

150

THE DEMAND FOR MONEY IN ALGERIA

by

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List of Figures

	Page
Behavior of stock of money and Income	40
Behavior of stock of money and price level	48
Behavior of currency and time deposits ratios	58
Evolution of the components of M	59
Behavior of Velocity	72

List of Tables

	Table	Page
Real GDP, price level and their respective yearly increases	4-1	49
Currency and time deposits ratios with their respective percentage yearly increases	4-2	57
Percentage change in the annual average velocity of M, real GDP, per capita real GDP and population	5-1	70
Percentage change in the annual average stock of M_2 , real investments, price level and real GDP	6-1	80

Table of Contents

	Page
Introduction	1
Chapter 1, The Theory of the Demand for Money:	
Some theoretical evidence	6
A - The Quantity Theory of Money	6
1 - The traditional quantity theory	6
of money	6
2 - The transaction approach	7
3 - The Cambridge cash balance approach	8
B - The Keynesian monetary theory	10
1 - Transactions demand for money	12
2 - Speculative demand for money	14
C - The monetary theory of M. Friedman	15
Chapter 2, The Demand for Money in LDCs:	
Some empirical findings	19
A - The demand for money: some results from	21
LDCs	21
B - The demand for money in two Latin	27
American economies	27
C - Some general conclusions about demand	31
for money in LDCs	31
D - Behavior of velocity in LDCs	32
Chapter 3, Monetary Policy in Algeria: a brief	
overview	39
Chapter 4, The Study of the Demand for Money in	
Algeria	47
A - The Demand for money: some empirical	49
results	49
1 - Definition of the variables	50
2 - The data	51
B - Analysis and results of the model	51
1 - The demand for money	51
2 - The demand for currency and deposits	56
Chapter 5, Behavior of Velocity in Algeria	66
A - Behavior of Velocity: Some theoretical	66
evidence	66
1 - The long-run behavior of velocity	67
2 - The cyclical behavior of velocity	69
B - Behavior of velocity in Algeria	70
C - Some empirical results	74

	Page
Chapter 6, Determinants of Inflation in Algeria	79
A - Inflation in developing countries: some characteristics	79
B - Growth and inflation in Algeria	82
1 - External factors	83
2 - Internal factors	84
C - Some empirical results	89
1 - A monetarist model	89
2 - A structural model	90
Conclusion	94
Bibliography	96

Introduction

In a modern economic system, money has an important influence on the level of economic activity; and monetary policy has to be considered as an aspect of overall economic policy because it is not an independent entity operating by itself. In this context, monetary policy must be regarded as being part of overall economic objectives.

In the specific case of less developed economies, the objective of money and monetary policy must be to help to accelerate the process of development in an environment of reasonable price stability. This monetary policy to be effective requires monetary and credit organization, geographically well spread and functionally varied and in harmony with the social and economical needs of the public in general. In order to conduct such monetary policy, it is necessary to find out the determinants of the demand-for-money function because it is only on the basis of such knowledge that monetary policy can be pursued effectively. However, given the nature of economic development between developed and less developed nations, and also given the relatively good knowledge of monetary economics in developed nations we may seek answers to questions such as:

- Does the form of the demand for money in less developed economies differ from that existing in the developed economies?

- Is it true that theoretical relationships which explain monetary behavior and conclusions on the interpretation of monetary experience in the developed economies hold for the economies of the less developed countries as well?

Answers to such important questions might be found in cross-section studies where findings from developed and less developed economies could be compared. Although such comparisons could be misleading because of some economic and technical limitations, it is generally believed that such action is worthwhile. The economic limitations might be identified, for instance, with the choice of variables used in the model. For example is the theoretical argument making, say, the interest rate a reasonably justifiable variable in the model of the demand for money in developed countries would also work for the demand for money model in a developing country where the interest rate does not reflect the market forces of supply and demand, and the same reasoning might hold true for other variables. The technical limitations reside in the fact that any such studies for either group of countries face statistical difficulties.

Another way of checking the "validity" of the economic tools used in determining the demand for money in a specific developing economy is to try to compare its empirical findings with the "standard" results of a typical demand-for-money function of a developed economy.

From different studies, findings suggest that while there is a wide scope of generalization about the desired money holdings, differences in the demand-for-money function can be found, although existing they are not believed to be decisive. This specific point will be dealt with with more attention in Chapter 2 after a brief presentation of the theoretical basis of the demand-for-money function in general. Also because of the close interrelationship between velocity and demand for money some empirical results of the behavior of income velocity in developing economies will be considered in Chapter 2. After that, Chapter 3 will be dealing with monetary policy in Algeria, and a special emphasis will be put on the strategy of development in terms of investment policy which is believed to be a "certain" way toward industrialization at the image of developed economies. Following that, some theoretical findings about the demand for money in Algeria will provide an answer to the question whether demand for money in Algeria is an intermediate case or not; by intermediate case it is meant that the demand for money is explained by both expected price changes and expected income. This might be expected given the fact that the Algerian economy underwent a period of secular increase in real income accompanied by a relatively substantial rise in the price level (over 8 percent per year on the average), and this will be the content of Chapter 4. Because of the general downward trend of velocity in Algeria for the period covering 1964-80, a

relatively close look will be taken to the behavior of velocity, and some empirical findings will also be considered. Finally and as a consequence of a parellel between an increasing rate of inflation, an enormous supply of money and a tremendous volume of investments carried through economic plans, a brief and simple investigation of the cause of inflation in Algeria will be conducted. In this context, the theory stating that inflation is a monetary phenomenon will be tested with an alternative structuralist model.

Chapter I

The Theory of the Demand for Money: Some Theoretical Evidence

A. The Quantity Theory of Money:

The "quantity theory of money" is rather a vague notion; "the quantity theory of money is a term of a general approach rather than a label for a well defined theory. The exact content of the approach varies. . ." [3]. Generally speaking, it is the theory of price levels. The "naive" theory is translated as the hypothesis of a proportional relationship between the stock of money and the price level. A more refined theory states that this simple relationship (between the stock of money and the price level) could be disturbed by changes in the level of output or the desire of economic agents to hold money. This modern quantity theory is mainly associated with Professor M. Friedman and some of his students. To get a better understanding of this theory, a review of preceding versions of the quantity theory may be enlightening.

1. The Traditional Quantity Theory of Money:

Based on the classical assumptions of flexible prices and wages which in conjunction with Say's Law implied a normal equilibrium condition of full employment, and given a short period of time, both output and velocity are stable. In these extreme conditions, it was held that a given change in the stock of money would result in an exact proportional change in the price level. Although this rigid formulation

of the theory is far from being a correct image of the "real economic world" because of the continuous fluctuations in output and velocity, the "naive" version can be regarded as a starting point for sophisticated developments of the quantity theory.

Faced with such severe limitations the classical economists started looking for the reasons that make people hold money and also the secret behind the behavior of velocity.

2. The Transaction Approach:

Irving Fisher (1911) began his analysis with a simple identity, that is, for the aggregate economy, the value of sales must equal the value of receipts. This famous equation took the mathematical form: $MV=PT$, where M is the total stock of money, V its velocity of circulation (number of times it turns over), T the volume of transactions and P the general price level. This identity says that the money supply times its velocity (money side of the equation) must equal the nominal value of real output at current prices (goods side). Among the four variables of the identity, velocity (V) is rather the difficult one to predict because it is influenced by more than one factor. Fisher's classification of the elements that do cause changes in velocity are:

1. Habits of the individuals toward the use of book credit and checks rather than money.
2. System of payments in the community.
3. General causes (e.g. density of population, rapidity of transportation) [2].

Although Fisher did not explicitly consider V as a constant, he did view it as constant in equilibrium, an equilibrium to which it would get back, fairly rapidly, after a disturbance [3]. In addition if T is taken as given following a full-employment situation, the equation of exchange can be translated into the quantity theory of money, a theory of determination of the price level that can be represented by:

$$M\bar{V} \equiv P\bar{T} \quad (1)$$

or

$$P \equiv M \frac{\bar{V}}{\bar{T}}$$

$$\therefore \Delta M \Rightarrow P$$

The bars over V and T indicate that they are constants in the short run. Implicitly from (1) it could be argued that the demand for money (with the assumption that supply equals demand for M) depends upon the transactions that are conducted in the economy. Fisher did not limit his analysis to currency (M); he also used M' , the quantity of demand deposit with V' as velocity for D.D.s.

$$PT = MV + M'V' \quad (2)$$

In connection with the demand for money, if we assume that total transactions and velocity in (2) are constant over a short period of time (which is probably the case), and also if we consider that there is a stable relationship between total transactions and national income in the short-term period, we end with the conclusion that the transactions approach tends to lead to the hypothesis that the

demand for money is a constant proportion of the level of national income (PY). That is the demand for money depends only upon the level of income and prices.

3. The Cambridge Cash Balance Approach:

An alternative formulation of the traditional quantity theory was provided by the Cambridge School. The cash balance approach was led by Marshall, Pigou, Robertson and Keynes, whose theory did not pretend to be in disagreement with Fisher's findings. While Fisher's approach was stating that the demand for money arises as a result of the need of individuals to trade with one another, it related the demand for money with total transactions, the Cambridge economists were focusing on what determined the fraction of money an individual would desire to hold in order to conduct the necessary transactions. Fisher had an analysis in macroeconomic theory of money but the Cambridge economists were interested in the individual's demand for money. Their approach involved the application of general demand analysis to the special case of money demand into the utility of money, the nature of the budget constraint facing the individual, and the opportunity cost of holding money as opposed to other assets. In these conditions the utility of money comes from two factors. First because money holdings provide a degree of security against future uncertainties.

In fact, an individual cannot hold all the money he desires because he is faced by a budget constraint represented by total income or wealth. In addition, within the

limits of the budget constraint, the actual proportion of income or wealth held by an individual in a form of money depends upon the yield of money in relation to the yield on other assets to be chosen from.

In short, for the Cambridge School, the opportunity cost of holding money consists of the rate of interest, the yield on real capital and the expected rate of inflation. These three yields could be regarded as an image of the nature of the composition of individual wealth.

The Cambridge approach to the theory of the demand for money amounts to a general function of the form:

$$M_d = L(W, PY, i, u, \dots)$$

where W =wealth, PY =money income, i =interest rates, u =utility of money.

Among these variables, the most important seems to be PY , the money income. Thus, the demand for money would be represented as a constant portion of income, that is,

$$M_d = k(PY)$$

In equilibrium conditions, the supply of money equals the demand for money

$$M_s = M_d$$

hence,

$$(*) \quad M_s \left(\frac{1}{k} \right) = PY \text{ with } \frac{1}{k} = V$$

$$(*) \quad MV = PY$$

The transformed Cambridge equation (*) looks similar to Fisher's identity, except that V stands for income velocity in contrast to transactions velocity used by Fisher.

By calling attention to more variables such as utility, interest rates. . . in the demand-for-money function, even though not included in the formal version of the function, the Cambridge economists went one step beyond Fisher's analysis of the demand for money.

In response to the classical quantity theory, which was mainly viewed as a long-term analysis, Keynes focused his efforts on the short-run because "in the long-run we are all dead."

B. The Keynesian Monetary Theory:

Given the assumption of wage and price flexibility, the economy, as viewed by the quantity theorists, was self-adjusting and could maintain a tendency towards continuous full-employment equilibrium. But Keynes argued that this classical self-adjusting mechanism could fail to hold because of several reasons. For one reason, wages and prices might not be flexible, for another, the occurrence of the "liquidity trap" would lead to an unemployment equilibrium.

Keynes (1936) started his analysis from the Cambridge approach to the problem of the demand for money. By recognizing the "transactions motive" as the first factor entering in the demand-for-money function, Keynes postulated that the "transactions" demand for money was proportional to the level of income. In addition, he also recognized the importance of the "precautionary motive" for holding money. His major contribution was probably the emphasis he put on the "speculative" demand for money. Keynes made the

transactions and precautionary demands for money functions of the income level [9]. In developing the speculative demand for money, rather than dealing with uncertainty, Keynes concentrated his analysis on one economic variable--the expected rate of interest. From the expected behavior of the interest rate (increase or decrease), the demand for money would behave inversely. To get to this result Keynes used what was referred to as the "normal" rate of interest. He argued that when the actual rate was above the normal rate there would be a tendency for people to expect it (the actual rate of interest) to fall and, when it was below that level, to expect it to rise. In these conditions an individual would expect capital gains and interest income when the actual rate of interest is expected to fall, or he would anticipate capital losses when this rate is believed to rise. Up to this point, the Keynesian demand for money can be represented by the summation of M_t , the transactions demand, M_p , the precautionary demand and M_{sp} , the speculative demand

$$M_d = M_t + M_p + M_{sp}.$$

In connection with the close relationship between the three motives Keynes stated that "Whilst the amount of cash which an individual decides to hold to satisfy the transactions-motive and the precautionary-motive is not entirely independent of what he is holding to satisfy the speculative-motive, it is a safe approximation to regard the amount of these two sets of cash-holdings as being largely independent of one another" [7].

Thus, by grouping the first two demands we get:

$$M_d = M_{tp} + M_{sp}$$

Using Keynes' notation, the demand for money will be:

$$M = M_1 + M_2 = L_1(Y) + L_2(r).$$

This implies that the transactions and precautionary motives are functions of the level of income and the speculative motive is a function of the rate of interest prevailing (*).

Thus L_1 is the liquidity function corresponding to the level of income Y , and L_2 the liquidity function corresponding to r .

1. Transactions Demand for Money:

As postulated by Keynes, the demand for money depends on two determinants which are quite far from being closely related. Thus the analysis of the motives separately would lead to more explicit results. The transactions demand was made a function of the practices that govern the receipts and expenditures of income. Following Keynes, Baumol (1952) [1] and Tobin (1956) [10] introduced more developments concerning the transactions demand for money. Baumol analyzed the money holding decision of a hypothetical individual who gets his income at a defined interval (of time) and spends it over the given period on a regular basis. The individual compares the costs and benefits of holding his revenue (M_1) instead of the savings deposits. The main cost of M_1 is

(*) Keynes put together all the assets (other than money) and called them "bonds" and r represents the rate of interest on these bonds.

the foregone interest rate on savings (r) when the income is held under the form M_1 instead of savings accounts. The major advantage of keeping M_1 is the avoidance of what Baumol calls the "broker's fee" of b dollars charged every time (T) cash is obtained either by cashing the original paycheck (income) or by obtaining cash from the savings account.

The number of times the broker's fee is incurred is equal to the size of income Q divided by the average amount of cash obtained each time (C). Thus the total cost of holding money balances would be:

$$\begin{aligned}\text{Cost} &= bT + r \frac{C}{2} \\ &= b \frac{Q}{C} + r \frac{C}{2}\end{aligned}$$

To minimize the cost of holding M , we need to take the partial derivative of the above equation with respect to C , which is

$$C = (2bQ)^{\frac{1}{2}} (r)^{-\frac{1}{2}}$$

Because money holdings over the period have an average $C/2$, the demand-for-money would be then

$$\begin{aligned}M_d/P &= C/2 \\ \text{that is } M_d &= \alpha b^{\frac{1}{2}} Q^{\frac{1}{2}} r^{-\frac{1}{2}} \\ \text{with } \alpha &= \sqrt{\frac{2}{2}}\end{aligned}$$

From his analysis, Baumol shows that the transactions demand for money is dependent on the rate of interest, in addition to the income level. Tobin dealt with the same problem, but from another angle, which was the combination of average bond holdings and the interest rate that maximizes the

individual's interest earning (earnings net of transactions costs). Tobin's model provided results quite similar to those of Baumol.

2. The Speculative Demand for Money:

The Speculative motive for holding money arises because the capital value of money is independent of the rate of interest. First Keynes suggested that each person would form an expectation of future interest rate and consequently would decide to hold either bonds or cash. If different persons had different expectations about future interest rates, there would be a smooth relationship between the speculative demand for money and the interest rate for the community as a whole. But Tobin (1958) [11] demonstrated the smooth relationship between the speculative demand for money and interest rate applied to each individual person. This demonstration of a diversified portfolio was based on the assumption that an individual would desire to maximize the utility from his wealth and would seek to avoid the risk associated with holding his wealth in various forms. In that situation the risk would be minimized if the portfolio consisted of cash only, and would be maximized if the entire holdings were bonds. However, despite the risk, a portfolio that contained bonds would be regarded as an explicit additional income from capital gains and interest income if the interest rate were to fall and capital losses if the interest rate were to rise above the current rate, and this because Tobin regarded the "normal" rate as the current one.

Tobin assumed that the expected value of capital gain or loss would be equal to zero, because the wealth owner is as likely to regard the interest rate as going to increase as decrease regardless of its current level. Thus the investor would make a compromise between safe and risky assets and his optimal combination of assets (money and bonds) would depend on his subjective choices between the utility from his expected wealth and his aversion of risk.

The optimum, or utility maximizing portfolio for an individual would result when his subjective trade-off is equal to the objective or market trade-off.

In summary, Tobin's clarification permitted the derivation of a schedule for speculative balances and explained a diversified portfolio which could be observed in the real economic world. His argument was based on the wealth level of an individual, the current rate of interest and the expected risk of changes in the capital value of bonds.

C. The Monetary Theory of Milton Friedman [4]:

At almost the same time that Tobin introduced the concept of the portfolio approach, Friedman came with the revival of the quantity theory. He treated money in the same way any durable good would be treated. While Keynes viewed money as an asset that can be used for speculative purpose, Friedman considered money as one way a person would keep his wealth, and demand for money was based upon total wealth, and the income obtainable from holding this wealth in different forms. Viewed under this angle "the analysis of

demand for money on the part of the ultimate wealth-owning units in the society can be made formally identical with that of the demand for a consumption service" [5].

According to Friedman's restatement of the quantity theory, the real demand for money can be written as:

$$\frac{M_d}{P} = L (r_b, r_e, \frac{1}{P} \frac{dP}{dt}, w, Y/p, u)$$

That is the real demand for money is a function of the returns on bonds and equities, the changes in the price level, the ratio of nonhuman to human wealth, a form of permanent income and tastes and preferences.

The main characteristics that distinguish this form of demand for money from any others are:

1. The stability and importance of the demand for money.
2. The independence of the factors affecting demand from those affecting the supply of money.
3. The independent variables that enter in the demand-for-money function (especially permanent income).

In other words, the main distinction of the modern quantity theory is that the demand for money is supposed to be a stable function because it is mainly a function of permanent income which is a stable variable. However the potential importance of the variables that enter in this demand-for-money equation is rather a matter of empirical findings.

In his empirical study "the Demand-For-Money: Some Theoretical and Empirical Results" [6] Friedman found that: "For twenty cycles, measured from trough to trough and

covering the period from 1870 to 1954, the simple correlation between the logarithm of the real stock of money per capita and the logarithm of real income per capita is 0.99 and the computed elasticity is 1.8."

Given this brief necessary presentation of some theoretical evidence of the theory of the demand for money, we can proceed with the study with some empirical results of the demand for money in developing countries with the assumption that this theoretical evidence holds in the developing economies.

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Chapter II

The Demand for Money in LDCs: Some Empirical Findings

Before dealing with specific empirical findings, a general overview of the principal variables that enter in the demand-for-money functions could be an interesting guide. Also it is probably incorrect to talk of a "standard" demand-for-money function that could be applied to any economy, and this is because each economy has its own economic environment. And even if we select a definite number of variables which we believe ought to be in the model, we cannot check the "validity" of these variables one at a time. We have got to deal with the model only when all the independent variables are included, so that the model will be, statistically speaking, complete (*). Thus, it is only from the "complete" model that the influence of each variable on the demand for money could be interpreted. For most demand-for-money studies, the inclusion of the rate of interest was fairly acceptable. However, in recent studies, in particular in LDCs, the use of interest rates became quite controversial. The choice of the expected rate of inflation seems to have solid theoretical justification, especially in economies experiencing severe inflation

(*) We will probably never have such a thing called "complete" model, but if the theoretical basis on which the choice of the independent variables is made pretty acceptable, the model could be regarded as reliable.

(Latin American economies are a good example). However, recent studies in the U.S. economy seem to be showing that expected inflation rates have a significant effect. As to the role of the price level, an important number of studies give little reason to doubt the empirical relevance of the proposition that the demand for nominal balances is proportional to the price level [17]. What variable is to be used--wealth or income? Both variables seem to be widely used as the major factors that enter in the demand for money. Wealth translated into permanent income is believed to be a major reliable element because people are supposed to consume according to their permanent incomes rather than measured incomes which are subject to ups and downs. Still this argument is not very convincing for some economists who keep using measured incomes.

Another issue deals with the use of the appropriate definition of the stock of money M_1 , M_2 . . . In addition to the theoretical background that might suggest which definition to use, the time period used in the analysis of the demand for money could, in some respect, dictate what definition of money to be used.

Given this very general framework in which the analysis will be done, specific references to the demand-for-money functions and analysis of velocity in LDCs will not be in any case exhaustive.

A. The Demand for Money: Some Results From LDCs:

Generally speaking, the empirical literature on demand for money in developing economies has provided little progress in the way of approaches to the problem of estimation compared to what has been realized for more developed economies. However, because of some monetary characteristics specific to developing economies, different results could be expected.

Among the early studies in this matter, Gujarati (1968) [13] provides a simple and apparently consistent study using the standard approach. His period of study covered the demand for money in India from 1948-64. A simple demand function is assumed:

$$M_t = L(R_t, Y_t)$$

where

M_t = aggregate real cash balances demanded at time t .

R_t = interest rate at time t .

Y_t = aggregate real natural income at time t .

He defines the long-run function in terms of an aggregate desired cash balance M_t^* ,

$$M_t^* = AR_t^b Y_t^c$$

and an adjustment model of actual cash balances towards the desired level of the forms:

$$\ln M_t - \ln M_{t-1} = \lambda (\ln M_t^* - \ln M_{t-1})$$

where: $0 \leq \lambda \leq 1$.

This can be used in conjunction with the long-run function to give the general short-run function used for estimating:

$$M_t = A^{\lambda} R_t^{\lambda} Y_t^{\lambda} M_{t-1}^{(1-\lambda)}$$

where λ = coefficient of elasticity of adjustment. If $\lambda = 1$, there is no lag adjustment, and $M_t = M_t^*$.

In his regression, Gujarati found that $\lambda = 0.4716$ which suggested that approximately 47 percent of the discrepancy between the actual and the desired cash balances was eliminated in one year. He also found that real income was the most significant determinant of the demand for real cash balances. The interest rate, although it had the right sign, was statistically insignificant.

From his findings Gujarati concluded that the Indian economy had an under-developed money market, a conclusion that would support the argument that the interest elasticity of the demand-for-money function would be more significant in economies with well developed money market systems.

Following Gujarati, Gupta (1968) [12] studied the demand for money in India for the period 1949-50 to 1965-66. He showed some contrary evidence concerning the significance of the interest rate and lag effect.

Gupta found that the yield on 90-day Treasury bills was highly significant and also stable over time. Furthermore, for total money, the coefficient of the lagged dependent variable was statistically insignificant, indicating instantaneous adjustment between the actual and the desired cash balances. Also he found that for the aggregate demand for money, wealth was not a significant factor.

Adding one more year to the sample period used by Gupta, Bhattacharya (1974) [6] tested his equations (demand for money) in linear form with all variables measured in current prices. Bhattacharya used M_d and MT_d , where M_d stands for currency plus demand deposits and MT_d includes M_d plus time deposits. Estimates from his study showed that M_d was sensitive to the interest rate of the organized money market, but the significance was revealed only through the use of the 2SLS (two-stage least squares) (*). However MT_d was not significantly related to the interest rate. In his demand-for-money equation using M_d , the interest elasticity was found equal to -0.08, a value that was much smaller than what was determined for more developed economies. In addition to that the income elasticity for M_d and MT_d were respectively 0.47 and 0.52, values that were considerably less than unity, which suggested that there were some economies of scale in money demand.

Bhattacharya concluded from his findings that the Keynesian liquidity preference seemed to be holding fairly well for the organized money market; therefore, the interest rate policy might be effective to a limited segment of the less-developed economies.

In a more recent paper by Sampath and Hussain [19], they conducted a study on the demand for money in India.

(*) The difference may be due to the possibility that the OLS was suffering from simultaneous equation bias.

From a conventional model they concluded that their results were, to some extent, simplistic because they ended up showing insignificant price levels, and long and short-run interest rates. Thus they concluded that an alternative approach ought to be considered. The alternative approach they proposed was mainly based on McKinnon's findings that can be summarized as follows: the demand for money is a function of current income, ratio of current gross domestic investment to current income, and the real return of money which is the difference between the rate of interest of government bonds, and rate of inflation [18]. They used a demand-for-money function of the form:

$$\left(\frac{M}{P}\right)_d = L[\bar{Y}, I/Y, (d-p^*)]$$

where Y is GDP in current price level, I is the investment (also in current price level), d is the rate of interest on government bonds (used as a proxy variable) and p^* the rate of change of the price level. Their rationale for including I/Y was "a rise in the average rate of return to physical capital increases the desired cash balance holdings because of the raises associated with an increase in the investment-income ratio" [20]. Also, following McKinnon's argument that money attractiveness in developing countries depends on its real return, that is $(d-p^*)$.

Their main results consisted of accepting M_2 definition of money and this when using McKinnon's model. The income elasticity was greater than unity, but the elasticity of the parameter $(d-p^*)$ had an algebraic sign opposite to the one

suggested by McKinnon who suggested a positive sign. They finally argued that their empirical finding implied that money and physical assets were more complementary than substitutes in the case of India.

Pakistan was also a subject of a similar study. S. Abe et al [1] conducted a study which was principally a criticism of the findings of M.A. Akhtar (1975) [3]. In fact they did support Akhtar's conclusion that income was the primary determinant of the demand for money, and in addition they agreed with him that the rate of interest was statistically significant in estimates of the narrowly defined money demand function. But contrary to Akhtar's results, they found that the coefficient of the expected rate of inflation was highly significant. A. Khan (1980) [16] presented a recent paper in which he showed that income, rate of interest on time deposits, the expected rate of inflation and the degree of monetization (*) were the most important explanatory variables which explain most of the variation in the demand for money. His findings led him to the conclusion that there was no support for the argument that permanent income was a better explanatory variable than measured income in the demand-for-money function. His reason was that because of low per capita income and also because of the agro-based characteristics of Pakistan's economy such different (permanent income versus measured income) would not be visible

(*) To capture the "monetization" effect, he extended the set of explanatory variables by adding the variable number of bank branches.

in the demand-for-money function. In addition, he found that the expected inflation variable became important (significant) only during the phase where the rate of inflation jumped above 10 percent.

A more extensive analysis covering Japan, Taiwan, Korea, India, Pakistan, Sri Lanka, Phillipines and Thailand was undertaken by Fan and Lin (1971) [9]. Essentially, they used the same model used by Gujarati [13] and broadly speaking they arrived at the same conclusions. Estimations using annual data from 1953 to 1968 indicated very low interest elasticity (except for Taiwan). All income elasticities were significantly different from zero and all were inelastic including India. Burma presented an unusually high income elasticity of 2.55 (as compared to less than 1.15 for the others). Fan and Lin argued that this exception was probably due to the irregular supply of money observed over the period in question. They also included a lagged dependent variable in their model along with the interest rate and income, which clouded rather than clarified the results because of a possible existing high multicollinearity. C. Wong (1977) [23] conducted a study in Korea, Phillipines, Sri Lanka, Taiwan and Thailand and the special dependent variable he used in his demand-for-money function was the credit constraint. In fact he proposed more than one credit constraint. To indicate one of his credit constraints, CR_{4t} ,

$$CR_{4t} = 1 - \frac{DC_t}{Y_t} \quad (*)$$

(*) The reason for selecting CR_{4t} is that this credit constraint is expected to be positive, so that its log can be taken.

The purpose of using this variable is that it is believed to replace the role of the interest in the demand-for-money function in an economy where financial markets are at their beginning or where lending rates and deposit rates of banks are pegged, causing the observed interest rates to fail to be the key linkage variables determining holdings of assets. In CR_{4t} , DC_t stands for net domestic credit of the banking system in period t , and Y_t represents nominal GNP during period t . Wong argued that some credit constraint variables could be determined for the 5 countries in question. However, some limitations could occur (case of Thailand) if foreign borrowing or balance of payments surplus became the major source of money creation.

So far the demand-for-money functions considered were mostly limited to countries that did not experience severe inflation (at least most of the time). The next step is to take a close look at some Latin American economies which have experienced at one time or another severe inflation (over 25 percent per year).

B. The Demand for Money in Two Latin American Economies:

The demand for money in Latin American economies was referred to as "intermediate case," it is also referred to as the demand for money in Israel as intermediate. Intermediate in the sense that these economies have been intermediate between economies whose demand for money has been dominated by expected price changes during high inflation periods and other economies (e.g. USA) where changes in

income have been the main determinants in the demand-for-money functions over the long-run.

A. Hynes (1967) [14] tried to study the monetary phenomena because real money balances, real income, and the cost of holding money have experienced large variations from 1935 to 1960. Hynes estimated the expected income and the expected rate of change of prices, both based on exponentially weighted sums of current and past observations. When combined with a mechanism for correcting disequilibrium in the money market, the resulting demand for money relation connects the actual quantity of real money balances per capita to measures of the expected rate of change of prices and expected income. Hynes did not have access to the interest rates, but it was accepted that the important changes in the money rate of interest were due to changes in the expected rate of change of prices. This latter variable may be taken to represent the cost of holding money. Hynes found that the estimated long-run interest elasticity of demand for cash balances in Chile was between -0.35 and -0.37. A result that was surprisingly enough similar to what was found for some developed countries (USA. . .) using the broader definition of money. The long-run income elasticities were rather impressive because M_1 (currency + demand deposits) had an income elasticity of 2, which classified money as a "luxury" good, and the broader definition of money had an income elasticity of about unity. The findings were contrary to what was found for the USA

economy (approximately 1 for M_1 and 1.4, 1.8 for the broader definition of M_2).

Deaver (1970) [7] investigated the demand for money in Chile. He tried in his model both permanent income (a weighted sum of recent incomes) and measured income. Higher income elasticities were obtained when permanent income was used in addition to the expected rate of inflation, but the income elasticity in each case was lower than unity. Deaver included in his measure of cash balances time deposits which were found to be more sensitive to changes in the cost of holding money than demand deposits or other kinds of money. He concluded that "because of the substantial degree of substitutability between time deposits and other money, it would clearly be a poor solution to exclude them" and his tests "show that a stable demand function can be defined for Chile that explains most of the variations that took place in the real money stock between 1878 and 1955."

The demand for money in Argentina (1935-62) was the object of a study conducted A.C. Diz (1970) [8]. During the period in question Diz found that variations in the expected rate of change in price levels and the expected per capita real income explain most of the fraction of the observed variations in per capita real money holdings. He also argued that the inclusion or exclusion of time and savings deposits in the stock of money could not change his main conclusion (mentioned above), but they did influence the level of elasticities, that is when savings and time

deposits are included in the stock of money the values of the estimated coefficients show that the cost elasticity increases and the income elasticity decreases. His findings also showed that an increase in uncertainty--as measured by the level of inflationary expectations--tended to increase desired money holding and that effect was more pronounced for the broader definition of money. He also argued that the rate of change in the money stock over the period considered had significantly affected the level of inflation.

T. Balino (1977) [5] also dealt with the demand for money in Argentina. His main objective was to find some evidence on whether the Argentina Monetary and Banking Reform of 1946-57 had any effect on the demand for money. The reform was called "nationalization of deposits." From his empirical findings he concluded that, despite the introduction of new institutional arrangements, the variations of demand for money (in real terms) was still largely explained, by few variables. However he suggested that during the nationalization period the substitution relations among money assets and between them and other assets changed enough that a better fit of actual demand for money was obtained by adding up the components of the broader definition of money, than by direct estimating using the aggregate stock of money (M2). He also found that the independent variable exhibited greater statistical significance. Balino argued that these two findings were the most significant consequences of the reform. In all his regressions (using

M and components of M), Balino found that the income elasticity was less than unity (only real income was used, in contrast to expected income used by Diz, who found the elasticity generally greater than one) and cost elasticity smaller than what Diz found.

C. Some General Conclusions About Demand for Money in LDCs:

By pooling together developed and less developed economies it may be possible to observe some differences in the matter of demand for money as a result of the structural differences in the economies of the two groups of countries. Adekunle (1968) [2] grouped the time series data on countries classified industrial, other developed and less-developed. His findings were, beside suggesting that there was a wide and important spectrum of generalization of the demand-for-money functions, some differences coming from each economic environment. For the LDCs the model that seemed to be satisfactory was one in which the demand for money was a function of interest rates, current real income and the expected rate of change in prices, a generalization (about the model) that could to some extent apply to developed countries too. Concerning the income elasticities, Adekunle's findings seemed to show little evidence that money was a "luxury" good in both sets of countries, although the estimated income elasticities were not highly different from unity. He also found that in the industrial countries desired real balances were related to interest rates and the expected income while in LDCs interest rates

and expected rates of change in prices were the important factors. The major difference in his findings consisted of the following: The industrial countries price movements did not seem to be a major element in explaining money holding, but in less developed countries they did manifest their importance. Thus, in the LDCs economic environment not only tended to lead to adjustments in desired money holdings but also were important in the formation of expectations about the future behavior of prices.

D. Behavior of Velocity in Less Developed Countries:

Friedman (1959) [10] stated that "In countries experiencing a secular rise in real income per capita, the stock of money generally rises over long periods at a decidedly higher rate than does money income. Income velocity--the ratio of money income to the stock of money--therefore declines secularly as real income rises." Following Friedman many other economists strongly supported the same idea, that is the income velocity is a negative function of per capita real income. Although, there is no unanimity about this notion, some empirical studies have indeed showed this negative relationship between velocity and real per capita income. Perhaps the reason supporting this inverse relationship is that as the savings to income ratio rises during development, (as development takes place important savings can be enregistered) it causes the ratio of money to income to rise (V decreases).

Another reason can be found in the empirical findings in which the income elasticity is greater than unity, and Friedman interpreted this as: "A one percent increase in real income per capita has therefore, on the average, been associated with a 1.8 percent increase in real cash balances per capita, and hence with 0.8 percent decrease in income velocity." [19]

Park (1970) [21] conducted a study on the variability of velocity from a set of countries which he classifies on (1) industrial, (2) other developed, and (3) less developed.

Park provided a sophisticated demand-for-money function that he believed was consistent with fluctuations in velocity over time:

$$\frac{Y_t}{M_t} = \frac{1}{a\beta} - \frac{1}{a} \frac{M_{t-1}}{M_t}$$

where $M_t = \alpha [\beta Y_t + \beta^2 Y_{t-1} + \beta^3 Y_{t-2} + \dots + \beta^n Y_{t-n}]$

He argued that the fluctuations of velocity are explained by fluctuations in the ratio $\left(\frac{M_{t-1}}{M_t}\right)$, an explanation he believed was not unrelated to Friedman's explanation for the fluctuations in velocity. That is, the demand for money is a stable function of permanent income so that when measured income is above permanent income velocity tends to increase, and when measured income is below the permanent one, velocity tends to decrease.

In testing the variability of velocity, Park used three types of velocities:

$$V_1 = Y/M_1 \quad V_2 = Y/M_2 \quad V_3 = Y/M_3$$

where M_1 = currency, $M_2 = M_1 +$ demand deposits and $M_3 = M_2 +$ quasi-money. He found that in all three definitions of income velocity, there were greater year-to-year fluctuations in less-developed countries than in the industrial ones. The group averages for fluctuations in V_1 , V_2 and V_3 were almost twice as high as those in the industrial economies (in terms of fluctuations). He also found that the relative variability of V_1 , V_2 , and V_3 was a mixed one, that is none of the three definitions of velocity was relatively more stable than the others over the period covered.

His justifications about the lack of stability of V in LDCs were the facts that in those countries there was more instability in the economic structure in addition to the social and political instabilities. He also argued that the dichotomy between monetized and non-monetized (*) income could have its share of responsibility in the instability of income. Higher inflation rates in LDCs were also mentioned in connection with these instabilities. Park did not exclude the lag effect repercussion on velocity because this effect was shorter in LDCs than in the industrial ones.

Short (1973) [22] conducted a study on Malaysia and Singapore (1951-66) in order to determine the type of relationship connecting real per capita income and velocity. He

(*) Non-monetized refers to the barter system that could be found in some economic sectors in less-developed economies (mainly agricultural sectors).

concluded that the presence of per capita real income variable with a negative sign in all the regressions showed that there was indeed a negative relationship between velocity and real per capita income in West Malaysia and Singapore for the period of time covered by the study. Short was also interested in checking the evolution of the degree of monetization in the two economies, and he found that: "The negative impact of per capita real income upon velocity was overpowered by the change in the monetary habits which the increase in bank offices caused and which it represents in the regression."

Akhtar (1974) [4] tried to present an extensive analysis of the determinants of velocity in the underdeveloped economy of Pakistan. He used two measures of velocity, V_1 based on the exclusive definition of money (currency plus demand deposits) and V_2 based on M_2 . From his findings, Akhtar concluded that the hypothesis that income velocity was inversely related to per capita real income was valid in Pakistan for the period in question. He also found that "it was not possible to appraise the negative impact of per capita real income on velocity independent of the overpowering influence exerted by institutional changes particularly by the availability of imported goods."

Khan (1974) [15] dealt with the same topic for the period 1960-61 and 1972-73, but contrary to Akhtar, he found that there was a positive relationship between velocity and per capita real income. Among other explanatory variables,

he found that the effect of monetization (through the evolution of bank branches on velocity) was very marked. He also found that "although the trend in velocity over the past 13 years has been downward having a dampening effect on inflation, the monetary expansion has been so great that it has more than offset this."

However, in Khan's study, the absence of a negative relationship between per capita real income and velocity could be attributed to the short period of time his study was covering (only 13 years were used in his time-series analysis).

In summary, if a negative functional relationship between per capita real income and velocity of money is a fact, it would probably have an important impact on development policies in developing economies, because the authorities responsible for the supply of money could issue more money and obtain a greater leverage on resources than if velocity were increasing over time.

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Chapter 3

MONETARY POLICY IN ALGERIA: A BRIEF OVERVIEW

Supply and demand for money in Algeria are to be considered as inherent elements of an economic model of development that has the strategy of carrying out economic growth through planning. The supply of money is primarily based on the idea of providing the necessary funds for the economic plan, a supply that is rather massive given the size and the period of time (since the political independence) of the Algerian economy. The stock of money went from 4.26 billions in 1964 to 83.7 billions of Algerian Dinars (A.D.) in 1980. The massive increase in money supply started essentially with the first three-year economic plan (1967-1969), and from then on it kept the increasing path throughout the first and the second four year plans (1970-73 and 1973-1977) and also throughout the five-year plan currently in progress (1980-1984). Following this path, the rate of growth of the gross domestic product has also experienced large increase, with some fluctuations of course. The GDP passed from A.D. 14.5 billions in 1964 to A.D. 56 billions in 1980 (figures in nominal terms). Figure 1 shows the behavior of both definitions of money (M_1 and M_2), and also the path followed by real GDP and nominal GDP from 1964 to 1980. Given the nature of investments (mostly highly capitalistic), imposed by the economic model chosen

BEHAVIOR OF STOCK OF MONEY AND INCOME

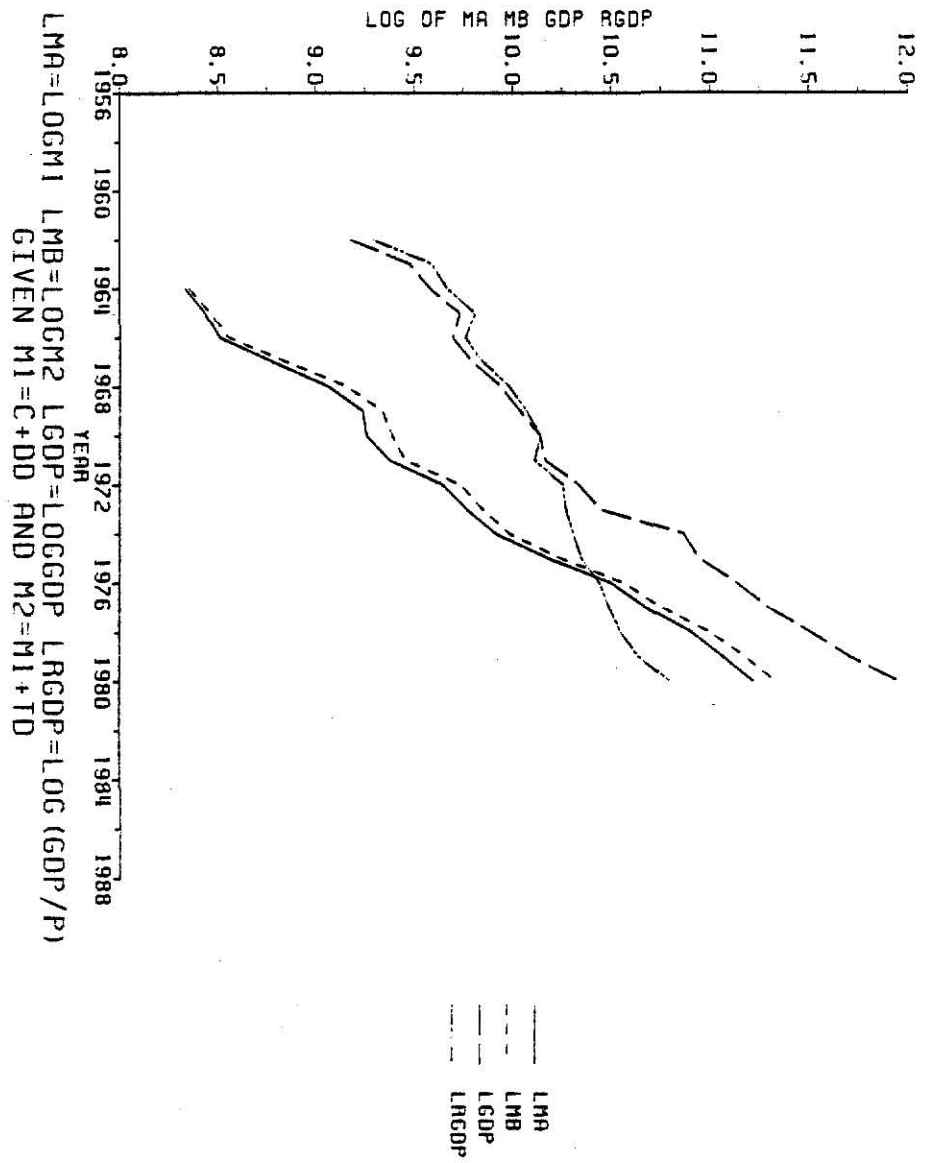


Figure 1

important quantity of funds were to be available in the system, a task that was not very hard given the fact that the central bank, in cooperating with all the financial institutions were able to provide the necessary money, through different channels (e.g. borrowing from outside, printing money) in order to finance the investments. But, in order to serve the needs of the economy, the banking system has been experiencing continuous reforms. Perhaps the most important one was in 1966 when the post-colonialist banking organization came to its end. Prior to 1966, in addition to the Central Banque of Algeria, there were about 20 foreign banks whose economic operations were revealed to be incompatible with the exigencies of a centrally planned economy. However the new organization of the banking system is far from being identical to the Eastern European banking system. In fact, it is quite similar, although less complicated, to the western banking organization. The 1966 reform gave birth to a simple system that consisted of a central bank, three commercial banks called "primary" banks, a bank of development, a savings institution, a post office checking deposits system and a treasury.

The Central Banque has the control of the classical instruments of monetary policy, and its main function is being the organizer of refinancing vis-a-vis the primary banks.

The Commercial Banques have the usual role of deposits, inside and outside, except for the long-term credit. The

Treasury has the function of being the tool of execution of the budget of the government, in addition to its role of being the lender of long-term credit. To summarize the banking organization in Algeria we can say that:

- The State which disposes the control of the supply of money has the duty of providing the necessary and favorable monetary policy in order to meet the requirements of economic growth.
- Although the State has the jurisdictive right of controlling the monetary system, every bank has a tendency to provide funds only to economic projects that seek profits.

Thus, the 1966 reform ended with the appropriation of all the banking and financial institutions by the government, an appropriation that is believed to be more compatible with the economic model in Algeria. The next reform to mention is the governmental decision of 1971 in connection with the policy of credits. Up to 1971 the Treasury had the responsibility of providing the necessary funds to finance all the public investments. In 1971, it was decided that the commercial banks would take over a part of the obligation to finance some of the productive investments of the public enterprises by providing medium-term credits so that the Treasury would have less pressure. Under the new system agreements between the government and the Central Banque are to be reached concerning the annual allowances of the necessary funds that would be needed by the public enterprises.

Also, in order to avoid unforeseen shortages of liquidity, the public enterprises could get additional funds for their operations from the Central Banque through their commercial banks. Given this framework, the supply of money, since the early years of the independence, has been showing substantial increases from year to year. As mentioned above, this monetary policy was set to answer the monetary needs of an economic strategy characterized by the target of industrialization, comparable to the western image. Also, the main element of this strategy is to start with industries such as steel and mechanics in order to provide an easy economic integration between different industrial sectors, and also between industrial and agricultural sectors. However such choice of investments may be contradictory with the immediate economic needs of the nation in terms of employment, and welfare economics in general. To finance such expensive investments, important financial resources have to be mobilized. First budgetary savings: this source of finance comes primarily from oil and natural gas taxes. Although subject to some fluctuations, this source becomes very important since the 1973-74 oil crisis. In 1974 it provided almost 75 percent of the necessary funds for the plan's programs. Second, borrowing from foreign banks: this source provides an average of 25 percent of the necessary funds for the planned investments throughout the period 1970-1977. An important feature of this source is the diversification of banks (western ones) so that less dependency toward

individual lenders would be felt. Third, the resources of the Treasury and institutional savings: the institutional savings (made through the Treasury correspondents such as the postal checkings) and the Treasury resources, although marked by ups and downs, have a modest participation in financing the planned investments. This source could easily expand with better organization to collect additional funds that are kept in the form of hard cash by the public. Fourth, the printing of money: this is perhaps the last refuge for the monetary authorities, but also the easiest way of financing the investment. Although known as a dangerous source, its participation in financing the planned investments was important, it reached a peak of 48.3 percent in 1970.

The following table summarizes the participation of each of the four elements cited above for the period covering the four-year economic plans.

Sources of Funds for the Planified Investments 1970-1977 (in percentage)								
	1970	71	72	73	74	75	76	77
Foreign Funds	28.9	26.0	22.4	19.8	31.6	24.1	33.0	28
Budgetary Savings	5.9	-0.4	15.1	12.2	74.4	35.4	33.2	14.5
Treasury & Savings	16.9	42.3	35.0	39.1	11.0	9.0	8.4	17.2
Monetary Financing	48.3	32.1	27.5	28.9	17.0	31.5	25.4	40.3

SOURCE: Palloix, C., "Industrialization et Financement," *Revue du Tiers-Monde* No. 83, July-Sept. 1980, Paris, pp. 546-47.

Given this brief review of monetary policy in Algeria
we can now proceed with the demand for money.

Chapter 4

A STUDY OF THE DEMAND FOR MONEY IN ALGERIA

As pointed out before the Algerian economy has been showing non-negligible rates of inflation during the last decade in parallel with a rapid growth in the supply of money. Figure 2 summarizes the evolution of price level and stock of money (M_1 and M_2). The purpose of this study is to try to find out if demand for money ranges in the category "intermediate" case or not, that is if the demand for money in Algeria is a function of both the expected income and the expected price changes (proxy for interest elasticity) or not. Also separate regressions for the demand for currency and deposits will be analyzed in relation with the demand for money in Algeria. Before that we take a brief overview of the three possible versions of demand for money.

First, the Friedman case, "The Demand for Money: Some Theoretical and Empirical Results," (1959) [3], in which the demand for money is practically dependent upon real income. This case is applicable to countries that have been experiencing growth for long periods of their economic history, and at the same time no major disturbances of the price level have been observed. Such economies can be identified with the U.S. economy.

The second case is the other extreme situation where the economy is characterized by extreme short-run price level

changes, which tend to erase any economic change. This case is usually identified with the work of Cagan [1]. In such economy, the demand for money is almost solely determined by changes in the cost of holding money, phenomena that could be observed in unstable economies characterized by short-lived hyperinflation.

The third case, which is in between the two situations mentioned above was investigated by Deaver [2] in the Chilean economy, an economy that has been experiencing substantial increases in real income in addition to a fairly important amount of inflation. In his study, Deaver found that the demand for money was a function of both the expected income and the expected changes in the price level.

Based on the brief overview of the Algerian economy, and given the fact that inflation, real GDP and stock of money were increasing over time, we wonder if the demand for money in Algeria does not fall in the category suggested by Deaver, that is, it would be a function of both income and cost of holding money. But first a look at Figure 1 (preceding Chapter) and Figure 2 combined with the following table 4-1 of real GDP and price level (plus their respective annual changes) would be helpful.

BEHAVIOR OF STOCK OF MONEY AND PRICE LEVEL

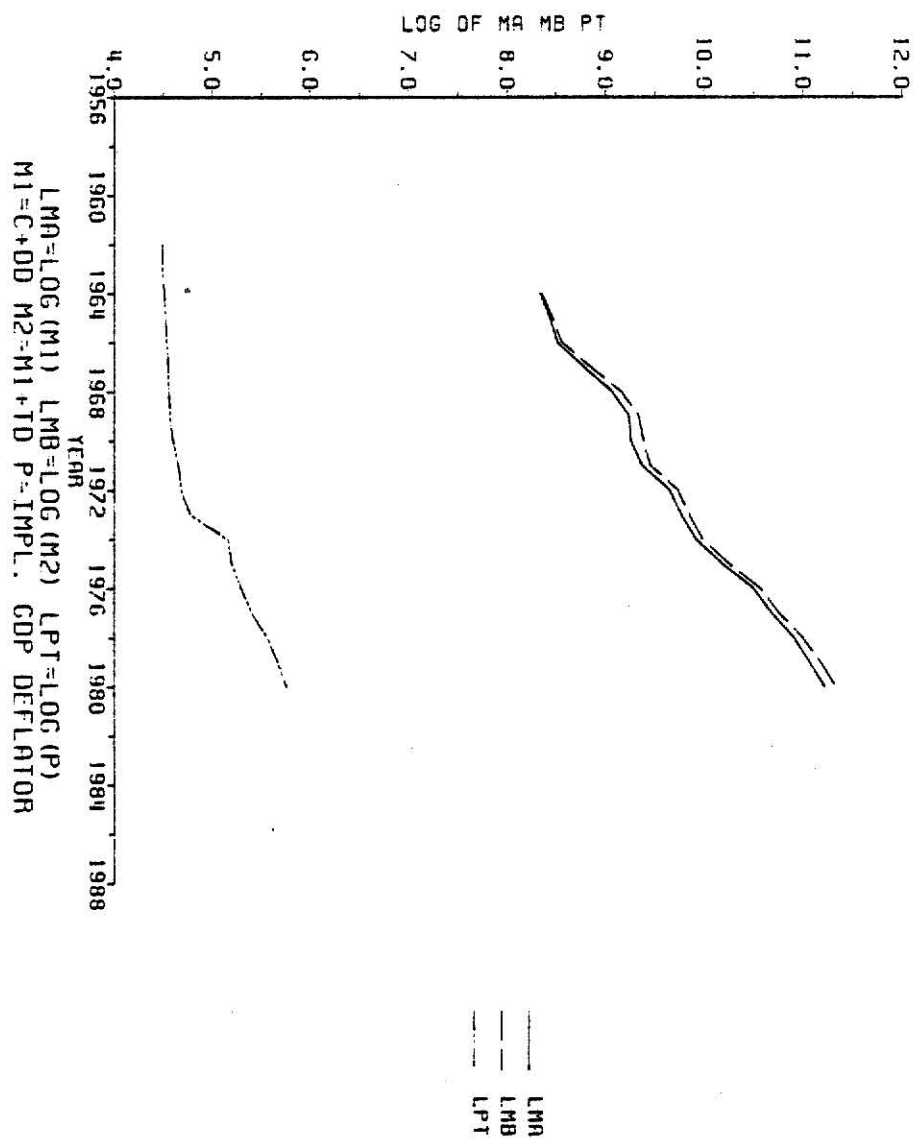


Figure 2

TABLE 4-1

Real GDP, Price Level and Their Respective Yearly Increases in Algeria (1964-1980)				
Year	Real GDP (Billions of 1970 A.D.)	% increase over previous year	Price Level (1970=100)	% increase over previous year
1964	15.85	--	91.5	--
1965	18.21	14.93	92.5	1.09
1966	17.30	-5.01	93.5	1.51
1967	18.92	9.33	94.9	1.06
1968	21.64	4.39	95.8	0.95
1969	23.66	9.34	96.7	0.93
1970	25.34	7.10	100.0	3.41
1971	24.64	-2.77	105.6	5.60
1972	28.47	15.56	108.4	2.65
1973	28.87	1.44	119.4	10.14
1974	30.01	3.93	174.5	46.15
1975	31.30	4.27	181.5	4.01
1976	34.28	9.55	200.3	10.36
1977	36.10	5.20	223.2	11.43
1978	38.26	6.07	261.4	17.11
1979	41.93	9.59	291.0	11.32
1980	48.99	<u>16.86</u>	318.4	<u>9.42</u>
Average		6.8		8.5

The above table shows that the economy has been experiencing fairly considerable changes in both real GDP and inflation, with respective averages of 6.8 and 8.5.

A. The Demand for Money: Some Empirical Results

The general form of the demand-for-money equation that will be tested throughout this chapter is:

$$\ln(M/P) = \beta_0 + \beta_1 \ln(\text{cost of holding money}) + \beta_2 \ln(\text{income})$$

Also the demand for currency and deposits will include the same variables.

We also note that throughout this chapter, and the following ones as well, all the regressions will be estimated by the two stage least squares (2SLS).

1. Definition of the Variables

a. Definition of Money and Its Components:

M_1 = Money supply defined as currency plus demand deposits.

M_2 = Money supply M_1 plus time deposits.

M_1/P = Real M_1 supply = m_1 (based on 1970=100).

M_2/P = Real M_2 supply = m_2 (based on 1970=100).

C = Currency held outside banks.

DD = Demand deposits.

TD = Time deposits.

C/P = Real currency = c (based on 1970=100).

DD/P = Real demand deposits = dd (based on 1970=100).

TD/P = Real time deposits = td (based on 1970=100).

b. Definition of Income:

Y = Nominal gross domestic product (GDP).

Y/P = Real GDP (based on 1970=100).

The proxy for permanent income is computed as follows:

$$y_t = \frac{(Y_t/P_t + Y_{t-1}/P_{t-1} + Y_{t-2}/P_{t-2})}{3}$$

where P_t is the implicit GDP deflator (1970 = 100).

c. Cost of Holding Money

Cost = the cost of holding money is the expected change in the implicit GDP deflator, assumed to be equal to the change in the most recent period.

$$\text{cost}_t = (P_t - P_{t-1})/P_{t-1}$$

2. The Data

Two principle data sources have been used for the study that covers a period of 17 years (1964-1980), and only yearly figures were available. These sources are the World Bank, World Tables 1976, World Tables 1980, and IMF, International Financial Statistics. The choice of only 17 years for the study is based on the limitations of the data prior to 1964. And the period prior to 1962 was a colonization era for Algeria, which makes the prior and post 1962 periods structurally different. We also note that the year 1965 corresponds to the coup d'etat that changed the economic and political path of development in Algeria.

B. Analysis and Results of the Model

1. The Demand for Money

The model as it stands allows for a partial adjustment of the real stock of money, that is:

$$\ln m_t - \ln m_{t-1} = \lambda [\ln m^*_{t-1} - \ln m_{t-1}] + u_t \quad (1)$$

with $0 < \lambda \leq 1$ and $t = 1, \dots, 17$.

and the desired demand for money is :

$$\ln m^*_t = \ln \beta_0 + \beta_1 \ln \text{cost}_t + \beta_2 \ln y_t \quad (2)$$

where m_t is the real stock of money at time t , m^*_t the desired real stock of money at time t , and y_t the proxy for permanent income at period t . Combining (1) and (2) we get:

$$\ln m_t = \lambda \ln \beta_0 + \lambda \beta_1 \ln \text{cost}_t + \lambda \beta_2 \ln y_t + (1-\lambda) \ln m_{t-1} + u_t \quad (3)$$

with the assumption that

$$E(u_t) = 0 \text{ for all } t.$$

$$E(u_t, u_j) = \begin{cases} 0 & \text{for } t \neq j. \\ \sigma_u^2 & \text{for } t=j. \end{cases}$$

If we assume that there is a perfect adjustment ($\lambda=1$), that is, a constant proportion of the discrepancy between the actual and desired real cash balances will be eliminated within a single period we get:

$$\ln m_t^* = \ln m_t = \ln L_0 + \beta_1 \ln \text{cost}_t + \beta_2 \ln y_t \quad (4)$$

When using M_1 definition of money we get:

$$\ln m_{1t} = -8.9595 - 0.0791 \ln \text{cost}_t^* + 1.8182 \ln y_t^{**}$$

(1.7241) (0.0436) (0.1746)

't' ratio -5.1963 -1.8137 10.4110

$$R^2 = 0.9469 \quad DW = 0.9672 \quad \text{period: 1964-80.}$$

When we assume $\lambda = 1$, equation (4) shows that the income elasticity is higher than unity (money is a "luxury" good) and very significant, but the cost elasticity is significant at 10 percent level only. However, from this regression we get a fairly high positive serial correlation among the residuals (.34).

Now if we consider that λ is different from unity, the regression of equation (3) gives us:

$$\ln m_{1t} = -4.3295 - 0.1269 \ln \text{cost}_t^{**} + 0.6375 \ln y_t^* +$$

(1.7608) (0.0337) (0.3444)

0.8000 $\ln m_{t-1}^{**}$

(0.2176)

't' Ratio -2.4588 -3.7609 1.8507 3.6765

$$R^2 = 0.9750 \quad DW = 1.3397 \quad \text{period: 1964-80.}$$

Equation (3) shows that the short-run income elasticity (using one year lag for the stock of money) is 0.637 which

* Statistically significant at 10 percent level.

** Statistically significant at 5 percent level.

makes it significant at 10% level, while the cost elasticity becomes significant at 5% degree of confidence. From this equation (3) we get the estimated value of the coefficient of adjustment λ , which is 0.20 ($=1-0.80$), this coefficient is considerably different from unity. This value of λ suggests that 20 percent of the discrepancy between actual and desired cash balances is eliminated in a year. Therefore, because of the extremely low value of λ , some doubts about the validity of equation (2) ought to be considered.

From the estimated value of λ , we now can determine the long-run demand for money. This can be done by dividing equation (3) by λ and transferring the term $(1-\lambda)/\lambda \ln M_{1,t-1}$ to the left hand-side of the same equation. Thus, the long-run demand for money in Algeria (using M_1 definition of money).

$$\ln m_t^* = -21.64 - 0.63 \ln \text{cost}_t + 3.18 \ln y_t.$$

Estimation of the demand-for-money equation using M_2 definition of money, if $\lambda = 1$.

$$\ln m_{2t} = -9.6852 - 0.0911 \ln \text{cost}_t^* + 1.8993 \ln y_t^{**}$$

(1.8451) (0.0467) (0.1868)

't' Ratio -5.2490 -1.9517 10.1628

$R^2 = 0.9428$ $DW = 0.8794$ period: 1964-80.

If $\lambda \neq 1$

$$\ln m_{2t} = -4.6369 - 0.1356 \ln \text{cost}_t^{**} + 0.6769 \ln y_t^{**} + 0.7937 \ln m_{2t-1}^{**}$$

(1.6889) (0.0323) (0.3108) (0.1855)

* Statistically significant at 10 percent level.

** Statistically significant at 5 percent level.

't' Ratio -2.7454 -4.1985 2.1780 4.2785

$R^2 = 0.9773$ $DW = 1.3737$ period: 1964-80.

from this last equation we can derive the estimated value of λ (when using M_2 definition of money), $\lambda = 0.21$, an estimate slightly higher than the one found when M_1 was used in the demand-for-money function. This estimate suggests that 21% of the discrepancy between actual and desired cash balances is eliminated in a year. The regression of (3), when using M_2 provides a better level of significance for all the coefficients in the model, suggesting that people tend to react to the inflation rate, but only when one year lagged-money is used in the model. Also we observe that the use of M_2 in the model provides a higher level of significance for the model as a whole in terms of level of significance of the coefficients. From the preceding results we can derive the long-run demand for money (M_2 as stock of money)

$$\ln m_{2t}^* = -22.08 - 0.64 \ln \text{cost}_t + 3.22 \ln y_t.$$

From the above results, we can see that the use of M_2 as the stock of money in the model provides better overall significance for the model, and better level of significance for the individual coefficients. When supposing that the rate of adjustment equals unity, both income elasticities (corresponding to the use of M_1 and M_2) are highly significant and also higher than unity, which indicates that money is considered as a luxury good. This is the result that can be supported by the possibility that, following the independence, people felt more secure about their incomes and expected

higher incomes given the level of poverty that they experienced during the colonization era. Also, when supposing λ equals unity the cost elasticities were not very insignificant, which suggests that people do not seem to try to adjust immediately their holdings of money when faced with inflation. The possible reasons for this behavior are:

1. Prices in Algeria are in most cases centrally fixed, and generally stable, and this especially for "basic" goods such as food, housing, etc. This belief of fixed prices may be inducing people to not expect any considerable inflation in the future.

2. The belief of price stability combined with the underdeveloped financial market in Algeria, which is accessible to a limited group of money holders, makes additional savings kept in the form of cash, assuming no change in the cost of holding money due to changes in the rate of inflation.

3. The third possible reason is the "banking habit" in Algeria which is not very developed. A large proportion of people do not use any form of deposits, they keep all their wealth in the form of currency or durable goods. They avoid deposits because of many reasons such as ignorance of the benefits they can get from the deposits, the fear of losing their wealth if deposited because of mistrust in the financial market in general.

4. The fourth reason, which may seem in contradiction with some points mentioned above, is the high proportion of

of money kept under the form of hard cash. Because not all prices are under control, and also because of the shortages characterizing some goods, people tend to hold large proportions of cash expecting higher prices for the products that are not on the market, but will be available some time in the future in limited quantities, products that will be in most cases sold at higher prices on the parallel market. These are perhaps some good reasons why people do not reduce considerably their holdings of money when inflation is expected.

The next step in this study is to consider the demand for cash and deposits, this is important given the higher proportion of currency used in the economy compared to the deposits.

2. The Demand for Currency and Deposits:

To visualize the behavior of currency and deposits, we can consider the currency ratios (K_1 = currency/demand deposits, K_2 = currency/demand deposits plus time deposits) and time deposits ratio (t =time deposits/demand deposits). Figure 3 shows the behavior of currency and time deposits ratios. The following Table 4-2 shows these ratios over time, and the percentage increase of currency, demand deposits, and time deposits over previous years, also Figure 4 shows the evolution of money components (currency and deposits).

TABLE 4-2

% increase over previous year of						
Year	K ₁	K ₂	T	Currency	D Deposits	T Deposits
1964	1.62	1.53	0.05	--	--	--
1965	1.49	1.39	0.06	7.13	16.36	49.41
1966	1.33	1.20	0.10	2.64	14.65	76.74
1967	0.98	0.85	0.15	13.70	54.41	114.03
1968	0.74	0.63	0.17	14.78	51.39	71.31
1969	0.67	0.57	0.18	12.23	23.35	32.77
1970	0.88	0.65	0.25	13.90	-5.75	30.72
1971	0.93	0.80	0.15	20.36	5.49	-32.87
1972	0.83	0.72	0.16	23.69	38.16	43.02
1973	0.78	0.69	0.13	25.08	33.31	31.15
1974	1.07	0.92	0.15	18.52	-13.20	6.05
1975	0.93	0.82	0.13	21.93	40.63	16.34
1976	0.90	0.79	0.13	35.31	39.36	42.63
1977	0.88	0.77	0.14	19.36	21.85	34.48
1978	0.99	0.83	0.19	32.58	17.32	54.01
1979	1.23	0.97	0.26	29.73	4.96	44.92
1980	1.31	1.02	0.28	19.62	12.38	20.13

As shown by the Figure 3, the currency ratios display a U-shaped behavior. This is mainly due to an increase in deposits and a relative decrease in the proportion of currency at the beginning of the period, and the situation was somewhat reversed at the end of the period. But the time deposits ratio, although experiencing some fluctuations, show a modest upward movement caused by a relative decrease in demand deposits at the end of the period.

However the main characteristic of the different components of money is the large proportion of currency in the stock of money.

a. The Demand for Currency

$$\ln c_t = \ln \beta_0 + \beta_1 \ln \text{cost}_t + \beta_2 \ln y_t \quad (5)$$

$$\ln c_t = \lambda \ln \beta_0 + \lambda \beta_1 \ln \text{cost}_t + \lambda \beta_2 \ln y_t + (1-\lambda) \ln c_{t-1} \quad (6)$$

BEHAVIOR OF CURRENCY AND TIME DEPOSITS RATIOS

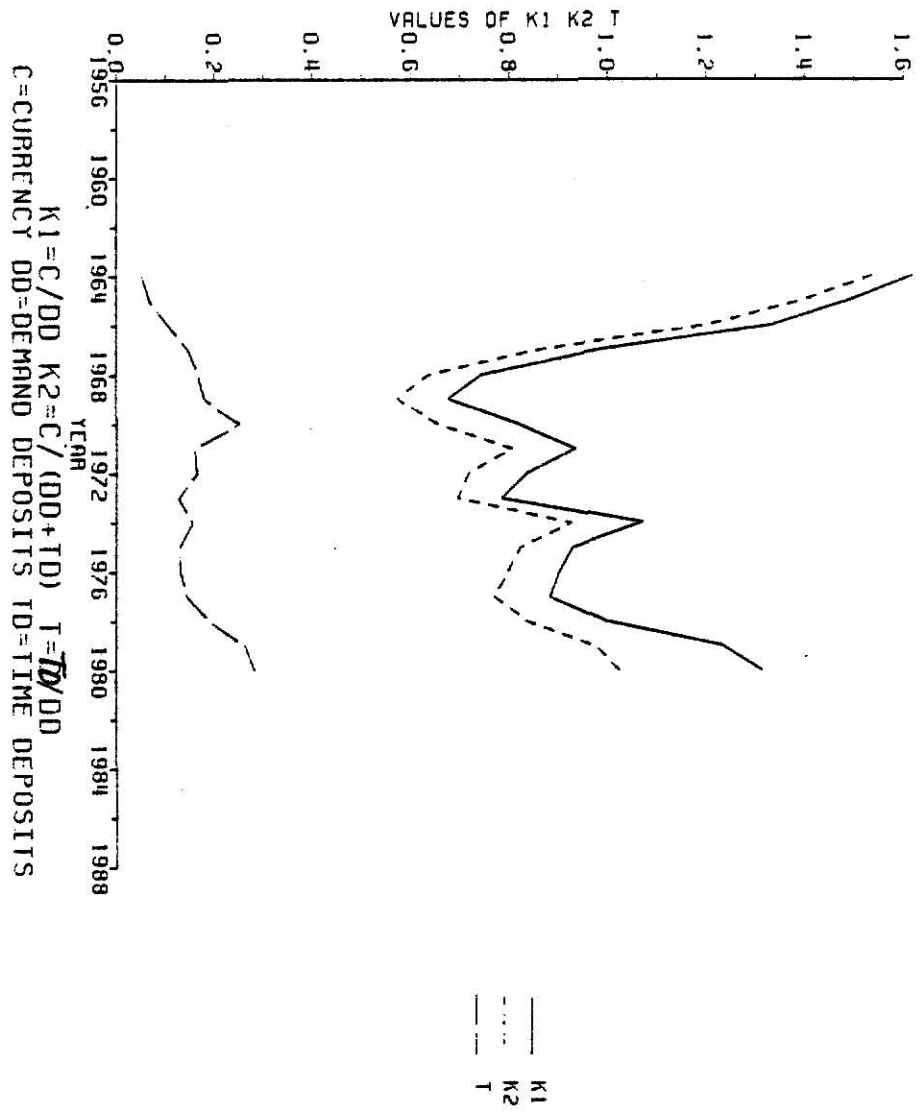


Figure 3

EVOLUTION OF THE COMPONENTS OF M (1964_80)

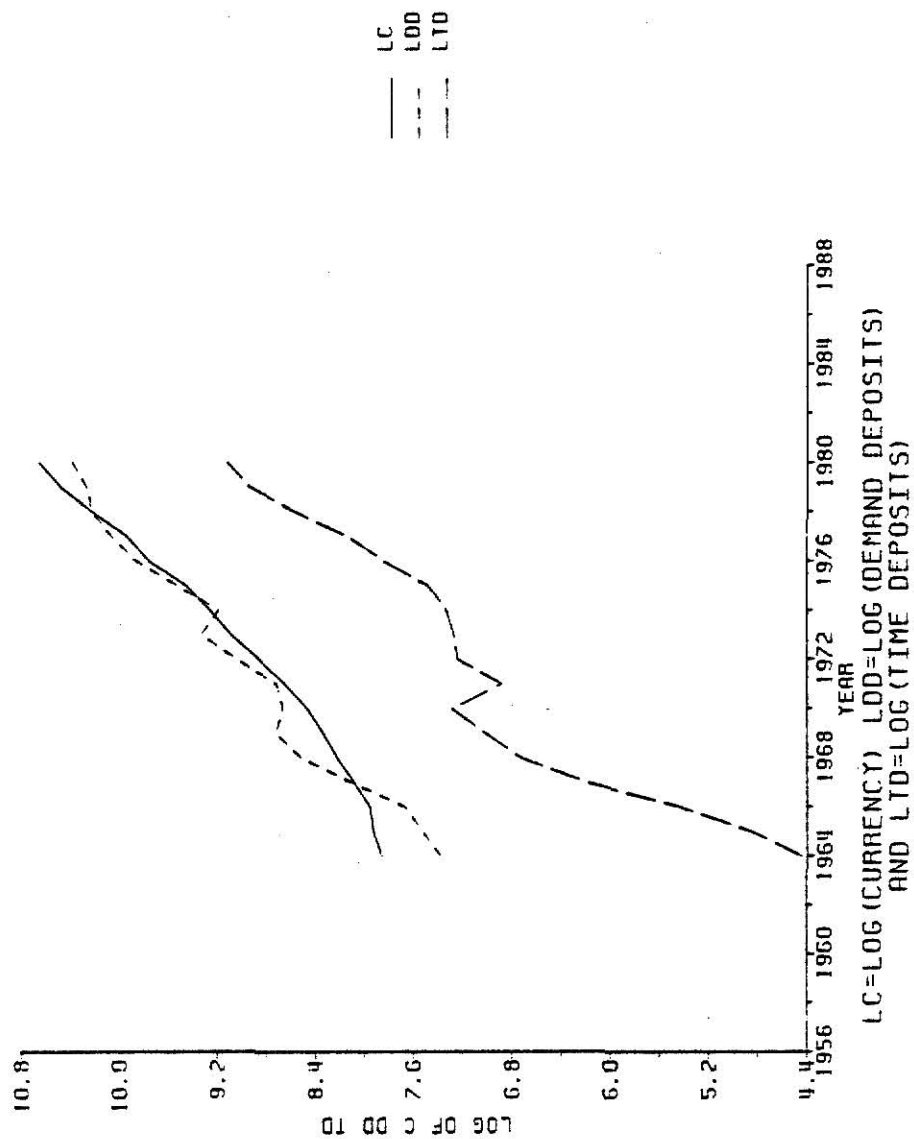


Figure 4

$$\text{and } \ln c_t^* = \ln \beta_0 + \beta_1 \ln \text{cost}_t + \beta_2 \ln y_t \quad (7)$$

The equations (5), (6) and (7) show that the same procedure used for the aggregate demand for money will be followed for the demand currency, and later on for the demand for deposits.

If $\lambda = 1$ we get

$$\ln c_t = -8.6939 - 0.0378 \ln \text{cost}_t + 1.7167 \ln y_t^{**}$$

(1.0451) (0.0264) (0.1058)

$$'t' \text{ Ratio } -8.3186 \quad -1.4323 \quad 16.2170$$

$$R^2 = 0.9804 \quad DW = 1.8972 \quad \text{period: } 1964-80.$$

If $\lambda \neq 1$ then

$$\ln c_t = -5.8736 - 0.0665 \ln \text{cost}_t^{**} + 1.0070 \ln y_t^{**} + 0.5155 \ln c_{t-1}$$

(1.9673) (0.0303) (0.4403) (0.3116)

$$'t' \text{ Ratio } -2.9857 \quad -2.1974 \quad 2.2869 \quad 1.6542$$

$$R^2 = 0.9840 \quad DW = 2.1642 \quad \text{period: } 1964-80.$$

Regression of equation (5) shows that income elasticity is highly significant with a coefficient greater than unity, while the cost elasticity is completely insignificant. That is to be expected because the proportion who hold their wealth in the form of cash and do not use deposits and other forms of money substitutes are the less responsive to inflation. From equation (6) regressed we get the estimated value of λ , $\lambda = 0.48$ ($1 - 0.5155$). This value of λ suggests that 50% of the discrepancy between actual and desired cash balances is eliminated in one year. Also because of the

* Statistically significant at 10 percent level.

** Statistically significant at 5 percent level.

insignificance of the coefficient of c_{t-1} , equation (5) can be seen as more accurate than equation (6) for the demand for currency. The long-run demand for currency is therefore:

$$\ln c_t^* = -12.12 - 0.013 \ln \text{cost}_t + 2.078 \ln y_t.$$

b. The Demand for Demand Deposits

$$\ln dd_t = \ln \beta_0 + \beta_1 \ln \text{cost}_t + \beta_2 \ln y_t \quad (8)$$

$$\ln dd_t = \lambda \ln \beta_0 + \lambda \beta_1 \ln \text{cost}_t + \lambda \beta_2 \ln y_t + (1-\lambda) \ln dd_{t-1} \quad (9)$$

$$\ln d_t^* = \ln \beta_0 + \beta_1 \ln \text{cost}_t + \beta_2 \ln y_t \quad (10)$$

If $\lambda = 1$ we get

$$\ln dd_t = -9.9791 - 0.0896 \ln \text{cost}_t + 1.8535 \ln y_t^{**}$$

(3.5759) (0.0951) (0.3622)

$$'t' \text{ Ratio } -2.7906 \quad -0.9903 \quad 5.1174$$

$$R^2 = 0.8065 \quad DW = 0.8041 \quad \text{period} = 1964-80.$$

Equation (8), again, shows that only income elasticity is significant, the insignificance of the coefficient of the cost of holding demand deposits might be explained by the fact that demand deposits do not bear any interest which makes them a substitute of hard cash except for the security reasons.

From equation (9) regressed we get the estimate value of λ .

$$\ln dd_t = -4.7578 - 0.2055 \ln \text{cost}_t^{**} + 0.6174 \ln y_t + 0.8722 \ln dd_{t-1}^{**}$$

(2.5620) (0.0632) (0.3603) (0.1951)

$$'t' \text{ Ratio } 1.8570 \quad -3.2487 \quad 1.7136 \quad 4.4692$$

$$R^2 = 0.9274 \quad DW = 1.5476 \quad \text{period: } 1964-80.$$

Thus $\lambda = 0.13$, which makes the long-run demand for demand deposits as follows:

$$\ln dd_t^* = -37.22 - 1.61 \ln \text{cost}_t + 4.83 \ln y_t$$

c. The Demand for Time Deposits

Because time deposits do provide interest rates, although artificially low, between 3 and 4 percent, one would expect time deposits users to react rationally when faced with inflationary expectations, that is they would reduce their holdings of cash and increase their savings.

$$\ln td_t = \ln \beta_0 + \beta_1 \ln cost_t + \beta_2 \ln y_t \quad (11)$$

$$\ln td_t = \lambda \ln \beta_0 + \lambda \beta_1 \ln cost_t + \lambda \beta_2 \ln y_t + (1-\lambda) \ln td_{t-1} \quad (12)$$

$$\ln td_t^* = \ln \beta_0 + \beta_1 \ln cost_t + \beta_2 \ln y_t \quad (13)$$

If $\lambda = 1$, we get

$$\ln td_t = -23.4957 - 0.2313 \ln cost_t + 3.0221 \ln y_t^{**}$$

(5.7975) (0.1467) (0.5872)

$$'t' \text{ Ratio } -4.0527 \quad -1.567 \quad 5.1464$$

$$R^2 = 0.7771 \quad DW = 0.6628 \quad \text{period: 1964-80}$$

Indeed, in addition to the significance of the coefficient of income, the coefficient of the cost of holding money is relatively significant compared to the demand for currency and demand deposits. In fact given the artificially low rates of interest, people are only minimizing their costs.

If $\lambda \neq 1$, equation (12) provides the following results:

$$\ln td_t = -8.4260 - 0.2260 \ln cost_t^{**} + 1.0750 \ln y_t^{**} +$$

(3.7354) (0.0730) (0.4234)

$$0.7075 \ln td_{t-1}^{**}$$

(0.1112)

$$'t' \text{ Ratio } -2.2557 \quad -3.0929 \quad 2.5388 \quad 6.3578$$

$$R^2 = 0.9490 \quad DW = 2.0643 \quad \text{period: 1964-80.}$$

From this equation we get the estimate of $\lambda = (1-\lambda) = 0.7075$

that is $\lambda = 0.29$. And the long-run demand for demand deposits will be

$$\ln td_t^* = -28.8 - 0.77 \ln \text{cost} + 3.67 \ln y_t.$$

Regression of equation (12) does provide the best estimate of the partial demands for money (currency, demand deposits and time deposits) in terms of overall level of significance (higher R^2) and also in terms of levels of significance of the coefficients (cost and income). Also the regression of equation (12) supports the hypothesis that people who do use time deposits increase their savings by decreasing their holding of hard cash when faced by inflation. This behavior is much more visible with one year lag as specified by the estimates (for the different coefficients) of equation (12).

In summary it can be stated that, in the aggregate the demand for money in Algeria is best explained by the variables permanent income and the cost of holding money, that is the demand for money in Algeria does represent an intermediate case. However it is to mention that the coefficient of the interest elasticity of the demand for money (where interest is the expected cost of holding money) is only significant at 10 percent level, also, this coefficient is low in Algeria, no more than -0.1. This value of cost elasticity is not surprising given the fact that Algeria's moderate rate of inflation constrains some erratic movements. People tend to adjust to the price level, although mainly with one year lag, and do not pay much attention to the relatively minor deviations that occur from time to time and

this in addition to the belief of price stability of some goods like housing and some foodstuffs.

But the income elasticity of the demand for money is well above unity (1.8), meaning that people regard money holding as a luxury good and increase their holdings of this commodity at a rate proportionately greater than their increase in income.

When dealing with component demands for money (currency, demand deposits and time deposits), the findings are not quite similar. Although the coefficients of income elasticity are highly significant and above unity, the interest elasticities in addition to their low level are not statistically significant and the best level of significance is found when dealing with demand for demand deposits (only 14 percent). This relative difference in cost elasticity could be explained by the important growth enregistered by time deposits as a result of the creation of some incentives to use these deposits. Also one might expect that better understanding of the banking and financial system in Algeria would make these types of deposits more attractive, a phenomenon that would be translated by secure sources of funds to the economy compared to other sources such as borrowing from outside or printing of money. Finally it is to mention that the demand for more inclusive definition of money, M_2 , provides a better econometric fit than M_1 .

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Chapter 5
BEHAVIOR OF VELOCITY IN ALGERIA

A. Behavior of Velocity: Some Theoretical Evidence

The velocity of circulation of money is a flow concept ($V = GNP/M$), it is defined as the average number of transactions made with one unit of money. This concept distinguishes between the stock of money and the volume of use of the same stock. The real stock of money is primarily determined by the holders of money who are able to change its value in the aggregate. A decrease in the real cash balance leads to greater volume of expenditures which does not decrease the nominal stock of money, however, through increased price level, it will decrease the real stock of money. Because velocity is the ratio of money income (or total transactions) to the nominal stock of money, an increase in money income through greater level of expenditures will tend to make velocity go up. However, since an increase in expenditures is the result of the desire to decrease cash balances, a rising velocity is equivalent to a decreasing demand for real cash balances. Throughout the years, it has been observed that velocity has been experiencing cyclical behavior (at least in Western economies) increasing during expansion phases, and declining during recessions. Also the long-run behavior of velocity has showed in Western economies a U-shaped pattern over the past century.

1. The Long-Run Behavior of Velocity

Perhaps the most popular attempts to explain the long-run behavior of velocity in the U.S. economy are the Friedman and Tobin explanations. It is also to note that most western economies have had a U-shaped pattern of velocity, which suggests that any reasonable explanation for the U.S. velocity could hold for the rest of Western development economies.

a. The Friedman Approach

Friedman (1959) [2] and Friedman and Schwartz (1963) [3] when examining the economic U.S. data from 1867 to 1960, observed a steady decline in velocity until the Second World War when it started to climb. By treating money as a "luxury" good (income elasticity greater than unity) Friedman deducted that the long-run trend of velocity should be downward. Up to the late 1940's his theory seemed to be holding. But the post World War II was seen by Friedman as a temporary phenomenon which would stop once the temporary events had disappeared. He treated these events (temporary) as a consequence of the post-war high degree of confidence about future economic stability that tended to gradually reduce the demand for money and other highly liquid assets.

However, the continuous rise in velocity since the Second World War seems to be suggesting some doubts about the theory that predicts that velocity should decline over time. The alternative approach that explains the behavior of velocity is provided by J. Tobin.

b. The Tobin Approach

J. Tobin (1965) [4] explains the upward trend in velocity by the increased financial sophistication and the improved economic stability. This approach is known as the institutional explanation. The financial sophistication is translated by the development of a large number of money substitutes which led to an increase in the demand for money substitutes which led to a reduction in the demand for money as an asset. Also the introduction of new methods of economizing on money balances (such as credit cards) and the development of commercial paper market in addition to the introduction of negotiable certificates of deposits are perhaps the most important images of the financial sophistication. The second important element that contributes to the rise of velocity is the improved economic stability which is translated by a general economic welfare protecting consumers against the consequences of any economic depression. All these institutional transformations give people confidence about the future which make them reduce their holdings of money.

In a recent paper Bardo and Jonung (1981) [1] contribute to the institutional approach with a study covering five western economies (Canada, United States, Norway, Great Britain and Sweden). By examining the data of the five economies over the past century, they found that the income velocity displayed a U-shaped pattern for the five countries. The authors tended to stress the influence of the institutional developments that occurred in the five nations over

the behavior of velocity in the long-run. They also suggested that international linkages between these countries might have contributed to the spread of institutional changes which had their effect on the demand for money. They finally concluded that "the introduction of variables representing monetization, financial sophistication and economic stability adds significantly to the explanation of the secular pattern of velocity, specifically putting into question the role of permanent real per capita income in the specification of the long-run demand for money."

2. The Cyclical Behavior of Velocity

The income velocity of money experiences a procyclical pattern. It rises when the economy is in expansion, and falls during recessions. The reasons for this behavior could be found in more than one hypothesis. To cite only two we have:

a. Velocity and Interest Rates

It is usually observed that interest rates tend to increase during expansion phases and decrease in recession periods. In connection with the demand for money, if we accept that interest rates are a determinant variable in the demand-for-money function, high interest rates, during expansion tend to induce people to minimize their holdings of money, which make the income velocity rise, and during depression the phenomenon is reversed.

b. Permanent Income Hypothesis and Velocity

Because demand for money depends on permanent income rather than measured income it follows that it (demand for

money) is a stable function, and following the ups and downs of measured income, velocity tends to display a procyclical behavior as a consequence. During depression, measured income falls below permanent income which makes velocity drop (because demand for money is stable) and inversely during expansion, measured income gets larger than permanent income which results in an increase in velocity.

B. Behavior of Velocity in Algeria (1962-1980)

Because of the short time life characterizing the Algerian economy since its independence (1962) it is rather impossible to talk of any such thing like long-run behavior of velocity in Algeria. The best that can be done is to deal with short-run analysis. To try to do that we can start by considering Figure 5 and the change of velocity, real GDP, per capita GDP, and population (Table 5-1).

TABLE 5-1

Percentage Change in the Annual Average Velocity of Money(*) Real GDP, Per Capita Real GDP and Population					
Year	% ΔV_1	% ΔV_2	% Real GDP	% Δ Per Capita Real GDP	% Δ in Population
1964	--	--	--	--	--
1965	+5.0	+4.3	14.9	9.9	4.5
1966	-10.3	-11.8	-5.0	-10.5	6.2
1967	-15.7	-18.0	9.3	5.8	3.2
1968	-13.3	-15.0	14.3	10.5	3.2
1969	-6.9	-7.9	9.3	5.6	3.4
1970	+8.4	+5.5	7.1	3.9	2.9
1971	-8.5	-3.8	-2.8	-5.7	3.1
1972	-9.5	-10.2	15.5	11.9	3.1
1973	-1.2	-0.4	1.4	-1.7	3.2
1974	+31.8	+32.4	3.9	0.7	3.2
1975	-17.2	-16.2	4.2	1.0	3.2
1976	-12.0	-12.2	9.5	6.1	3.1
1977	-2.0	-2.8	5.2	1.9	3.2

TABLE 5-1 Continued

Year	% V_1	% V_2	% Real GDP	% Per Capita Real GDP	% in Population
1978	-1.0	-2.7	6.0	3.5	2.4
1979	+4.1	+2.0	9.5	5.9	3.4
1980	+9.7	+9.3	16.8	13.8	2.6

(*) V_1 is defined as GDP/M_1 and V_2 as GDP/M_2 .

The general pattern of velocity is mostly downward for the period in question. And if we try to apply the reasoning presented above, that is velocity increases during expansion and decreases during contraction we would apparently be facing a contradiction given the figures displayed by real GDP and per capita real GDP. It should also be mentioned that given the very nature of development policy adopted in Algeria, on the basis of a centrally planned economy, the theory of business cycle is rather unknown to the system, and imported cycles are also an exception like political disturbances. In connection to this we could mention that following a coup d'etat in June 1965 a decline in GDP occurred in 1966, also as a consequence of a nationalization of the oil industries, and a boycott of Algerian exports especially on the French market (because most of expropriated oil firms were French). Another decline in real GDP took place in 1971, during the same year of the events. With the exception of these two years, real GDP has been increasing, although not steadily.

BEHAVIOR OF VELOCITY

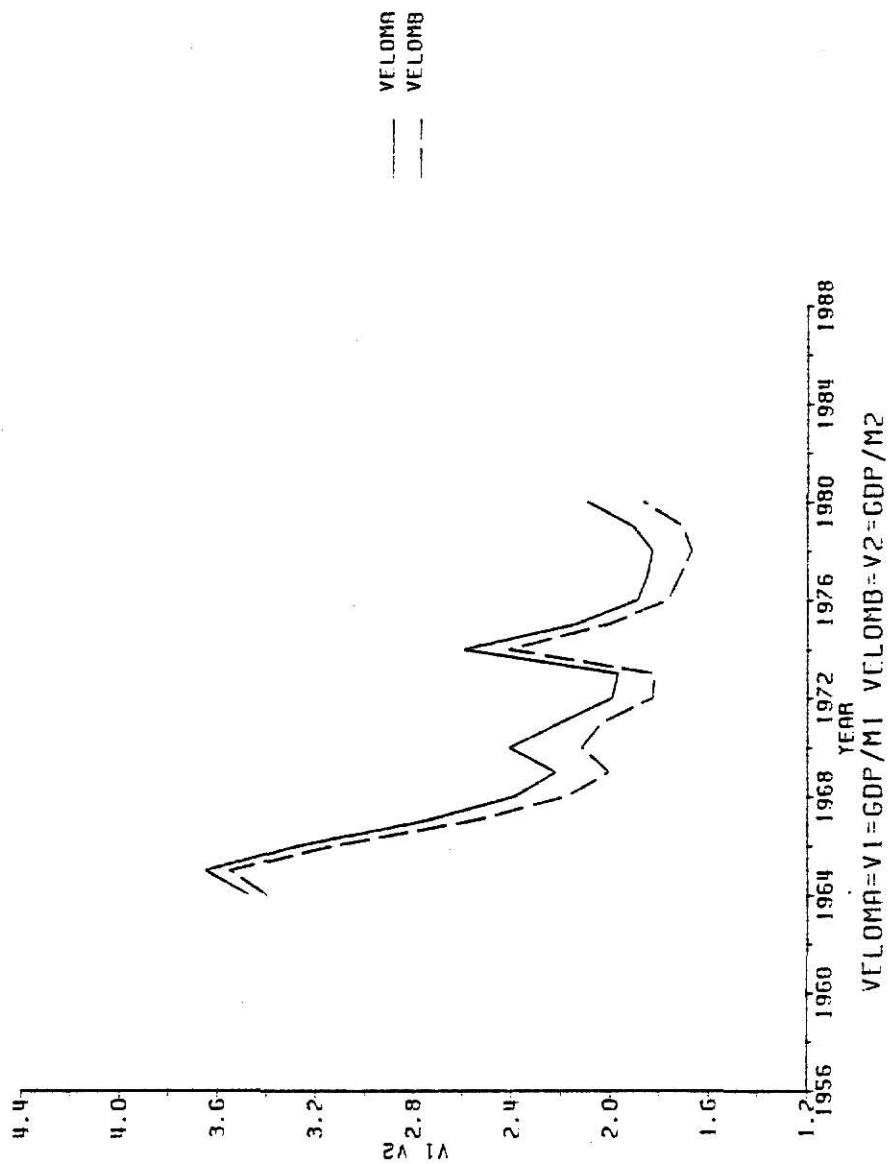


Figure 5

The downward trend of the income velocity must be seen in the context of the structural transformations that are taking place in Algeria. These structural transformations are generally difficult to quantify, but some proxy variables could be reasonable. The monetization process for instance is an important element of these structural transformations. Throughout these transformations visible consequences would be reflected on elements such as shifts from self-subsistence agricultural production to market production, increase in agricultural and industrial production, spread of commercial banking facilities. . . and all these changes would have their effect on GDP and stock of money, and therefore on velocity. For instance, the development of the banking system leads to changes in monetary "habits" and increases the stock of money which may increase or decrease velocity given the behavior of the national income. In the case of Algeria, it is certainly a negative effect (in the sense of a decreasing velocity) that arises from a relative rapid growth of deposits which is accompanied by a slow and gradual change in monetary habits with less intensive use of money balances. That is, increases in deposits cause the denominator of velocity ($V = \text{GDP}/M$) ratio to rise faster than the gross domestic product. The demand deposits went from A.D. 1.59 billions in the 1964 to A.D. 32.2 billions in 1980, that is an increase of 20.2 times during the 17 year period covered. At the same time, time deposits started with A.D. 0.085 billions in 1964 and ended with A.D. 9.105 billions that is an increase of 107 times during 17 years. In

parallel to this currency increased by 16.4 times only, and most of the fluctuations (upward) after 1970 are mainly due to fluctuations in deposits (see Figure 4 in previous chapter). With respect to the tremendous increases in time deposits, one could attribute the phenomenon to incentives to hold such deposits in order to be eligible for housing benefits, given the housing crisis from which the country has been suffering and perhaps to the very modest interest rates (around 3 and 4 percent), through which time deposit holders are only minimizing their costs.

It is also to suspect that with some amelioration of the banking and financial facilities (that lead to larger deposits) velocity would decrease even further.

C. Some Empirical Results

In this section we will try to identify the factors that influence the income velocity in Algeria. The first variable in the model will be a proxy for permanent income (and also per capita permanent income). This is based on the belief that velocity is inversely related to per capita real income with the assumption that money is a luxury good. Also a proxy for the cost of holding money is included in the model (the cost variable is identical to the one used in Chapter 4). The models that will be considered are as follows:

$$\ln V = \beta_0 + \beta_1 \ln y_t$$

$$\text{and } \ln V = \beta_0 + \beta_1 \ln y_t + \beta_2 \ln \text{cost}_t$$

Two measures of velocity will be considered depending on the definition of money: V_1 based on the inclusive definition of

M (M_1 = currency plus demand deposits) and V_2 based on the broader definition ($M_2 = M_1 +$ time deposits), both measures (V_1 and V_2) use the gross domestic product as numerator.

The actual results from the regressions are as follows:

$$\ln V_1 = 6.6771 - 0.5752 \ln y_t^{**}$$

(0.9313) (0.0918)

't' Ratio 7.1650 -6.2592

$R^2 = 0.7231$ $DW = 1.1427$ period: 1964-1980.

$$\ln V_2 = 7.1521 - 0.6298 \ln y_t^{**}$$

(1.0118) (0.0997)

't' Ratio 7.0683 -6.3117

$R^2 = 0.7265$ $DW = 0.9935$ period: 1964-80.

From these first two regressions it is clear, that the proxy for permanent income is highly significant with a negative sign supporting the hypothesis that velocity is inversely related to real income. However to be more accurate about this hypothesis we should try real per capita permanent income instead of aggregate real income.

y_t (c) will be defined as real per capita permanent income.

$$\ln V_1 = 9.4194 - 1.1445 \ln y_t^{*(c)}$$

(1.5113) (0.2017)

't' Ratio 6.2326 -5.6733

$R^2 = 0.6821$ $DW = 1.2152$ period: 1964-80.

$$\ln V_2 = 10.1965 - 1.2587 \ln y_t^{*(c)}$$

(1.6266) (0.2171)

't' Ratio 6.2684 -5.7971

$R^2 = 0.6914$ $DW = 1.0906$ period: 1964-80.

Indeed velocity is negatively related with real per capita income, and this is another way of stating that money is a

luxury good. By introducing the variable cost in the model we get:

$$\ln V_1 = 7.9547 - 0.7084 \ln y_t^{**} + 0.0490 \ln \text{cost}_t$$

(1.3744) (0.1399) (0.0393)

't' Ratio 5.7877 -5.0635 1.2460

$R^2 = 0.7508$ DW = 1.0741 period: 1964-80.

$$\ln V_2 = 8.7944 - 0.80102 \ln y_t^{**} + 0.0630 \ln \text{cost}_t$$

(1.4587) (0.1484) (0.0417)

't' Ratio 6.0289 -5.3945 1.5091

$R^2 = 0.7647$ DW = 0.9802 period: 1964-80.

Also by using $y_t(c)$ (real per capita income) we get:

$$\ln V_1 = 10.8255 - 1.3393 \ln y_t^{**}(c) + 0.0354 \ln \text{cost}_t$$

(2.2781) (0.3104) (0.0426)

't' Ratio 4.7520 -4.3144 0.8318

$R^2 = 0.6971$ DW = 1.1839 period: 1964-1980.

$$\ln V_2 = 12.1472 - 1.5289 \ln y_t^{**}(c) + 0.0492 \text{cost}_t$$

(2.4115) (0.3286) (0.0451)

't' Ratio 5.0371 -4.6527 1.0900

$R^2 = 0.7155$ DW = 1.1032 period: 1964-80.

From all the above regressions, one thing is made clear, the coefficient of the proxy of permanent income is highly significant, and its negative sign confirms what has been stated in Chapter 4; money is a superior, that is people increase their holdings of money at a rate proportionately greater than their increase in income. However the coefficient of the cost of holding money, although having the expected sign (positive) is not highly significant, and perhaps the reasons for that are the same that made the coefficient of the cost variable in Chapter 4 not highly significant. That is, the

(**) Statistically significant at 5% level

price policy in Algeria which assures some price stability for some goods, and also the state of development of the banking and financial system which can be considered relatively underdeveloped.

In summary, findings of the analysis of velocity in Algeria do support the results found when dealing with the demand for money in the previous chapter. Although some other factors are affecting the behavior of velocity (making it decline for most of the periods under consideration), the fact that the money is shown to be a superior good is probably the main reason for making the velocity of money income have a declining path.

In Chapter 4 it has been shown both income elasticity and interest elasticity were significant in the determination of the demand for money in Algeria (intermediate case). However it has also been found that the coefficient of the interest elasticity (cost) was significant at a 10% level only in the demand for money model, and not significant when dealing with the velocity model, and all this in spite of a non-negligible rate of inflation (averaging 8% per year), especially during the last decade. Because of this phenomenon a closer look at inflation in Algeria might be considered in order to try to provide a reasonable explanation.

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Chapter 6 Determinants of Inflation in Algeria

A. Inflation In Developing Countries: Some Characteristics

With the exception of some countries (Latin American ones perhaps), inflation in developing nations is not always a threat to economic development. That is because inflation varies in space and time, in other words fluctuations in the rates of inflation tend to vary from one country to another and change over time for each economy. Therefore, the absence of a steady trend in most developing nations has to do mainly with the type of economic policy followed. In this framework economists are divided between one group that argues that inflation is a monetary phenomenon, and another group that suggests that inflation is rather a consequence of structural changes that occur in the socio-economic system when development starts taking place.

In the monetarist model, inflation is viewed as a result of an excess supply of money over its demand. That is, if the money supply rises by more than the demand then expenditure on goods and services will rise with a consequent rise in prices or output. If we assume that the economy is at its full capacity level, the excess supply of money will result in a proportional increase in the price level. From this simplified scheme of the quantity theory, inflation can be seen as a function of the growth of money supply.

With respect to this monetarist context, we may refer to a study by Vogel (1974) [5], a study in which inflation in 16 Latin American countries was covered. In fact, Vogel's paper was a continuation of a study done earlier by Harberger (1963)-"The Dynamics of Inflation in Chile." Vogel presented a number of results for the pooled data (of the 16 countries) and also for individual countries. Vogel tested the hypothesis that inflation in Latin America was a monetary phenomenon. The pooled data generated a high R^2 's of over 0.80, but for individual countries the results were rather mixed, especially for El Salvador, Mexico and Chile, for which the model did not provide satisfactory results. Vogel concluded that "Even if the causes of inflation in Latin America are adequately explained by the present monetarist model, purely monetarist conclusions may not be implied for stabilization policy, since rates of inflation require up to two years to adjust to changes in the money supply, and this may be a longer period of austerity than most Latin American regimes can tolerate politically." The useful side of the monetarist model is perhaps the fact that there is a model which is clearly recognizable as a derivation from the postulate of a stable demand function for real cash balances, while the structuralist models are rather an amalgamete of economic, social and political factors hardly quantifiable. An important feature of the structuralist models, however, is the emphasis placed on the relationship between inflation and economic growth, that is inflation is an unavoidable phenomenon given the nature of the massive investments

deployed, and only long-run sustained growth will be the appropriate cure for this inflation. It is also often suggested that the relative inelasticity of the supply, in particular food supply, is the main characteristic of the structural model, that is there is a tendency for output of food and other goods to lag behind the demand, a demand that is growing quite fast as a consequence of the expansion of the income in the non-agricultural sector and also a shrinking in the national supply of food. It is also necessary to note that in the structuralists do not deny the effect of monetary expansion on inflation. R. Prebisch (1971) [2] is perhaps the leading figure in the structuralist school in Latin America. He considers that "the general mistake persists of considering inflation as a purely monetary phenomenon to be combated as such. Inflation cannot be explained as something divorced from the economic and social maladjustments and the stress to which the economic development of our countries gives rise." In this context the disturbances in every economic sector, as a result of structural transformation, tend to witness the process of economic growth that is taking place. Shifts of labor force and capital from traditional and less productive sectors such as agriculture lead to sudden shortages of food and other goods, and the refuge to the international market is not always the best solution for poor nations given their budgetary deficits.

B. Growth and Inflation in Algeria

Inflation in Algeria, especially starting in the early seventies has become a serious threat for a young centrally planned economy. The implicit GDP deflator for instance increased from 100 in 1970 (1970 year base) to 318.4 in 1980, and the consumer price index reached the level 174.6 during the same period (1970 year base). And this inflation happened to correspond to a period of massive investments which in most cases were located in highly capitalistic (capital intensive) industries, and a good proportion of these investments were financed by creation of money from the central bank. For the first four year plan (1970-1973) planned investments needed 24.96 billions of Algerian Dinars (A.D.) of which 32.5% was generated by creation of money; the second four-year plan (1973-1977) required A.D. 90.27 billions of which 25.9% money created by the central bank [1]. All these investments created a new economic environment that took the image of transfer of labor force from rural to urban zones. Also new networks of transportation, communication, . . . were to be provided into the system in order to try to adjust to the new economic environment. The introduction of the Agrarian reform in 1971 generated its share of transformation by setting of new distribution of land, and the mechanization of the agricultural sector, but the new process did not provide a continuous adjustment between supply and demand for agricultural products. In parallel to these changes, monetary expansion in general was characterized by

a rapid growth. The money supply grew by as much as 20 times between 1964 and 1980, and by 7 times between 1970 and 1980. Imports of machinery, and some other products were also growing over time given the increasing demand for practically every item. It also happened that in many cases recourse to the international market was relatively inevitable in order to satisfy the national demand, and by doing so the economy was running the risk of importing some inflation that would be added to the domestic one.

1. External Factors:

The average propensity to import in Algeria was 0.248 during the decade 1960-1977, and most of the imported goods consisted of machinery required by the economic plans. Also larger quantities of food products were imported during the last decade as a result of the deterioration of national food production and also as a result of a better pattern of consumption, especially in urban areas. Thus, because of this increasing dependence vis-a-vis the international market one might consider it as a potential source of inflation. However, starting in 1971 the nationalization of foreign oil firms gave new dimension in the import-export operations in the advantage of the national balance of payments and more helpful was the 1973-74 increase in oil price. As a result of both actions the export index price went from 100 in 1970 to 675 in 1977 and even higher for 1980, while the import index price showed a relatively moderate jump. It went from 100 to 214 for the same period (1970=100) [6]. These figures might not provide an

absolute explanation, but still they could suggest some idea that the effect of the international market was not decisive on inflation in Algeria except through the transfer of technology that created a continuous form of dependence with the western firms, a problem that goes beyond the scope of this present study. Still some of its effect could be captured in the variable investments. Also, the very nature of import-export that takes the form of monopoly controlled by the government seems to be minimizing the effect of imported inflation.

2. Internal Factors:

The accelerated rate of growth of investments in Algeria bred very high pressures on sectors such as construction, where the high level of demand on constructing products induced inflation that would represent a serious problem for the realization of the economic plans and also some forms of disequilibrium and a fall in productivity in general.

a. Intersectoral disequilibrium:

In the construction sector the supply of the construction materials was well below the excessive demand, and this was due mainly to the fact that the objectives of the economic plans were not realized on time. Only 50% for the cement, 65% for the briques. . . of the material demand was satisfied from the national production and the recourse to the international market did not resolve the problem because of the unorganized import-export monopoly (by the concerned authority) and also because of higher prices on the international markets as a result of higher energy cost on the

world market. As a consequence of these difficulties, and also a consequence of the quasi-stable price on the national market (because of governmental decision) parallel markets were created where prices were almost doubled relative to the official ones. Also because of the shortage of qualified labor force, and union pressures, wages went up compared to the national standards, while the average hourly wage was between A.D. 2.36 and A.D. 2.6 in other sectors. The construction sector had an average of A.D. 2.63 to A.D. 2.88 per hour, and rates were even higher for qualified workers (A.D. 3.86 to 4.45 per hour) [3]. It is also pertinent to mention that these shortages hit hard small and private corporations. All these disturbances resulted in higher costs and delay in the realization of many economic projects. This was perhaps the obscure angle of the resulting transformations that spread from one sector to another, but the overall result was a noticeable progress in this construction sector where the annual growth rate went from 1.3 during the decade 1960-1970 to 13.5 during the period of the two economic plans (1970-1977) [6].

b. The deterioration of the productivity level:

The shortage of raw materials and semi-refined products added to the delay of realization of many economic projects, had led to a fall in general levels of production and productivity. The drops in productivity varied from one sector to another; serious declines occurred in new industries such as steel and mechanics. P. Antoine and D. Labbe

estimated an average decrease of productivity of 17 percent between 1969 and 1973 [3].

c. Price policy:

Faced with a decline in productivity, especially in sectors where enormous economic and social sacrifices were done, the price policy became a very sensitive element in the process of development. As mentioned before, prices, generally speaking, are centrally determined or fixed on the basis of negotiation between the national corporation and the government. The policy did not always have a positive effect on the overall economy. The aim of the government in supervising the prices is to try to provide a favorable climate for industrialization, but the profit incentive of the national corporations was not in perfect harmony with the government directives. And this form of contradiction might find its origin in the age and the level of development of the new established industries which cannot compete with the international firms whose products can be found on the national market given the fact that the national production is unable to supply the growing demand inside the country. And what might have worsened the situation for the national production is the role of commercialization given to the same companies, that is each company in addition to the production role it has the duty of commercializing the imported goods related to its area of specialization. Although high tariffs are imposed on import goods, differentials in quality give the advantage to imported products,

which in their turn provide a source of profit for the same national corporations. The following figures show the evolution of the process of production and commercialization of imported goods for two major companies of steel and mechanics industries respectively.

S.N.S. and Sonacome (Figures in percentage terms)		1969	1970	1971	1972	1973
National Production						
	S.N.S.	37	34	54	51	39
	Sonacome	47	19	13	7	31
Sales of Imported Products						
	S.N.S.	62	65	44	45	50
	Sonacome	43	76	86	92	69

From: Donnees sur L'activite des Societies Nationales 69-74
Alger Sep 1975 p. 85-86.

C. Some Empirical Results:

In relation to the massive increase in the supply of money and investments some empirical work will be tried in order to find the potential source(s) of inflation in Algeria, but before that, a numerical presentation of some important determinants of the economy will give a concrete image to the process.

Percentage Change in the Annual Average Stock
of Money (M_2), Real Investments and Price Level, and
Real GDP (Billions of 1970)

Year	M_2	Real GDP	Real GDI	Price Level
1964	--	--	--	--
1965	11.43	14.93	43.13	1.09
1966	9.39	-5.01	-25.59	1.51
1967	34.79	9.33	47.56	1.06
1968	35.91	4.39	45.04	0.95
1969	19.85	9.34	27.99	0.93
1970	4.96	7.10	30.67	3.41
1971	6.72	-2.77	-2.07	5.60
1972	32.08	15.56	6.58	2.65
1973	12.22	1.44	16.39	10.14
1974	14.75	3.93	-0.33	46.15
1975	29.93	4.27	19.80	4.01
1976	37.73	9.55	2.20	10.36
1977	20.62	5.20	11.21	11.43
1978	27.62	6.07	-14.14	17.11
1979	10.56	9.59	7.79	11.32
1980	16.93	16.86	18.05	9.42
Average	22.21	7.29	14.64	8.57

As shown above by the figures, the supply of money between 1964 and 1980 has shown considerable increase with some fluctuations over time. This increase was a direct consequence of an economic strategy that dictated massive investment mainly in the industrial sector financed in part by money creation. In parallel to these monetary policies, structural transformations were taking place, and often translated themselves by intersectoral disequilibria. Given these few facts tests will be conducted in order to try to find out the potential sources of inflation in Algeria.

1. A Monetarist Model:

Perhaps the most common monetarist model is written as follows: $P = M - aY + bC$ (1) where P is the rate of growth of GDP deflator or consumer prices, M the rate of growth of the stock of money supply, Y the rate of growth of real income, and C the rate of change of the expected cost of holding money. In this model, it is assumed that there is an instantaneous adjustment of the economic system to changes in the money stock. The other formulation of the model that can take into account the lagged adjustment is as follows:

$$P = a_0 + a_1 M_t + a_2 M_{t-1} + a_3 Y_t + a_4 P_t^1 \quad (2)$$

where $P_t^1 = (P_{t-1} - P_{t-2})$ is supposed to quantify the cost of holding money and M_{t-1} is the money supply lagged for 1 period. Using Algerian data we get:

$$\ln P_t = 3.2269 - 0.0257 \ln M_{1t} + 0.0322 \ln M_{1t-1} - 0.7850 \ln Y_t + 0.0083 \ln P_t^1$$

(3.6163) (0.5390) (0.9122) (0.6160) (0.4353)

't' Ratio 0.8923 -0.0478 0.0354 -1.2743 0.0193

$R^2 = 0.1967$ DW = 1.1018 period: 1964-1980

$$\ln P_t = 4.2852 - 0.2146 \ln M_{2t} - 0.1395 \ln M_{2t-1} - 0.7640 \ln Y_t - 0.0379 \ln P_t^1$$

(3.7066) (0.7331) (0.8062) (0.6343) (0.4366)

't' Ratio 1.1561 -0.2927 -0.1731 -1.2044 -0.0869

$R^2 = 0.2068$ DW = 0.9886 period: 1964-1980

In the regression we first note that no coefficient is statistically significant. Thus, the overall level of

significance is very low. We know that in the monetarist model, inflation is a monetary phenomenon, that is, if holding everything constant, the current rate of inflation will be positively related to the stock of money. In the above finding not only the coefficient of the current rate of growth of the stock of money has the wrong sign, but also it is insignificant, a result that allows us to reject the monetarist explanation of inflation for Algeria. However, the coefficient of the lagged stock of money shows the expected sign when using ΔM_1 , but it is also insignificant. Also in the monetarist thesis the current rate of inflation ought to be negatively related to the rate of change of real income, in our case, although the coefficient of the change of real income (Y_t) carries the right sign, it is far from being significant, and the same observation of sign and level of significance holds for the coefficient of holding money. It is also expected that the coefficients of the stock of money add to unity, fact that is not true in the above findings. In summary, we can state that the available data applied to the standard monetarist model is conclusive about the rejection of the theory that inflation is a monetary phenomenon. An alternative approach to this problem of inflation in Algeria is proposed below.

2. A Structural Model:

As discussed above, the investment policy through the economic plans is rather unusual for a developing nation, and perhaps the major reason that has been encouraging this

policy in Algeria is the relative availability of funds from the export of oil and natural gas, especially after the 1973-74 oil crisis. However, such policy has not provided a perfect economic environment, at least in the short-run, a policy that has been followed by structural transformations in the rural and urban areas resulting in intersectoral disequilibriums. Given this important role played by the investment policy in Algeria, one might expect it as a potential source of inflation--that is, the more investment is done the more inflation is to be expected, at least in the short-run, until these investments get to maturity. The following model is a simple formulation of a structural model that includes the rate of change in the money supply and real investments.

$$\ln P = \beta_0 + \beta_1 \ln M_t + \beta_2 \ln I_t + u_t \quad (3)$$

where P is the rate of change in the implicit GDP deflator, M_t is the rate of change in the stock of money (using both definitions of M) and I_t the real investments (nominal investments deflated by the implicit GDP deflator).

The results using M_1 (currency plus demand deposits) definition of money are:

$$\ln P_t = -16.1296 - 0.1077 \ln M_{1,t} + 1.9001 \ln I_t$$

(3.7883) (0.2289) (0.3860)

$$'t' \text{ Ratio } -4.2577 \quad -0.4704 \quad 4.9227$$

$$R^2 = 0.7899 \quad DW = 1.5936 \quad \text{period: } 1964-80$$

And using M_2 definition of money we get

$$\ln P_t = -15.4671 - 0.1950 \ln M_t + 1.8585 \ln I_t$$

(4.0738) (0.3134) (0.3941)

't' Ratio -3.7967 -0.6222 4.7150

$R^2 = 0.7946$ DW = 1.5187 period: 1964-80

Once again the coefficient of change of stock of money carries the wrong sign (negative instead of positive) and because it is not significantly positive, the case for a monetarist explanation is nonexistent. The new feature of the model above is the introduction of the variable real investments. With this new variable the model gets a higher overall level of significance in terms of R^2 ; it is also found that the coefficient of real investment is positive and significant suggesting that investment is a source of inflation, and this finding may suggest some form of support to the idea of the inflation of development suggested by the structuralists.

Thus, given this simple postulation of inflation in Algeria, we can conclude that the available data used in the models does not provide any support for the theory that inflation is a monetary phenomenon. Also if we accept that investment is a relevant variable in the structuralist model, we may conclude that investment is a cause of inflation, and this feature might persist in the economy until the "infant" industries newly established get to maturity and arrive at the stage of being able to produce at low costs that would adjust national prices with the ones on the international market. This possibility might not be very far in the future if enough mastering of the advanced imported technology happens pretty soon, in addition to a better integrating of the economy as a whole.

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CONCLUSION

Despite the fact that prices in Algeria have a tendency to be centrally determined, it was found that the demand for money was determined by the cost of holding money in addition to the permanent income. In other words, the demand for money in Algeria did represent an intermediate case. The possible consequence of the relative prices control, the state of development of the banking and financial system and also the banking "habits" of the public in Algeria was that the interest elasticity in the demand-for-money function was significant at a 10 percent level only.

It was also found that the income elasticity for the demand for money was well above unity, a result that was suggesting that people regarded money holdings as a luxury type of good and increased their holdings of this commodity (money) at a rate greater than their increase in income. Also the interest elasticity of the demand for money (where interest was the expected cost of holding money) was found relatively low (no more than -0.1). This low value of the interest elasticity could be considered as expected given the relative moderate rates of inflation experienced by the economy. This estimate suggested that people had a tendency to adjust to a relatively steady rise in the price level and did not seem to react to the sudden deviations from the price increase trend.

Following the analysis of the demand for money, a simple study of the behavior of velocity in Algeria was considered. Given the general downward trend displayed by the income velocity from 1964 to 1980, it was showed, through empirical work, that real per capita income was inversely related to velocity. The decreasing income velocity was expected because when dealing with the demand for money it was found that money was a superior good.

Finally, when considering inflation in Algeria important emphasis was put on the strategy of development and this through intensive investments carried out by different economic plans. In spite of tremendous rates of growth of the money supply during the period under consideration, it was not possible to conclude that inflation was a monetary phenomenon. The alternative model considered was containing the variable real investment as a proxy for structural transformations, and this was based on the belief that some proportion of the inflation was taking its roots from the accelerated investment plans while some other economic sectors were lagging behind (the agricultural sector in particular). Indeed, the estimated model did provide some satisfactory results suggesting that investment was a potential source of inflation in Algeria.

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THE DEMAND FOR MONEY IN ALGERIA

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AN ABSTRACT OF A MASTER'S THESIS

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The thesis starts with a brief presentation of the two main approaches to the demand for money (Keynesian and Monetarist). Then with the assumption that the theoretical framework of the demand for money holds broadly for developed and developing economies, some empirical findings from the analysis of the demand-for-money function in some less-developed economies are presented and this with some subsequent analysis of the behavior of velocity. Following this, the main point of the thesis, which is the demand for money in Algeria is considered under the angle whether the demand for money in Algeria can be identified to what is referred to as intermediate case or not, that is if both income

and interest rates are influencing the demand for money. This is done keeping in mind the effective price policy in Algeria, a policy which has been rather restrictive, that is faced with political and social constraints, prices have not been able to perform their assigned role at the image of free market prices. The analysis takes also into account the state of development of the banking and financial organization which has experienced different reforms in order to adjust with the financial needs of the strategy of development that is taking place in Algeria. Also because of the relative lack of development in the banking "habits" and because of the policy of setting artificially low rates of interest, a very important

proportion of the money in the economy is held under the form of hard cash. Given these facts, in addition to the estimation of the aggregate demand for money (using both M_1 and M_2 definitions), demand for currency and deposits (demand deposits and time deposits) are also separately estimated. Although the regressions considered do provide enough support to conclude that the demand for money is an intermediate case despite the fact that the elements mentioned above were expected to make the interest elasticity insignificant. It has been determined that money is a "luxury" good. Also from the analysis of the behavior of velocity during the same period under consideration (1964-1980), velocity was found inversely related to per capita real income, a finding that does confirm that money is a luxury good.

Finally, in dealing with inflation in Algeria, important emphasis is put on the strategy of development and this through the intensive investments carried out by the different economic plans. Despite the tremendous rates of growth of the money supply during the period in question it was not possible to support the theory that inflation was a monetary phenomenon. Consequently, another alternative to determine the causes of inflation was considered. The structuralist alternative was considered given the fact that the economy has been experiencing important structural transformations, and considering the investments undertaken as a proxy for these structural transformations estimation of inflation in a simple structuralist model was considered. Indeed the

estimated model does provide some satisfactory results suggesting that inflation has some origins in the structural transformations experienced by the economy through its period of 17 years. Consequently, future economic policies might take into consideration such results.