

# ECONOMIC PAPERS

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An Analytic Formulation and Evaluation  
of the Existing Structure of Legal  
Reserve Requirements of the Greek  
Economy : An Uncommon Case

George D. Demopoulos  
Internal Paper



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ABSTRACT

This paper provides a qualitative evidence concerning the effectiveness of the existing institutional arrangements pertaining to the differential reserve requirements on banks' liabilities and assets of the Greek economy in achieving the desired objectives of economic development and stabilization. The innovative feature of the paper is that it systematically incorporates into an operating framework the country's institutional arrangements bearing on reserve requirements.

The analysis shows that the maintained categories of reserve requirements and the mechanism of allowing banks to withdraw from the central bank part of their reserves to cover credit to different sectors of the economy, produce such a complex system of required reserves that it makes it more difficult for the central bank to keep full control over the aggregate volume and direction of bank credit. In addition, the credit policy on secondary reserve requirements presents obvious weaknesses, since banks can evade their primary objective through other means of borrowing.

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## 1. INTRODUCTION

Regulations over the availability of banks' liabilities and assets as a means of controlling the overall economic activity are a feature to be found in developed and developing countries. In many countries, monetary authorities also attempt to control the distribution of available credit between the private and the public sector, reallocate credit to sectors of "national priority" and prohibit the allocation of credit to non productive activities. To this end, monetary authorities employ a variety of policy instruments, ranging from those of differential reserve requirements on banks' liabilities and assets to fixing of interest rates paid on bank credit and deposits and credit ceilings. However, the economic implications associated with the variety of these policy instruments and the effectiveness thereof for the stabilization and economic development objectives are seriously disputed <sup>1</sup>. The problem is particularly acute when one analyses a complex system of quantitative controls on the outstanding amount of specific types of bank credit.

With specific reference to Greece, the research endeavours that take some good account of the problems mentioned above are those by Avramides (1972), Kasmas (1972) and, very recently, Halikias (1979). Nonetheless, these studies by-pass, among other things, the question of differential reserve requirements on banks' liabilities and assets as an instrument of allocating bank credit to different sectors of the economy. Hence, the objective of this paper is to shed light on certain aspects of the Greek monetary system which have been left out in these three studies, and particularly to provide a qualitative evidence concerning the effectiveness of the existing institutional arrangements pertaining to the differential reserve requirements on banks' liabilities and assets of the Greek economy in achieving the desired objectives of economic development and stabilization <sup>2</sup>.

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<sup>1</sup> See particularly the survey article by Silber (1973).

<sup>2</sup> For a detailed analytic presentation of the structure and functioning of Greece's financial system, see, Demopoulos (1981) and (1983). Some very good account on the question on the efficacy of selective credit controls to stimulate gross fixed investment is given by Bitros (1981).

The innovative feature of the paper is that it systematically incorporates into an operating framework the country's institutional arrangements bearing on reserve requirements. This chosen framework allows for an evaluation of the existing institutional arrangements of the required reserve system and its effectiveness in bringing about the deliberate shifts in real resource utilization and hence in part the effectiveness of the Greek monetary policy. It helps to understand how monetary authorities and government officials affect the behavior of the banking system when they manipulate policy variables; it thus brings about numerous implications which enhance in part the comprehension of the Greek monetary system. It also yields an analytic structure for a useful series of follow-up studies exploring the relevant empirical patterns.

The qualitative results obtained are quite explicit. The structure of controls maintained by the monetary authorities on banks' liabilities and assets, the maintained categories of reserve requirements and the mechanism of allowing banks to withdraw from the central bank part of their reserves to cover credit to different sectors of the economy, produce such a complex system of required reserves that it makes it more difficult for the central bank to keep full control over the aggregate volume and direction of bank credit. In addition, the evidence shows that the existing legislation pertaining to secondary reserve requirements  $RR_2$  is accompanied by negative allocative effects and regulates bank credit inefficiently. First, it is often possible for banks to switch the primary objective of  $RR_2$ ; secondly, they can offset almost all the remaining power of  $RR_2$  through other means of borrowing. Consequently, the reallocation of credit to sectors of "national priority" may not be best accomplished through the  $RR_2$  policy.

Section II presents a general discursive elaboration of the nature of the institutional arrangements bearing on reserve requirements on which their analytic formulation and evaluation is based. Section III proceeds with the analytic formulation of the institutional arrangements of the required reserve system and sets up an innovative framework which allows for an evaluation of the existing structure of required reserves and their complexity. Section IV presents an evaluation of the system and its complexity. Section V summarizes the main conclusions of the paper.

## 2. THE INSTITUTIONAL ARRANGEMENTS OF THE REQUIRED RESERVE SYSTEM

The Greek authorities, in their effort to achieve the stabilisation and economic development objectives, have heavily relied on monetary policy as a means of demand management as well as influencing the allocation of credit to various sectors of the economy. To these ends, a new complex of quantitative controls was introduced in 1966 on the outstanding amount of specific types of banks' credit. The various controls currently in force are aiming at : the efficient distribution of available credit between the private and the public sector; the reallocation of credit to sectors of "national priority"; and the prohibition of allocating credit to nonproductive activities. The main instruments introduced by the monetary authorities to efficiently allocate bank credit are : differential reserve requirements on banks' liabilities and assets, fixing of interest rates paid on bank credit and deposits, and credit ceilings.

In this section, we introduce, first, a general elaboration of the nature of the arrangements on reserve requirements and then proceed with an analytical formulation and evaluation of reserve requirements.

### 2.1. The nature of the arrangements on reserve requirements

There are two major categories of reserve requirements referred to as primary and secondary.

1. Under primary reserve requirements, banks are required to deposit with the Bank of Greece a percentage of their private deposit liabilities and of certain types of credit extended by them.

In the case of banks' private deposit liabilities, we distinguish the following categories of reserve requirements <sup>3</sup> :

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<sup>3</sup>The required reserve ratios also differentiated with respect to the size of the banks (large and small banks). For expositional clarity, we do not draw this distinction in this paper.



Since 1972, banks have been required to deposit with the Bank of Greece a percentage of their private savings, private demand and restricted deposits as non-interest bearing primary reserves; reserve requirements have also been extended on private savings deposits (excluding savings deposits on 3-month notice), private time and private demand and restricted deposits respectively as interest-bearing primary reserves; also, reserve requirements are imposed periodically on private savings and private demand deposits as interest-bearing seasonal primary reserves.

In the case of credit extended by banks, we distinguish the following categories of reserve requirements :

Banks are required to deposit with the Bank of Greece a percentage of their short-term credit extended to industry and to domestic and import trades respectively as non-interest-bearing primary reserves, while they are allowed to withdraw from the Bank of Greece part of their reserves to cover credit to export and tobacco trades and shipbuilding, to medium and long-term credit for investment in plant and equipment and to public enterprises.

2. Secondary reserve requirements relate to the compulsory investment in Treasury bills, government bonds and bonds of public enterprises as well as to a percentage of banks' private deposit liabilities on certain types of bank credit. Analytically :

Banks are required to invest a percentage of their private demand, savings and restricted deposits respectively as well as a percentage of their private time and 3-month notice savings in interest-bearing Treasury bills as secondary reserves; they are also required to extend a percentage of their total private deposits as medium and long-term credit to industry and other enterprises for investment in plant and equipment and a smaller percentage for credit to handicraft as secondary reserves. The excess of these requirements over the credit is either invested in Treasury bills (with the approval of the Bank of Greece) or is deposited with the Bank of Greece in an interest-bearing account.

This is a discursive elaboration of the nature of the arrangements on reserve requirements. This "liberated" required reserve system which was introduced in 1966 and subsequently modified in 1972 has been characterized by the authorities as capable of meeting the needs of the Greek economy. We will then proceed with an analytical formulation and evaluation of the system <sup>4</sup>.

### 3: THE ANALYTIC FORMULATION OF RESERVE REQUIREMENTS

#### 3.1. The structure of primary reserves <sup>5</sup>

Total required reserves (RR) consist of primary-required reserves (RR<sub>1</sub>) and secondary-required reserves (RR<sub>2</sub>). That is

$$(1) \quad RR = RR_1 + RR_2$$

We have seen above that banks are required to hold non-interest bearing reserves with the central bank against certain types of bank credit. On the other hand, banks are allowed to withdraw from the central bank part of their reserves to cover credit to trades of the private sector which are specified by the monetary authorities. Also, banks hold reserves against their private deposit liabilities (Q). Thus, the aggregate level of primary reserves is given by

$$(2) \quad RR_1 = \sum_{i=1}^2 r_i L_i - \sum_{i=3}^5 r_i L_i \\ + (r_7 + r_{13} + \delta_x r_{10}) D + r_{12} T \\ + (r_6 + r_{11} + \delta_x r_9) S \\ + (r_8 + r_{14}) B1$$

---

<sup>4</sup>On the banks' responsibility and role to meet the needs of the Greek economy, see Zolotas (1965).

<sup>5</sup>A reform which avoids only the breakdown of banks' total private deposits to satisfy reserve requirements and introduces deposits in foreign exchange for this purpose was introduced in 1977. Neither affects the arguments of our analysis.

where

- $L_1$  = short-term credit to industry
- $L_2$  = short-term credit to domestic and import trades
- $L_3$  = credit to export and tobacco trades and shipbuilding
- $L_4$  = medium and long-term credit for investment in plant and equipment
- $L_5$  = credit to public enterprises
- $r_i$  = statutory reserve ratios applied to :
- $r_1$  = short-term credit to industry as non-interest-bearing primary reserves
- $r_2$  = short-term credit to domestic and import trades as non-interest-bearing primary reserves
- $r_3$  = credit to export and tobacco trades and shipbuilding as non-interest-bearing primary reserves
- $r_4$  = medium and long-term credit for investment in plant and equipment as non-interest-bearing primary reserves
- $r_5$  = credit to public enterprises as non-interest-bearing primary reserves
- $r_6, r_7, r_8$  = private savings (S) and private demand (D) and restricted (B1) deposits respectively as non-interest-bearing primary reserves since 1972
- $r_9, r_{10}$  = private savings and private demand deposits respectively as interest-bearing seasonal primary reserves
- $r_{11}, r_{12}, r_{13}, r_{14}$  = private savings (excluding savings deposits on 3-month notice), private time (T) and private demand and restricted deposits respectively as interest-bearing primary reserves since 1972
- $\delta_x$  = dummy for seasonal reserves

The reserves ratios  $r_i$  applied to primary reserves ( $RR_1$ ) are given in the upper part of Table 1.

TABLE 1

Legal Reserve Requirements since 1966

PRIMARY = RR <sub>1</sub>				
Non-interest-bearing reserves			Interest-bearing reserves	
Credit to				
Industry	Domestic and Import trades	De-positions*	Seasonal	De-positions*
r <sub>1</sub>	r <sub>2</sub>	r <sub>6</sub>	δ <sub>x</sub> r <sub>9</sub>	r <sub>11</sub> , r <sub>12</sub>
		r <sub>7</sub>	δ <sub>x</sub> r <sub>10</sub>	r <sub>13</sub>
		r <sub>8</sub>		r <sub>14</sub>
SECONDARY = RR <sub>2</sub>				
S <sub>r</sub> <sup>B</sup>	L <sub>f</sub>	L <sub>h</sub>		
r <sub>15</sub> *				
r <sub>16</sub> **	r <sub>f</sub>	r <sub>h</sub>		
* Since 1972				
** Since 1971				

The term with negative sign in equation (2) corresponds to reserves that banks are allowed to withdraw from the central bank for the corresponding types of credit.

3.2. The structure of secondary reserves

In terms of secondary reserves (RR<sub>2</sub>), banks are required to invest a percentage (r<sub>15</sub>) of their private demand, savings and restricted deposits as well as a percentage (r<sub>16</sub>) of their time and 3-month notice

savings deposits ( $S_1$ ) in interest-bearing Treasury bills. They are also required to extend medium and long-term loans to industry and other enterprises for investment in plants and equipment ( $L_f$ ) equal to a percentage ( $r_f$ ) of their total private deposits ( $Q$ ). The excess of the requirement over the credit is either invested in Treasury bills (proportion  $j_1$ ) or is deposited with the central bank in an interest-bearing account (proportion  $1-j_1$ ). In addition, banks are required to extend loans to handicraft ( $L_h$ ) equal to a percentage ( $r_h$ ) applied to the increment of their total private deposits ( $Q-Q_0$ ); where  $Q_0$  are deposits as of January 1, 1966. Again the excess of the requirement over the credit is either invested in Treasury bills (proportion  $j_2$ ) or is deposited with the central bank in an interest-bearing account (proportion  $1-j_2$ ). The proportions  $j_1$  and  $j_2$  are determined by the monetary authorities.

The reserve ratios  $r_i$  applied to secondary-reserves ( $RR_2$ ) are given in the lower part of Table 1 where :

- $r_{15}$  = private demand, savings and restricted deposits on interest-bearing Treasury bills as secondary reserves since 1972
- $r_{16}$  = private time and 3-month notice savings deposits on interest-bearing Treasury bills as secondary reserves since 1971
- $r_f$  = total private deposits ( $Q$ ) for medium and long-term credit to industry and other enterprises for investment in plant and equipment as secondary reserves
- $r_h$  = total private deposits ( $Q-Q_0$ ) for long-term credit to handicraft as secondary reserves ( $Q_0$  = value of  $Q$  as of January 1, 1966).
- $L_f$  = medium and long-term credit to industry and other enterprises withdrawn from banks' secondary reserves.
- $L_h$  = credit to handicraft withdrawn from banks' secondary reserves.

Thus, the stock of government securities held by banks is

$$(3) \quad S^B = S_r^B + S_0^B$$

and

$$(4) \quad S_r^B = r_{15} (D + S + B1) + r_{16} (T + S_1) \\ + j_1 (r_f Q - L_f) \\ + j_2 (r_h (Q - Q_0) - L_h)$$

where

$$S_r^B = \text{statutory component of } S^B$$

$$S_0^B = \text{non-statutory component of } S^B$$

On the other hand, the stock of banks' interest-bearing deposits with the central bank is

$$(5) \quad D^B = D_0^B + D_r^B$$

and

$$(6) \quad D_r^B = (1 - j_1) (r_f Q - L_f) + (1 - j_2) (r_h (Q - Q_0) - L_h)$$

where

$$D^B = \text{banks' interest-bearing deposits with the central bank}$$

$$D_r^B = \text{statutory component of } D^B$$

$$D_0^B = \text{non-statutory component of } D^B$$

Hence, the secondary reserves are given by

$$(7) \quad RR_2 = D_r^B + S_r^B$$

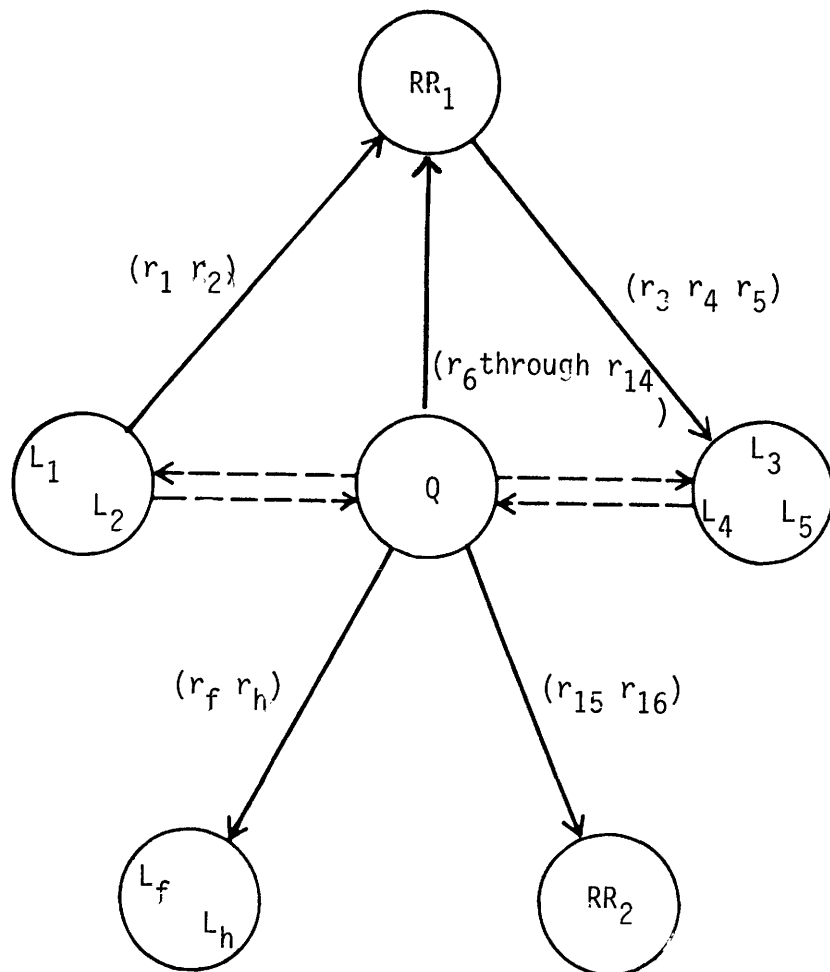
or

$$(7a) \quad RR_2 = (r_f + r_h) Q + r_{15} D + r_{16} T \\ + r_{15} S + r_{16} S_1 + r_{15} B1 \\ - (r_h Q_0 + L_f + L_h)$$

via equations (4) and (6).

Diagram 1 below simplifies the structure of  $RR_1$  and  $RR_2$  as described by equations (2) and (7a) respectively. Banks' private total deposits ( $Q$ ) are distributed over required reserves ( $RR$ ) and credit ( $L$ ). The ordinary funds between deposits and credits are denoted by the broken lines; the statutory flows, i.e., the legal requirements, are denoted by solid lines. The upper part of the diagram seems to indicate that the primary objective of  $RR_1$  is to properly channel banks' credit from sectors  $L_1, L_2$  to sectors  $L_3, L_4, L_5$ . The  $RR_2$  are intended to induce banks to channel credit to sectors which the monetary authorities consider of "national-priority". The structure of  $RR_2$  and hence expression (7a) is evaluated below<sup>6</sup>.

DIAGRAM 1                      The Structure of Legal Reserve Requirements



<sup>6</sup>For the importance of the distribution of bank credit for economic development in Greece, see also, Papandreou (1962, p. 104); Coutsoumaris (1963, pp. 195-196); Ellis et al (1964, pp. 50-54); Pesmazoglu (1965, pp. 20-21).

#### 4. AN EVALUATION OF THE EXISTING STRUCTURE OF RESERVE REQUIREMENTS

##### 4.1. An evaluation of the structure of secondary reserves

The analytic formulation of secondary reserves reveals that, if banks extend the long-term credit to industry and other enterprises ( $L_f$ ) as well as to handicraft ( $L_h$ ), then the term  $(r_h Q_0 + L_f + L_h)$  in (7a) holds. However, banks might avoid extending credit sufficiently, and deposit a percentage of their required reserves with the central bank, thus profiting from the interest-bearing deposits as expressed by  $(r_f + r_h)Q$  in (7a).

Why might banks choose so? It might be that the monetary authorities' credit policy "allows" them sometimes to use their interest-bearing  $(r_f + r_h)Q$  more profitably than what the credit in  $L_f$  and  $L_h$  yields. That is, banks are occasionally allowed to invest in Treasury bills  $S_0^B$  their interest-bearing deposits with the central bank. Obviously, banks may very well deposit a proportion of their requirement for  $L_f$  and  $L_h$  and then switch into the higher yield bearing  $S_0^B$  rather than make loans to the two sectors  $L_f$  and  $L_h$ . At the same time, they might extend high yielding short-term credit to  $L_h$  and  $L_f$  from their free reserves.

The underlined weakness of  $RR_2$  may not be so serious since banks' investment of  $r_f Q + r_h (Q - Q_0)$  in Treasury bills is at the monetary authorities' discretion. Nonetheless, in practice, the authorities allow banks to do so, which then invalidates the term  $(r_h Q_0 + L_f + L_h)$  thus confirming the underlined weakness of  $RR_2$ .

Thus, given the current structure of policy, the monetary authorities' action could very easily subvert the intent of that policy <sup>7</sup>.

##### 4.2. The complexity of required reserves

To see the complexity of the existing system of reserve requirements, the expression for  $RR$  is rewritten via (2) and (7a) as

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<sup>7</sup>Hence, selective bank credit policies designed to promote the stabilization and economic development objectives of the country might produce perverse effects.



$$(1a) \quad RR = \theta_1 Q + \theta_2 D + \theta_3 T + \theta_4 S + \theta_5 Bl + \theta_6 + r_{16} S_1$$

where

$$\theta_1 = r_f + r_h$$

$$\theta_2 = r_7 + r_{13} + r_{15} + \delta_x r_{10}$$

$$\theta_3 = r_{12} + r_{16}$$

$$\theta_4 = r_6 + r_{11} + r_{15} + \delta_x r_9$$

$$\theta_5 = r_8 + r_{14} + r_{15}$$

$$\theta_6 = \sum_{i=1}^2 r_i L_i - \sum_{i=3}^5 r_i L_i - r_h Q_0$$

The parameters  $\theta_1, \theta_2, \theta_3, \theta_4, \theta_5$ , and  $r_{16}$  represent the average reserve requirements for a combination of banks' private deposits. In this respect, they reflect the complexity of the existing system of required reserves.

To further analyze this complexity, let us utilize the behavioral ratios describing the distribution (allocation) of banks' private deposits affecting RR.

Let

$x = D/Q =$  demand-banks' total private deposits ratio

$t = T/Q =$  time-banks' total private deposits ratio

$s = S/Q =$  savings-banks' total private deposits ratio

$s_1 = S_1/Q =$  3-month notice savings-banks' total private deposits ratio.

$\delta = Bl/Q =$  restricted-banks' total private deposits ratio.

Substituting these ratios into (1a) we have

$$(1b) \quad RR = \theta_n Q + \theta_6$$

where

$$\theta = ( \theta_1 \ \theta_2 \ \theta_3 \ \theta_4 \ \theta_5 \ r_{16} )$$

= vector of reserve requirements

$$\eta = (1 \ x \ t \ s \ \delta \ s_1)'$$

= vector of banks' deposits distribution

$\theta_\eta$  = is a scalar equal to

$$\theta_\eta = \theta_1 + \theta_2 x + \theta_3 t + \theta_4 s + \theta_5 \delta + r_{16} s_1$$

Expressions (1b) and ( $\theta_\eta$ ) suggest that RR are affected by changes in banks' total private deposits Q, changes in the distribution of Q (vector  $\eta$ ), and changes in the statutory requirements (vector  $\theta$ ).

Vectors  $\theta$  and  $\eta$  are then important constraints influencing RR. Any change, however, in RR also influences banks' desired quantity for base money or total-reserves  $R^8$ . Let us then look closer to see how RR, and thus R, are affected by changes in banks' deposits distribution and changes in their statutory requirements.

Defining the required reserves ratio as

$$(8) \quad r_r = RR/Q$$

and substituting (1b) into it, we have

$$r_r = \theta_\eta + \theta_7$$

where

$$\theta_7 = \theta_6 / Q$$

Expression (8) indicates that the required reserves ratio depends on the statutory requirements (vector  $\theta$ ), on the distribution of banks' deposits (vector  $\eta$ ), and on the term  $\theta_7$  which was previously defined.

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<sup>8</sup>The reserve requirements, being on an average basis over a monthly period, introduce stochastic weights on the known values of the reserve ratios and thus make it impossible to determine the direction of the change in elements of vector  $\eta$  and especially t and s except by forecasting the values of the stochastic weights. This introduces some uncertainty in the monetary authorities' ability to effectively predict changes in the banks' holdings of base money and reserves requirements.

Then the relative effects of changes in the statutory and endogenous variables on  $r_r$  in terms of elasticities are

$$\varepsilon (r_r, \theta_1) = \frac{\theta_1}{r_r}$$

$$\varepsilon (r_r, \theta_2) = \frac{\theta_2^x}{r_r}$$

$$\varepsilon (r_r, \theta_3) = \frac{\theta_3^t}{r_r}$$

$$\varepsilon (r_r, \theta_4) = \frac{\theta_4^s}{r_r}$$

$$\varepsilon (r_r, \theta_5) = \frac{\theta_5^\delta}{r_r}$$

$$\varepsilon (r_r, r_{16}) = \frac{r_{16}^{s_1}}{r_r}$$

Our analysis demonstrates that the existing legislation pertaining to reserve requirements is very complex. It was a welcome development that the monetary authorities introduced, in January 1977, a reform which somewhat alleviated the complexity of the required reserves system. Nevertheless, radical simplifications are still needed.

## 5. SUMMARY AND CONCLUSIONS

The objective of this paper has been to provide qualitative evidence concerning the effectiveness of the existing structure of the legal reserve requirements of the Greek economy. By first incorporating into an operating framework the relevant institutional arrangements that condition the behavior of the monetary authorities and the banks, it was found that the existing system of required reserves is very complex. Specifically, the structure of controls maintained by the monetary authorities on banks' liabilities and assets, the maintained categories of reserve requirements and the mechanism of allowing banks to withdraw from the central bank part

of their reserves to cover credit to different sectors of the economy, produce such a complex system of required reserves that it makes it more difficult for the central bank to keep full control over the aggregate volume and direction of bank credit.

In addition, the existing legislation pertaining to reserve requirements, and particularly that concerning the secondary reserves  $RR_2$ , displays obvious disadvantages. It was shown, contrary to the objectives of the Greek monetary authorities, that : banks may very well switch the primary objective of  $RR_2$  ; banks can offset almost all the remaining power of  $RR_2$  through other means of borrowing; and the reallocation of credit to sectors of "national priority" may not be best accomplished through the  $RR_2$  policy. By implication, this finding also suggests that the existing structure of  $RR_2$  is accompanied by negative allocative effects in bank credit, regulates credit inefficiently, introduces uncertainty in the implementation of monetary policy, and gives rise to losses of economic welfare.

The central bank has recognized the problems posed by the unwieldy system of required reserves, and has on several occasions announced its intention of reforming it. This paper concludes that such reforms would be highly desirable.

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