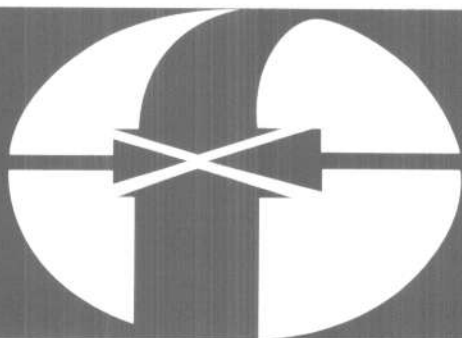


Savings and Development



"GIORDANO DELL'AMORE" FOUNDATION

A Centre for Financial Growth and Development Assistance

established by

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Quarterly Review - No. 3 - 2006 - XXX



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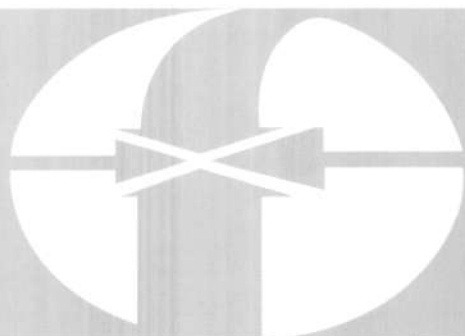
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Contents

MONEY DEMAND IN ALGERIA

by A. Bakhouché 221

PROGRAM COSTS FOR INDIVIDUAL DEVELOPMENT ACCOUNTS

by Mark Schreiner 247

VALUING MICROFINANCE INSTITUTIONS

by Barclay O'Brien 275

THE LONG AND SHORT-RUN DETERMINANTS OF WORKERS' REMITTANCES TO BARBADOS

by Trevor Campbell 297

NON-INTEREST INCOME AND FINANCIAL PERFORMANCE AT COMMERCIAL BANKS IN BARBADOS

by Roland Craigwell and Chanelle Maxwell 309

THE MONETARY CONTROL FRAMEWORK OF GUYANA: EXPERIENCES, LESSONS AND CONSEQUENCES

by Tarron Khemraj 329

MONEY DEMAND IN ALGERIA

A. Bakhouche
University of Wales

1. Introduction

With the continuing transition of Algeria to a market-based economy, it appears that there is a crucial need to assess whether a market-based monetary policy is adequately implementable. As Banque d'Algérie is legally privileged with the role of maintaining inflation at "low" levels, the estimation of a money demand function would help to decide whether to set an inflation rate or broad money aggregate as an immediate target for monetary policy. Even though the period under study is relatively short (1988-2004), the current analysis attempts to estimate a money demand function in Algeria, within the framework of financial and economic reforms that include measures of prices, interest rates, directed credit and entry-exit liberalisation.

The empirical estimation and theoretical analysis of money demand function is extensively well-documented in the literature especially in developed countries. Previous studies identify a number of potential economic variables, which include variables controlling for the opportunity cost and the own rate of return money and transactional activity (scale variable). For the case of Algeria, however, literature is rather scarce. Therefore, this paper attempts to bridge this gap, and also intends to i) investigate the money demand in Algeria, ii) examine the properties of the money demand function over the period 1988-2004, that is, relating money stock to factors that economic theory claims importance; as so to find whether the money demand function can be used for monetary policy, and iii) employ the cointegration analysis as suggested by Johansen (1988, 1995¹).

This paper estimates a function for money demand (M2) and its determinants in Algeria, over the period 1988-2004. Specifically, the analysis seeks to explore whether a cointegrating relationship exists between money estimate (dependent variable) and other selected relevant economic variables, including scale, own return and opportunity cost of money holding variables. We employ the cointegration approach suggested by and Johansen (1988), which is widely used in similar studies as to estimate a money demand function for the case of Algeria. Particularly, we focus upon identifying the potential determinants of money demand function and discussing its properties in order to decide whether it can be used for monetary policy design purposes.

¹ Harris (1995, p22) states that cointegration can be interpreted as "if two or more series are linked to form an equilibrium relationship spanning long-run, even though the series themselves may not contain stochastic trends (i.e., be non-stationary) they will nevertheless move together over time and the difference between them will stable (i.e., stationary)".

2. Money Demand Theory

Money demand theories explain the relationship between the quantified money held by individuals and firms and the factors that influence the decision to hold a certain quantity of money. Such factors are related to transaction, precautionary and investment purposes. Individuals and firms tend to hold money to carry out their regular transaction, to use money for future transactions (precautionary) and/or to invest in interest-bearing assets. Policy-makers tend to be interested in estimating money demand function in order to design an appropriate policy in line with the principle of price level targeting. Policy-makers would set a quantity for the supply of money consistent with the quantity of money demand. While money supply can be determined by the Central Bank, money demand function studies have used variables such as wealth and income, cost opportunity of money, and inflation are potential variables to estimate money demand.

There are two major frameworks upon which money demand studies have based their empirical modelling analyses; the monetarists and the Keynesians. These frameworks start their analyses of demand for money by explaining the role of money itself. While the Monetarists state that money is only used as a medium of exchange, i.e., numéraire, to facilitate the exchange of transactions, (that is, neutral and exogenous), the Keynesians add the store-of-value function. The classical quantity theory of money considers that the relationship between the quantity of money and inflation are directly related, that is, an increase in the quantity of money would lead automatically to an increase in inflation, holding other factors constant.

Money demand function estimation studies have used the cointegration approach to quantify the parameters included in the equation. These parameters represent the elasticity of the relationship between money demand quantity and other variables. Humphrey (1973) explains the usability of the sensitivity of these parameters in terms of policy implications. For example, monetary policy engineers attempt to identify interest rates elasticity to money demand to estimate how much money holders would respond to changes in interest rates.

While money demand equation has been well documented in developed countries and a number of other developing countries, this issue still seems to be under-addressable in Algeria. To the best knowledge of this paper, only Koranche-

lian (2003) investigated Money demand in Algeria using the cointegration approach over the period 1974-2001. Koranchelian (2003) employs a model that incorporates real money aggregate M2 (independent variable) and real GDP, inflation and discount rates (independent variables). The times series of these variables are found non-stationary but significantly integrated at order 1, using the ADF stationary test. Koranchelian (2003) includes two dummies in his model as exogenous variable to reflect the impact of the structural reforms implemented in 1988 and 1994.

Koranchelian (2003) finds the following significant coefficients; 1.32 (income), 1.59 (inflation) and 0.03 (discount interest rates). First, the coefficient of income of larger than one reflects a downturn trending of money velocity in the long-run. Money seems to be the principal instrument for the accumulation of financial savings in Algeria. Second, discount interest rates are found to exert very small impact on the quantity of money that Algerian residents tend to wish to hold. Koranchelian (2003) interprets this small impact by the behaviour of government-owned enterprises which is relatively dominated the economy and tend to be insensitive to changes in interest rates, in addition to the absence of alternative financial instruments. Third, inflation rates seem to be important for money demand decisions. In addition, Koranchelian (2003) performs a weak exogeneity test and find that weak exogeneity for money, income and interest rates cannot be rejected while it is rejected for the case of inflation.

3. Methodology, Data, Definition of Variables

Our investigation procedures in this paper include five main steps. First, the ADF test of stationarity is used to test for the unit root in our time series. Second, we perform the Johansen's Cointegration approach to test for the existing of cointegrating vectors between our time series. Third, we derive a long-run money demand function from the cointegrating vectors. Fourth, we proceed towards testing the hypothesis of weak exogeneity of our variables. Finally, we derive the ECM model and its implications. Empirical study is performed using Eviews 5 software.

The data set used in this study is derived from the IMF and Ministry of Finance statistics yearbook and covers an annually sample period of 1988-2004. Over this period, Algeria embarked upon a programme of financial, economic and

monetary liberalisation. Prior to 1990, Algeria had a centrally-planned economy. For this reason, an extension of our period to cover the years prior to 1988 seems to be irrelevant, as money demand analysis does not apply to centrally-planned economies. However, we use the results of Koranchelian (2003) for comparison between pre- and post-liberalisation periods.

The monetary aggregate subject to this study is real broad money M2. This aggregate consists of narrow money M1 (which is composed of currency in circulation and demand deposits), time deposits in both Algerian, and other deposits denominated held in foreign currencies. The scale variable is proxied by real GDP to control for the transactional side of the money demand function. M2 and GDP are both expressed in logarithm and obtained in real terms by deflating with Consumer Price Index (CPI). Inflation and deposits rates are retained unconverted.

While money aggregate, M2, and scale variable, real GDP, are expressed in logarithm terms, interest and inflation rates are preserved in their absolute terms. Inflation rates are computed as the difference of the logarithm of prices (CPI) between two periods, and are measured according to the consumer price index in which 1987 is a year base. The scale and other variables are deflated according to the 1987 prices.

Thus, the variables exploited in this analysis are: real broad money (M2/CPI), (Billion Dinar), Real GDP (GDP/CPI), (Billion Dinar), deposit interest rates (D), and Inflation Rates (π). Figure 1 accommodates the graphical charts of our variables. It displays the evolution of our selected variables between 1988 and 2004, and shows two main trends for M2; a downward trend (1988-1996) and an upward one (1996-2004). The upward trend starting from 1996, may reflect two patterns, first, economic agents are more inclined to hold more wealth in a more less liquid forms, and second, it is because of the economic and financial reform and liberalisation programme launched in 1994.

The scale variable measured by real GDP is also shown in Figure 1. As it can be seen, overall, real GDP witnessed three main trends, an upward (1988-1991), a downward (1991-1994), and an upward (1994-2004). As the Algerian economy is more based on the hydrocarbon sector, the changes in the overall GDP trend can considerably be explained by oil prices shocks in oil markets.

Figure 1: *Graphic Display of Variables (1988-2004)*

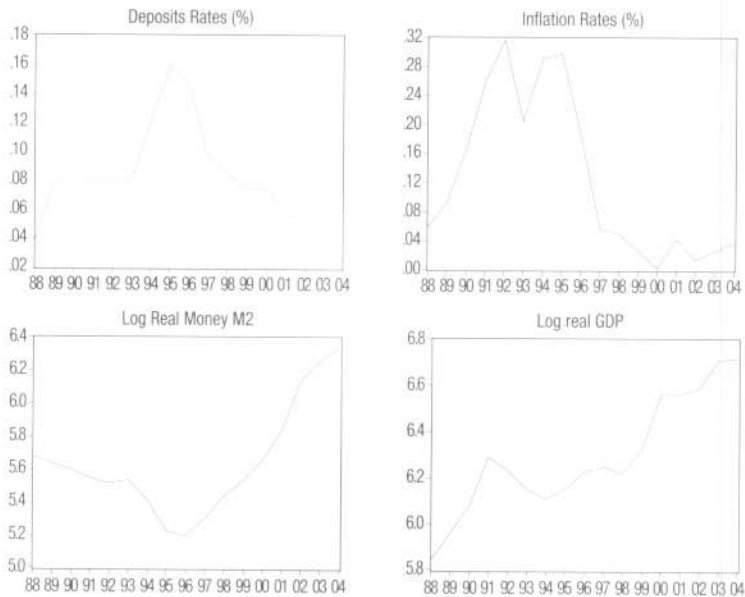


Figure 1 shows also the trend of the own rate of money proxied by interest rates on deposits. Deposits rates increased between 1988-1989, then remained constant until 1993, but increased between 1993-1995 to be soared in 1995, by maintained a decreasing trend until 2004. The increase in interest rates is a result to the financial reforms started in 1988 a consolidated during 1993-1995. After 1995, interest rates declined due to the decrease in inflation rates and relatively successful stabilisation programme.

Finally, Figure 1 displays the evolution of the opportunity costs of holding money measured by annual inflation rates. Inflation rates, overall, experienced, three main trends, an upward (1988-1995), a downward (1995-1998), and then remained less than 4% until 2004. The increasing trend in inflation rates can be explained by the government policies to liberalise prices in the first half of the 1990s and in accordance with reform programme prepared with the IMF.

4. Model Estimated

Derived from Mutluer and Barlas (2002) and following Koranchelian (2003) and Bjornland (2004), the long-run money demand function estimated in this analysis can be expressed as:

$$\ln \left[\frac{M_t}{P_t} \right] = \alpha + \beta_1 \ln \left[\frac{Y_t}{P_t} \right] + \beta_2 R_t + \beta_3 \pi_t + \varepsilon \quad (1)$$

Where M_t/P_t represents the real monetary aggregate (M2/CPI) at time t , Y_t/P_t , represents the real income or output (GDP/CPI), R_t represents the own return of holding money measured by deposits interest rates, and π_t represents the opportunity cost of holding money. P_t represents Consumer Price Index (CPI) with a basis year of 1987 and ε_t is error term. In addition, real money and real output are expressed in log terms, whereas interest rates and inflation rates are not logged. Accordingly, the coefficient associated with real output β_1 specifies the log-term elasticity, the coefficients β_2 and finally, β_3 represent the semi-elasticity of interest rates and deposits rates.

Based on theory and literature, we can predict the signs of the coefficients in the equation based upon theory. First, the (Y_t/P_t) -elasticity of money demand, β_1 , is expected to have a positive sign as a higher level of income (output) requires more real balances as explained either by the quantity money theory or transactions theory. That is, $\beta_1 > 0$. Second, the R_t -semi elasticity of money demand, β_2 , is expected to have a negative sign. Higher levels of interest rates will reduce money demand as interest rates represent the opportunity cost of holding money. That is, $\beta_2 < 0$. Finally, the semi-elasticity of inflation rates is expected to have a negative sign due too the fact that higher rates of inflation will economic agents to demand less money and instead invest their balances in real assets. That is, $\beta_3 < 0$.

In our analysis, we retain the following notations, M for real money, Y for real outputs, R for deposits rates and π for inflation rates.

5. Stationarity and Unit Root Test

Kogar (1995) states that the stationarity of time series at a similar order would results in an existing of a money demand function that shows a long-run relationship represented by a cointegrating vector among the included variables (money, real

income and opportunity cost of holding money). Thus, by cointegrated variables, it will be constrained to equilibrium relationship in the long-run.

Accordingly, we commence our analysis by testing for stationarity of our time series. We use the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) unit root test for our variables. The lag structure included in the test starts from 6 lags, based on Schwartz Information Criterion (SIC). The test is performed with the three possibilities of only a constant, constant and trend, and none, for the null hypothesis of a unit root..

Table 1 in the appendix presents the results for the unit root test of our explored variables. The null hypothesis tested using the ADF test states that a variable time series contains a unit root. The four variables tested for unit roots are M, Y, R and π . The table of ADF tests reports that we cannot reject the null hypothesis if unit root for all the variables at the 5% critical level. However, at the first differences level, the null hypothesis can be rejected at the significance level of 5%. This implies that our variables are integrated of order one, that is, I(1).

6. VAR and Cointegration Test

The cointegration analysis starts with the formulation of an unrestricted VAR system with endogenous variables M, P, and Y. We apply the Johansen's approach to determine the number of cointegration vectors and to test for weak exogeneity. The unrestricted UVAR takes the following form;

$$x_t = \sum_{j=1}^k A_j x_{t-j} + \varepsilon_t \quad (2)$$

Where x_t contains all endogenous variables (M, Y, π and R), and the system can be presented in the equivalent VECM (vector error correction) form:

$$\Delta x_t = \sum_{j=1}^{k-1} \prod_j \Delta x_{t-j} + \prod x_{tt} + \varepsilon_t \quad (3)$$

Where $\prod = \sum_{j=1}^{k-1} A_j - I$ and $\prod_j = - \sum_{j=1}^{k-1} A_j$ for $j=1,2,\dots,(k1)$. We use the Johansen procedure to determine the rank of Π , which defines the number of cointegrating

vectors. The matrix Π can be contains two components α and β' . While α represents the speed of adjustment to equilibrium, β' represents the long-term coefficients. In our data we include one dummy controlling for the price increase in 1991-1992.

7. Cointegration Estimation and Results

One aspect of the Johansen cointegration approach (1988) is to determine the number of cointegrating vector (relations) between the variables included in the system. This is carried out through determining the rank of $\alpha\beta'$ using two statistics, λ trace and λ max. These two statistics are calculated using eigenvalues of the matrix $\alpha\beta'$, with respect to the hypotheses related to the number cointegrating relations. Table 2 in the appendix shows, based upon the two statistics, that there is only one cointegrating equation between the variables at the 1% significance level.

Table 2 reports the results of the Johansen's cointegration estimation procedure without imposing restrictions on the long and short-term coefficients. According to the results, there is only one cointegrating vector that links the four variables into a system. In this cointegrating vector, real output and inflation rates have significant explanatory power, whereas deposits rates are found to be insignificant at 5% level. As there is only one cointegration equation, the long-run money demand function for real broad money can be given as;

$$M = 1.278Y + 0.0019R + 1.3028\pi \quad (4)$$

The cointegrating relationship represented in specification (4) shows that in the long-run real money demand is positively related to income, own rate of return and inflation rates. While the signs of long-term estimated coefficients of income and interest rates are compatible with previous empirical findings and theoretical analyses, the sign of the coefficient of inflation is found positive and is not consistent with previous findings in the literature. The equation shows that an increase of 1% in income would lead to an increase of 1.28% of money demand aggregate. Similarly, an increase of 1% in deposits rates would lead to increase of 0.0019%, whereas an increase of 1% in inflation would lead to increase of 1.30% of M2. While only output (Y) and inflation (π) are statistically significant, we can conclude that in Algeria, in the long-run, inflation can be determined by the interaction of money and output.

The coefficient of income found in our analysis appears to be within the range surveyed by Sriram (2001) for non EU countries. Mutluer and Barlas (2002) find income elasticity of 1.00 for Turkey. Sriram (2001) finds wealth coefficient to be within the range 0.13 and 2.00, with an exception of Argentina which was found to be 3.45. For EU countries, the survey of Browne, Fagan and Henry (1997) reports income elasticities within the range of 0.27 and 1.84. Koranchelian (2003), who found 1.32 as a value of the coefficient for real GDP in Algeria (1974-2001), claims that if income elasticity exceeds unity, the money velocity is expected to have a declining trend in the long-run.

In addition, the positive sign of the income elasticity of the long-run money demand function appears to be consistent with the transaction theory. An increase in income would encourage individuals and firms to hold more money in order to ease their transactions. The magnitude of our coefficient seems to be closer to that encountered by Koranchelian (2003), who found 1.32 as a value of the coefficient of real output. Koranchelian (2003) states that when income elasticity is found to exceed unity, money velocity is expected to have a declining trend in the long-run. Aghevli et al. (1997) explains that in developing countries, the monetisation effects (M/GDP) resulted from the under-development of the financial sector seems to be the main reason behind the unproportional changes between held money and output. The financial sector appears to lack to offer money holders appropriate and more sophisticated less liquid instruments as alternative to liquid forms of money, due mainly to, among others, prolonged period of financial repression. Thus, the relationship between money and income (GDP) is found to be positive and unproportionably above unity².

We can derive from Knell and Stix (2004) that when estimating for a less developed country, the results should be consistent with the fact that income elasticity in the narrow money demand function should exceed the income elasticity derived from the use of broad measure of money aggregate. This is in contrast to the case of a more developed country, in which income elasticity of a broad money demand function is found to be greater than income elasticity. Knell and Stix (2004) argue that economic agents in developed countries have more alternative that allow them carry less money for their transactions. Payment systems in less developed countries offer less alternative interest-bearing forms of

² We test for the restriction of unit income/output homogeneity, and find the related statistics to be significant at 5% significance level, implying that the unit income elasticity cannot be rejected for the long-term relationship.

money to currency, in which money demand would be less sensitive to variations in interest rates. Thus, and similar to the explanation of Muhd-Zulhibri (2004), who found long-run income elasticity slightly above one, the magnitude of the long-run output reflects the increasing degree of monetisation of the Algerian economy, the continuing reforms made to the financial sector and the small number of the alternative assets. The magnitude of long-run elasticity of income as higher than unity can also be related to the declining trend of income velocity of M2 as well as a declining in the trend of inflation rates. Muhd-Zulhibri (2004) states that a larger than unity for the long-run income elasticity is common for developing countries.

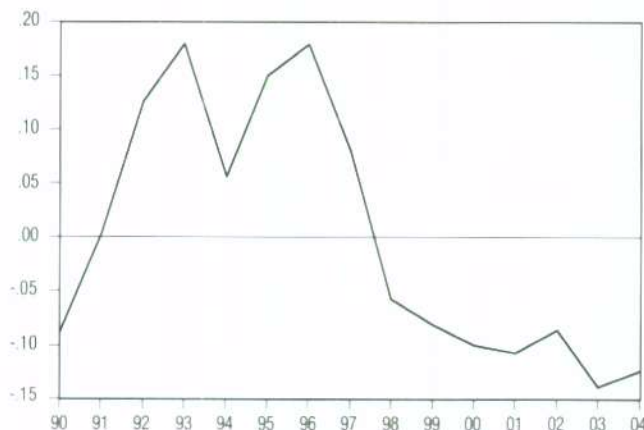
Even though the magnitude of deposits rates coefficient is found to be insignificant, as closer to zero, its positive sign is consistent with its inclusion as remuneration for holding money. However, as the elasticity of inflation rates is higher than the elasticity of deposits rates elasticity, we can indicate that individuals in Algeria have more motives to increase their holdings of money than other financial assets when inflation is high or expected to be high.

The coefficient of deposits rates has a positive sign as it represents the own return of money. However, the magnitude of the coefficient seems to be small, or rather inexistent, and not influencing real broad demand M2. The importance of the elasticity of income and the weak impact of deposits rates on money balances in Algeria may reflect that status of financial intermediaries. The payment system seems to be not developed to allow individuals to better economise on their transactions balances. It also implies that monetary wealth is not held within the financial system due either to the absence of attractive assets instruments or to the under-development of the payment system in the country. That is, interest rates in Algeria seem to be incapable of influencing money demand and affecting the portfolio decisions of individuals. This finding was mentioned by Knell and Stix (2004) who report that payment systems in less developed countries offer less alternative interest-bearing forms of money to currency, in which money demand would be less sensitive to variations in interest rates. In this case, we predict that individuals in Algeria do not tend to use interest rates as one factor influencing their decision to hold a certain quantity of money, due either to their levels or other reasons. Instead, it seems that these individuals might have been facing only two choices in which they hold their assets, either in currency or real assets, such as property.

The semi-elasticity of inflation rates (elasticity 1.3) is found to be important, reflecting the importance of inflation in real balances in Algeria. However, the positive sign of the coefficient seems to be inconsistent with findings in the literature and not in line with theoretical analyses. The theory states that in periods of (high inflation) individuals tend to hold their wealth in less liquid forms, and instead hold more real assets. In Algeria, it positive sign of inflation seems to reveal that individuals tend to hold more liquid assets regardless of inflation levels. Inflation seems to have not reached levels at which individuals would be prompted to hold real assets instead of liquidity. Or it may reflect that individuals in Algeria tend to hold more money to carry out their transactions rather than face inflation. Inflation might have not been reached levels that would lead individuals to sway away from liquidity holdings to real assets.

Another explanation for the positive sign of the elasticity of inflation as an indication of the positive relationship between real money balances and inflation is the liberalisation programme started in early 1990s in Algeria. The Algerian government initiated a programme of deregulation of funds and goods and services' prices. This deregulation resulted in massive increases in prices especially of basic and alimentary commodities, particularly during the first half of the 1990s. The lifting of the price subventions from the government budgets (in order to reduce budget deficit) prompted consumers and individuals to increase the quantity of held real money in order to compensate for the actual margin by which prices increased.

Even though our findings of the positive sign of the coefficient of inflation rates is not common in money demand literature, there are some studies that found positive coefficients for inflation. For instance, Bradhan and Subramanian (2002) estimate a money demand function for India and find that the long-run demand for real money is, among others, positively affected by the own rate for return for money and prices. Sriram (2002) states that the relationship between inflation and money demand is an empirical issue, and therefore, it is possible that inflation affects the demand for money positively. Sriram (2002) elaborates that when inflation rates are expected to increase individuals could increase their money holdings as a response to the expectation that their planned nominal expenditure would go up. Similarly, Dwyer and Hafer (1999) state that individuals hold money in order to exchange them for goods and services. If prices rise, individuals tend to hold more money in order to exchange it for the same amount for goods and services in order to cover for the decreased purchasing power of the money.

Figure 2: *Cointegrating relation Graph*

The cointegrating relationship represented in the demand for money function can be displayed graphically in Figure 2. Following the explanation reported by Bjornland (2004), Figure 2 displays the deviation of real model demand from the long-term cointegrating relationship presented in (4). The graph shows that excess money levels occurred during the period of 1991 to 1998, which is the period of structural adjustment programme implemented by the IMF.

The adjustment values (α) shown in Table 2 of the Appendix measure the speed of the short-run response to disequilibrium in each of the four equations. -0.39% measures the speed at which real M2 moves towards restoring the long-run equilibrium of our system; similarly, 8.92%, 0.01%, and 4.59% measure the speed at which real GDP, deposits rates and inflation rates respond to the short-term equilibrium in our cointegrating vector for our real money demand equation. The negative (positive) sign of an adjustment value implies that lagged excess money induces smaller (larger) holdings of current money, which is a "slow (rapid) adjustment".

The coefficients in the first column of α in report the feedback of effects of (lagged) disequilibrium in the cointegrating relationship onto the variables in the vector autoregression. The i th row of α , measures the contribution of the vector error-

correction model. The individual values of α_{ir} indicate the force with which the i th equation corresponds to disequilibrium to in the r th cointegrating relations. The larger the absolute value of α_{ir} , the faster the force of adjustment. A negative-signed coefficient implies slow adjustment too remaining disequilibrium. Thus, the coefficient associated with $\Delta \ln(M2)$ is -0.003938. Similar to Ericsson and Sharma (1996), if this adjustment level is considered low, it would imply that Algeria has been lacking the sufficient availability of alternative assets to M2, a typical characteristic of a financially-repressed system.

8. Weak Exogeneity test and Its Implications

Gujirati (2003, p701) states that "a variable X is *weakly-exogenous* if variable Y does not explain X ". That is, a variable is weakly-exogenous if another variable does not influence this weak-exogenous variable in a relational system. In other terms, Y_t is explained by X_t if X_t is weakly exogenous.

The weak exogeneity test is performed to test the null hypothesis that a variable is weakly exogenous at a critical level of 5%. We use the likelihood ratio test to perform the weak exogeneity test for the variables included in our system. The significance of the outcome of the test is measured using the Chi-square distribution with a number of degrees of freedom equal to the number of restrictions. The outcome of the test is presented in the cointegration results Table 2 in the appendix.

The weak exogeneity test results show that adjustments only take place in 2 equations in which Real GDP and inflation rates are endogenous variables. Significant corrections do not seem to take place in the equation for Real M and Deposits rates. Consequently, we only estimate a model for inflation rates. Therefore, a single equation of short-term inflation can be estimated with an error correction term included in the equation.

Using individual tests, the table shows that the weak exogeneity of real money and Deposits rates cannot be rejected at the at 5% significance level, whereas for the scale variable, real GDP, and inflation rates, weak exogeneity is rejected at the 5% significance level. This implies that we need to estimate an error-correction mechanism models for the short-term dynamics only for real GDP and inflation rates.

The non-rejection of weak exogeneity of money is also found in the literature on transition economics. For instance, Maliszewski (2003), who attempts to model inflation in Georgia, does not reject the weak exogeneity of money at 5% significance

level, while the weak exogeneity of prices is strongly rejected. Maliszewski (2003) interprets this result by stating that prices adjust to generate changes in real money balances to restore equilibrium in the real market. Budina et al. (2002) investigates money demand in Romania and found real money and inflation are not exogenous whereas income is exogenous. Budina et al. (2002) interprets this findings by that, in equilibrium, both price levels and real money are determined by the interaction of the supply and demand for money. Based upon this interpretation, the weak exogeneity of money and non weak exogeneity of inflation and output indicate that, in equilibrium, prices are determined by the interaction of income (demand) and output (supply).

The weak exogeneity of money aggregate M2 and the endogeneity of Real GDP and inflation rates would "invalidate" the quantity theory context to inflation (in the short-run). It would lead to conclude that the monetary aggregate (M2) in Algeria seems to be not under the full control of the monetary authorities. This may be explained by the size of the informal market (17% of GNP).

Table 2 shows that the hypothesis of weak exogeneity for real money aggregate (M2) and deposits rates cannot be rejected, whereas the hypothesis that weak exogeneity for real GDP and inflation rates tests can be rejected. The hypothesis of joint weak exogeneity of (money-deposits rates) and (real GDP-Inflation rates) is also tested. The table shows that the joint weak exogeneity of (money-deposits rates) cannot be rejected ($X^2(2) = 58.19$). However, the joint weak exogeneity of (real GDP-Inflation) is rejected at 5% significance level ($X^2(2) = 19.27$). Consequently, we can reveal that both real money and inflation rates variables have a long-run relationship. However, since the initial objective of this paper was to model short-term money demand function and since real money aggregate appears to be weakly-exogenous, we proceed to estimate an error correction model of inflation rates.

The estimation of the short-term inflation rates model using error correction model requires the determination of the cointegrating vector. Also, the estimation of the inflation rates short-term model shows how the adjustments mechanism operates to restore equilibrium to the long-run relationship when the system is disturbed by external shocks. The dynamics that influence the short-run inflation rates model are derived from the differenced forms of the variables used in the long-run. The ECM contains the one-lagged error term to capture the long-run dynamics in the short-run (excess money in the previous period). As the coefficient of the error term provides information on the magnitude of the adjustment (affected by the disturbance) in one period, its inverse shows how many periods later the effect of the disturbance fades.

Weak exogeneity tests are reported in Table 2. We find that the weak exogeneity of real money aggregate and deposits rates cannot be rejected, while it is rejected for both real income and inflation proxies. This finding can be interpreted as, in equilibrium, both the price level and real income are determined by the interaction of supply and demand for GDP (goods and services), whereas real money aggregate is not. This interpretation appears to be consistent with the analyses on restructuring and reallocation of GDP. Thus, one result of this study is that, over the period 1988-2004, inflation short-run dynamics in Algeria depend upon the supply and demand for GDP, rather than being a monetary phenomenon. The movements in annual rates of inflation in Algeria can be explained by an error correction vector or mechanism in which lagged real money and real output (at 1%), and changes in output and inflation (difference in lagged real output and EC (5%)) are significantly explanatory variables. (To estimate a model which includes several lagged differences and the level variables lagged once to capture long-term effects).

The finding of weak exogeneity of money demand and the endogeneity of inflation and real income seems to be consistent with some findings in the literature on economies in transitions. Inflation has been found weakly exogenous and a monetary phenomenon in developed industrialised countries, where the financial sector is very developed. That is, inflation is related to the structure of the economy and its causes tend to be related to cost-push or excess demand variables rather than monetary variables, at least in the short-run.

9. Short-term model and ECM Model for Inflation rates

The short-term model provides information about the speed and nature of adjustments that take place among the variables included in the system to restore equilibrium to the long-run level in response to short-term disturbances in demand for money. It represents an Error Correction (EC) term to ensure the long-run to ensure that the relationship is satisfied. As Real money variable is found to be weakly-exogenous, we estimate an EC equation from the cointegrating vector representing the Inflation rate equation.

Table 3 in the appendix reports the results of the VEC model taking into consideration a number of restrictions related to the insignificance of a several variables.

$$D(\pi) = -0.3942 - 0.0963^* M_{t-1} + 0.1230^* Y_{t-1} - 0.4408^{***} D(\pi_{t-1}) + 0.0714^* D(M_{t-1}) - 0.2618^{***} D(Y_{t-1}) + 2.2412^{***} D(R_{t-1}) - 0.4741^{***} ECM + 0.21120^{***} D \quad (5)$$

Equation (5) of inflation provides information about how the dependent variable, inflation rates, adjusts to restore long-run equilibrium in one period as a reaction to external shocks through the EC term. Mutluer and Barlas (2002) and Muhd-Zulhibri (2004) state that the EC term carries a negative sign and is not higher than unity. The inverse of the coefficient of EC represents the number of periods later the effects of the disturbance fades away (Mutluer and Barlas, 2002). Deriving from the explanation made by Muhd-Zulhibri (2004) who estimates a money demand EC term, a significant EC term for an inflation model reflects the inflation that individuals would correct in the present period a proportion of previous disequilibrium inflation. It, thus, represents excess inflation in the previous period. The EC term in our model (47.41%) is found to show a moderate adjustment of inflation towards its equilibrium level indicating that 47.4% feedback from the previous period into the short-run dynamic process. For comparison, Laryea and Sumaila (2001) found inflation EC term to be rapid at the level of 76% for the Tanzanian case.

Equation (5) also shows that the coefficient of output is significant at 5%, whereas the coefficient of money is not. In addition, the coefficient of Money (7.14%) is found to be lower than the coefficient of output (26.18%). Therefore, income and output can be both used to explain the inflationary process in the short-run in Algeria. That is, structural factors and factors influencing output and the distribution of outcome seem to be more important in explaining inflation in Algeria.

The coefficient of the EC term is found to be significant at 5% critical level and have a negative sign. The magnitude of the EC term indicates that 47.41% of the equilibrium is eliminated every year, and it takes nearly two years so the effects of the disequilibrium fade away. If inflation last year was 10% higher than it would have been expected given the values of M and GDP last year, the coefficient on the EC term would produce a negative value for $D(\pi)$ of -4.741%. In other words, inflation would be expected to fall by 4.7%. That is, the adjustment in inflation for the case of Algeria seems to be moderate in comparison with other estimates in developing countries (see literature listed in References)

There are a number of observations that can be made from the short-term model of inflation. First, as the error correction term coefficient is found to be significant at 5% critical level, we can conclude that there is cointegrating long-run relationship between the variables included in our system; the significance of change in inflation

equation reveals that short-run inflation is explained by inertia at 10% significance level (its own lag) in addition to other variables. Second, the error correction coefficient for the inflation equation (47.41%) is found to be significant with a negative sign implying a slow adjustment. However, following Altunkemer (2004) who found similar coefficient to be -0.466, tends to describe this magnitude as "moderate". That is, there is a 47.4% feedback from the previous period unto the short-run dynamic process.

The significance of the coefficient model of ECM implies that the cointegrating relationship between the variables is valid. Second, the ECM coefficient of 0.4741 implies that when an external shock disturbs the equilibrium condition, 47.41% of its effects is adjusted in one period. The inverse of the EC term indicates that it would take approximately two years for the disturbance effects to fade away.

Equation (5) also indicates that short-term elasticity of money is significant but smaller in magnitude compared to real output's elasticity. This may infer that the inflationary trend in Algeria over the defined period can be explained more by output factors rather than monetary factors. This would lead us to conclude that inflation in Algeria is a phenomenon generated by real factors and imbalances between aggregate demand and supply in output and income.

The diagnostic tests reported in Table 4 in the appendix show no connection with autocorrelation, heteroscedasticity, and normality affecting the residuals at 5% level. Therefore, the model results can be applicable. However, we cannot perform a constancy and stability test due to the small sample of observations under study. Table 4 shows no predicament with autocorrelation, heteroscedasticity effect and normality concerning the residuals. Hence, the model specification and results can be applied to the Algeria.

10. Policy Implications and Conclusion

The finding of the importance of inflation and endogeneity in our study may infer that, for the case of Algeria, inflation targeting is more appropriate for monetary policy rather than putting a target on money aggregate. On the other hand, the Algerian policy-makers should concentrate on finding remedies to the structural aspects of the economy, as inflation is found to be related to the supply and demand for output. Also, the exogeneity of money aggregate would infer that

money quantities circulating in Algerian markets are not under the control of the monetary authorities due to the importance of the informal market.

This paper shows that the effect of monetary policy upon inflation is rather limited or restricted, from either monetary aggregate or interest rates. On the other hand, the relationship between prices and output is found to be strong in this paper. Similar to Laryea and Sumaila (2001), the government should concentrate on reducing inflation in the short-run by affecting real factors. The government should increase output, especially alimentary output, and review its policy of income distribution. That is, the inflationary process in Algeria tends to be driven by demand-side and supply-side factors. A similar finding was found by Leheyda (2004) who investigates the determinants of inflation in Ukraine and finds no significant effects from the monetary policy on the inflationary process. Leheyda (2004) states the non-relationship between money and inflation seems to be associated with the case of countries in transition.

This study finds that the demand for money M_2 in Algeria seems to be significantly inelastic with respect to deposits interest rates. This finding implies that interest rates cannot be used to influence inflation due either to the weakness of the financial sector and the investment sector as a whole. Also, one finding of this paper is that money seems to be exogenous. That is, the quantity of money circulating in Algeria seems to be not under the total control of the monetary authorities. This finding is supported by unofficial press statistics that the black market, which is outside the financial sector, represents more than 20% of GNP. That is, the Algerian government should work to bring the black market under its control. Finally, inflation is found to be not a monetary phenomenon in Algeria and rather related to the structure of the Algerian economy. Inflation was triggered by the programme of financial liberalisation, and is related to the under-productivity of the economy.

In this paper, we used the cointegration approach to estimate a money demand function for Algeria over the period 1988-2004. The results indicate that there is a long-run cointegrating relationship (equilibrium) for real broad money (M_2) in Algeria. The long-term cointegrating vector indicates that income elasticity is larger than unity, a finding that is consistent with empirical findings in the literature. In addition, the results indicate a positive relationship between real money and all of real GDP, deposits interest rates and inflation rates. While real GDP is retained to proxy for the scale dimension, deposits interest rates and inflation rates are retained to control for own rate of money and opportunity cost of holding

money, respectively. However, the finding of positive relationship between real broad money and inflation rates is not popular in the literature, it may imply for the case of Algeria, that money balances increase with prices. The results also show that real money is weakly exogenous, while inflation rates and outputs are not. This finding implies that inflation rates in Algeria are not determined by monetary factors; instead, they are determined by structural factors related to the demand and supply of output.

Finally, as Algeria is heading towards a fully-fledged market-based economy, we recommend that money demand equations in Algeria to be under continuous revision and scrutiny. We recommend, as this paper suffers from using a sample of observation with low frequency, whenever opportunity is available, to reconstruct the model with the utilisation of higher (quarterly) frequency data.

References

- Bjornland H.C. (2004), "A Stable Demand for Money despite Financial Crisis: the case of Venezuela", Department of Economics, University of Oslo.
- Bradhan B. and A. Subramanian (2002) "On the Stability of Demand for Money in a Developing Economy: Some Empirical Issues", *Journal of Development Economics*, 72, pp. 335-351.
- Browne F.X. and G. Fagan. and J. Henry (1997), "Money Demand in EU Countries: a Survey", *European Monetary Institute Staff Paper No. 7*.
- Budina, N., and W. Maliszewski and G. De Menil and G. Turlea (2002), "Money, Inflation and Output in Romania, 1992-2000", Working Paper No. 2002-15, CNRS, Paris.
- Dwyer Jr G.P. and R.W. Hafer (1999), "Are Money Growth and Inflation Still Related", *Federal Reserve Bank of Atlanta, Economic Review, Second Quarter*, pp. 32-43.
- Ericsson N.R., and S. Sharma, (1996), "Broad Money Demand and Financial Liberalisation in Greece", Board of Governors of the Federal Reserve System, *International Finance Discussion Papers*, November, No. 559.
- Gujarati D.N. (2003), "Basic Econometrics", 4th Edition, McGraw-Hill Companies.
- Harris R. (1995), "Cointegration Analysis in Econometric Modelling", Prentice Hall, Harvester Wheatsheaf.
- Knell M. and H. Stix. (2004), "Three Decades of Money Demand Studies: Some Differences and Remarkable Similarities", June, Oesterreichische Nationalbank.
- Kogar Ç. I. (1995), "Cointegration test for Money Demand: The case of Turkey and Israel", *The Central Bank of the Republic of Turkey, Discussion Paper No. 9514*.
- Koranchelian T. (2003), "Monetary Demand and Monetary Policy: Evidence from Algeria", (pp. 20-36), in Lazare et al. (2003), "Algeria: Selected Issues and Statistical Appendix", IMF, Middle Eastern Department, Country Report No. 03/69.
- Laryea. S.A., and U.R. Sumaila (2001), "Determinants of Inflation in Tanzania", WP 2001:12, Chr. Michelsen Institute, Development Studies and Human Right, Norway.
- Leheyda. N. (2004), "Determinants of Inflation in Ukraine: a Cointegration Approach", CDSEM, University of Mannheim.
- Maliszewski W. (2003), "Modelling Inflation in Georgia", IMF Working Paper No. 03/212.
- Muhd-Zulhibri A. (2004), "Reassessing the Stability of Broad Money Demand in Malaysia", *Central Bank of Malaysia*.
- Mutluer, D. and Y. Barlas (2002), "Modelling the Turkish Broad Money Demand", *Central Bank of Turkey, Central Bank Review*, No. 22, pp. 55-75.
-

Sriram, S.S. (2001), "a Survey of Recent Empirical Money Demand Studies", IMF Staff Paper, Vol. 47, No. 3, pp. 334-365.

Sriram S.S. (2002), "Determinants and Stability of Demand for M2 in Malaysia", Journal of Asian Economics, 13, pp-337-356.

Stock J.H. and M.W. Watson (2001), "Vector Autoregressions", Journal of Economic Perspectives, Vol. 15, No. 4, Fall 2001, pp. 101-115.

APPENDIX

Table 1: Unit Root Results: ADF test

Levels						
Trend/Constant/None	Constant		Constant and Trend		None	
Variables	ADF	Number of lags	ADF	Number of lags	ADF	Number of lags
M	-1.9092	6	-3.6357***	6	0.8019	6
Y	-0.8329	6	-2.9761	6	2.3423	6
R	-0.7070	6	-1.1063	6	-0.6259	6
π	-1.0386	6	-1.7481	6	-0.9748	6
1 st Difference						
Trend/Constant/None	Constant		Constant and Trend		None	
Variables	ADF	Number of lags	ADF	Number of lags	ADF	Number of lags
M	-2.9750***	6	-3.0037	5	-2.2346**	6
Y	-1.5439	6	-3.1283	5	-2.6530**	6
R	-2.6348	6	-3.6923***	5	-2.7101**	6
π	-2.2590	6	-2.4277	5	-3.1714*	6

*significant at 1%

**Significant at 5%

***significant at 10%

Table 2: Cointegration Analysis

Cointegration Rank test (Trend assumption: Linear deterministic trend)				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesised No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value 5%	Prob.**
None *	0.989748	95.78018	47.85613	0.0000
At most 1	0.666110	27.07595	29.79707	0.0998
At most 2	0.472692	10.62180	15.49471	0.2359
At most 3	0.065880	1.022255	3.841466	0.3120
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesised No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value 5%	Prob.**
None *	0.989748	68.70423	27.58434	0.0000
At most 1	0.666110	16.45415	21.13162	0.1994
At most 2	0.472692	9.599543	14.26460	0.2396
At most 3	0.065880	1.022255	3.841466	0.3120
Standardised Eigenvalues: Unrestricted Cointegrating Coefficients				
	M	Y	R	π
β	1.908336	-2.438270	-0.043686	-19.82890
β	-10.42244	8.738569	-91.22818	-4.276359
β	5.689369	-3.553044	-23.10347	7.380668
β	2.087707	-11.56018	10.35077	17.40537
Unrestricted Adjustment Coefficients (alpha)				
D(M)	-0.002064	-0.010435	-0.028856	-0.009232
D(Y)	0.046723	-0.017618	-0.034184	0.010071
D(R)	-5.76E-05	0.011275	0.002053	0.001488
D(π)	0.024037	0.025987	0.015348	4.81E-05
Normalized cointegrating coefficients (standard error in parentheses)				
M	Y	R	π	
1.000000	-1.277694*	-0.022892	-10.39068*	
	(0.18559)	(1.22455)	(0.50607)	
Adjustment coefficients (standard error in parentheses)				
D(M)	D(Y)	D(R)	D(π)	
-0.003938	0.089164**	-0.000110	0.045871**	
(0.03828)	(0.04526)	(0.01031)	(0.02629)	
Weak Exogeneity test				
	M	Y	R	π
X2 (1)	0.0197	5.8771**	0.0002	4.7412**
Joints Weak Exogeneity test				
	Y/R/ π	M/R	Y/ π	
	58.1887*	0.0340	19.2711*	
Significance of Betas				
	Y=1, M=-1			
	3.2030***			

Trace test and Max-eigenvalue test indicate 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 5% level.

**McKinnon-Haug-Michelis (1999) p-values.

Table 3: Vector Error Correction Estimates for Inflation

Cointegration Restrictions:				
B(1,1)=1, B(1,4)=0, A(2,1)=0, A(4,1)=0				
Chi-square(3)	0.034442 (Probability 0.998317)			
Cointegrating Equation				
$\pi(-1)$	M(-1)	Y(-1)	R(-1)	C
1.000000	-0.096258	0.123014	0.000000	-0.371724
	(0.01486)	(0.01887)		
	[-6.47586]	[6.52023]		:
Error Correction:				
	D(π)	D(M)	D(Y)	D(R)
CointEq1	-0.474088	0.000000	-0.935583	0.000000
	(0.13788)	(0.00000)	(0.45369)	(0.00000)
	[-3.43848]	[NA]	[-2.06216]	[NA]
$\Delta(\pi(-1))$	-0.440808	0.823177	-0.044687	-0.070834
	(0.33378)	(0.48588)	(0.57437)	(0.13083)
	[-1.32067]	[1.69418]	[-0.07780]	[-0.54143]
$\Delta(M(-1))$	0.071430	0.202123	-0.413846	0.074336
	(0.30108)	(0.43829)	(0.51811)	(0.11801)
	[0.23724]	[0.46116]	[-0.79876]	[0.62990]
$\Delta(Y(-1))$	-0.261762	0.623154	-0.342203	-0.162600
	(0.20960)	(0.30512)	(0.36069)	(0.08216)
	[-1.24885]	[2.04231]	[-0.94875]	[-1.97915]
$\Delta(R(-1))$	2.241191	-4.166685	1.154065	0.728818
	(1.23319)	(1.79518)	(2.12211)	(0.48337)
	[1.81739]	[-2.32104]	[0.54383]	[1.50780]
Constant	-0.022520	0.041190	0.071142	-0.003206
	(0.02494)	(0.03631)	(0.04292)	(0.00978)
	[-0.90295]	[1.13450]	[1.65759]	[-0.32791]
DUMMY9192	0.211965	-0.245874	0.105647	0.039178
	(0.06749)	(0.09824)	(0.11614)	(0.02645)
	[3.14078]	[-2.50269]	[0.90969]	[1.48106]
R-squared	0.674960	0.780065	0.443742	0.481281
Adj. R-squared	0.431180	0.615114	0.026548	0.092241
Sum sq. resids	0.022784	0.048283	0.067470	0.003500
S.E. equation	0.053367	0.077688	0.091836	0.020918
F-statistic	2.768728	4.729074	1.063635	1.237100
Log likelihood	27.38888	21.75637	19.24680	41.43769
Akaike AIC	-2.718518	-1.967516	-1.632906	-4.591692
Schwarz SC	-2.388095	-1.637092	-1.302483	-4.261268
Mean dependent	-0.003667	0.046667	0.050667	-0.003667
S.D. dependent	0.070760	0.125224	0.093080	0.021955
Determinant resid covariance (dof adj.)	3.81E-13			
Determinant resid covariance	3.08E-14			
Log likelihood	148.1728			
Akaike information criterion	-15.48971			
Schwarz criterion	-13.97920			

Table 4: Diagnostic Tests

VEC Residual Serial Correlation LM Tests H0: no serial correlation at lag order h, (df:16)		
Lags	LM-STAT	Prob.
1	25.70277	0.0584
Normality test		
Jarque-Bera	df	Prob.
11.29555	8	0.1855
VEC Residual Heteroscedasticity Tests: No Cross Terms (only levels and squares)		
Chi-sq	df	Prob.
118.8456	110	0.2657

Abstract:

Cointegration methodology is employed to estimate a money demand function for Algeria, using data for the period 1988-2004. Evidence is found of a long-run cointegrating (equilibrium) relationship between real income, the rate of inflation and real broad money (M2). The estimated income elasticity is larger than unity. There is no relationship between the deposit rate and real broad money, but there is a positive relationship between the rate of inflation and real broad money. The finding that the demand for money responds positively to an increase in inflation is uncommon but not unique in the previous literature for transition economies. A null hypothesis of weak exogeneity is not rejected in the case of real money, but weak exogeneity is rejected in respect of real income and inflation. This finding suggests that inflation in Algeria is not determined by monetary conditions; instead, inflation appears to be driven by structural conditions related to aggregate demand and aggregate supply.

Key Words: Money demand, Algeria, Cointegration