RESERVE RATIO AND COMMERCIAL BANKS PORTOFOLIO BEHAVIOUR IN GREECE, 1960 - 1981

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1. INTRODUCTION

The crucial questions which center monetary analysis are : What determines the money supply? Can the Central Bank act to influence that supply? If yes, how? These questions have generated a good deal of controversy in the past two decades. Given that money supply can be defined as the sum of currency in circulation outside the Banking System plus demand (and Time and Saving) deposits, the questions reduce to what determines cash and bank deposits. Therefore, the isolation of the factors [affecting the ingredients of the money stock (especially total deposits which constitute the main bulk of it) will lead to the understanding of the mechanism which causes changes of the money stock.

The purpose of this paper is to analyse the changes of the total money stock in terms of changes in the money multiplier and in cash-base and decide what has caused these changes. More specifically, following the so called «New View» of Money stock determination, it tries to examine the case according to which the reserve-ratio (which constitutes an ingredient of the money multiplier) depends on some index of rates of interest. If this holds true, changes in the rate of interest, will ceteris paribus, cause changes in the value of the money multiplier and hence the value of the money stock. This brings about the very important policy implication that money supply is an endogenous variable of the system.

2. SOME THEORETICAL ISSUES

The traditional approach (or the «old view») to the determination of the volume of bank deposits accepts that in a fractional reserve system, where rb

is the minimum ratio of reserves to deposits, the level of deposits D is equali to the level of reserves R times 1/rb : D = 1/rbXR, under the simplified assumptions of the existence of (a) a closed economy, (b) only two financial assets-cash and bank deposits, (c) a fixed non-bank public's demand for cash, (d) a supply of cash totally controlled by the government. If reserves increase by one unit $\Delta R = 1$, say by Central Bank purchases of securities from the non-bank public, then deposits will increase by a multiple amount of $\Delta (D) = 1/rb$. Of course, at a more complicated level, where an internal cash drain (c_p) is introduced, the expansion of deposits will be given by the formula : $\Delta (D) = 1/1 - (1 - c_p) (1 - r_p)$, and this amounts to say that the extent to which banks can create deposits is limited not only by their own cash requirements but also by the cash requirements of the non-bank public, i.e. the distribution of cash between bank and non-bank public.

Therefore, this approach considers the multiple expansion of deposits as the result of a converging process (since Cp and r_p are less than one) of successive rounds which have been initiated by an initial increase in reserves, resulting in a difference between the actual and the desired volume of them. In each round some of the initial excessive reserves, («leak» partly into required reserves by banks (rb) and partly in desired cash holdings (C_p of the public.

The importance of cash distribution between the bank and he non-bank public, creates the issue of the Governments' ability to control the money supply : ! If the Government expands the supply of cash [2], either through open market operations in the securities market or by purchasing goods and services from the private sector, those who receive it will either use it for consumption or deposit it with commercial banks providing thus reserves for expansion. In the first case the money supply has increased. In the second, bank reserves have increased and reserves are not included in the money supply ; only bank deposits held by the public are. If commercial banks are willing to build up reserves then the money supply changes only proportionately to the amount of cash held by the non-bank public. Besides, the rise in deposits which increases the money supply does not necessarily increase the supply of credit ; any increase in deposits should be matched by an increase in one or more of bank's assets i.e. they purchase claims such as advances, treasury bills, longer - dated government securities and commercial bills. To the extent they purchase not newly-issued assets,

1. See V. Chick: The Theory of Monetary Policy». Gray-Mills Publishing Ltd., London 1973, pp. 14, 20, 86.
2. The two monetary assets have two distinct cources of supply : The government supplies cash and banks supply deposits.

they do not create new credit ; they simply take over the claim from another creditor.

Therefore, the Government can only decide on the initial distribution of cash between the bank and the non-bank public while the ultimate distribution depends only on bank portfolio behaviour and purblic's preferences. The deposit multiplier theory put forward by the traditional theory (the «Old View») ignores the importance of the initial distribution of cash and concentrates on the influence of banks behaviour and public's preferences. Since much of the newly received cash by the public will be deposited with banks, they are in a position to purchase earning assets, expanding deposits as they do so.

Thus, within the framework of this theory, the deposit multiplier can be considered to be exogenous, hence the money stock to be exogenous as well, only under some strict assumptions concerning both banks' and public behaviour.

And this is justified on the grounds that the biggest part of the money stock (deposits) is supplied by the banking system. Exogeneity therefore, requires a certain behaviour on the part of the banking systems, constrained by the behaviour of the non-bank public. More formally this theory has been stated in terms of the following equation :

$$M_s = \frac{1+c_p}{c_p + r_b} \times B$$

where B = High Powered Money or Cash Base or Money Base, and c_p, rb are cash ratio and reserve ratio respectively. It follows that if (c_p) and (rb) are constant, and banks are fully loaned up so as to operate at the minimum required rb, any change in reserves or supply of cash could lead to a change in the money supply. According to monetarists the link between the cash base (or reserve base) and the total money supply is strong. (B) and (rb) are two policy instruments which can be effectively controlled by the authorities. But the doubts casted over the constancy of (c_p), i.e. the slippage created in the link between changes in cash and the money supply, are severe. Even the monetarists accept that the case of perfect control is impossible and argue that what is required for money to be exogenous, is that the control variables B and rb dominate money supply changes. [3]

3. V.Chick, o p. c i t., p. 87.

However, they argue [4], the cash/deposits ratio is a behavioural relation depending on economic factors, and therefore it may be controlled or at least it may be kept constant over a short - period of time.

More specifically, this ratio can be explained, apart from long - run considerations such as population growth and other structural changes, by the following variables : 1) Income : In case of cash being an inferior good and deposits a luxury good, an increase in income will lower (c_p) ; 2) The Social and occupational structure, in the sense that as far as some workers are usully paid in cash rather than by cheque, the (c_p) ratio is high ; 3) Record keeping : To the extent that a bank account is an advantage, in the sense of being a cheap and convenient way of keeping records, it will increase the demand for deposits ; 4) The character of the economy in the sense that rural economies depend more on credit and less on curreuncy than urban economies ; 5)|Substitutes for currency, in the sense that the availability of credit cards and charge accounts lower the demand for currency.

It is essential to point out at this stage, that for the money supply to be exogenous, the exogeneity of the multiplier is only a necessary condition. The sufficient condition lies on monetary authorities' policy choice to control the money stock or the level of interest rates. Generally speaking, while the possession of a securities portfolio and the existence of a market for it, gives the authorities the power to deal, it does not give them the power to set both the price at which transactions take place arid the volume of purchases or sales.[5] There are two alternative strategies open to the authorities. They choose to control either the prices of some financial assets and supply whatever quantities the private sector wants to hold at those prices, or the quantities of assets held by the public and accept whatever prices are implied. More specifically the monetary authorities have to choose between aiming at a target set of interest rates-a price objective and letting the money supply to be determined by the preference of the public at that set of rates, or aiming at a target money supply and letting interest rates to be determined freely in the market.

This «Old View» of money stock determination, developed so far has been challenged by an alternative approach, widely known as the «New View».[6]

4. H.G. Johnson, «Macroeconomics and Monetary Theory», Gray - Mills Publishing Ltd., London 1971, pp. 136,137.
5. See A.D. Bain : The Control of the Money Supply, Penguin, pp. 37 and 38.
6. This view appeared first by Gurley and Saw in a series of papers in professional periodicals : American Economic Review, 1955 ; Journal of Finance, May 1956; Review of Econ. and Sta-

This approach assumes that both the non-bank public and commercial banks act rationally by having a profit maximising behaviour. Within this framework the cash/deposits ratio (c_p) is influenced by the rate of interest on deposits, i.e. by changes in relative yields of cash and deposits. These changes influence private sector's assets preferences which in turn affect commercial banks attempts to achieve an optimal portfolio of assets and debts.[7] In other words, public's and banks' behaviour is directed by microeconomic principles. Therefore the assumptions made above, in the framework of bank deposits multiplier theory, about the constancy of the reserves/deposits ratio (r_p) ignores such a portfolio behaviour. The loan rate affects also both the public's demand for bank loans and the profitability of lending. If lending rates are high, banks expand credit to gain more profits. If they find themselves short of cash they resort to the Central Bank and borrow reserves, or develop non-deposit sources of funds. In general, the higher the interest rate that can be earned on earning assets the more willing the banking system will be to borrow reserves from the Central Bank ; the higher the volume of idle reserves the lower is the return on bank portfolio, and also the lower is the risk of illiquidity of commercial banks. Clearly, therefore, the reserves/deposits ratio is a choice variable, and depends negatively on the rate of interest on alternative earning assets ; as the difference between the market rate of interest and the discount rate increases, the opportunity cost of holding reserves also increases inducing banks not to hold excess reserves. This is the point of the main difference between the two views : Commercial banks may or may not be fully «loaned up», depending on the opportunity cost of holding excess reserves, and this implies that the amount of reserves commercial banks hold relative to deposits may or may not coincide with the amount the monetary authorities require.

Hence, the relaxation of the two strict assumptions on which the traditional approach is based (i.e., the cash/deposit ratio assumed to be constant in the short-run and the reserves/deposit ratio to be equal to the required one), breaks the

tistics, August 1957. These were subsequently consolidated in : Gurley and Saw : «Money in a theory of Finance» Washington 1960. But the «NewView» as an approach determining the money stock found its fullest exposition in the work of J. Tobin, in : «Commercial Banks as creators of Money», in D. Carson (ed.) Banking and Monetary Studies, reprinted in J. Tobin, Essays in Economics: Macroeconomics (Volume I), North Holland Publishing Company, Amsterdam 1971.

7. See, P. Gemtos : «Basic Problems of the Theory of Money», Sacoulas, Athens, 1980, p. 78 (in Greek).

tight link between cash-base and money stock making the latter an endogenous variable, in the sense that the monetary multiplier depends on the cash/deposit ratio and the reserves/deposit ratio which is considered to be optimum by the banks themselves. That is, the money multiplier is an increasing function of the differential between the market rate of interest and the Bank rate, which means that changes in the rate of interest will, ceteris paribus, cause changes in the same direction to the money multiplier and hence the money stock. This implies that changes in wealth holders' portfolio preferences between money and other interest bearing assets affect the rate of interest which in turn affects the stock of money. This endogenous mechanism which operates between cash base and stock of money lowers the value of the multiplier resulting in a less than proportional to the initial increase in the cash base, increase in money stock. Finally, another reason should be added here which makes authorities unable to control the stock of reserves and which arises on an open economy operating under a fixed exchange rate regime, is the following : All gold and foreign exchange reserves of a country are treasured in an account usually with the Central Bank, and any foreign currency earned by country's residents must be exchanged for local currency in the Bank. Conversely, any domestic currency required by the country's residents for payments abroad must be exchanged in this account for foreign currency. If receipts exceed payments this account gains foreign exchange and vice-versa. Further if an economy operates under a fixed exchange rate regime, the authorities fix the rate by operating in the foreign exchange market buying and selling their own currency to maintain its price. Now, suppose that the country is in a balance of payments surplus. This means that the public is receiving domestic currency. This augments their deposits with Commercial Banks and consequently banks acquire the same amount of liquid assets. In other words domestic bank deposits and bank liquidity have risen and hence the money supply. If the authorities want to neutralise the effect of that surplus on the money supply, they will sell government securities through their daily open market operations.[8] This induces domestic interest rates to rise (if, of course, interest rate differentials are formed in a free market, which is not the greek case) and consequently foreigs capital will be attracted in and thus the balance of payments surplus will, other things being equal, increase. A bigger surplus requires bigger operations in the foreign exchange market and bigger neutralising operations in selling securities with a consequent further upward pressure on the rate of interest leading to further capital inflows. The only way the authorities can end this vicious

8. Of course they can increase the reserve ratio, which results in a contraction **of the money supply.** But **in** this case, the public economising on cash balances **sell securities causing interest** rates to move **up.**

circle is to allow money supply to increase and stop attempting to neutralise the effect of the balance of payments surplus on the domestic money supply. Therefore, the effect of operating a fixed exchange rate policy is to make the reserve base interest elastic and prevent monetary authorities from pursuing an independent monetary policy, in the sense that they must keep an eye on the world level of interest rates.

But we should not think of every foreign exchange transaction as having a direct impact on the assets or liabilities of the private sector and, therefore, as influencing the domestic money supply. 9 if the government itself makes payments or receipts in foreign exchange, this involves transfers from one government account to another, without any result on the private sector's accounts or any other assets or liabilities. Also, if foreigners buy government securities, this fact by itself will augment foreign exchange account with the central Bank and then government's account in domestic currency with the Central Bank. In other words, the Government's foreign exchange assets and its domestic currency liabilities to foreigners rise by equal amounts, without any effect on the private sector.

After all these amendments the Bank credit multiplier can be written now as :

$$M = \frac{1 + C_p(r)}{C_p(r) + r_b(r)} \times B \qquad (2)$$

or M= (r)xB., where (r) is the market rate of interest.

Therefore, one car. hardly argue that money supply can be effectively controlled by the monetary authorities. Of course, they may exercise a considerable, even dominant influence.[10] They can control the supply of cash but this does not mean control over its distribution between bank and non-bank public.

3. ANALYSIS OF THE CHANGES IN THE STOCK OF MONEY DURING 1960-1981.

Variations in the Money stock can be studied through variations in the Mo-

9. A.D.Baïn, op. ci t., p. 59.

10. For an excellent exposition of the direction-of-causation debate seeV. Chick, op. cit., pp. 83 - 90.

netary Base and the Money multiplier. If we define the Money supply as currency in circulation (outs'de the monetary system) plus Demand, Saving and Time Deposits (M = C + D + S + T) and the Monetary Base (or High Powered Money) as Currency held by the public plus Banking reserves, (B = C+R), then the Money multiplier is :

$$\frac{M}{B} \qquad \frac{C+D+S+T}{C+R} \text{ or, } M = \frac{C+D+S+T}{C+R} B, \text{ and, } m = \frac{C+D+S+T}{C+R}$$

Therefore, M= m B, i.e. the quantity of Money M is a product of the «Base multiplier» and the Monetary Base. This formulation does not rest on any assumption as to the exogeneity of the base.

The growth rate of money stock is given by: $M = m + B$.

The table on the page gives the annual average percentage rate of change of the end-of-year figures of these three variables for the whole period and for the subperiods 1960 - 70,1975 - 8 1, and 1971 - 8 1.

This table gives an idea of the relative importance of the components of the total change in the quantity of money. It exhibits not only variations of the Monetary Base as it is defined in the traditional textbook context ($B\tau$), but also variations of the «extended» Base (BE) which applies to the Greek reality due to the «extended» meaning of Reserves of the commercial banks. In other words, as it will be seen further on, bank reserves contain not only vault cash plus deposits with the Bank of Greece but also other commitments such as Treasury bills, Government and Public Enterprises bonds. We thought that the inclusion of such an «extended» Bace in the table above would serve to the better understanding of the variations of the money stock on the one hand and to the study of the influences of the monetary system on these variations, on the other. Naturally, the variations of the relevant multiplier (m_{Ti} and m_{Ei} respectively, where i= 1,2) are exhibited as well.

As we can easily realise, changes in B have been quantitatively the most important, but the changes in m (particularly m_{E1}) are not to be neglected. More specifically, the negative m_{T1} and m_{E1} during the whole period and in the subperiods, and mE_2 in the subperiods 1971-81 and 1975-81 «sterilize» a bit of the changes in M_1 and M_2 over those periods, Also the positive mE_2's over all the periods and mE_2 over 1960-81 and 1960-70 reinforce the average change in M (both M_1 and M_2). The «sterilization» caused by mE's is, as expected,

TABLE 1.

Average Annual Percentage Rate of Change in M, m, B.
(Rates of change continuously compounded).

	1960 – 81	1960 – 70	1971 – 81	1975 – 81
M_1	15.50	11.93	17.96	16.92
M_2	19.92	16.02	21.71	21.82
m_{T1}	–1.81	–0.36	–2.81	–3.57
	(–0.12)	(–0.03)	(–0.16)	(–0.21)
m_{E1}	–4.99	–2.47	–5.76	–6.68
	(–0.29)	(–0.21)	(–0.32)	(–0.39)
m_{T2}	2.61	3.73	0.94	1.33
	(0.13)	(0.23)	(0.04)	(0.06)
m_{E2}	0.07	1.62	–2.01	–1.78
	(0.00)	(0.10)	(–0.09)	(–0.08)
B_T	17.31	12.29	20.77	20.49
	(1.12)*	(1.03)*	(1.16)*	(1.21)*
	(0.87)**	(0.77)**	(0.96)**	(0.94)**
B_E	19.99	14.40	23.72	23.60)
	(1.29)*	(1.21)*	(1.32)*	(1.39)*
	(1.00)**	(0.90)**	(1.09)**	(1.08)**

Source : Bank of Greece, Monthly Bulletin.

Note : Figures in parenthesis indicate the fraction of the total relative change in M, each rate of m and B represents.
* refer to M1, ** refer to M2

greater than that of the mT's, since during the recycling procedure of the new liquid means,[11] in the credit system (these means have caused the increase in the monetary base which by definition represents the total liquid means available to the economy), a substantial part of them is «absorbed» by the various commitments posed on commercial banks' assets by the authorities, so the ability of

11. See J. M. Papadakis : «Money and Economic Activity. The Greek Experience 1950 - 1975». Institute of Economic and Industrial Research, Athens 1979, p. 19.

the system to produce money is limited at a greater extent than that concerned with the «narrow» definition of reserves.

However, during the whole period under review and on the average, the «extended» monetary base (BE) played the main part in the evolution of the broad money supply (M_2), while the role of the credit system was very small. On the contrary, the latter plays a contractionary role in the variations of M_1 irrespectively of which Base definition one uses.

The study therefore of the money stock variations, passes through the study of the variations of the monetary base. The latter can be changed if the supply of cash and the amount of bank reserves change. And as we have referred above, the authorities can control the amount of cash only and not its distribution, which in turn depends on public's preferences. These preferences also affect banks' attitude towards the amount of reserves they should hold because, as said, this amount is a choice variable depending on an index of interest rates, and some other variables as well. On the other hand-, the monetary multiplier can be transformed to

$$m = \frac{\frac{C}{D} + \frac{T}{D} + 1}{\frac{C}{D} + \frac{R}{D+T}\left(1 + \frac{T}{D}\right)}$$

which exhibits all the components of it.

This formula maintains the reserves held by Banks as a fraction of total bank deposits. It is affected therefore by the level of interest rates, the same way as the money base does.

The examination of the money supply changes therefore passes through the examination of the changes of the amount of reserves held by commercial banks and its proximate determinants.

Using the broad definition of the Money supply we see that Money stock has been more than double the narrow Money Base up to 1968 and more that triple for the rest of the period. This reflects the fractioneal reserve nature of the Greek Commercial Banking Institutions. The size of the multiplier depends not only on the distributiou of high powered money between the banks and the public (as we have already seen) but also on the relative amounts of different kind of deposits, since there are différend reserve requirements (and reserve preferences on the part of the banks) by kind of deposits.

4. THE RESERVE - DEPOSIT RATIO OF COMMERCIAL BANKS

As we shall see in the following sesction (4.1) what is viewed as a «policy» variable with regard to means of intervention in the financial system, is rather the reserve ratio, i. e. the ratio of reserves to deposits of the Comercial Banks[12] than the absolute amount of reserves held. And as we have also seen, according to the «New View», in the modern banking sysrems the reserve ratio is determinned by both the individual requirements of banks for reserves through their profit maximising behaviour, as well as by conventional or legal obligation, i. e. a minimum reserve ratio required by the monetary authorities. The total Bank reserve ratio consists therefore of two parts : A minimum legal part established by regulations of central authorities, and part reflecting bank's demand for excess reserves. Hence we can formulate a hypothesis explaining the reserve ratio of the banking system as a whole, containing two kinds of elements : Institutional and Behavioural.

4.1. Regulations concerning hank reserves.
Some **Institutional** background.

By examining the time series on Bank rate, we observe that it has not shown great variations from year to year. This may suggest two things : First, that the authorities were aware of the inadequacy of the discount rate policies and, hence, the discount rate mechanism in the Greek Economy for exercising monetary control over the economy. This view can be supported by the fact that great amounts of deposits flew into the banks and therefore they have not felt the need to resort to the Central Bank to be accommodated with additional funds when they were short of cash. But, commercial banks always accounted on the Bank rate as a penalty rate, in case their reserves had fallen below the legally required ratio- Second, the authorities thought of the existence of a kind of equilibrium in the money market, and this made them reluctant to manipulate interest rates. Hence, with this equilibrium in mind the authorities administered interest rates and let the money supply be determined by the demand of the public. Interest rates were directly influenced by the Currency Committee, since the existing imperfection in the capital market prevented open market operations as well as discount rate policies to acquire the significance they usually have in more developed economies as tools of monetary policy.[13] The structure of interest rates aims at favou-

12. We concentrate our analysis on Commercial Banks, because no ratio constraints (reserve or rebate ratios) appiy on the liabilities and assets of special credit institutions.

13. O.E.C.D. Economic Survey of Greece 1972, pp. 20-21.

ring activities such as exports and long-term capital investment.

The observed limited ability on the part of monetary authorities to determine interest rates and hence the level of deposits and the supply of money through open market operations and discount rate policies, led them to manipulate the reserve ratio imposing restrictions on both deposits and credit of commercial banks, by requiring them to hold reserves in both interest and non-interest bearing accounts with the Bank of Greece. The Monetary Committee has had, under the Law 971/20.2.1946, the right to regulate and establish the percentage of compulsory deposits of commercial banks with the Bank of Greece. It also has had the right to require from commercial banks to keep a certain percentage of their total liabilities as cash balances. These deposits constituted a certain percentage of total sight and saving deposits at each commercial bank. As from October 1966, these compulsory deposits were related to the magnitude and the distribution of credit of each commercial bank. Specifically, Commercial Banks were obliged to deposit at non-interest bearing accounts with the Bank of Greece several amounts being percentages of the various categories of credit (6 % on short-term credit to industry, 37 % on domestic trade and import trade). At the same time they had the right to withdraw from their deposits with the Bank of Greece, several amounts being percentages of other categories of credit (25 % on credit in exports, 5 % on medium-term credit, for fixed capital formation, 15% on credit to public entities). The actual percentage depends on the type of credit and on the size of the bank concerned.

Since December 1972, apart from the above obligation, commercial banks were required again to keep deposits with the Bank of Greece, linked to the magnitude of private in drachma deposits with them, as follows : a) In non-interest bearing account 20% of sight and blocked deposits, plus 5 % of saving deposits, b) in interest bearing account 20 % of sight and blocked deposits, plus 3 % of saving and time deposits. Today these obligations stand uniformly at 8 percent of all private deposits (including foreign currency deposits).

The purpose of deposits linked to credit is to equalise the return from the different categories of credit, due to different interest rates applied to each category.

The Monetary Committee trying also to influence the distribution of credit in a way helpful to the country's economic development blocked several percentages of total bank deposits to be loaned for investment in industry and handicraft, the purchase of Treasury bills, other Government securities, bonds of public enterprises and shares of newly established or expanding firms. The per-

centage required today for Treasury bills, Government securities and Public Enterprises Bonds is at the percentage of 34 %, but no less than 5.5 per cent and no more than 12 per cent must be invested in Government and Public Enterprises bonds. They also did not allow Post Office Saving Bank to redeposit funds with commercial banks, and when a reduction in liquidity was aimed, Post Office Saving Bank withdrew funds from commercial banks. These measures affected the demand for excess reeerves of commercial banks.

Also Special deposits and Selective Credit schemes were in operation for a more effective control of the liquidity of the economy. Selective credit control in particular aimed at determining both the total volume of credit and its distribution between the various sectors of the economy according to their contribution in the economic development of the country.

Besides those measures, a new regime was established, in August 1957, in the Banking System in an attempt on the part of the Central Bank to influence commercial banks' ability to expand credit, according to which the latter could resort to the Bank of Greece to discount their portfolio in short-run claims (up to three months) or to take advances on their sight accounts, in order to preserve their liquidity. Interest rates were determined at high levels 11 % in the first case and 12 % in the second to discourage over-expansion of credit. Basically, the Bank of Greece guaranteed the liquidity of commercial banks in periods of short-run variations in their deposits. This had two repercussions : On the one hand commercial banks could be fully loaned up, and therefore keeping just the legal reserve ratio, and on the other that the Bank rate could be proved to be one of the regulatory elements of the demand for excess reserves.

4.2. The Hypothesis Formulated

There have been many alternative hypotheses formulated[14] which suggest that banks keep either a constant ratio of precautionary reserves to deposits above required ones, or a precautionary reserve ratio proportional to the legal ratio and therefore a total reserve ratio proportional to the legal ratio. In this paper we formulate and test a hypothesis according to which the total reserve ratio is the sum of the legal ratio plus an excess precautionary ratio and determine the factors causing the changes in the total ratio. The variations of the legal ratio can be examined if we consider the following definition :

14. A. Diz : «Money and Prices in Argentina», in D. Meiselman (ed.) *Varieties of Monetary Experience*, Chicago U.P., p. 82.

$$l_{,t} = \sum_{1}^{n} di_t \; r - i^{1}_{t,} + \left(\frac{Di_t - Di_0}{D_t}\right) \quad mi^{1}_{t,}$$

where : nt = Total number of legal categories of deposits at time t.

$r^{e}_{it,}$ ^{l} $m_{it'}$ = Average and marginal coefficients applicable to the ith-category of deposits at time t.

Dit, dit = Amount of the ith category of deposits and the fraction of total deposits they represent at time t.

Dio= Amount of the ith category of deposits at time (t= 0) when marginal requirements are established.

Dt = Total amount of deposits at t, D_i, D_{10}.

The first part of the definitional equation above, shows that the legal ratio is a weighted average of the average coefficients applicable to different kind Of deposits, where the percentages of the different kinds of deposits to total depo. sits are used as weights. The second part shows any influence on the legal ratio resulting from a change in any of the different kinds of deposits. Therefore the legal reserve ratio is affected by any change in average and marginal coefficients (policy variables) as well as the public's preference to different kinds of deposits which affects dj, although these preferences can be very much influenced by the decisions of the Central Bank through the determination of different levels of interest rates. Hence we can conclude that the part of total ratio which is determined by legal requirements is totally controlled by the monetary authorities and, therefore, it is by itself a «policy variable».

Thus, the variations of total reserve ratio, are due to what has been called precautionary or usable reserve ratio and to legal reserve ratio. Assuming that the legal part is given, in the sense that it is totally and effectively controlled by the authorities, the precautionary ratio can be viewed as the difference between the total ratio and the legal one, or, in other words, as any excess above the total legal ratio.

So following Meigs[15] we test the hypothesis that the value of the total reserve ratio through time is determined by the commercial banks' demand for pre-

15. A.J. Meigs, Free Reserves and the Money Supply, Chicago University Press, 1962.

cautionary reserves and by the rate at which the Central Bank injects or withdraws total reserves, given the legal reserve ratio. Commercial bank's demand for precautionary reserves can be considered as depending on the cost of holding those reserves and the composition of deposits, in the sense that the composition influences bank's expectations about clearing drains and thereby affects desired positions and because the Central Bank itself institutes different percentages for each kind of deposits and credit given. On the other hand the injections or withdrawal of reserves by the Central Bank may offset banks' intentions to change the reserve ratio and keeps them at a position which is not the desired or equilibrium one as far as the combination of cost of holding reserves and excess reserves ratio is concerned. Finally it is very likely the reserve ratio of commercial banks to be influenced by the rate of rediscounting or borrowing from the Central Bank.

The testable equation will be :

$$r = f\left(d,\ i,\ \frac{1}{R} \cdot \frac{dR}{dt},\ b_r\right)$$

where : r = the reserve ratio

d = ratio of Demand to Saving and Time deposits.

i = cost of holding assets.

$R = \frac{1}{R} \frac{dR}{dt}$ = rate of change in the flow of reserves.

b_r = Bank rate.

4.3. Specification of the variables

All data are on a yearly basis.

We have defined the reserve ratio as the total amount of cash commercial banks keep in their vaults plus their deposits with the Central Bank plus reserves in foreign exchange plus the value of Treasury bills, Government bonds and Public Enterprises securities, that constitute the portfolio of commercial banks ever the Total amount of deposits (including in foreign reserves) with the commercial banks net of inter-bank deposits.

As proxy for deposit composition the ratios of Demand over Time and Savings Deposits and of Time and Savings over Demand Deposits have been considered interchangeably. Since the Central Bank as we saw, required higher percentages of holdings for demand (sight) and savings than for time and blocked deposits, we cannot say anything a priori about the sign when the ratio $\frac{D}{S+T}$ ro its reciprocal is used. Moreover, an increase in D may make banks to feel more secure as regards their liquidity position and so they are not willing to keep a higher amount of liquid assets than the required one.

The cost of holding reserves is proxied by the weighted average of a series of interest rates on bank credit. This series has been produced as follows :

Since the monetary authorities aim at influencing the bank credit expansion by sector by changing the reserve ratio on total commercial banks deposits and credit, and the rebate ratio on these banks' deposits with the Central Bank, we have considered for each year the level of interest rates applied to Bills discounted Working Capital and Long-term Loans to Industry, Handicraft, Domestic and Imports Trade and Exports and Tobacco Trade. These rates have been weighted by the percentage of each of these types of credit to the total credit of commercial banks to the above sectors of economic activity. On theoretical grounds this «cost» variable is expected to have a negative sign.

The Bank rate which has been considered as influencing the cost of borrowing of commercial banks from the Central Bank, has been averaged over four quarters at an annual basis. This variable is expected to enter with a positive sign. Finally the rate of change in the flow of reserves variable is entered with B positive sign.

As the data on reserve ratio do not show any dramatic variation over most of the period under examination, no dummy variables have been used in the regressions. The only significant variation was through the period 1966-68. In 1967 the reserve ratio fell drastically while in 1968 it increased with respect to the previous year. These changes can be attributed to both a change in banking regulations occurred in late 1966 and to the military coup of April 1967 : As from October 1966, the reserve requirements apply no more to deposits but to credits, differentiated by type of credit and according to the size of the bank concerned. More specifically as we have seen while there has not been any obligation for credits to export and tobacco trade and for credits to handicraft, the rate applied to short-term credits to industry was 6 % (2 % for small banks, i.e. those with deposits up to 2.000 million drs), and 25 % (19 % for small banks) for short **term** credits to domestic trade and import trade. The relatively low growth rate of cre-

dits to domestic and import trade of the first years of the dictatorship (the credit to domestic trade increased by 11 % in 1967 with respect to 1966, while in 1966 and 1968 it increased by 15.2 % and 20.2 % respectivelly with respect to the previous year, while the credit to import trade showed an absolute reduction by 7.6 in 1966 and an increase of 6.4 % in 1967 with respect to the previous year), caused the above mentioned reduction in the reserve ratio. Besides that, the April 1967 military coup which overthrew the existing constitutional government caused commercial banks, by expecting greater economic instability, to decide to increase their precautionary reserve ratios, other things being equal, with a time lag of one year. But this increase in reserves can be captured by the «flow-of-reserves» variable $\frac{1}{R}\frac{dR}{dt}$ and the need for the introduction of a dummy variable does not arise.

In explaining variations in the total Reserve ratio one should include an index of the legal reserve requirements coefficients in the regressions. Here, we did not follow this practice due to the non-availability of a time series of various reserve requirements and the difficulties involved in constructing one. But besides that even if such an index were available, it is expected to be highly collinear with some of the other variables included in the equations, e.g. with the flow-of-reserves variable. An increase in the legal reserve requirements would cause an increase in the flow of reserves and this would make the coefficients insignificant.

4.4. The Empirical Results

The estimation of our model has been done by using the OLS method. The selection of this model is justified by the small number of observations at hand. Besides the argument stated by the Gauss-Markov Theorem, that within the class of linear unbiased estimators of the coefficients, the least squares estimator has minimum variance, the Monte Carlo studies suggest that in small samples, method's smaller variance may more than affect its greater bias (which the method exhibits, since OLS is assymptotically biased, while the other methods are not), so that it has smallest mean squared error. Thus, OLS cannot be rejected out-of-hand in small samples merely because of its large sample deficiency of inconsistency[16]. On the other hand, as we will see further on, the Durbin -

16. RJ. Wonnacott and T.H. Wonnacott : Econometrics, Wiley International Edition, 1970, pp. 21 and 399.

Watson coefficient provide an inconclusive test for autocorrelation in the residuals, as the empirical value d* calculated from the regression residuals is between the upper (d_u) and the lower (d_1) limits of the tabulated values of d. This may result to predictions with larger variances as compared with those when the residuals exhibit no autocorrelation. However, even when the residuals are serially correlated the parameter estimates of OLS are statistically unbiased, in the sense that their expected value is equal to the true parameters[17].

Having decided on the method, we experimented by using the variables described above, in various combinations and with different time lags. In general, most of the regressions (not all of them are listed here) explain between 85 and 92 per cent of the variations of the reserve ratio, but only one or two of the independent variables, including always the constant term, bear a statistically signiticant coefficient. A reasonable explanation for this statistical significance of the constant term could be that the dependent variable exhibits a small variance. But this should not be the case here. The coefficient of variation of the dependent variable is about 19.2 %, which of course is not very high but anyway cannot be claimed sole responsibility for the significance of the constant term. Another supplementary explanation is that the one-equation model developed here could be part of a larger econometric model which specifies several other relations among the variables, and that as such is an aggregative model. That is it cannot handle matters as structural, institutional and behavioural relationships among the monetary variables. This may be one of the reasons for the low value of the D.W. statistic. The omission of variables which could be included in complete models would exert influences on the dependent variable and result in serially dependent values of the disturbance term. In other words, although the above developed equation which links the reserve ratio of commercial banks to rates of interest is the core for the construction of an endogenous money supply hypothesis, it does not in itself constitute such a hypothesis. These «complete» models[18] link some measurement of the money stock to an index of interest rates and the Bank rate, However, this omission should not be considered as invalidating the model's explanatory ability because its findings are not contradictory, at least qualitatively,

17. A. Koutsoyiannis : Theory of Econometrics. The Macmilian Press **Ltd., 1978,** p.208.

18. For an excellent survey of the most important models of this kind, see : J. Vittorias : «The Money Supply Process and the Transmission Mechanism in the Greek Economy», Unpublished Ph. D. Thesis, London University, Feb. 1980.

with those of a recently developed «complete» one for the Greek Economy[19].

With these shortcomings in mind we will try to explain the results ot the regression analysis performed on the one-equation model, developed in the previous pages.

1. The Deposit composition variable ($\frac{D}{S+T} = d$) taken in its both current and lagged form and linear and non-linear is always significant bearing a negative sign. This behaviour of the variable during the period means that the reserve ratio of commercial banks has been very much influenced by the composition of deposits. Indeed, although since the end of 70's the requiremenl is that commercial banks hold on an interest bearing account with the Centrât Bank a uniform percentage of all private deposits including foreign currency deposits, in the past and over most of the period under examination, (up to 1966 and from 1972 to the end of 70's) the Bank has differentiated between types of deposits, requiring a higher percentage of total sight and saving deposits. The negative sign may also shows a specific behaviour on the part of the commercial banks, meaning that when the proportion of Demand deposits to total deposits increases, banks feel secure for their liquidity position and therefore try to keep only the minimum required combination of reserves.

2. The cost-of-holding-assets variable, proxied by a weighted average of rates on bank credit, bears a strong correlation with the Bank rate (r = 0.96 when the former is taken at its current values, r = 0.89 when it is taken at its oneyear - lagged values and r= 0.96 when both are taken at their lagged values), causing multicolinearity in the independent variables, and therefore-making their coefficients statistically insignificant :

$$r- 40.213 -57.1\ d + 0.177\ i + 0.535\ b_r$$
$$(6.803)\quad (3.17)\quad (0.181)\quad (0,684)$$
$$R2=0.83,\qquad D W = 1.1108$$

$$r= 37.75 - 54.23\ d_{-1} +0.641\ i_{-1}+0.285\ b_r$$
$$(7.51)\quad (3.52)\quad (1.163)\quad (0.711)$$
$$R2 = 0.85,\quad D W = 1.0862$$

19. See G. D. Demopoulos : «Monetary Policy in the Open Economy of Greece», Centre of Planning and Economic Research, Athens 1981.

r= 39.52 -55.i2d_1+0.231i_1+0.63l b_{r-1}
(7.23) (3.78) (0.255) (0.873)
R2 = 0.85, DW = 1.1513.

(Figures in parenthesis are T-statistics).

To remove such an obstacle we have combined those two variables in one, in two different forms : first as the difference between i and br and second as their ra. tio. The results are very encouraging.

r= 52.90 -66.58 d_,-1.807 $(i-b_r)$
(21.55) (4.41) (2.918)
R2 = 0.81, DW=1.16

r =61.88 - 66.11 d_{-1}-9.438 (i/b_r)
(16.35) (3.86) (2.397)
R2=0.79, DW=1.01

(Figures in parenthesis are T-statistics)

As we observe, the coefficients of the combined variables are statistically significant and bear the right sign. This implies that an increase in the annual yield of bank credit combined with the cost of borrowing of commercial banks from the Central Bank, influences the banks' choice between borrowing and keeping a higher percentage of deposits when reserve adjustments become necessary. In other words the level of market interest rates, influence the choice between hold ing excess reserves or holding earning assets.

When we considered the «cost» variable lagged by one period, its coefficient becomes insignificant. This is not due to multicolinearity as the correlation coefficient of this variable with the deposit compositions lagged by one period is very low : 0.29. It may mean that banks adjust their reserves within a year from the time of the change in the differential of market interest rate and the Bank rate.

3. The coefficient of the rate of change of total reserves (R) is statistically insignificant although it bears the right sign (positive). This in significance cannot be attributed to the phenomenon of multicolinearity as the correlation coefficients of this variable with the deposits composition variable lagged one period and the cost-of-holding-reserves variable are 0.06 and 0.38 respectively :

r= 50.64 -67.99 d^+0.066 R-1.42 $(i-b_r)$
(18.36) (4.68) (1.57) (2.20)
R2=0.83, DW = 1.0108

The lack of multicolinearity between these variables, as well as the insignificance of the coefficient of R may mean that there has not been any attempt on the part of the Central Bank to offset any of its previous actions which affect the level of reserve ratio (i.e. changes in the market rate of interest or the Bank rate), by altering the rate of flow of reserves. It also possibly means that the Central Bank has been using the other «policy» variable - the legal reserve ratio-to smooth out any variation in the total reserve ratio, otherwise the flow-of-reserves variable would be significant in explaining the variations of the total reserve ratio.