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Effectiveness of Selective Credit Controls in Less Developed Countries: An Empirical Test Applied to the Indian Sugar Industry

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I. Introduction

There is a widespread perception, particularly among less developed countries (LDCs), that the financial system, left to itself, will not provide a pattern of credit allocation that is socially most desirable. Thus, apart from regulating the overall level of credit as a means of controlling economic activity as a whole, monetary authorities also attempt to influence the distribution of credit among various activities through the instruments of selective credit control. A basic assumption underlying selective credit policies is that it is possible to redirect real resources to particular activities through a reallocation of financial resources. This hypothesis, which apparently has wide support from practitioners of allocative credit policies, is hotly contested in academic circles. It is therefore clear that the effectiveness or otherwise of selective credit policies cannot be decided without empirical evidence. The purpose of this paper is to test the hypothesis that it is possible to change the allocation of real resources through changes in the distribution of financial resources for a less developed country like India. More specifically, the paper analyzes the impact of the credit policies, adopted by authorities, on stock accumulation and on total gross investment in the Indian sugar industry. The choice of country is dictated more by the availability of data than by a particular institutional structure. But the evidence that emerges from this investigation may have more general applications for other LDCs.

Apart from controversies concerning the desirability of intervention by monetary authorities in the credit market, a major part of the discussion of selective credit controls has focused on whether they can be effective in achieving the desired results and whether they provide the best method of redirecting real resources. The latter question concerns the efficiency and equity implications of such policies. 1/ It has been argued, for example, that selective credit policies involving subsidized interest rates for priority sectors will result in financial fragmentation and disintermediation as new channels will tend to emerge to redirect subsidized credit. These issues, while relevant and important to a discussion of the effects of selective controls on the economy as a whole, are not considered in the present paper, 2/ which is concerned only with the question of the effectiveness of selective credit policies; that is, whether the specific policies pursued by the monetary authorities of India have been successful in changing the pattern of expenditure in the desired fashion. Moreover, in examining the success or failure of these policies, the paper concentrates only on the behavior of borrowers. 3/

1/ Johnson (1974) argues that on equity and efficiency grounds a tax-cum-subsidy program is superior to selective credit controls.

2/ These and other issues are discussed in detail in Silber (1973), and Khatkhate and Villanueva (1980).

3/ Such outcomes can be due to the behavior of borrowers and lenders in the credit market. For an analysis of the latter see Ghandhi (1977).

The present study departs from the existing empirical studies of selective credit controls in several respects. Firstly, most of these studies are concerned with advanced industrial countries and few rigorous tests of the effects of selective controls have been performed on the LDCs. Secondly, the present study attempts to integrate the theories of credit rationing and selective credit controls by explicitly introducing a proxy for credit rationing into the model. Thirdly, to our knowledge no previous study has made the distinction adopted in the present paper between the periods when controls are in effect and when they are not. This distinction is important on the strong theoretical grounds that investment depends only on the cost of credit when credit availability is not restricted, while it is governed by both the cost and the level of credit when restrictions are in force. The present study also permits an analysis of substitutability between bank and nonbank credit which has been ignored in the previous literature on selective credit policies. Finally, in the model of this paper, as in Bitros (1981), a firm's investment decisions regarding stocks, equipment and other fixed assets are treated as simultaneous and interdependent.

The rest of this paper is organized as follows: section II presents the theoretical framework for the analysis; section III discusses the selective credit policies adopted by India and reviews their impact on credit flows; it also presents the empirical results of the study; and section IV contains the conclusions.

II. Efficacy of Selective Credit Controls: Some Theoretical and Methodological Issues

Whatever the definition of selective credit policies or the instruments used for their implementation, such policies aim at redirecting the flows of real resources by imposing restrictions on the use of particular financial instruments. Previous studies have shown that selective credit controls cannot influence real resource allocation as long as borrowers and lenders can substitute one form of financial market instrument for another. 1/ Additionally, the effectiveness of selective credit policies depends on the degree of fungibility of credit, that is, on the extent to which credit obtained for one purpose can be channeled to another. This section will present a framework for an empirical investigation of the existence of such substitutability based on two assumptions: (a) that selective credit policies lead to nonprice credit rationing, and (b) that investment demand depends on credit availability when credit rationing is in effect. The rationale for these assumptions is presented in the sections below.

1/ The formal statement of this condition for the type of controls imposed on lenders has been derived by Rao and Kaminow (1973), and adjusted for the case of developing countries by Khatkhate and Villanueva (1980).

1. Selective credit controls and nonprice credit rationing

This section considers the relationship between selective credit policies and nonprice credit rationing. Before discussing this issue, however, we should see what we mean by the existence of nonprice credit rationing, so that we can determine whether or not rationing exists during a particular period. If there is no interference in the credit market, the interest rates tend to adjust to levels where the demand and supply of funds are in equilibrium in each sector. Clearly the amount of funds available and the interest rate applicable to each sector may vary depending on the risk of default by that sector and other factors. However, in this case credit rationing is not in effect or required as each sector is being given the amount of credit it demands under prevailing conditions.

Now, if because of governmental or other policies, there is an effective ceiling on overall credit and/or there is a maximum lending rate which is below the equilibrium level for some sectors, then the total amount of credit available will be below the amount demanded under prevailing conditions. This means that some form of nonprice credit rationing will have to come into effect in order to distribute the available credit among the different sectors. 1/ Under these conditions, credit to certain sectors, which are perceived to be more risky, is likely to be curtailed substantially more than that to those which are considered less risky. In other words, whenever overall credit is being constrained by the monetary authorities and/or the interest rate is set below market equilibrium it is likely that certain high risk sectors will be rationed out of the credit distribution to a considerable extent. Thus the divergence between actual interest rates and equilibrium interest rates, or lags in the adjustment of interest rates to their equilibrium levels, will tend to be associated with credit rationing. If interest rates are below equilibrium level, excess demand for credit would lead to rationing and this would persist as long as it takes for interest rates to adjust to equilibrium.

The next question is whether selective controls lead to credit rationing. Selective credit controls may be defined as policies that change the proportion of credit allocated to different sectors. Suppose there are two borrowing sectors, A and B, and that A is to be favored by the use of such controls. If initial conditions in the credit market are such that there is full equilibrium with A and B both receiving the credit they demand at prevailing interest rates, then selective credit policies should aim at raising both A's demand for credit, and the supply of credit for it. Clearly the supply side of this objective may be achieved by raising the overall level of credit as a result of which A will receive more credit without B receiving less. However, in

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1/ Available evidence suggests that banks do engage in nonprice credit rationing even in the absence of governmental regulations. See, for example, Stiglitz and Weiss (1981).

this case, the policy indicated is a general credit policy and not a selective one; a selective policy will only be required if policymakers also aim at keeping the total level of credit unchanged or reduced. 1/

It is, of course, conceivable that a selective credit policy would lead to an increase in demand and supply of credit to A, while reducing those for B by the same amount or more, leaving the total unchanged or reduced, respectively. In this case, credit policy has in effect caused a shift from a particular configuration of equilibrium in the credit market to another and, admittedly, selective credit policies should not be described as leading to credit rationing. It should be noted, however, that preserving equilibrium at the same level for B, while raising the flow of credit to A, implies either that additional resources can be quickly raised or that lenders have excess resources that they cannot use more profitably elsewhere so that they would be willing to increase lending to the favored sector without causing excess demand in the other sector--an unlikely possibility.

The conclusion therefore is that credit rationing will not result from the imposition of selective control policies if the impact of such policies on the nonfavored sector is neutral, leaving its supply of and demand for credit in equilibrium (although perhaps at a different level). This requires a substantial degree of coordination on the part of the policymakers. They need to devise a policy package for this purpose that will influence all credit market variables in exactly the desired manner and the required amount. However, this is a highly unlikely possibility and, in most cases, an increase in the supply of credit to A, not accompanied by an expansion in the overall level of credit, will have to be realized by restricting supply to B, resulting in excess demand for B, and thus credit rationing. The likelihood that imposition of selective credit policies will entail nonprice credit rationing increases as the number of lenders and borrowers increase, and also if the credit market is not in initial equilibrium. 2/

The above discussion points to the relationship between the efficacy of selective credit controls and the impact of rationing on the investment behavior of borrowers. If investment expenditures of the borrowers are influenced by credit rationing, then the selective controls which result in credit rationing can be said to be effective in achieving their purpose. Therefore, one must first test for the existence of rationing caused by selective credit policies, and then test for the impact of credit rationing on the investment behavior of borrowers. The question that remains is how to measure the extent of credit rationing. The next section addresses this issue.

1/ In most countries selective credit policies are accompanied by general credit policies which aim at reducing overall supply.

2/ If credit rationing is already in effect before selective controls are contemplated, the adoption of selective policies would widen the extent of credit rationing for nonfavored sectors and ameliorate it for others.

2. The credit rationing proxy

The extent of credit rationing should be measured, in absolute terms, by the excess demand for credit by rationed customers and, in relative terms, by the proportion of excess demand to total demand of the rationed borrower, or

$$H' = \frac{D^r - L^r}{D^r}$$

where H' = ideal rationing proxy
D^r = demand for credit by rationed customers
L^r = supply of credit to rationed customers.

Measurement of D^r and L^r requires information about the behavior of demand and supply which is usually not available. 1/ However, following Jaffee (1971) we can define a different proxy H which is based on observable magnitudes.

$$H = \frac{L - L^r}{L}$$

where L = total supply of credit.

H and H' are related by the identity:

$$H \equiv \frac{1}{1 + d(1 - H')}$$

where $d \equiv D^r/(D-D^r)$, and D = total demand for credit. 2/

Note that $\frac{\partial H}{\partial H'} > 0$, $\frac{\partial^2 H}{\partial H'^2} > 0$.

1/ Identifying demand functions for bank credit is particularly difficult in countries with restrictions on the operations of the banks, such as maximum interest rate ceilings. In such countries banks rarely lend funds at rates lower than specified ceilings. Thus no matter how the supply curve moves relative to demand, the observations tend to cluster around the horizontal lines defining maximum interest rates, so that identification of demand curves is almost impossible.

2/ Note that: $L - L^r = D - D^r$.

Thus for given d, the proxy H is a monotonic function of the ideal measure H'. Any change in d would, however, lead to variations in H that do not necessarily correspond to variations in H', so that if d varies substantially over time, because of, for example, shifts in the demand curve, the proxy will contain measurement errors.

3. Investment demand under rationing

The second issue concerning the analytical framework used in this paper relates also to the theoretical underpinning of much of the empirical analysis on this subject. The question is whether the firm's expenditure decisions depend on the availability or the cost of credit. The possibility of the financing constraint affecting investment expenditure has long been recognized. However, it has been generally ignored in equilibrium models, because, as a disequilibrium phenomenon, financing constraint has no relevance for comparative static analysis, or for studies of equilibrium growth. The first systematic exposition of financing constraint appeared in the form of the so-called "Availability Doctrine." 1/

The principal proposition of the availability doctrine is that small variations in the rate of interest on government securities, resulting from open market operations, may be effective in influencing real expenditures even if they are relatively interest inelastic. This is because the effect of an increase in interest rates may be transmitted through a reduction in the availability of funds from financial intermediaries, rather than directly through the increase in the cost of borrowing, as in orthodox theory. This reduction in availability of credit would then reduce real expenditures. Most of the literature on the "Availability Doctrine" has focused on the mechanism whereby changes in interest rates on government securities may lead to changes in the availability of funds from financial intermediaries. While this aspect of the "Availability Doctrine" is not directly relevant to the present study, the second part, i.e., that credit availability will influence investment expenditures, is of direct relevance. Many attempts have been made to provide a rationale for the link between expenditures and credit with varying

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1/ This doctrine was first introduced by Roosa (1951) and later formalized by Scott (1957) and Modigliani (1963).

degrees of success, but these will not be discussed in this paper. 1/ Instead, we derive this relationship from the effect of credit rationing on loan demand.

The demand for credit is a derived demand. Each individual decision-maker faces a set of parameters: current and expected future income streams, prices, and interest rates. Subject to these parameters, he determines his current spending on each commodity, his borrowing, and additions to cash balances in such a way as to maximize his utility. His decision on one is determined jointly, through his budget constraint, with his decisions on the others. The general principle involved is that the existence of excess demand or supply in one market (credit market in this case) will influence the effective demand in other markets. In other words, the optimal quantity of investment will generally be different if maximization is performed subject to an effective quantity constraint, than if there is no such constraint. Thus, at any given level of interest rates, if the individual is not permitted to borrow as much as he wants, and if attempts by him to offer a higher rate of interest than quoted are in vain, then the level of investment will depend on the amount of credit available to him. This means that investment will not only be a function of rates of return and the cost of financing but also of the amount of credit available.

According to conventional analysis, under rationing, the firm would borrow up to the constrained level of credit supply, irrespective of the

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1/ The first attempt to provide a rationale for the link between expenditures and credit was the development of the "debt-expenditure" hypothesis, which implied the following. In the neoclassical expenditure models, investment is financed by borrowing, cash dishording, and sale of financial assets. Given that investment is a decreasing function of interest rate, once the latter is given, investment demand, and thus financial flows, are determined. However, with the introduction of internal sources of finance (income variables) in the investment function, the identity between investment and external finance is broken, and expenditure no longer represents an equivalent financial flow. Changes in interest rates may denote reduced or increased finance depending on the manner in which the supply and demand curves shift. Interest rates thus do not have a precise relationship with external sources of finance. Cohen (1968) suggests that the best approach to resolving this issue would be to determine interest rates jointly with financial flows, and then use the solutions for the financial variables as explanatory variables in the investment function.

Mishkin (1976) has also argued that, in the case of expenditure on durable goods, because of the imperfections in such market, consumers cannot easily finance their purchases through sales of such items. Thus their purchases are positively related to their financial assets, and negatively to their liabilities.

interest rate, as long as the latter remains below the level where the constrained supply curve and demand curve for credit meet. However, this analysis does not take into account the fact that the investment demand may shift as a result of credit restriction. In other words, if the availability of credit is lowered by a certain amount, say $100, investment may decline by either, say, $95 or $105, depending on the manner in which all the variables in the investment equation adjust as a result of the new constrained borrowing level. These adjustments would depend on the interest cost of borrowing, even under rationing. It is clearly conceivable that as a result of the revision in investment demand, following a new restriction on credit availability, the demand curve for credit (which is a derived demand) would shift such that it intersects the new constrained supply curve at the prevailing interest rate, thus eliminating excess demand and hence rationing.

Let I' = demand for investment in the absence of any borrowing constraint. This is the conventional demand function which depends on a vector of variables (X);

$$I' = f(X)$$

When the firm realizes that the amount it can borrow in a particular market (say from the commercial banks) is limited to B, it reduces its demand to the constrained level I^c: 1/

$$(1) \qquad I^c = I' - h\,(B' - B)$$

where B' is the desired level of borrowing 2/ from that market and h is a coefficient indicating the extent to which investment demand will be adjusted because of the credit constraint ($0 < h < 1$). If $h = 1$, then investment demand will be adjusted by the full extent of rationing. Moreover, for any given rationing gap $(B' - B)$, the degree to which investment demand will be adjusted depends on the level of credit actually available (B); the greater the volume of credit available, the less the firm will adjust to the amount of rationing, or for a given $(B' - B)$ the higher is B, the smaller will be the parameter h. Thus,

$$h = h(B), \; h' < 0 \qquad \text{and,}$$

1/ Note that to the extent that rationing in one market affects credit availability in other markets, the credit obtainable in these markets must also enter the equation for investment.

2/ Both B' and B can be interpreted in stock term also, i.e., B' can be viewed as total desired stock of liabilities and B as the actual stock of liabilities.

$$I^c = f(X) - h(B)(B' - B) = f(X) - Bh(B)[(B' - B)/B]$$

In a general form this can be rewritten as:

$$I^c = F(X,B,H) \quad 1/$$

where H is the proxy for $(B' - B)/B$ or the magnitude of the credit rationing gap.

If there is no credit rationing, then $H = 0$, and B does not enter the demand function. To take this into account we rewrite the demand for investment as:

$$I = F(X,VB,VH)$$

where X = vector of variables, other than credit, affecting investment demand
B = volume of credit available
H = credit rationing proxy
V = dummy variable
= 0, when credit rationing is not in effect (periods when interest rates are at or above equilibrium level)
= 1, when rationing is in effect.

For $V = 0$, we now have $F(X) = f(X)$, or $I = I'$; and for $V = 1$, we get $I = I^c$.

III. The Empirical Findings

1. Relevant aspects of selective credit policies in India

Selective credit policies, as practiced in India, comprise ceilings on interest rates and loans, subsidies and margin requirements on the provision of normal loans. Interest rates have been used extensively to subserve the objective of channeling credit in desired directions. Institutional lending rates are determined, as are margin requirements, collateral percentages, etc., on a variety of criteria, such as the size

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1/ Note that:

$(\partial F)/(\partial B) = -h'(B)(B' - B) > 0$ since $h'(B) < 0$, and

$(\partial F)/(\partial H) = -Bh(B) < 0$.

of loan, maturity, and source of the funding. The lending institutions, which are predominantly nationalized banks, are not compensated fully for lower interest rate loans through the rediscount system, but limitations imposed on normal credit expansion provide indirect incentives for banks to extend subsidized credit. 1/

Selective credit controls have been utilized since May 1956 to curtail the flow of credit for the speculative holding of inventories in order to restrain increases in prices of commodities in short supply, and to increase the flow of credit to production; the ultimate goal has been to encourage investment activity. The main commodities for which selective credit controls have been in effect include sugar, cotton, edible vegetable oils and jute. The regulations enforcing selective credit controls comprise the imposition of a minimum margin on advances granted against stocks of these commodities. The requirements affect mainly mills, factories and industrial users; in the case of sugar, the mills account for more than 97 per cent of total advances against this commodity. These regulations have changed frequently in line with the overall availability of stocks.

Given data availability, the consistency in the application of selective credit controls to the sugar sector, and other reasons given below (p. 15), this sector was chosen for the empirical part of the present study. 2/ Movements in the ratio of bank credit to inventories in the sugar industry strongly indicate that the flow of credit has been affected by the imposition and relaxation of selective credit controls. This ratio declined in almost all the years subsequent to the imposition or strengthening of controls, and rose following the relaxation or withdrawal of such controls (Table 1). Another indication of the impact of these policies on stock financing is provided by movements in the ratio

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1/ Fry (1981) concluded that priority borrowers have obtained an increasing share of domestic credit, though the aggregate supply of bank credit has been reduced because of lower interest rates. Moreover, non-price credit allocation does not seem to have produced efficient investment either, as the average incremental output/capital ratio over the 1976-78 period has been very low (0.21). A study of the private corporate sector in India by Venkatachalam and Sarma (1978) also seems to imply that selective credit controls have adversely affected investment, and Datey (1978) concludes that India's credit policy has not affected agricultural productivity.

The present study is not concerned with the efficiency of the investment undertaken or its overall volume, but aims at testing whether credit policies have been effective in the individual industries concerned.

2/ Moreover, sugar is one of the largest sectors in India, and about a quarter of Indian farmers produce sugar cane.

Table 1. India: Bank Credit and Inventory Ratios in Sugar Industry (1960/61-1978/79)

(In per cent)

	Ratio of Bank Credit to Inventories	Ratio of Inventories to Current Assets 1/
1960/61 2/	57.5	76.5
1961/62	59.2	78.2
1962/63 3/	57.8	73.7
1963/64	48.3	62.4
1964/65	53.7	63.8
1965/66	60.8	70.4
1966/67	64.3	79.8
1967/68	68.4	72.9
1968/69	71.1	70.8
1969/70 2/	68.2	77.4
1970/71 3/	73.9	81.3
1971/72 2/	69.0	78.5
1972/73	52.8	66.6
1973/74 3/	61.6	80.4
1974/75	53.7	69.2
1975/76	57.6	70.7
1976/77	50.9	67.2
1977/78	64.7	73.1
1978/79	68.4	79.9

Source: RBI Bulletin, various issues.

1/ Current assets include inventories, receivables, cash and bank deposits.

2/ Margin requirements were withdrawn during the year.

3/ Margin requirements were reimposed during the year.

of inventories to total current assets for the industry. 1/2/ Following the imposition of selective credit controls on sugar, the share of inventories in current assets declined, albeit with a time lag. For example, the Reserve Bank of India (RBI) issued a directive in 1970 removing the restrictions on advances against sugar stock. The share of inventories in current assets rose following this directive from 77.4 per cent in 1969/70 to 81.3 per cent in 1970/71 (Table 1). Conversely when the RBI issued a directive in December 1974, reimposing the required margin on advances against sugar stocks, the ratio of inventories to current assets declined to 69.2 per cent in 1974/75 from 80.4 per cent in 1973/74. The relationship between the margin requirement and inventory/current assets ratio was also discernable in other years.

However, the movements in these ratios could well have been caused by many other factors influencing the inventory decision of the firm. Final judgement therefore has to await a formal test of the impact of these policies. Moreover, although the above analysis indicates that the availability of credit for inventory accumulation was affected by the imposition of selective controls, the impact of these policies on total investment also needs to be investigated. These are the questions posed in the following section.

2. Formulation of the tests

The methodology to be employed in this section is based on the interaction of credit variables and real expenditure and three tests are carried out. The first examines whether or not overall external credit rationing affects investment. This can be viewed as a test of the substitutability of internal finance for external credit. If the credit rationing proxy and credit variables are not significant in the investment equations, the implication will be that internal finance can be substituted easily for external finance, rendering selective credit policies ineffective.

The second test examines substitutability between various sources of external finance. For instance, a firm may cut back on its credit to customers, obtain more suppliers' credit, or sell more of its shares on the stock market in order to compensate for restrictions on bank credit. The methodology employed for this purpose is similar to that of Cohen (1968). It consists of gradually broadening the definition of the financial variables in the investment equations to see whether the significance of the coefficient and the explanatory power of the equation improves. An improvement would imply that borrowers make use of alternative sources of

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1/ Current assets include inventories, receivables, cash and bank deposits.

2/ The rationale of this test is provided by Meltzer (1974) who argues that if the share of a particular asset in total has not changed in the desired fashion over a long period of time as a result of selective credit policies, then such policies have been ineffective.

credit. A deterioration indicates that the new, broader variable also includes a type of credit which is not closely related to the investment variable in question. This approach has the advantage of permitting an analysis of the substitutability between all forms of credit without the loss in degrees of freedom that would be entailed in the simultaneous introduction of several credit variables in the estimating equation.

The same test is also carried out for the sum of all investment categories. If total investment shows a closer relationship with a particular credit source (as indicated by t-ratios) than do its component categories, this can be interpreted as indicating that borrowers depend on a given financial market to finance more than one type of investment. In other words, these types of investment are substitutes as far as the utilization of a particular financial source is concerned, and selective credit controls are not effective.

It remains to determine the exact form in which credit variables enter the investment equations. Cohen and Bitros both utilize credit flow variables. 1/ This approach has been criticized by Hamburger and Zwick (1979), who argue that positive correlation between particular expenditure flows and particular credit flows may actually reflect the influence of expenditures on customary finance (rather than the other way round), or the simultaneous response of both variables to other factors. That is, while increases in expenditures may necessitate recourse to higher levels of customary credit and thus raise the flow of that type of credit, a restriction on that type of credit will not necessarily reduce the level of expenditures. They suggest instead that the stock of liabilities should be used in the investment equation. This suggestion, which draws on the work of Mishkin (1976), is based on the view that firms seek not only to achieve a desired level of capital stock, but also desired levels of financial assets and liabilities. Thus, if firms use a particular type of liability to finance particular expenditures, imbalances in the cumulated stock of these liabilities will have a stronger effect on their associated expenditures than imbalances in other liabilities. 2/ In the present study we experiment with both types of credit variables as their relative significance is essentially an empirical question.

As indicated above, one of the objectives of the policies to curb bank credit associated with stock accumulation in India was to restrain the speculative accumulation of sugar stocks which could lead to a

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1/ Cohen also uses credit stock variables.

2/ Molho (1983) argues that the influence of accumulated debt on expenditures materializes through increased debt service and that debt service is not necessarily affected differentially by different types of debt. He thus suggests the use of credit flow rather than stocks in the expenditure equations.

reduction in the amounts of credit available to finance increases in the productive capacity of the sugar industry. In order to examine the efficacy of this policy, two types of investment expenditures were chosen for analysis: investment in inventories and total gross investment. However, for the firm, decisions to invest in inventories and/or fixed capital are interdependent so that it is necessary to specify the determinants of the latter also in order to be able to capture the simultaneity of these decisions. As mentioned before these decisions depend on the cost of the various forms of financing during periods when no restrictions are imposed; but they will depend on the actual level of such financing, as well as their interest cost, during periods of credit rationing. A simultaneous equations model is thus specified in two variables: investment in fixed assets (I_t) and changes in inventories (INV_t).

$$I_t = F_1(INV_t;\ V_tH_t,\ R_t,\ S_t,\ K_{t-1},\ V_tC_t)$$

$$INV_t = F_2(I_t;\ V_tH_t,\ R_t,\ S_t,\ NV_{t-1},\ V_tC_t)$$

where: R_t = average interest cost of all debt
S_t = gross sales 1/
K_t = gross stock of fixed assets
C_t = credit variable
NV_t = inventory of finished and intermediate products and raw materials
H_t = proxy variable for credit rationing 2/
and V_t = dummy variable (= 0, when no credit rationing).

The relevant interest rate variables are those charged on each type of debt. However, because this kind of information is not available, we have used the average interest cost of all debt as a proxy for the overall impact of all the different rates of interest. The variable C represents the following:

LR = Total stock of accumulated debt
BFR = Total liabilities to the bank and nonbank financial institutions
LBR = Total liabilities to banks

1/ The gross sales variable has been introduced to account for the accelerator relationship and the presence of K_{t-1} and NV_{t-1} result from the stock adjustment process.

2/ To the extent that credit to other sectors is also rationed, the proxy will be subject to measurement errors.

COI = Liabities to nonbank financial institutions
NPR = Liabilities to suppliers less claims on customers

Total gross investment (TGI), which is defined here as the sum of investments in inventories and in fixed assets, was taken to be given by the following function:

$$TGI_t = F_3(V_tH_t, R_t, S_t, TGI_{-1}, V_tC_t)$$

where the reasons for the introduction of the variables listed above are the same as in the equations on inventories and investment in fixed assets. Clearly, the simultaneity aspect is not relevant in this case.

3. The data

The study concentrates on medium and large public limited sugar companies during the period 1960/61-1978/79. 1/ Although there are other industries such as cotton, textiles, jute, and vegetable oil, to which the same type of credit restrictions also apply, these have not been chosen because they qualify for preferential credit in conjunction with the incentive schemes for export promotion and/or for development of priority sectors. 2/ It would thus be difficult in these cases, to concentrate on a particular form of credit control, namely control of short-term loans secured by inventories. It is partly due to this problem that application of the empirical tests to pooled cross section and time series data for different industries has also been avoided. 3/ Moreover, the homogeneity of such a pooled sample might be distorted by different demand or other conditions facing different industries during the sample period. Another factor, making study of the sugar industry particularly appropriate is that close to 97 per cent of all credit to the sugar industry goes to the industrial mills which constitute the great majority of the firms covered in the survey data. 4/

The data have been obtained from the periodical surveys of company finances published in the Reserve Bank of India Bulletin. Although the size of the sample of sugar firms surveyed varies from year to year, this will not affect the results assuming the behavior of all sugar firms follows a common norm. However, because of the existence of lagged values, all variables have been put on a per firm basis.

1/ Years ending October 31st.
2/ These sectors include agricultural and small-scale industries.
3/ Bitros (1981) uses pooled data.
4/ The sugar industry has been subject to price controls during part of the sample period. This is accounted for by the introduction of gross sales as a variable in the estimating equations.

As mentioned earlier, the credit controls applied to the sugar firms have been changed frequently. However, except for a few years during the sample period, these modifications entailed either a tightening or a relaxation of these controls rather than their removal or reintroduction. The dummy variable, V, was set equal to one in periods when restrictions were in effect, and to zero in other periods. This follows the analysis of section II, where it was argued that selective credit policies lead to nonprice credit rationing and that this can be said to exist whenever interest rates are below equilibrium. 1/

4. The results

The regression results with credit stock variables are presented in Tables 2 and 3, and those with credit flow variables are reported in the Appendix. The equations for inventories were estimated using the instrumental variables method to capture the simultaneity assumption of the model, and the equations for total gross investment were estimated using the OLS technique. The following discussion of the results is based on the equations incorporating credit stock variables since the estimation results produced by these equations were on the whole superior to those produced by equations with credit flow variables.

The properties of the estimates meet the standard statistical criteria with varying degrees of success. The equations for inventories (Table 2) show the highest reliability. As the t-statistics underneath the estimated coefficients reveal, the great majority of the estimates meet the 5 per cent two-tailed test and a large number meet the 5 per cent one-tailed test. The signs of the coefficients of H (rationing proxy), S (gross sales), and the credit variables, about which a priori expectations exist, are consistent in most of the equations. Given that the lowest adjusted R^2 is 78 per cent, and that in some cases it exceeds 94 per cent, the explanatory powers of the equations are also quite impressive. Furthermore, the inventory equations compare well with previous studies of the same subject. 2/ They also provide strong evidence of the influence of external finance on inventory accumulation decisions of the firm.

Before coming to the central question of this study, namely, the substitutability of credit variables in inventory decisions and the

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1/ Although a minimum interest rate for lending secured by commodities has been in force since 1973/74, this does not mean that no excess demand existed during these periods. The fact that selective controls had to be imposed even with a minimum interest rate already applicable, and the existence of overall interest rate ceilings, point to the possibility that the actual lending rate has been below equilibrium.

2/ See, for instance, Lovell (1961), Meltzer (1963), Nadiri (1969), and Bitros (1981).

Table 2. India: Regression Results for Inventories

Equation	(1)	(2)	(3)	(4)	(5)	(6)
Constant	80.680** (3.596)	66.720** (4.524)	436.676** (3.074)	99.452** (13.098)	136.030** (6.324)	-59.114 (-0.814)
I	11.116** (2.776)	-1.071 (-0.530)	-12.669** (-2.248)	-0.033 (-0.060)	-1.292 (-0.957)	18.986* (2.401)
H	-12.663 (-0.632)	-38.374* (-1.868)	-570.235** (-2.605)	-95.423** (-6.280)	-105.736** (-3.433)	49.299 (1.608)
R	404.362 (0.403)	-1289.390** (-4.024)	-1976.130** (-5.332)	-691.141** (-4.537)	-890.660** (-3.511)	1455.970 (0.987)
S	-0.6002 (-1.542)	0.399** (2.617)	-0.310 (-1.329)	0.194** (5.680)	0.177** (2.680)	-0.768 (-1.684)
NV_{-1}	0.458* (-1.994)	-0.734** (-3.134)	-0.123 (-1.753)	-0.730** (-8.026)	-0.712** (-4.321)	-0.446* (-2.042)
LBR		0.883** (2.699)				
COI			20.224** (2.659)			
BFR				0.813** (7.129)		
LR					0.749** (3.827)	
NPR						-2.749* (-1.822)
$\bar{R}^2$	0.780	0.891	0.837	0.983	0.942	0.795
DW	1.776	1.461	1.728	2.054	1.337	1.700
SEE	19.910	14.000	17.140	5.530	10.230	19.210

t-statistics in parenthesis.
**Significant at 5 per cent level.
*Significant at 10 per cent level.

Table 3. India: Regression Results for Total Gross Investment

Equation	(1)	(2)	(3)	(4)	(5)	(6)
Constant	48.203 (1.465)	76.572** (3.113)	141.801** (3.548)	127.194** (7.051)	146.667** (5.346)	98.129* (2.102)
H	23.909 (0.925)	-37.805 (-1.506)	-113.454* (-2.291)	-133.674** (-5.440)	-103.306** (-3.492)	-1.198 (-0.040)
R	-2562.500** (-4.892)	-1382.300** (-2.790)	-1846.150** (-3.945)	-538.100 (-1.487)	-1009.700** (-2.323)	-2327.900** (-4.418)
S	0.416* (2.081)	0.629** (4.099)	0.075 (0.395)	0.499** (5.675)	0.356** (3.065)	0.292 (1.397)
TGI_{-1}	0.165 (0.730)	-0.606** (-2.266)	0.007 (0.039)	-0.753** (-4.684)	-0.532** (-2.781)	0.066 (0.293)
LBR		1.005** (3.595)				
COI			4.459** (3.030)			
BFR				1.180** (7.217)		
LR					0.778** (4.984)	
NPR						0.839 (1.448)
$\overline{R}^2$	0.617	0.808	0.773	0.927	0.872	0.649
DW	1.958	1.601	1.850	1.946	1.730	1.926
SEE	30.810	21.820	23.760	13.440	17.830	29.490

t-statistics in parenthesis.
**Significant at 5 per cent level.
*Significant at 10 per cent level.

use of the same type of credit for different purposes, a digression may be necessary to explain the significance of the performance of the credit rationing proxy, H, since this is the first attempt to link credit rationing specifically to selective credit policies. The coefficient of this variable is significant in three out of six equations estimated for inventories or total gross investment, and its sign is consistent with a priori expectations in all but one equation in each expenditure category. In the first equation of Tables 2 or 3, H has been entered but no credit variable appears. While the sign of its coefficient conforms to expectations, the coefficient is not significant. Moreover, the level of significance is higher in all equations which include a credit variable. This implies that, as a factor influencing inventory decisions, the extent of rationing is not as significant as the level of credit supply at which rationing comes into effect. 1/ Moreover, the results show that the more significant the particular credit variable entering the equation, the more significant is the rationing proxy. 2/ The result supports the argument of section II, that both H and the credit variable should enter the expenditure equation when credit restrictions are in effect. The insignificance of H in some equations may also imply that the desired and actual levels of credit available may have been very close during the sample period. 3/

The main issue that need to be discussed here is the question of substitutability among financing sources. The credit variable which, at first sight, is most closely related to inventory financing is bank credit. 4/ As shown in Table 2, the results for the equation that includes this variable are quite satisfactory and show that there is a relationship between bank credit and inventories. However, in order to test the substitutability of the possible sources of inventory financing other equations were also estimated to examine whether a broader definition of the credit variable would be more closely linked to inventories. This substitutability is measured here in terms of the t-statistics of the coefficients of credit variables in the estimated equations, where a higher t-statistic means a closer relationship between the credit variable and the dependent variable. Table 4 presents these statistics for the case when credit stocks are used.

The first step to broaden the credit variable would be to take total borrowing from financial institutions (BFR) instead of bank credit (LBR). This change results in a much improved equation for inventories.

1/ Or $(B' - B)$, as in the formulation of section II, is less important than B itself.

2/ Equations which did not include H, but included a credit variable were on the whole less satisfactory.

3/ That is, $B' - B$, may have been close to zero during most of the period.

4/ An even more likely candidate would have been short-term bank credit but data on this variable are not available for the whole period of the study.

Table 4. Substitution Possibilities Among Alternative Sources of Credit

(Results based on credit stocks)

	t-statistics of:					Ratio of:			
	(1) LBR	(2) COI	(3) BFR	(4) LR	(5) NPR	(2)/(1)	(3)/(1)	(4)/(1)	(5)
A. Inventories equation	2.699	2.659	7.129	3.827	-1.822	0.985	2.641	1.418	-0.675
B. Total gross investment equation	3.595	3.030	7.217	4.984	1.448	0.843	2.008	1.386	0.403
C. Ratio of (A) to (B)	0.751	0.878	0.988	1.421	1.258				

Sources: Tables 2 and 3.

The t-statistic of BFR is much higher than the one for bank credit and the overall explanatory power of the equation has increased. 1/ The fact that inclusion of BFR improves on the results obtained with LBR seems to indicate that inventory accumulation can be financed not only by bank credit but also by credit from other financial institutions. That is, there is at least some degree of substitutability between bank credit and other financial institutions' credit (COI). This is also confirmed by equation (3) in Table 2, which shows that other financial institutions' credit is related to inventory accumulation, though less so than bank credit. Thus, a policy that restricts bank credit to reduce inventory accumulation is likely to fail because in the inventory decision of the firm, LBR and COI are substitutes.

A further step to broaden the credit variable is still possible. Another source of financing to the sugar industry is net trade credit (NPR), that is, the difference between payables and receivables. Thereby, an additional credit variable (LR) was defined as the total stock of accumulated debt, including not only credit from the financial institutions but also net trade credit. As shown in equation (5) in Table 2, the introduction of LR reduces not only the t-statistic of the credit variable, but also the explanatory power of the equation. This implies that, in the inventory decision of a firm, net trade credit cannot be easily substituted with other sources of inventory financing. This view is reinforced by examination of the results of equation (6) in Table 2 which show that net trade credit (NPR) is not significantly related to inventories. It therefore follows that if a selective credit policy is to be used to affect inventory accumulation in the sugar industry in India, the chances of success would be maximized if the credit tightening is applied not to bank credit alone but to total credit by the financial institutions. The effectiveness of this policy is assured because net trade credit, which is unlikely to fall under the purview of the monetary authorities, cannot replace total financial system credit in financing inventory accumulation.

A third test is based on the total investment equation. In this test, the relationship between total gross investment and the credit variables is estimated in order to assess the consequences of a selective credit policy which is geared specifically toward reducing stock accumulation, for overall investment in the industry. The results shown in Table 3 indicate that a pattern similar to the one found for investment in inventories is also present in the case of total gross investment. The implication again is that a policy aimed at controlling total credit from the financial institutions to the industry is more likely to be effective than a policy aimed at controlling only bank credit. Moreover, the ratio between t-statistics for the same credit

1/ This indicates that LBR in equation (2) may be acting as proxy for BFR.

variable in the inventory and total gross investment equations reveals that each type of institutional credit can be used for different purposes. In other words, LBR can be used for financing inventory accumulation or for total investment. Thus controlling LBR will not necessarily channel resources from inventory accumulation to other types of investment; it will have the same impact on inventories as on other investment. The same is true for COI; that is, a policy that encourages credit from non-bank institutions is equally likely to raise both inventory accumulation and total investment. Thus a policy that is successful will affect not only investment in inventories but also overall investment expenditures. This last statement remains true even if the selective credit control policy in India is strengthened by broadening the credit controls to include all institutional credits. This would be more effective in dampening stock accumulation but would adversely affect overall investment expenditure.

V. Some Broad Conclusions

The conclusions emerging from the foregoing analysis may now be broadly summarized. It is generally recognized that there are both cons and pros about selective credit control policies, but a definitive statement on their efficacy can only be made through empirical investigation. For that reason, an attempt has been made in this paper first to develop an appropriate methodology for assessing the effectiveness of selective credit controls and secondly to determine, in a concrete situation, whether they can work. In the case of the sugar industry in India, the results tell us that, as applied, that is, as a restriction on bank credit, these controls are not effective because of the possibilities of substitution between different sources of financing. However, if the authorities were to apply selective controls not only to one source of credit, say, to bank credit, but to total credit from all financial institutions, the policies could be successful in affecting inventory accumulation. 1/

This implies that before devising a program of selective credit controls the authorities should be clear about the decision-making process of the industry to which credit is to be regulated so that such controls are successfully implemented. As long as credit rationing is already present in the market and credit variables are part of the expenditure equations, such a determination can be easily done on the basis of the tests described in this paper. However, if the market is in equilibrium so that nonprice credit rationing by commercial banks on their own, or imposed through regulation, is absent, then it would not be possible to know, a priori, the most effective way of implementing credit controls

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1/ However, this carries the risk of leading to the creation of informal credit markets.

because the credit variables will not appear in the expenditure functions. In such cases, if the government insists on introducing selective credit controls, there will be necessarily a period of trial and error before an effective policy is eventually evolved.

The authorities should also recognize that the effects of the selective credit policies chosen might be more pervasive than initially intended. This problem appears clearly in the case of the Indian sugar industry presented in this paper. Although correctly chosen, selective credit policies can be used successfully to discourage inventory accumulation, the same policies are likely to have a similar negative effect on overall investment. To the extent that the second effect is serious and undesirable, it might rule out the use of selective credit policies to correct the existing imperfections in the credit market. Again, one can test these side effects as long as credit rationing exists in the economy even prior to the introduction of selective credit controls.

Appendix Table 1. India: Regression Results for Inventories with Credit Flow Variables

Equation	(1)	(2)	(3)	(4)	(5)
Constant	-17.742 (-0.140)	59.196 (0.191)	-16.747 (-0.137)	-42.179 (-0.199)	79.753** (4.356)
I	0.605 (0.655)	3.875** (3.122)	-0.026 (-0.033)	-1.316 (-0.695)	8.229** (2.050)
H	52.406 (0.367)	14.804 (0.042)	44.689 (0.325)	53.448 (0.226)	4.523 (0.308)
R	-877.029** (-3.615)	-1758.300** (-3.447)	-806.853** (-3.292)	-153.123 (-0.265)	-1499.880** (-2.707)
S	0.123* (1.998)	0.033** (2.937)	0.123** (2.276)	0.204 (0.199)	-0.054 (-0.344)
NV_{-1}	0.242 (0.220)	-0.393 (-1.623)	0.076 (0.693)	0.113 (0.574)	-0.245 (-1.512)
ΔLBR	0.748** (4.282)				
ΔCOI		-8.268** (-2.404)			
ΔBFR			0.849** (4.857)		
ΔLR				1.045* (2.746)	
ΔNPR					-2.053* (-1.891)
$\overline{R}^2$	0.956	0.731	0.958	0.878	0.851
DW	1.983	2.287	1.971	2.302	2.229
SEE	8.493	21.990	8.637	14.840	16.390

t-statistics in parenthesis.
Δ implies change in the variable.
**Significant at 5 per cent level.
*Significant at 10 per cent level.

Appendix Table 2. India: Regression Results for Total Gross Investment with Credit Flow Variables

Equation	(1)	(2)	(3)	(4)	(5)
Constant	18.416	47.747	17.579	15.210	45.142
	(1.108)	(1.514)	(1.248)	(1.192)	(1.335)
H	-5.778	20.734	-7.332	-10.355	20.145
	(-0.432)	(0.834)	(-0.645)	(-1.001)	(0.750)
R	-762.818*	-2369.950**	-668.597*	-134.754	-1963.930*
	(-2.001)	(-4.560)	(-2.052)	(-0.398)	(-2.004)
S	0.190*	0.250	0.141	0.012	0.274
	(1.844)	(1.118)	(1.577)	(0.134)	(0.973)
TGI_{-1}	0.033	0.269	0.057	0.043	0.148
	(0.296)	(1.178)	(0.611)	(0.510)	(0.640)
ΔLBR	0.995**				
	(6.329)				
ΔCOI		3.853			
		(1.434)			
ΔBFR			1.019**		
			(7.747)		
ΔLR				1.001**	
				(8.741)	
ΔNPR					1.058
					(0.729)
$\bar{R}^2$	0.910	0.648	0.935	0.948	0.602
DW	2.518	1.681	2.356	1.946	2.002
SEE	14.940	29.530	12.660	11.420	31.430

t-statistics in parenthesis.
Δ implies change in the variable.
**Significant at 5 per cent level.
*Significant at 10 per cent level.

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