

1. For further discussion about currency substitution hypothesis see, for example, Arango and Nadiri (1981), and Thomas (1985).
2. The results for Morocco and Mauritania are different from those obtained by Arize et al (1990), because they use monetized income, nominal partial adjustment, and foreign interest rate; while in this study we use total income, real partial adjustment, and expected depreciation.

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