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A Test of the Effectiveness of Selective Credit Controls in Greece

by Lazaros E. Molho*

Approved by V. Sundararajan

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I. Introduction

Selective credit policies are employed in many countries in order to influence the composition of aggregate expenditure and real resource allocation. 1/ One general argument against the use of such policies is that they lack effectiveness. 2/ According to this argument, redirection of financial flows will not necessarily have the desired effects on the real sector of the economy owing to the fungibility of financial assets and liabilities. The extent to which such fungibility is empirically relevant may vary from country to country, depending on institutional arrangements.

The consensus emerging from a large number of empirical studies on the U.S. economy appears to be that government efforts to allocate credit can, at best, be effective only in the very short run as a countercyclical policy for selected economic sectors (e.g., residential construction). 3/ In the longer run, portfolio substitutions, financial innovations or even outright evasion are likely to undermine the effectiveness of these policies. 4/ Of course, this evidence from the U.S. economy is not necessarily relevant for other countries where the financial system may be much more centralized, limiting the scope for evasion of credit controls.

The purpose of this paper is to assess the impact of a particular type of credit control that has been used in Greece, a country with a less developed, highly centralized financial system. The credit control in question consists in increasing the supply and lowering the cost of long-term loans relative to short-term loans, in order to stimulate fixed capital formation while discouraging speculative activities. Such policies have also been employed in most developing countries as well as in some western European countries. 5/

1/ For descriptions of the various types of policies implemented in different parts of the world, see Fry (1981) on Asian countries, Johnson (1975) on African countries, Hodgman (1976) on Western European countries, and Jaffee (1975), Smith (1975), and Barth, Cordes and Yezer (1979) on the United States.

2/ Costs, efficiency and equity are other related issues which will not be addressed in this paper. For discussions on these issues, see Silber (1973) and Mayer (1975).

3/ See, for example, Kearl, Rosen and Swan (1975) and Hamburger and Zwick (1977).

4/ For some illustrations on the long-run effects of selective credit controls in the United States, see Kane (1977).

5/ See Virmani (1982) and Hodgman (1976).

The paper develops a model of the firm's financing decision that helps derive the conditions under which this kind of policy will be successful. The model implies that lengthening the average maturity of a firm's debt will succeed in stimulating investment spending when this policy is viewed as temporary, but will be completely ineffective when the policy is thought to be permanent. In the latter case, firms will tend to adjust their patterns of financing in a way that neutralizes this policy.

The estimation of an empirical version of the model provides support for these findings. Using data from the balance sheets of Greek industrial firms, we estimate investment functions over the mid-1970s, a period in which the Greek authorities intensified their efforts to selectively restrict the supply of short-term credit. The estimates suggest that shifts in the firms' patterns of financing tended to offset the impact of the authorities' credit policy.

The remainder of this paper is organized as follows. Section II gives a brief description of the institutional setting in the Greek financial sector and of the conduct of selective credit policies. Section III develops a microeconomic model of the firm's investment and financing decisions, which allows a systematic evaluation of the effectiveness of interest rate and loan supply policies. In Section IV, pooled cross-section time-series data are used to estimate investment functions for Greek industrial firms, and to test for any systematic changes in firm behavior in response to selective tightening of short-term credit supply. Concluding remarks are presented in Section V.

II. The Greek Financial Sector 1/

This section describes the workings of the Greek financial system, highlighting some of the elements that may seem to enhance the effectiveness of selective credit policies. Of particular significance in this regard are the low level of development of the capital market, and the authorities' tight control over the banking system.

1. The capital market

The securities market accounts for a very small fraction of external financing in the Greek economy. New issues of stocks and bonds constitute an insignificant source of funds for the private nonfinancial sector, which meets most of its financing requirements by borrowing from the banking system.

1/ For a detailed description of the Greek financial sector, see Halikias (1978).

This is illustrated in Table 1 which presents data on the values of new security issues and the flow of bank credit over the period 1968-84. The value of total gross security issues amounted to about 13 percent of the total flow of bank credit during that period, while issues by private nonfinancial enterprises amounted to less than 1 percent of the flow of bank credit to the private sector. In the equity market, more than half the new shares of the whole period were issued by financial institutions in the years 1976-80. Issues by public enterprises and the Central Government dominated the bond market until 1973, when the Government started to finance a large part of its deficit with treasury bills. 1/ In the 1973-77 period, financial institutions and public enterprises accounted for the bulk of new bond issues, and since 1978 only financial institutions have issued new bonds. Compared with other OECD countries, Greece had the lowest ratio of total security issues to GDP during the period 1968-77 (Table 2).

The low level of activity in the capital market can be attributed to the inadequacy of both supply and demand for securities. Large industrial firms have little incentive to issue securities as they can usually meet all their financing needs by borrowing from commercial banks on favorable terms. 2/ Individual investors may be reluctant to hold corporate shares owing to the family character of most private companies and the uncertainty over their dividend policies. This uncertainty derives from the fact that the directors of the board of such companies are usually members of the controlling family, allowing them to inflate their salaries at the expense of profits. 3/ Larger institutional investors, such as pension funds, mutual funds and insurance companies are either prohibited by law from holding private securities or have insufficient resources to make any significant contribution to the level of activity in the Stock Exchange. 4/

1/ Currently, these bills are mostly held by commercial banks in partial fulfillment of their compulsory investment requirements; they are not negotiable and cannot be discounted by the Bank of Greece. However, steps were recently taken to initiate the direct sale of treasury bills to individuals and private enterprises. To this end, the Bank of Greece intends to take measures toward the development of a secondary market and plans to sell treasury bills in small denominations (Bank of Greece, Summary of the Governor's Annual Report for 1984, p. 28).

2/ The authorities set ceilings on the loan rates charged by banks. As a result, real loan rates have been negative for some loan categories in recent years (see Table 3 below).

3/ For a detailed description of the Greek capital market, see Psilos (1964).

4/ Bitros (1981, p. 461).

Table 1. Greece: Security Issues and Flow of Bank Credit

(In millions of drachmas, current prices)

	Shares			Bonds (Public Issues)					Flow of Bank Credit 1/		
										Private Sector	
	Total gross (1)	Private non-financial enterprises (2)	Financial institutions (3)	Total gross (4)	Central Government (5)	Public non-financial enterprises (6)	Private non-financial enterprises (7)	Financial institutions (8)	Grand Total (9)	Total (10)	Manufacturing (11)
1968	86	86	--	3,253	1,800	1,403	50	--	12,389	8,548	4,691
1969	78	72	6	2,100	2,000	--	0	100	19,181	16,385	6,336
1970	434	189	245	2,273	2,200	--	73	--	23,387	20,853	8,710
1971	392	14	378	3,850	2,350	1,500	--	--	28,426	25,225	11,172
1972	3,369	263	3,106	4,900	3,000	1,800	100	--	36,332	33,155	12,809
1973	1,900	1,430	470	2,950	--	2,500	450	--	38,576	30,943	11,868
1974	1,083	1,083	--	100	--	--	100	--	48,560	40,629	19,844
1975	1,367	530	837	330	--	--	84	246	67,509	59,594	32,266
1976	6,313	688	5,625	2,949	--	--	304	2,645	88,524	76,513	35,963
1977	1,324	520	804	6,808	--	3,000	--	3,808	105,673	96,488	43,399
1978	2,827	400	2,427	3,987	--	--	--	3,987	116,950	109,223	55,128
1979	4,490	197	4,293	6,007	--	--	--	6,007	131,691	106,730	56,636
1980	7,146	130	7,016	13,892	--	--	--	13,892	185,592	136,294	84,348
1981	1,199	1,034	165	17,440	--	--	--	17,440	295,650	212,043	131,131
1982	1,130	1,130	--	30,420	--	--	--	30,420	330,934	237,794	123,725
1983	1,664	1,488	176	57,907	--	--	--	57,907	293,213	223,490	106,207
Jan.-Sept. 1984.	2,576	2,576	--	65,622	--	--	--	65,622	209,793	172,999	73,170
Total	37,378	11,830	25,548	224,788	11,350	10,203	1,161	202,074	2,032,380	1,606,906	817,403

Sources: OECD, Financial Statistics; and Bank of Greece, Monthly Statistical Bulletin.

1/ The figures in columns (9), (10), (11) are first differences of the respective outstanding stocks of consolidated banking system credit excluding credit to the Central Administration.

Table 2. Security Issues on the Various Domestic Markets

(As a percentage of GDP)

Country of issue	Type of security	1968	1971	1974	1977	Average 1968-1977	
Austria	Shares	1.14	0.32	0.36	0.45	0.68	3.51
	Bonds	0.98	2.01	1.92	4.61	2.83	
Belgium	Shares	2.22	1.45	1.32	...	1.58 1/	
	Bonds	7.65	11.91	7.73	...	8.67 2/	10.53
	Debt ceritificates	0.65	0.14	0.09	0.18	0.28	
Canada	Shares	0.81	0.40	0.53	1.45	0.75	3.74
	Bonds	2.61	3.92	2.78	4.72	2.99	
Denmark	Shares	0.96	1.88	1.13	...	1.62 2/	10.57
	Bonds	7.28	7.86	8.73	10.30	8.95	
Finland	Shares	5.28	4.02	...	...	4.05 3/	4.84
	Bonds	1.43	0.47	0.53	0.73	0.79	
France	Shares	0.60	0.92	0.84	0.60	0.83	2.65
	Bonds	0.93	2.26	1.16	2.10	1.82	
Germany	Shares	0.58	0.62	0.35	0.36	0.49	
	Bonds	3.55	2.82	2.60	4.41	3.44	4.91
	Debt certificates	0.45	0.74	1.08	1.72	0.98	
Greece	Shares	0.04	0.12	0.19	0.14	0.29	0.78
	Bonds	1.19	0.90	-0.22	0.47	0.49	
Italy	Shares	1.08	1.73	0.82	1.30	1.59	9.80
	Bonds	6.59	7.98	5.24	12.17	8.21	
Japan	Shares	1.09	1.20	0.69	0.74	1.11	7.36
	Bonds	4.50	5.42	5.42	9.07	6.25	
Netherlands	Shares	0.26	0.11	0.05	0.15	0.14	
	Bonds	1.59	2.32	1.44	2.72	1.92	11.42
	Debt certificates	7.44	8.03	9.26	12.18	9.36	
Norway	Shares	1.18	0.81	0.68	0.85	0.87	4.49
	Bonds	3.61	2.69	4.17	3.34	3.62	
Portugal	Shares	2.44	2.44	2.15	0.53	2.40	
	Bonds	0.22	-0.17	1.73	1.60	2.49	4.97
	Debt certificates	0.02	0.08	0.05	0.08	0.08	
Spain	Shares	2.12	2.54	3.66	1.66	2.61	
	Bonds	2.51	1.96	2.62	2.46	2.34	6.01
	Debt certificates	1.71	1.49	0.48	1.10	1.06	
Switzerland	Shares	2.58	2.94	2.25	1.87	2.45	9.61
	Bonds	4.75	6.97	4.59	8.56	7.16	
United Kingdom	Shares	0.87	0.45	0.15	0.56	0.60	3.69
	Bonds	-0.13	7.10	1.30	7.23	3.09	
United States	Shares	0.53	1.22	0.45	0.61	0.79	5.44
	Bonds	4.13	4.32	4.05	7.03	4.65	

Source: OECD, Financial Statistics, 1978, Vol. 12, Part I.

1/ 1968-75 average.

2/ 1968-74 average.

3/ 1968-73 average.

2. The banking system and the conduct of credit policy

The Greek banking system consists of the Bank of Greece, which is the central bank, 13 locally owned commercial banks, 20 subsidiaries of foreign banks, 3 investment banks, and 4 state-controlled specialized credit institutions. The Bank of Greece, in addition to performing the usual functions of a central bank, provides funds for the specialized credit institutions and occasionally engages in direct lending to the private sector. Commercial banks obtain most of their funds by attracting deposits and extend loans to most economic sectors. The local banks also own or have interests in some major insurance companies and industrial and tourist enterprises as well as in the investment banks, which engage in long-term financing and participate in the equity capital of industrial enterprises. Finally, the specialized credit institutions obtain most of their funds from the central bank, and provide loans to agriculture, long-term loans to industry, housing loans to low-income groups and public employees, and loans to public utilities and public enterprises. 1/2/

The authorities exercise direct control over the portfolio policies of the specialized credit institutions, but the commercial banks, which supply about 50 percent of total bank credit, have a greater degree of discretion over their operations. Monetary and credit policies are thus mainly aimed at controlling commercial bank behavior, with a wide range of rules and regulations. This control is enhanced by the highly oligopolistic structure of the banking system and the state ownership of the two largest commercial banks. These two banks also hold controlling interests in five smaller commercial banks, giving them effective control of around 70 percent of commercial banking activity.

The general objectives of the commercial bank regulatory policies have remained relatively unchanged, although the details of bank regulations have varied over time. In addition to controlling aggregate demand, the monetary authorities also seek to encourage what are perceived

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1/ Beginning in 1984, two of the specialized credit institutions made considerable progress in attracting private deposits and in reducing their dependence on central bank funds. Also in 1984, the Central Bank abandoned its practice of regulating credit allocation by these institutions, with the aim of decentralizing the formulation of banks' portfolio policies. Currently, the Central Bank sets ceilings on its financing of these institutions as well as on their total credit, leaving the allocation of credit to the institutions' discretion (Bank of Greece, Summary of the Governor's Annual Report for 1984, pp. 26-27).

2/ The commercial banks and the specialized credit institutions have traditionally made little use of foreign loans as a source of funds. For both types of institutions, deposits in foreign exchange--mainly by Greek seamen, emigrants and shipping companies--constitute the bulk of foreign liabilities. As of November 1984, nondeposit foreign liabilities as a percentage of total liabilities amounted to 2.6 percent for commercial banks and 3.7 percent for specialized credit institutions.

to be desirable economic activities at the expense of less desirable ones. Accordingly, credit policies are generally aimed at encouraging agriculture, small-scale manufacturing, industrial investment and export and tobacco trade, while discouraging speculative investment in real estate, import and domestic trade, and consumer expenditure.

The monetary authorities have pursued these allocative goals with a combination of direct restrictions on commercial bank portfolio policies, interest rate ceilings on deposits and loans, and ceilings on the supplies of certain types of credit. In what follows we briefly discuss each policy type in turn.

a. Direct restrictions on commercial bank portfolio policies

Banks are required to deposit a fraction of their deposits in a noninterest-bearing account with the central bank, and to invest an additional fraction in treasury bills and government bonds. Also, specified fractions of total deposits are earmarked for the long-term financing of fixed capital formation, for loans to handicraft enterprises and for the financing of other favored sectors; if banks fall short of these targets, any unused balance of the designated amounts is to be deposited with the central bank at a low interest rate. Altogether, these compulsory uses of funds amount to more than 70 percent of total commercial bank deposits and constitute the authorities' principal instrument of control over the liquidity and credit allocation of the banking system.

b. Deposit and loan rate ceilings 1/

The authorities set ceilings on commercial bank deposit and loan rates in an effort to influence the demand for various types of deposits and loans. These ceilings have been effective through most of the 1970s and early 1980s. Beginning in 1973, the rate of inflation rose to levels consistently above deposit rates, and usually above most loan rates. The authorities attempted to close the gap between the rate of inflation and the level of interest rates by raising all interest rate ceilings in 1978, but this gap widened again in 1979-81 as inflation accelerated (see Table 3). Inflation moderated thereafter, but most real loan rates remained negative through 1983, becoming slightly positive only in 1984, while real deposit rates remained negative throughout the 1973-84 period.

1/ The rediscount rate of the Bank of Greece, which applies to commercial bank borrowing from the central bank, is not used to influence money market rates, as most interest rates are fixed independently by the Bank of Greece. Through most of the 1970s, monetary growth was high enough for commercial banks to meet their obligations with their own funds, without having to resort to the central bank. Thus the rediscount rate has been important mainly as an indicator of monetary policy trends.

The structure of Greek deposit and loan rates reflects the authorities' policy objectives rather than market preferences or expectations. The term structure of deposit rates is designed to encourage demand for longer-term time deposits, which carry interest rates of 1-2 percentage points above the rates on savings deposits (Table 3). In contrast, long-term loan rates have been lower than short-term rates by 0.5-5 percentage points, in conformity with the authorities' efforts to encourage fixed capital formation. Similarly, loans to import and domestic trade have cost 3-14 percentage points more than loans to export and tobacco trade, reflecting the authorities' view that the former tend to finance speculative, nonproductive activities. In May 1983, the authorities undertook to simplify and rationalize this loan rate structure by raising the rates on some of the previously subsidized loan categories. Currently, three different rates apply to about 90 percent of credit to the private sector, and the margins between these rates have been substantially narrowed. Since 1966, this policy of differential loan rates has been complemented with a system of differential reserve requirements--reserve withdrawals on the various types of commercial bank loans. This system was designed to equalize the banks' nominal rates of return from all loan categories and thereby to ensure that banks would have no incentive to undermine the authorities' policy.

c. Credit ceilings

The monetary authorities set upper limits on the sizes of specific types of loans as well as on the overall supply of credit to certain sectors of the economy. Beginning in the early 1970s, total short-term credit, supplied by commercial banks for the financing of industry, mining and domestic and import trade, was subject to periodically revised ceilings, while credit to export and tobacco trade and long-term credit for fixed capital formation were unrestricted (see Table 4). This policy, complemented by a suspension of housing loans, was aimed at curtailing inflationary pressures without depressing the level of activity in the more productive sectors of the economy. The policy of selectively restricting short-term credit was abandoned in 1976, when the authorities began imposing ceilings on total private sector credit instead. The allocation of credit has since been left to the discretion of commercial banks, within the limits set by the aforementioned compulsory investment requirements.

3. The effectiveness of selective credit policies in Greece

The foregoing discussion suggests that the Greek authorities should be able to direct the flow of financing to the private sector with relative ease. Credit is channeled almost exclusively through the highly regulated and centralized banking system, which is mostly state owned. As a result, the authorities have direct or indirect control over the terms, conditions and quantities of credit allocated to the various sectors of the economy.

Table 3. Greece: Selected Interest Rate Ceilings on Commercial Bank Deposits and Loans 1/

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Savings deposits	5.0	5.0	7.0	9.0	7.5	7.0	7.0	10.0	13.5	13.5	13.5	13.5	13.5	15.0
3-6-month time deposits	5.75	5.75	8.0	10.0	9.0	8.5	8.5	11.0	14.5	14.5	14.5	14.5	14.5	15.5
Short-term loans to industry	9.0	9.0	11.0	13.0	12.5	12.5	13.0	15.5	21.0	23.5	21.5	21.5	21.5	21.5
Long-term loans to industry	8.5	8.5	9.5	11.5	11.0	11.0	11.0	12.0	16.0	18.5	18.5	16.5	18.5	18.5
Loans to import and domestic trade	12.0	12.0	14.0	15.0	14.5	14.5	15.0	18.0	23.0	23.5	21.5	21.5	21.5	21.5
Loans to export trade	6.5	6.5	8.5	9.5	9.0	9.0	9.5	9.5	9.0	10.5	10.5	10.5	21.5	21.5
Loans to tobacco trade	6.5	6.5	8.5	9.5	9.0	9.0	9.5	9.5	9.0	10.5	10.5	10.5	18.5	18.5
Memorandum item:														
Annual rate of change of consumer price index (period average)	3.0	4.3	15.5	26.9	13.4	13.3	12.1	12.6	19.0	24.9	24.5	20.9	20.2	18.4

Source: Bank of Greece, Monthly Statistical Bulletin.

1/ End of period interest rates, in percent per annum; loan rates include commission.

Table 4. Greece: Ceiling Rates of Growth of Commercial Bank Credit

(In per cent)

Time period over which ceilings applied	Time at which ceilings were announced	Ceiling rate of growth of restricted credit 1/
4/71 - 12/71	7/71	0
4/71 - 6/72	1/72	15
12/72 - 6/73	12/72	4
12/72 - 12/73	7/73	10
12/72 - 6/74	3/74	12.2-14.4
12/73 - 12/74	7/74	6
12/73 - 12/74	8/74	12
12/73 - 12/74	11/74	15
6/74 - 6/75	3/75	17
6/75 - 12/75	6/75	8

Sources: Bank of Greece, Monthly Statistical Bulletin; and OECD, Economic Surveys, Greece.

1/ Restricted credit includes short-term credit to industry and mining, and credit to import and domestic trade; unrestricted credit includes long-term credit to industry and mining and credit to export and tobacco trade.

Nevertheless, there is evidence suggesting that, despite the apparent strict regulation of the Greek banking system, the effectiveness of selective credit controls has been limited by the ability of lenders and borrowers to behave in a way that frustrates the authorities' goals. Although most of the banking system is state owned, banks have often tried to evade credit regulations, acting as if they were profit-maximizing firms. 1/ A notable example of this type of behavior is the banks' tendency to increase the supply of high-interest-rate loans, in violation of the spirit of the authorities' loan rate policy. This type of behavior prompted the authorities to institute the system of asset reserve requirements--reserve withdrawals referred to above, but the resulting equalization of effective nominal loan rates may not have been sufficient to ward off that kind of behavior. 2/

Borrower behavior may also tend to undermine the effectiveness of credit controls. For example, firms may divert their own funds in order to finance restricted activities; in this regard, trade credit is widely known to have played a primary role in Greece. 3/ Similarly, firms may have been able to break the presumed linkage between fixed capital formation and long-term credit by changing their patterns of financing so as to offset changes in the pattern of credit supplies.

1/ According to Halikias (1978, pp. 225-226), "In many cases, the banks, instead of acting in accordance with the stated aims of the credit policy, are actually cooperating with their clients in finding ways to evade credit regulations. In fact, the banks have shown great ingenuity in this respect."

2/ Bitros (1981, p. 464) has pointed out that even if all loan types bear the same nominal rate of return, systematic differences in risk characteristics may still make banks favor the types of lending that the authorities wish to discourage. Halikias (1978, pp. 229-239) has also discussed and evaluated this loan rate policy, underlining its possible perverse results, and the same issues have been treated more formally by Molho (1983 and 1984).

3/ Halikias (1978) presents evidence that Greek manufacturing enterprises channel a high proportion of their borrowed funds to trading companies, by selling them their products on credit. He concludes that "...under conditions of essentially free bank financing of the manufacturing industry, combined with restrictions on lending to trade, bank financing of the latter sector could not be prevented. It merely became indirect. In fact, Greek industrial enterprises were converted into financiers of trade." (op. cit., p. 212) The monetary authorities have been aware of these developments. According to the Report of the Governor of the Bank of Greece for 1975 (p. 15), "To a significant extent, the working capital requirements of industrial and commercial enterprises were met by credit leakages out of commercial bank lending not subject to a ceiling. This is evident from the fact that the growth rate of commercial bank lending in this category was very high (61 percent) last year, without being justified either by developments in economic activity or by the increasing cost of inputs. Credit leakages grew especially after the elimination of credit ceilings for funds intended to finance industrial exports and handicrafts."

This paper focuses on the implications of the latter type of firm behavior for the effectiveness of the Greek authorities' credit policies during the mid-1970s. In an effort to underscore the potentialities and limitations of using the term structure of loan supplies and loan rates as a selective credit control, the next section presents a theoretical model of industrial firms' financing decisions.

III. A Model of the Firm's Investment and Financing Decisions

This section develops a model of firm behavior in order to determine the conditions under which the policy of lengthening the average maturity of loans and lowering the cost of long-term credit to the private sector will have the desired effect of encouraging fixed capital formation. If fixed capital formation is indeed more strongly affected by long-term than by short-term credit, then there is reason to believe that this policy will be successful. One of the aims of our model is to establish the nature of the relationship between the term structure of a firm's debt and its asset composition. 1/

We distinguish accordingly between fixed capital, which includes structures and machinery and equipment, and circulating or working capital, which includes advances to workers prior to actual sales, inventories of finished goods, goods in process and raw materials, and trade credit. Owing to the time and adjustment costs associated with its acquisition and installation, the quantity of a firm's fixed capital is changed far less frequently than holdings of circulating capital. If the firm chooses to match the maturities of its assets and liabilities, then long-term loans will be more closely associated with fixed capital, while short-term loans will be more closely associated with working capital. This, however, does not necessarily imply that a relative increase in the supply of long-term loans will encourage the acquisition of fixed assets. From the firm's point of view, long-term credit may be a perfect substitute for revolving short-term credit. Thus, a permanent change in the term structure of firm debt in favor of long-term loans may only affect the firm's liability composition, leaving its asset composition unchanged.

1/ In order to simplify the analysis, the model distinguishes between total short-term and total long-term debt without any breakdown between domestic and external funds. The existence of external finance possibilities, however, would only strengthen the model's results on the effectiveness of selective credit controls. If, in addition to substituting between domestic short-term and domestic long-term funds, firms could also substitute between domestic and external funds, the effectiveness of controls on the domestic banking system would be further weakened. Substitutions between external short-term and external long-term funds, however, would probably be less likely to occur. The bulk of external borrowing by Greek manufacturing firms consists of short-term suppliers' credits, with only a few large firms borrowing directly from foreign banks (Halikias (1978, pp. 150-152)).

1. The model

In order to determine firm behavior in response to selective credit policies, it is useful to set up the firm's optimization problem. 1/ Following other studies, we treat fixed and working capital as separate factors of production. 2/ The criterion for the effectiveness of credit controls is the extent to which they succeed in stimulating the firm's demand for fixed capital and in discouraging demand for circulating capital.

We assume that firms maximize expected profits net of financing costs over a two-period horizon. Firms hold the same amount of fixed capital, but may vary their holdings of working capital over the two periods. On the liability side, firms can obtain long-term loans with a two-period maturity in the beginning of the first period, and short-term loans with a one-period maturity in the beginning of each period. Equity capital is exogenous and constant throughout the two periods. Firms determine the composition of their assets and liabilities on the basis of the interest rates and/or the supplies of short- and long-term loans, which are known at the beginning of the first period, and the interest rate and/or the supply of short-term loans that are expected to prevail in the beginning of the second period. To simplify the analysis, we assume that there is no uncertainty about future credit market conditions.

More formally, each firm chooses its fixed capital stock (KF_t), its long-term borrowings (LL_t) and its short-term borrowings (LS_t and LS_{t+1}), so as to maximize the present discounted value of its profits (P) subject to its technological and balance sheet constraints. We have:

$$(1) \quad \max P = (R_t - LS_t r_t^s - LL_t r_t^l) + \frac{1}{1+r}(R_{t+1} - LS_{t+1} r_{t+1}^s - LL_t r_t^l)$$

subject to:

$$(2) \quad LS_t + LL_t + E_t - KF_t - KC_t = 0$$

$$(3) \quad LS_{t+1} + LL_t + E_t - KF_t - KC_{t+1} = 0$$

1/ A similar approach is employed by Wood (1975).

2/ Morley (1971), McKinnon (1973) and Kapur (1976) have all argued that working capital may be an important factor of production in countries with less developed capital markets. The function of the distinction between fixed and working capital in these studies is to highlight the contractionary effects of disinflationary policies on output that are due to the linkage between bank financing and working capital (e.g., Kapur (1976, p. 778).

$$(4) \quad R_t = F^t(KF_t, KC_t)$$

$$(5) \quad R_{t+1} = F^{t+1}(KF_t, KC_{t+1})$$

where

E_t = equity capital in periods t and t+1

KC_t = working capital in period t

KC_{t+1} = working capital in period t+1

KF_t = fixed capital in periods t and t+1

LL_t = long-term loan demand in period t

LS_t = short-term loan demand in period t

LS_{t+1} = short-term loan demand in period t+1

P = present discounted value of profits net of financing costs

R_t = revenues in period t net of labor costs and depreciation

R_{t+1} = revenues expected to materialize in period t+1, net of labor costs and depreciation

r = discount rate

r_t^l = long-term loan rate in period t

r_t^s = short-term loan rate in period t

r_{t+1}^s = short-term loan rate expected to prevail in period t+1

Equation (1) gives the firm's profits as a function of revenues net of labor costs and depreciation, and financing costs. Equations (2) and (3) are the firm's balance sheet constraints for periods t and t+1, respectively. Finally, equations (4) and (5) give the firm's revenue functions which represent the technical relationships between net revenue and productive inputs (fixed and working capital), in periods t and t+1,

respectively. Labor is not included as a separate input because it is subsumed in working capital, which includes advances to workers prior to output sales.

2. Selective credit controls and the firm's investment decision

When the authorities exercise direct control over both the cost and the availability of credit, interest rates may be inconsistent with loan market equilibrium. For any given supply of credit, artificially low rates will generate excess demand, while excessively high rates will result in excess supply. As a consequence, the effectiveness of credit policies depends crucially on whether loans are in excess demand or in excess supply at the time that the policies are initiated. Loan rate increases will have little effect on expenditure when these rates are artificially low, while loan supply increases will fail to stimulate spending when the cost of credit is too high for borrowing to be worthwhile.

Based on the optimization framework presented earlier, we can discuss the impact of selective credit controls on the firm's investment decision, distinguishing between the cases of excess supply and excess demand for loans. In each case we assume that actual loan transactions are determined by the short side of the market. The firm borrows exactly as much as it wishes to when there is excess supply of loans, and exactly as much as is supplied when there is excess demand.

The main results, discussed in detail in the next two subsections, can be summarized as follows. When loans are in excess supply, a fall in the long-term loan rate will stimulate or leave unchanged the firm's demand for both types of capital. A rise in the short-term rate, however, will discourage demand for working capital, but may encourage or discourage demand for fixed capital. When loans are in excess demand, a change in the maturity composition of loan supply in favor of long-term loans will stimulate demand for fixed capital only if this policy is viewed as transitory. If the policy is viewed as permanent, firms will tend to neutralize it by using more long-term and own funds to finance working capital.

a. The firm faces no borrowing constraints (excess supply of loans)

In this case the firm is free to choose KF_t, KC_t, KC_{t+1}, LL_t, LS_t and LS_{t+1}. The first-order conditions that are necessary for an optimum imply that, in general, the firm will not wish to hold non-zero amounts of LL_t, LS_t and LS_{t+1} at the same time. 1/ In particular, if

1/ Formal proof of this and other propositions stated in this paper can be obtained from the author upon request.

$$r_t^l + \frac{1}{1+r} r_t^l < r_t^s + \frac{1}{1+r} r_{t+1}^s \qquad (6)$$

then either $LS_t = 0$ or $LS_{t+1} = 0$, and if

$$r_t^s + \frac{1}{1+r} r_t^s < r_t^l + \frac{1}{1+r} r_t^l \qquad (7)$$

then $LL_t = 0$. Only in the special case of equality between the terms in the left- and right-hand sides of (6) and (7) is it optimal for the firm to hold positive amounts of short- and long-term loans in both periods.

The intuitive explanation of these results is simple. Firms will always choose the cheapest way to finance their capital. When rates are administered it is highly improbable that they are set so as to make firms indifferent between long- and short-term financing. Thus, in general, firms will finance all their capital either with revolving short-term credit or with long-term credit. 1/ The possibility of a combination of long-term and short-term financing for one of the two periods arises only because the firm's capital requirements may differ over time. If the firm needs more funds in the second than in the first period, then it may be optimal to obtain some short-term loans for the second period to avoid having an excess of funds in the first period. Similarly, the inability to prepay long-term loans may make it optimal to hold both short- and long-term loans in the first period.

As was pointed out earlier, changes in the supply of loans will have no effect on the firm's decisions since actual borrowing is demand-determined. Interest rate changes, however, will alter the composition of assets and liabilities in a way that depends on the firm's pattern of financing.

When the firm borrows positive amounts of short-term funds only in the first period ($LS_{t+1} = 0$), then it can be shown that, under plausible conditions, a rise in the long-term loan rate (r_t^l) will lower demands for long-term loans (LL_t), fixed capital (KF_t) and working capital (KC_t). The effect on demand for short-term loans (LS_t), however, is ambiguous. This is because a fall in LL_t reduces total funds available in the second period. If fixed and working capital are complementary inputs, the firm finds it optimal to spread the fall in resources between the two inputs, i.e., we have:

1/ In a free market setting, arbitrage in the markets for securities of different maturities may be expected to bring short-term, long-term and expected future short-term rates in line. Arbitrage possibilities are generally much more limited in the loan market, and in the particular case that the government sets loan rates, the term structure of interest rates will reflect the authorities' goals rather than the market's expectations.

$$\Delta KF_t + \Delta KC_{t+1} = \Delta LL_t \tag{8}$$

$$\Delta KF_t < \Delta LL_t \tag{9}$$

In the first period, long-term funds are supplemented with short-term funds, allowing the firm to adjust working capital to the optimal level. Given ΔKF_t, the size of the optimal change in first-period working capital ΔKC_t will determine the sign of ΔLS_t. In particular, ΔLS_t is positive if and only if:

$$\Delta LL_t - \Delta KF_t < \Delta KC_t \tag{10}$$

Similarly, a rise in the short-term loan rate r_t^s will lower LS_t and KC_t, but has ambiguous effects on KF_t and LL_t. The latter will be positively related to r_t^s when the firm finds it optimal to offset part of the decrease in short-term funds with an increase in LL_t, which by (8) must be associated with a rise in KF_t, if the two inputs are complementary. This case is of particular interest because it gives one possible justification for policies that are aimed at stimulating fixed capital formation with high short-term and low long-term loan rates.

The effects of changes in r_t^l are analogous when the firm borrows short-term funds only in the second period ($LS_t = 0$). Changes in r_t^s, however, affect the firm's financing decision only indirectly through their effect on expected future short-term rates (r_{t+1}^s). With static expectations, i.e., if $r_{t+1}^s = r_t^s$, the effects of changes in r_t^s will also be analogous to those discussed above.

Finally, when the firm finances all of its capital with revolving short-term credit ($LL_t = 0$), changes in the long-term loan rate have no effect on financing decisions. An increase in either the current or the expected future short-term rate, however, lowers the firm's demand for each asset and liability unambiguously when the two inputs are complements. This is because a rise in the cost of short-term funds in any one of the two periods decreases demand for both fixed and working capital in that period. The lower level of fixed capital implies a lower marginal productivity of working capital in the other period and thereby lower levels of working capital and borrowing. The effect of changes in the current short-term rate will be even stronger if there is feedback from actual to expected future interest rates as this will reinforce the effect of changes in current financing costs.

b. The firm is constrained in the loan market (excess demand for loans)

We assume that all three loan markets are in excess demand. This implies that LS_t, LS_{t+1} and LL_t are no longer the firm's decision

variables as they are always equal to the exogenous supplies $\overline{LS}_t$, $\overline{LS}_{t+1}$ and $\overline{LL}_t$, respectively. It follows that loan rate changes can have no effect on the firm's asset or liability composition, although they still have obvious effects on net profits. The authorities can alter firms' capital requirements in this case through direct manipulation of loan supplies. The aim of the Greek monetary authorities, in particular, has been to encourage fixed capital formation with a relative abundance of long-term credit. 1/

In order to isolate the impact of selective credit controls from that of general credit conditions, we consider the policy of changing the maturity composition of credit while keeping the total quantity of credit outstanding unchanged. Thus, we have:

$$\Delta\overline{LS}_t + \Delta\overline{LL}_t = 0 \qquad (11)$$

which implies that any increase in $\overline{LL}_t$ is accompanied by an equal decrease in $\overline{LS}_t$. The policy is considered successful if lengthening the average maturity of credit encourages demand for KF_t at the expense of KC_t.

Assuming complementarity between KC_t and KF_t and solving for the comparative static effects of changes in LS_t and LL_t yields the following results:

$$0 < \frac{dKF_t}{d\overline{LS}_t} < \frac{dKF_t}{d\overline{LL}_t} \qquad (12)$$

and

$$0 < \frac{dKC_t}{d\overline{LL}_t} < \frac{dKC_t}{d\overline{LS}_t} \qquad (13)$$

From (11), (12) and (13) it follows that increasing $\overline{LL}_t$ at the expense

1/ The spirit of this policy is similar to that of Operation Twist which was tried in the United States in the early 1960s, in an effort to stimulate investment spending without any deleterious balance of payments effects. The major differences between the two policies have to do with the method of implementation which is ultimately a function of the institutional setting. Thus, instead of open market operations which are impractical in the absence of well developed capital markets the Greek authorities used direct controls over the maturity composition of bank credit. For empirical evidence on the effects of Operation Twist, see Modigliani and Sutch (1966).

of $\overline{LS}_t$ will have the expected expansionary effect on KF_t and the corresponding contractionary effect on KC_t. The relevance of this result, however, may be limited in view of the possible effects of current policies on firms' expectations of future loan supplies. Taking these effects into account yields:

$$\Delta KF_t = \frac{dKF_t}{d\overline{LL}_t} \Delta\overline{LL}_t + \left(\frac{dKF_t}{d\overline{LS}_t} + \frac{dKF_t}{d\overline{LS}_{t+1}} \frac{d\overline{LS}_{t+1}}{d\overline{LS}_t} \right) \Delta\overline{LS}_t \qquad (14)$$

and

$$\Delta KC_t = \frac{dKC_t}{d\overline{LL}_t} \Delta\overline{LL}_t + \left(\frac{dKC_t}{d\overline{LS}_t} + \frac{dKC_t}{d\overline{LS}_{t+1}} \frac{d\overline{LS}_{t+1}}{d\overline{LS}_t} \right) \Delta\overline{LS}_t \qquad (15)$$

where $\frac{d\overline{LS}_{t+1}}{d\overline{LS}_t}$ is the sensitivity of the expected future short-term loan supply to changes in current loan supplies. Equations (14) and (15) imply that the loan supply policy in question will be effective if, and only if $\frac{d\overline{LS}_{t+1}}{d\overline{LS}_t} < 1$. It will have no effect if $\frac{d\overline{LS}_{t+1}}{d\overline{LS}_t} = 1$ and will be counterproductive if $\frac{d\overline{LS}_{t+1}}{d\overline{LS}_t} > 1$.

The effects of an increase in $\overline{LL}_t$ at the expense of $\overline{LS}_t$, thus, depend on whether this change is expected to be transitory or permanent.

A transitory change ($d\overline{LS}_{t+1}/d\overline{LS}_t = 0$) will induce firms to increase their fixed capital so as to be prepared to increase productivity in the second period when short-term loan supply rises back to its normal level. A permanent change ($d\overline{LS}_{t+1}/d\overline{LS}_t = 1$), however, provides no such incentive since total available resources are expected to remain unchanged in both periods. In the extreme case in which short-term loan supply is expected to fall even further in the second period

($d\overline{LS}_{t+1}/d\overline{LS}_t > 1$), total available resources are expected to decline and firms will tend to cut down on their fixed capital stock to prepare themselves for the anticipated credit crunch.

These results have important policy implications. First, any permanent change in the maturity composition of bank credit will be completely ineffectual. Firms will substitute long-term funds for revolving short-term credit while leaving their asset composition unchanged. Second, a temporary change in loan supply composition will be more effective the lower the responsiveness of the firm's expectation of future policies to current policy. The government can maximize the short-run impact of its policy by making it explicit that it constitutes a temporary measure that will be reversed in the near future. 1/ This will also help prevent the perverse possibility of any firm overreacting in anticipation of further tightening of short-term credit in the future. Finally, it follows that the usefulness of this specific type of selective credit policy is, at best, very limited. The firm's capital structure is primarily a function of technological factors which cannot be much affected by its liability composition. Redirection of the government's efforts toward affecting the marginal productivities of the two inputs might be a more promising way to encourage fixed capital formation.

IV. A Test of the Effectiveness of Selective Credit Controls

The above theoretical framework can be used to test for the effectiveness of the Greek authorities' policy of selectively restricting short-term credit over the period 1973-1977. As was pointed out in Section II, long-term loans to industry had been exempted from any such restrictions with the aim of encouraging fixed investment expenditure. Although this generated a relatively ample supply of long-term loans during that period, private firms might have diverted these loans to

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1/ Note that these results differ from those in Wood (1975) in an important way. Wood (1975) finds that the effectiveness of credit controls is stronger when firms are caught by surprise. In our model there are no surprises in the first period as firms determine their asset structure having full information on current loan supplies. Future loan supplies, however, can only be forecast and this is why the important distinction in our model is between transitory and permanent credit policies. In the second period there are obvious real effects of surprise changes in loan supplies, but in our model these effects are not very interesting because the fixed capital stock is determined in the beginning of the first period. Finally, note that in our model explicitly transitory measures are more effective than permanent ones. This is the opposite of results on the relative effects of temporary and permanent tax increases on aggregate demand (e.g., Eisner (1969)).

any other kind of expenditure, thereby limiting the effectiveness of this policy. This section presents empirical evidence on the extent to which such diversions took place, based on the estimation of variants of equations (14) and (15).

Implicit in the use of equations (14) and (15) is the assumption of excess demand for loans, according to the analysis of Section III. This assumption is crucial for purposes of estimation, as it allows us to treat loan supplies as exogenous to the firm's investment decision. There is good reason to believe that, during the sample period (1973-77), loans were indeed in excess demand. The figures in Table 3 imply negative or near-zero real interest rates throughout that period, which are likely to have contributed to such excess demand. Further evidence to this effect is provided by banks' persistent tendency to exceed the authorities' credit ceilings. 1/

The obvious difficulty in estimating equations (14) and (15) directly is our inability to measure the responsiveness of firms' expectations of future loan supplies to current policies. One practical alternative is to assume that, in normal times, firms view current changes in loan supplies as temporary deviations from trend, with no implications for any systematic change in future loan supplies. In terms of our theoretical model, $d\overline{LS}_{t+1}/d\overline{LS}_t$ is zero in such periods and this allows us to estimate the coefficients of $\Delta\overline{LS}_t$ and $\Delta\overline{LL}_t$ directly. On the other hand, in times of announced deliberate government measures to change the mix of $\Delta\overline{LS}_t$ and $\Delta\overline{LL}_t$, firms may be reasonably assumed to expect that this change may persist for some time. This may render $d\overline{LS}_{t+1}/d\overline{LS}_t$ positive and may exert a systematic impact on the coefficients of $\Delta\overline{LS}_t$. If $\Delta\overline{LL}_t = -\Delta\overline{LS}_t$, then the estimated coefficients of both loan supply variables may move in a way that tends to neutralize the government policy. The test of the effectiveness of selective credit controls is thus reduced to a test of the stability of firms' investment equations (14) and (15).

The methodology of the test is as follows. We estimate separate investment equations for fixed and working capital over the entire sample period (1973-1977) in an effort to determine firms' average patterns of financing. If firms keep these patterns constant at all times and if inequalities (12) and (13) hold, then the credit policy in question is found to be effective. However, if firms shift their patterns

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1/ For example, the target rates of growth for commercial bank credit were 18 and 20 percent for 1976 and 1977, respectively, compared with actual rates of growth of 32 and 25 percent.

of financing in response to credit policy they may render it ineffective. 1/ To determine the extent to which such shifts have taken place, we re-estimate the two investment functions allowing separate coefficients over the tight short-term credit period 1973-74 and over the more normal period 1976-77. We then compare the estimated coefficients over the two subperiods and run stability tests to determine whether policy-induced changes in firms' patterns of financing tended to significantly weaken the impact of the credit policy in question. 2/

More specifically, we adapt equations (14) and (15) to allow for the possibility of internal financing by including a profit variable on the right-hand side. The data are obtained from the balance sheets of all Greek industrial corporations with capital over 500,000 drachmas and are aggregated into 20 industry groups. 3/ In each equation all variables are normalized by the appropriate capital stock in order to minimize any problems of heteroscedasticity. We pool the data over the years 1973, 1974, 1976, and 1977 and estimate separate equations for investment in fixed capital (IF_{it}) and investment in circulating capital (IC_{it}) with 80 observations. 4/ We obtain

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1/ For a more general and rigorous discussion of how optimizing agents may take actions that offset fully anticipated government policies, see Lucas (1976).

2/ The tests of this section can be viewed as an extension of the work of Bitros (1981). In that work, estimation of expenditure equations on data from 153 Greek manufacturing firms provided evidence that the supplies of short- and long-term bank funds were endogenous variables, from the firms' point of view. From this it was inferred that government efforts to redirect loan supplies were ineffective. In this paper, we confine our attention to a period in which there is evidence that loans were in excess demand and, therefore, exogenous to firms' decisions, and show that, even then, redirection of loan supplies may have been ineffective, as firms tended to neutralize the government policy by shifting their patterns of financing. Our results strengthen Bitros' findings by highlighting the possibility of endogeneity of the structural parameters of firms' expenditure functions in the presence of credit rationing.

3/ The data source is The State of Greek Industry, Federation of Greek Industries, various years.

4/ We exclude 1975 from our sample for two reasons. First, the investment climate was especially bad in that deep-recession year. This may account for the fact that, when our equations are estimated separately for each year, the coefficients for 1975 are outliers, and exert a disproportionate influence on the coefficients of the pooled regressions. Second, the monetary tightening was eased in 1975 but the selective credit policy was completely abandoned only in 1976. Comparing 1973-74 with the later period may thus provide for a sharper test if 1975 is excluded from it. Inclusion of 1975 does not alter our results in any significant way, however. Results of estimation over the whole period 1973-77 and for different specifications are presented in Molho (1980).

$$\frac{IF_{it}}{KF_{it-1}} = \underset{(2.406)}{.071} + \underset{(2.921)}{.496}\,\frac{P_{it}}{KF_{it-1}} + \underset{(3.713)}{.273}\,\frac{\Delta LS_{it}}{KF_{it-1}} + \underset{(5.062)}{.686}\,\frac{\Delta LL_{it}}{KF_{it-1}} \quad (16)$$

$R^2 = .548$ F-Statistic = 30.706 D.W. = 2.072

$$\frac{IC_{it}}{KC_{it-1}} = \underset{(1.672)}{.042} + \underset{(2.913)}{.325}\,\frac{P_{it}}{KC_{it-1}} + \underset{(6.944)}{.566}\,\frac{\Delta LS_{it}}{KC_{it-1}} + \underset{(5.325)}{.511}\,\frac{\Delta LL_{it}}{KC_{it-1}} \quad (17)$$

$R^2 = .780$ F-Statistic = 89.745 D.W. = 2.036

where: i = industry group, $i = 1, 2, \ldots, 20$

KC_{it} = working capital and reserves of industry i in year t (includes inventories and accounts receivable)

KF_{it} = fixed capital stock of industry i in year t (book value)

LL_{it} = long-term liabilities of industry i in year t

LS_{it} = short-term liabilities of industry i in year t

P_{it} = profits (including depreciation) of industry i in year t

t = year, $t = 1972, 1973, \ldots, 1977$

$IC_{it} = KC_{it} - KC_{it-1}$

$IF_{it} = KF_{it} - KF_{it-1}$

$\Delta LL_{it} = LL_{it} - LL_{it-1}$

$\Delta LS_{it} = LS_{it} - LS_{it-1}$

and the numbers in parentheses are t-statistics.

All of our estimated slope coefficients are positive and statistically significant, suggesting that profits, short-term loans and long-term loans are all important sources of funds for both types of investment. Moreover, the coefficient of long-term loans is larger in the IF_t equation and smaller in the IC_t equation relative to the respective

coefficients of short-term loans. 1/2/ This is consistent with the results of our theoretical model (inequalities (12) and (13)), but does not necessarily imply that shifting the maturity structure of loans will be an effective selective policy. This is because the coefficients in (16) and (17) may be themselves endogenous and may change systematically in response to any policy change that is expected to be lasting. The endogeneity of firms' patterns of financing was already discussed in the context of equations (14) and (15) of the theoretical model. We now proceed to test empirically for any such systematic effects of the Greek authorities' selective tightening of short-term credit in 1973-74.

We re-estimate (16) and (17) on the pooled data with the two dummy variables D7374 and D7677 incorporated in the equations. D7374 is equal to 1 for observations in the years 1973 and 1974, and 0 for observations in 1976 and 1977. Similarly, D7677 is equal to 0 for observations in 1973 and 1974 and 1 for all other observations. We obtain:

$$\frac{IF_{it}}{KF_{it-1}} = \underset{(.734)}{.028}\ D7677 + \underset{(2.843)}{.134}\ D7374 + \underset{(3.270)}{.852}\ \frac{P_{it} \times D7677}{KF_{it-1}}$$

$$+ \underset{(.688)}{.163}\ \frac{P_{it} \times D7374}{KF_{it-1}} + \underset{(1.896)}{.197}\ \frac{\Delta LS_{it} \times D7677}{KF_{it-1}}$$

$$+ \underset{(2.528)}{.300}\ \frac{\Delta LS_{it} \times D7374}{KF_{it-1}} + \underset{(4.294)}{.796}\ \frac{\Delta LL_{it} \times D7677}{KF_{it-1}}$$

$$+ \underset{(2.851)}{.565}\ \frac{\Delta LL_{it} \times D7374}{KF_{it-1}}$$

$$R^2 = .574 \qquad D.W. = 2.175 \qquad F\text{-Statistic} = 76.429 \qquad (18)$$

1/ The hypothesis of equality of the short-term and long-term loan coefficients cannot be rejected for the IC equation, but can be rejected at the 5 percent level of significance in the IF equation.

2/ Our results differ substantially from those in Bitros (1981), not only because the samples in the two studies are different, but also because of major differences in specification. Bitros (1981) disaggregates KC_t into inventories and accounts receivable, and liabilities into short- and long-term bank loans, nonbank long-term loans and trade credit. He also includes several explanatory variables in addition to financial flows.

$$\frac{IC_{it}}{KC_{it-1}} = \underset{(3.409)}{.122}\ D7677 + \underset{(1.197)}{.035}\ D7374 + \underset{(1.125)}{.178}\ \frac{P_{it} \times D7677}{KC_{it-1}}$$

$$+ \underset{(1.771)}{.225}\ \frac{P_{it} \times D7374}{KC_{it-1}} + \underset{(3.821)}{.362}\ \frac{\Delta LS_{it} \times D7677}{KC_{it-1}}$$

$$+ \underset{(7.009)}{.791}\ \frac{\Delta LS_{it} \times D7374}{KC_{it-1}} + \underset{(1.725)}{.227}\ \frac{\Delta LL_{it} \times D7677}{KC_{it-1}}$$

$$+ \underset{(4.185)}{.493}\ \frac{\Delta LL_{it} \times D7374}{KC_{it-1}}$$

$R^2 = .846$ D.W. = 2.296 F-Statistic = 147.09 (19)

The results reveal substantial differences between the estimated coefficients for each subperiod. The profit coefficient in the IF equation is much lower in 1973-74 than in 1976-77. The reverse relationship holds for the profit coefficients in the IC equation. This suggests that in 1973-74, when the supply of short-term credit was tight, firms shifted internal funds from IF to IC. The external funds coefficients still satisfy inequalities (12) and (13) but the difference between dKF_t/dLS_t and dKF_t/dLL_t shrinks in 1973-74 to almost half its 1976-77 size. In the IC equation both external funds coefficients in 1973-74 are more than twice their 1976-77 size. This evidence is consistent with a systematic effort on the part of firms to change their patterns of financing in favor of IC in order to mitigate the impact of the Government's 1973-74 selective credit policy. 1/

1/ Data limitations have not allowed the disaggregation of firms' liabilities into domestic and foreign loans. In view of our results, it seems likely that firms might also seek to adjust their mix of foreign liabilities in response to selective credit policies, thereby placing an additional limitation on the effectiveness of these policies.

Testing for the stability of the coefficients of equations (16) and (17) more formally, we find that the null hypothesis of no structural change between 1973-74 and 1976-77 cannot be rejected for IF but can be rejected at the 1 percent level of significance for IC. We also test the null hypothesis of no structural change for each coefficient separately and find that the hypothesis can be rejected for only half of our coefficients. The results are summarized in Table 5.

In sum, even though some of our results are not statistically significant, there is enough evidence of a systematic effect of selective credit policies on the structural coefficients of our equations to warrant cautious use of such policies. Even if inequalities (12) and (13) are found to be valid on average, the endogeneity of patterns of financing does not allow us to make inferences on the impact of selective credit policies strictly on the basis of these relationships.

V. Concluding Remarks

This paper has focused on how firms' profit-maximizing behavior can limit the effectiveness of selective credit policies, even when the authorities exercise direct control over interest rates and credit supplies. If, as a result of this type of control, loan markets are in disequilibrium, the impact of loan rate and loan supply policies will depend on the state of the loan market. Changes in loan rates will be the more appropriate policy tool when there is excess supply of loans, while changes in loan supply will be more effective under excess demand.

When loans are in excess demand, a policy of lengthening the average maturity of credit will be most successful in stimulating fixed capital formation when it is explicitly temporary. The effects of any change in the maturity composition of credit that is perceived to be permanent will be completely neutralized as firms change their patterns of financing. These results give support to Silber's assertion that "selective credit policies have their greatest potential usefulness within a cyclical context rather than secularly." 1/

The empirical results suggest that the short-term credit ceilings implemented in Greece in 1973-74 may have exerted a systematic influence on firm behavior, which may have tended to neutralize the selective credit controls in question. Disregard of such policy-induced changes in behavior may lead to erroneous conclusions on policy effectiveness. Selective controls on short-term credit may fail to encourage fixed capital formation even if the impact of long-term credit on fixed investment is stronger, on average, than that of short-term credit. This latter condition is necessary but not sufficient for policy effectiveness. Only if the strengths of these impacts are unaffected by the imposition of credit controls can we be sure that the controls will be effective.

1/ Silber (1973, p. 339).

Table 5. Tests for Changes in Regression Coefficients in Tight Money Period (1973-74)

1. Dependent variable: IF_{it}/KF_{it-1}

Independent variable	1973-74	Null Hypothesis H_o	F-statistic	Significance level
Intercept	larger	rejected	3.09	7.9%
P_{it}/KF_{it-1}	smaller	rejected	3.84	5.1%
$\Delta LS_{it}/KF_{it-1}$	larger	accepted	0.42	52.7%
$\Delta LL_{it}/KF_{it-1}$	smaller	accepted	0.72	40.4%
All variables	--	accepted	1.09	36.8%

2. Dependent variable IC_{it}/KC_{it-1}

Independent variable	1973-74	Null Hypothesis H_o	F-statistic	Significance level
Intercept	smaller	rejected	3.48	6.3%
P_{it}/KC_{it-1}	larger	accepted	0.06	80.1%
$\Delta LS_{it}/KC_{it-1}$	larger	rejected	8.48	0.5%
$\Delta LL_{it}/KC_{it-1}$	larger	accepted	2.27	13.2%
All variables	--	rejected	7.68	0.0%

There are a number of questions not addressed in this paper that may be worth investigating in future research. The theoretical model of the firm's investment decision can be extended into a multi-period framework allowing for variations of the firm's equity capital over time, through the retention of profits. Each period's profits would then enter not only the firm's objective function but also the financing constraint of the following period. This would allow a formal investigation of the effects of selective credit controls on firms' dividend policies and of the way these effects influence the outcome of the controls in question.

Uncertainty about future credit conditions is another important variable that might be incorporated in the model. Changes in the expected variability of these conditions may have systematic effects on firms' investment decisions. For example, if the firm is uncertain about the amount of short-term credit that will be available in the future, it may tend to underinvest in fixed capital for fear of incurring losses if a credit squeeze forces it to restrict its working capital and to underutilize its fixed capital. We can introduce risk into the model by allowing the firm's objective function to depend on expected profits as well as on their expected variability, and by letting the interest rate and the supply of future short-term credit be random variables.

The empirical tests can also be strengthened with a more disaggregated and more carefully selected data sample. It would be useful to distinguish between external and domestic borrowing as the former is more likely to be beyond the authorities' control. It would also be desirable to restrict the sample to those particular firms that were actually unable to obtain all the credit they demanded. This would ensure the exogeneity of loan supplies which is a necessary condition for our estimates to be unbiased. The simultaneity problem may be somewhat more serious for the profit variable, which is not only a constraint on but also the outcome of financing and investment decisions, according to the theoretical model. This problem may be alleviated with the use of an instrumental-variables technique of estimation or with the construction of a better measure for the firm's cash-flow constraint. Finally, it would be most fruitful to use data from other countries that have had experience with selective credit controls to assess the effectiveness of these policies. The results of this paper suggest that stability tests should be an integral part of any such endeavor.

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