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THE IMPACT OF RURAL CREDIT ON
PRODUCTION AND INCOME DISTRIBUTION

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INCOME DISTRIBUTION

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I. INTRODUCTION

The objective of this paper is to analyse the effectiveness and income distribution impact of rural credit when it is used as an incentive mechanism to promote investments in the agricultural sector. The paper deals only with the Brazilian case which provides empirical evidences supporting some of the results.

The conclusions are rather pessimistic: rural credit programs do not change the share of agriculture investments in the total if the rate of return of these investments is not changed; furthermore, they have ^{eff.}perverse ~~on~~ income distribution.

The paper is organized as follows: the next section presents a brief description of the institutional and economic environment where the Brazilian rural credit program is imbedded; section III presents the model through which the effectiveness of rural credit is analysed; section IV discusses the impact of the program on income distribution; section V presents the empirical evidence and the last section summarizes the results and proposes further research.

II. THE BRAZILIAN RURAL CREDIT PROGRAM

Brazilian financial markets were very small before the 60's. They were composed only of commercial banks which operated with short term loans (up to 180 days) and a few consumer

credit companies which were only starting their operations. The 1966 Capital Markets Reform Law inaugurated a new period for financial markets. Investment banks, savings and loan associations, development banks, and other financial firms were created. The Central Bank and the National Housing Bank started their operations. New financial assets were created: federal government issued National Treasury bonds which earned interest rate plus a return represented by the indexation of its value to a general price level (monetary correction); savings accounts earned 6% interest rate plus monetary correction; other financial assets were also issued, some being sold at market interest rates, others with monetary correction. Furthermore, of financial assets holdings were incentivated through large income tax deductions (1).

The result was rapid growth of financial assets hold by the private sector. Higher income and output growth rates in the 67-74 period provided an additional incentive for the growth of financial assets hold by the private sector. Non-monetary assets which represented not more than 4% of gross domestic product in 1966 increased to 17% in 1972. Loans from the financial sector which represented 13% of gross domestic product in 1966 moved to levels as high as 40% in 1973 (2).

Important changes took place in the rural credit area. In 1965 laws were enacted creating the National System of Rural Credit. This system was composed of the Banco do Brasil and the commercial bank sector. Banco do Brasil is a government owned bank, which holds 40% of demand deposits, and implements many government planning decisions. Banco do Brasil loans for the agricultural sector are made in accordance to plans issued by the National Monetary Council (the highest authority organization in

terms of monetary policy). By the new laws commercial banks have to lend not less than 15% of their demand deposits to the farm sector. If this amount of loans is not attained the difference has to be kept as required reserves in the central bank which will then lend it through the Banco do Brasil or other commercial banks. The rural credit interest rate for working capital was fixed at 17% a year, when inflation rates were moving very rapidly from 40% a year to levels around or below 20% until 1973. In 1971, the interest rate was lowered to 15% a year (3).

After 1973, Brazilian economy trends were drastically changed. The inflation rate which was moving steadily downwards, reaching levels below 20% a year, started to increase, moving rapidly to the 40% level, with large chances of attaining even higher levels. The rate of growth of national product began to oscillate attaining levels as low as 4% a year in 1978, when post war average is 6.5% and 10% in the 1968-1973 period. Balance of payments conditions were tightened by the drastic increases in oil prices, and large financial charges of interest and amortizations (4).

The rural credit system continued to operate at 15% nominal interest rates. Moreover, a number of special programs were created to incentivate the agricultural occupation of specific regions (with poor soil as the "cerrados") or low income regions (the Northeast). In these cases, rural credit was offered at rates as low as 5% on a long term basis. Rural credit for the purchase of fertilizers were subsidized through zero interest rate loans to compensate for the higher prices of these inputs after the oil crisis.

The table below shows the annual flow of subsidized credit in recent years and the share they represent of total

TABLE 1

GOVERNMENT EXPENDITURES AND ANNUAL FLOWS OF SUBSIDIZED CREDIT PROGRAMS

(in millions of current cruzeiros)

Year	Government Expenditures			Rural Loans	Other Subsidized Loans		TOTAL (3)+(4)+(5)
	Consumption (1)	Investment (2)	Total (1)+(2)	Banco do Brasil and Commercial Banks (3)	Federal Development Banks (4)	State Development Banks (5)	
1970	20512	8273	28785	2676	1262	250	4188
1971	26779	10596	27375	3519	819	492	4830
1972	34688	13884	48542	5985	2466	1199	9650
1973	46190	18066	64251	13606	3907	1837	19350
1974	65455	28715	94169	18749	12876	4023	35648
1975	99354	43350	142704	36211	23484	6275	65970
1976	157434	65643	223077	42717	41423	13949	98089
1977	220640	90487	311327	53240	59902	18584	131726

SOURCE: Centro de Contas Nacionais - Conjuntura Econômica, oct. 1978.
Boletim do Banco Central.

government spending. The rural sector, is the most important sector in terms of subsidized loans. Table 2 show the amount of rural credit as a percentage of agricultural income, and commercial bank credit as a percentage of GDP for the economy as a whole. The table shows that each dollar of agricultural production required at least 80 cents of rural credit and as much as 20 cents of subsidy in last years.

Agriculture is considered a high priority sector by the new administration which took office in March, 1979. The balance of payments problems, the urban real wage and the supply of new energy sources are at least partially dependent on increased farm production.

But the economic policies directed to the sector continue to rely on subsidized interest rates. "Planning through credit" continues to be a major preference of Brazilian economic authorities. This preference is easy to understand. In the short run, agriculture cannot increase production at constant prices. But higher food and export prices represent higher nominal wages and inflationary pressure. Food prices controls, taxes on agricultural exports, or lower exchanges rates for specific crops are widely used policies in the Brasil⁽⁵⁾.

Subsidized credit seems to represent a way of increasing agricultural investment and production without having to rely on changes in relative prices. Moreover, from a psychological point of view, although changes in relative prices and profitability might be enough to increase investment, this is a very uncertain and remote result from planners point of view.

In the case of subsidized credit programs, not only relative price changes are avoided, but also investments expenditures

TABLE 2
OUTSTANDING RURAL LOANS AS A PERCENTAGE
OF FARM INCOME - BRAZIL/1960-1977

Year	Rural Loan/Farm Income	Bank Loans/Gross Domestic Product
1960	16,9	30,0
1961	23,7	29,2
1962	25,9	28,6
1963	25,8	25,9
1964	27,6	23,2
1965	21,7	21,4
1966	24,6	18,3
1967	29,4	20,3
1968	33,2	23,8
1969	34,2	23,8
1970	38,9	23,7
1971	38,1	24,3
1972	46,0	27,5
1973	49,3	30,9
(1)1974	56,8	31,5
(1)1975	74,4	37,3
(1)1976	91,8	37,9
(1)1977	87,2	37,1

(1) Conjuntura Econômica, Outubro de 1978
SOURCE: Boletim do Banco Central
Conjuntura Econômica Vol. 29. nº 1, January, 1975.

can start immediately since they don't have to wait for the growth of profits that can be reinvested in the sector. Therefore, planners seem to believe that rural credit programs constitute a magic trick that is able to change the private sector pattern of investment quickly, without inflationary pressures and no uncertainty.

Finally, when planning decisions are implemented through special credit programs there is no need of changes in tax laws or Congress approval of new expenditures, which would have to be obtained in the case of a tax subsidy. Moreover, these programs are implemented by a very efficient and centralized bureaucracy of Banco do Brasil which has more than 1000 branches distributed over Brazilian towns.

The argument for government preference for special credit programs instead of price or fiscal incentives is analogous to the text book explanation of the preference for "inflationary finance" (6). Subsidies as high as 20% of agricultural production are not visible to non economists, making credit programs even more attractive to planning authorities.

III. THE IMPACT OF RURAL CREDIT ON THE FINANCE OF AGRICULTURAL PRODUCTION

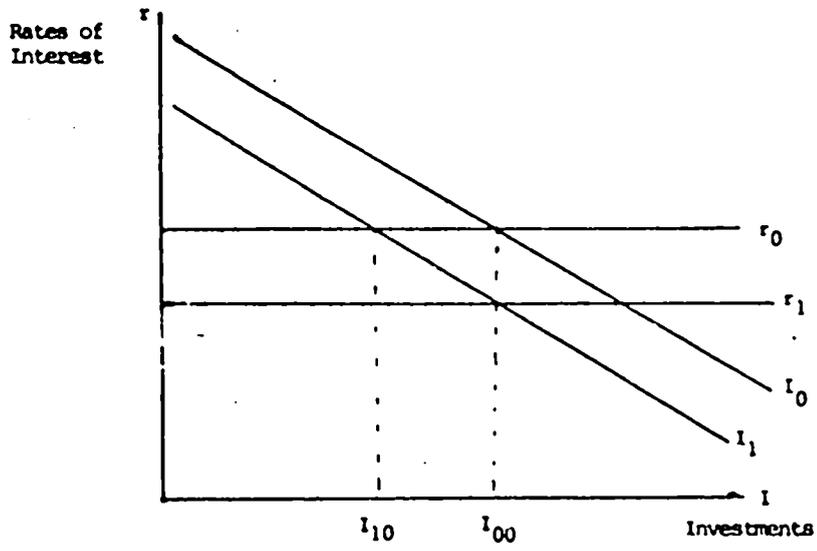
Formally, the argument for low interest rates might be described as follows. The graph shows the marginal efficiency of investments in agriculture, labeled I_0 , and the market rate of interest, r . With price controls or lower exchange rates the agricultural production and investments become less profitable and the marginal efficiency of investment curves moves to the left to curve I_1 . When the market rate of interest is r investments in agriculture decrease to level I_{11} . But if the government supplies credit at r_s , the subsidized interest rate, the level of investments in agriculture increases to the previous level I_0 , and everything

works as if there were no price controls at all. Agricultural investments increased from I_{11} to I_0 without changes in food prices, for the urban sector or higher import prices for the industrial sector.

The argument is subject to several criticisms. First of all, borrowers are not projects. Borrowers are firms which have a portfolio of investments and will always try to allocate their investible funds in the most profitable way. If the rate of return in agriculture is somehow decreased by government policies, subsidized interest rate loans can not increase the rate of investment in this sector. Farmers will accept the offer of loans at lower interest rates. They may even invest these loans in accordance with the loan contract. But they will transfer the maximum amount of their own funds to more profitable activities or assets. The net result might be more financing of agricultural investments by the rural credit system, but less internal financing, less commercial banks loans and a constant total amount of investment in agriculture.

The argument can be explained by a simple model. Assume an economy with two types of assets: asset A represent investment in agricultural production. A is composed of working capital and long term investments in farm production. B represent all other real assets of the economy. Thus the definition includes all types of real investments of the economy. The choice between A and B will depend on the two rates of return (r_a and r_b), and on the size of the firm (W), or wealth of the individual investor. The purchase of A and B might be financed either by own resources or by bank loans. Formally, these assumptions can be written as below,

GRAPH I



$$\begin{aligned}
 A &= A (\overset{+}{r}_a, \bar{r}_b, \bar{r}, \bar{W}) \\
 B &= B (\bar{r}_a, \overset{+}{r}_b, \bar{r}, \bar{W}) \\
 L_c &= L_c (\overset{+}{r}_a, \overset{+}{r}_b, \bar{r}, \overset{?}{W}) \\
 E &= E (\overset{+}{r}_a, \overset{+}{r}_b, \bar{r}, \overset{?}{W})
 \end{aligned}$$

were r_a , r_b and r represent, respectively, the rate of return on A, B, and the cost of commercial bank loans, (L_c). E stands for own capital. The signs on each variable indicate the expected sign of the derivative of each function with respect to the variable.

The choice between A and B will depend on r_a and r_b and other variables as liquidity and risk which are implicitly represented in the specification of the functions A, B, L_c and E.

Graphically, the same model could be shown as below, where r is measured in the vertical axis and the total amount of wealth in the horizontal axis.

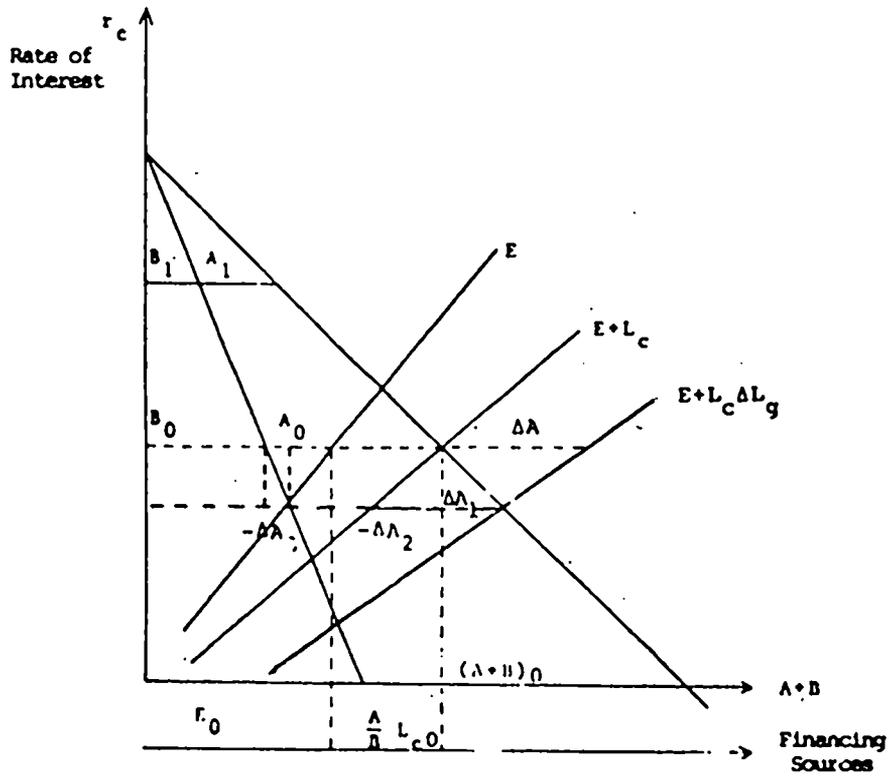
Curve A+B shows the demand for real assets. For given rates of return on A and B, higher interest rates decrease the demand for A and B. The division of total assets between A and B is given by the curve A/B. This curve depends only on the rates of return on A and B. When the rates of return on A and B are constant, the share of each assets in the total wealth is kept constant (thus A_1/B_1 is equal to A_0/B_0).

The curve $E + L_c$ shows the amount of own resources and debt supplied to the firm. It is an increasing function of r , the market rate of interest on loans.

The initial situation of the firm is given by the rate of interest r_0 . At this rate, the particular firm under analysis

GRAPH II

DETERMINATION OF TOTAL ASSETS SIZE
AND SOURCES OF FINANCE



buys A_0 of A, B_0 of B. These purchases are financed by own funds and resources borrowed from financial intermediaries equal to $E_0 + L_{CO}$, shown in a second horizontal axis.

The same situation can be seen in a balance sheet as below

Assets	Liabilities
A_0	E_0
$\frac{B_0}{W}$	$\frac{L_{CO}}{W}$

It is possible to analyse how this firm will change its holdings of A and B when the government offers a loan of a given amount which can be spent only in the purchase of A (the rural credit). The new loan is accepted since its interest rate is well below the rate of inflation and the market rate of interest. The new loan shifts the $E + L_C$ curve by the amount ΔL_g which represents the government rural credit loan. The horizontal distance between the new and old curve is equal to ΔL_g and it must also be equal to purchases of A, investments in the agricultural sector, according to the terms of the contract.

In the graph the purchase of A financed by the rural loan was divided in 3 parts: ΔA_1 which represents the purchase of new A's by the firm; ΔA_2 which represents only a financial substitution: part of A which was financed by own funds and other loans is now purchased with rural loans and does not represent a net addition to the stock of A. The 3rd part shown as ΔA_3 , has been sold and the proceeds of the sale have been reinvested in B.

Since r_a and r_b have not changed the firm doesn't want to change the shares of A and B in total wealth.

The new balance sheet of the firm after the rural credit contract is shown below:

Assets	Liabilities
$A_1 = A_0 + \Delta A_1$	$E_1 = E_0 - \Delta E$
$B_1 = B_0 + \Delta B$	$L_{C1} = L_{C0} - \Delta L_C$
$W_1 = W_0 + \Delta W$	$W_1 = W_0 + \Delta W$

and the difference between the two balance sheets can be written as

$$\Delta L_g - \Delta L_C - \Delta E = \Delta A - \Delta A_2 - \Delta A_3 + \Delta B$$

$$\Delta L_g = \Delta A_1 + \Delta B - \Delta L_C - \Delta E$$

The borrower acted in accordance with the loan contract. He has purchased the amount of A determined by the contract. But at the same time it has decreased the amount of alternative sources of finance and bought some additional amounts of B.

From the last result one can write

$$\frac{\Delta A_1}{\Delta L_g} = 1 - \frac{\Delta E}{\Delta L_g} - \frac{\Delta L_C}{\Delta L_g} - \frac{\Delta B}{\Delta L_g}$$

which shows how much A, agricultural investment is obtained for each dollar of rural credit. The result shows that each cruzeiro of rural credit results in less than one cruzeiro of agricultural investments. Alternatively, one may say that if the government wants one cruzeiro of agricultural investments, it needs to supply more than one cruzeiro of rural credit.

Given r_a and r_b it can be assumed that the amounts of A and B that the firm is willing to hold are constant and given, respectively, by aW and $(1-a)W$. Thus the previous expression can be rewritten as

$$\frac{\Delta A_1}{\Delta L_g} = a(1-S)$$

where S represents the finance substitution effect represented by

$$- \frac{\Delta E}{\Delta L_g} \text{ and } - \frac{\Delta L_c}{\Delta L_g}$$

This result suggests some conclusions. First, the effectiveness of rural credit programs depends heavily on the possibilities of substitution. S can be rewritten as

$$S = \frac{N_A + B}{N_{A+B} - N_E - N_{L_c}}$$

where N is the elasticity of the curves presented with respect to r.

From this expression one can conclude immediately that the substitution will be larger the larger the demand elasticity for A and B and the larger the elasticity of the supply of loans and own funds. Larger firms, firms whose profits grow faster, and firms with more access to financial markets will have larger S, and might substitute more easily rural credit for other sources of finance. The first conclusion is that the effectiveness of the rural credit program depends heavily on the characteristics of the borrowers of the program. Thus loan distribution policies have a very important role in fixing the amount of the rural credit program which results in new agricultural investments, and the amount which generates only substitution.

Secondly it is interesting to evaluate the aggregate effect of the rural credit program in total investments. If one assumes that farmers and non farmers buy A and B in the proportion a and (1-a) and that while all farmers are supplied with rural loans, non farmers are not, the total purchase of A, i.e., the total amount of investments in A is given by

$$\frac{\Delta A_T}{\Delta L_g} = a(1-S) + aS = a$$

which means that the rural credit program has not increased the share of agricultural investments. The rural credit program has had no allocative effect in terms of changing the amount of investments in agriculture relatively to other sectors.

A different assumption would be that only farmers buy A and only they have access to rural credit. In this case, the aggregate effect of the rural credit program would be

$$\frac{\Delta A_T}{\Delta L_g} = a(1-S) \quad \text{and} \quad \frac{\Delta B}{\Delta L_g} = 1-a(1-S)$$

that is the amount of investments has increased by a smaller proportion than in the case of a larger supply of regular credit lines.

In other words, the rural credit program under these two extreme assumptions has negative results: either it leaves the aggregate proportions of A and B constant, or it decreases the aggregate proportion of A purchased in the economy relatively to a general credit expansion.

These conclusions are extremely negative in terms of the effectiveness of the rural credit programs and one should analyse

in which circumstances they might be changed. First, one can see that the rural credit program might be more effective if the financial market were segmented and financial transaction costs were very high not allowing substitution between different sources of finance. This result points out that the development of financial markets and the implementation of planning programs through the credit systems are highly inconsistent decisions. It also follows that the recent development of financial markets in Brazil have contributed to the decrease in the effectiveness of rural credit programs.

Secondly the result might also be changed if one consider a much larger increase or supply of rural credit for each borrower. The result is changed because after a given amount of credit supplied for each borrower there won't be enough quantities of B and of alternative sources of finance to allow the borrower to perform the substitution between A and B. In this case the efficacy of rural credit program would be larger than admitted.

This is the long run result. Borrowers will finance all their purchases and holdings of A with rural credit and all their purchases and holdings of B with other sources of finance. But in the long run one has to consider a different definition of effectiveness, which considers the growth of own resources generated by the returns of A and B. If one considers the profits of A and B, the amount of resources available to buy B are given by

$$E + L_C = (r_A A + r_B B - r_C L_C - r_g L_g) + L_C$$

and if all A is financed by L_g , one has $A = L_g$

$$B = (r_A - r_g)A + r_B B + L_C (1 - r_C)$$

and

$$B = \frac{r_A - r_g}{1 - r_B} L_g + \frac{1 - r_C}{1 - r_B} L_C$$

and a measure of effectiveness analogous to the previous definition could be

$$1 - \frac{B}{L_g} = i - \frac{r_a - r_g}{1 - r_B} - \frac{1 - r_c}{1 - r_B} \frac{L_c}{L_g}$$

that is the effectiveness will be smaller, the smaller rate of interest on regular loans, the lower the rate of return on B and the higher the share of other sources of finance relatively to the rural credit. It is interesting to observe that if A is being "over financed", the effectiveness of rural credit is smaller the smaller the rate of return on A as shown in the expression above! But if r_a increases the demand for A and B is not given by (aW) and $(1-a)W$ anymore and the result has to be changed.

Finally, the result would be different if the rural credit program supplied most of their funds to borrowers which were previously rationed in the regular financial markets. But with negative interest rates this case is quite unlikely, since larger clients will receive the larger share of rural credit. This is the object of next section.

The result obtained in terms of impacts of rural credit programs on the purchases of A and B might be applied analogously to other cases where it is thought that credit programs affects allocation decisions.

The first case refers to effects of rural credit programs in input mixes. It is usually believed that a situation of credit availability at low interest rates "distorts" the "optimum combination" of inputs. Sometimes this conclusion is simply based on a frequent mistake in economics, that is, the confusion between interest rate and the rental rate of capital⁽⁷⁾. Lower interest

rates are assumed to be equivalent to lower rental rates on capital. Thus, low interest rates on loans would increase the capital labor ratio, the number of tractors per acre, or per worker. This result is clearly mistaken: the availability of credit at lower interest rates does not lead to more capital equipment per worker unless this is the most profitable solution. Lower interest rates and credit availability can be used either to buy mechanic equipment or to pay workers in advance, and it doesn't change relative factor costs.

Another argument is based on the fact that rural credit is usually tied to the purchases of tractors and other mechanical equipments. In the Brazilian case some lines of rural credit are tied to the purchase of what has been called "modern inputs" as fertilizer or special seeds. If the results of substitution presented in this section are correct, special credit programs are not likely to change the input mix at farm production by the same reasons they are not likely to change the investment mix between A and B, unless the "modern technology" is profitable.

IV. THE LOAN DISTRIBUTION POLICY AND WEALTH DISTRIBUTION

As economists and bankers know the interest rate is only one of the characteristics of a loan contract. A loan contract is also characterized by maturity, collateral, compensating balance, risk, liquidity and other variables. A credit operation is defined by a vector of variables, the interest rate being only one of them. There is a relation of substitutability between interest rate and other loan characteristics. For example, lower interest rates are generally accompanied by higher collateral. Borrowers with more liquid assets pay lower interest rates than less liquid borrowers, and so on.

The relation of substitutability between different characteristics of the loan contract is easy to observe. Consumer loans require less collateral than commercial loans and have higher interest rates. General consumer credit command a higher interest rate than consumer credit for the purchase of a durable good if this good is kept as a collateral and the market for used items are well organized.

If this kind of substitution is general, one may conclude that in the rural credit program commercial banks will prefer to supply a larger share of rural credit to large borrowers, to borrowers with more collaterals per dollar of loans, more liquid assets, and borrowers which represent a smaller risk. But these characteristics happens to be also the characteristics of borrowers which have lower transaction costs in finance markets, and larger possibilities of substituting other sources of finance for rural credit loans. With low interest rates larger and more liquid borrowers will have the largest share of rural loans and the effectiveness of the program will be extremely low or even null as shown before.

One might argue that "Banco do Brasil", development banks and other government owned banks involved with rural credit are banks concerned with "social" objectives of government policy and that the observation about loan distribution policies doesn't apply in their cases.

But the banking business has specific characteristics which don't allow a different type of behavior. Assume, for exemple, that Banco do Brasil decides to increase the share of small, less liquid and riskier loans. Once this decision is taken, bank managers know that the percentage of default loans allowed will have

to increase. Branch managers in charge of approving rural loans can profit by telling the borrowers that a higher percentage of default is now allowed and the control of bank loans operations becomes impossible. The banking business is subject to a special information problem which doesn't allow this type of arrangement. Larger and less risky clients can't be denied loans in favour of clients with higher risks of default without ruling out the possibility of controlling the legitimacy of each bank operation.

The low interest rate policy of the rural credit system not only increases the share of larger farmers loans in the total, but also has effects on income distribution. The table below shows the amount of subsidies implicit in the rural credit program calculated as the difference between the interest rate in rural loans (estimated as 15% a year) and the inflation rate. They represent almost 75 billion cruzeiros in 1977 and 25% of total government spending (federal, state and municipal government).

These subsidies are distributed mostly for larger landowners which constitute the bulk of the rural credit system borrowers. The effects on wealth distribution are easy to understand. The table below shows the distribution of rural credit among different size farms.

The negative result on income distribution becomes more dramatic if one analyses how the funds for rural credit are raised. Part of the funds comes from fiscal revenues whose incidence is not quite well known, but it is presumed to be regressive after average income classes ⁽⁸⁾. A second part comes from the sale of public debt, which costs interest rate plus monetary correction and represents one of the most attractive financial assets in the market. There are no studies about holders

TABLE 3

TOTAL COSTS OF SUBSIDIZED CREDIT PROGRAMS

Year	Total Subsidized Loans	Annual (4) Inflation Rate	Real Rate of Interest (5)	Total Cost	Government Expenditures
1970	15041	19.8	-4.2	631	28785
1971	20872	20.4	-4.7	980	27375
1972	32038	17.0	-1.7	544	48542
1973	53649	15.1	0	-	64251
1974	55790 ⁽²⁾	28.9	-12.1	6750	94169
1975	97219 ⁽³⁾	30.1	-13.1	12735	142704
1976	243313	41.2	-18.6	45256	223077
1977	375039	43.4	-19.8	74257	311327

(1) It includes Rural Loans and Development Banks Loans.

(2) It excludes ENDE.

(3) It excludes all Development Banks.

(4) General Price Index - Column 2 of Conjuntura Económica

(5) Assuming 15% Nominal Rate of Interest.

of the public debt but it is known that financial income represent a larger share of income of higher income classes. Moreover, public debt can be considered presently as the best alternative investments particularly to the borrowers which have easy access to subsidized loans. In this case the perverse effect in income distribution is doubled: the government supplies the negative interest rate subsidy and pays the difference. Finally, a third part of the funds for financing rural loan operations come from the increased amount of high powered money but the distribution of costs is hard to tell in this case.

It is important to notice that although it is argued that higher interest rates would generate a less concentrated distribution of rural credit among different size borrowers, it has not been said that higher interest rates would be capable of generating non concentrated loan distribution. This point is worthwhile to discuss since it bears on the income distribution effects of relying on financial markets and credit programs as planning instruments.

The banking business is deeply involved with risk and uncertainty ⁽⁹⁾. Higher interest rates in general are able to make risky loans and investments more attractive to bankers. But higher interest rates can be used only within given ranges. This is so for two reasons. First, after a certain level, higher interest rates increase much more the possibility of default than the expected value of a loan ⁽¹⁰⁾. Secondly, and more important, in each loan operation there is an asymmetric distribution of information. The borrower knows much better what are the probabilities he has to pay back the loan. The lender, on the other hand, although he might know the probabilities of success of the investment he is financing, will never be sure about the future

actions or the actual financial situation of the borrower.

These two factors make the problem of information and confidence specially acute in the banking business. Although the interest rate might compensate for some higher risk, bankers will never give up margin requirements and collaterals. The proverb "banks lend money to whoever does not need it" illustrates the point⁽¹¹⁾.

In operational terms, this means that the interest rate will never be able to substitute collateral and wealth in many credit operations. This means that the distribution of loans, or, the distribution of new purchasing power and of investments will always be extremely dependent upon the actual distribution of wealth. Thus, the future distribution of wealth will be dependent on the current distribution of wealth.

Things might get even worse if one considers that, in general, banks discriminate against small borrowers. For example, a one dollar loan for a small borrower is supplied only if 3 dollars are put as collaterals while, for large borrowers the collateral might be only one dollar. If this is the case, the financial system distributes new purchasing power and new investments not accordingly to the current wealth distribution, but in a more concentrated way. If bank discrimination with respect to collaterals is larger than the differences in savings rate, the financial system generates a more concentrated distribution of future wealth⁽¹²⁾.

V. EMPIRICAL EVIDENCE

The effectiveness of rural credit depends on how rural credit is distributed among different size farms, borrowers with

different degrees of liquidity and profitability. Because the possibilities of substitution depend upon these characteristics.

This section presents empirical evidence about the distribution of rural credit and tests the hypothesis that larger, more liquid and more profitable farms present lower measures of effectiveness.

The data available was not collected for this purpose and is not suited for the questions which have been posed.

The data basis is a sample of 1686 farmers which answered a questionnaire about sources and uses of funds in 1971. The sample and the questionnaire were built for a research on technological innovation⁽¹³⁾. The year is also a bad year for the purposes of the test; the inflation rate in 1971 was about 20% a year, decreasing while the rate of interest on rural credit was 17%. Although this represented an ex post negative real rate of interest it can be considered a positive real rate of interest on an a priori basis. It is, in any case, a much higher rate of interest than those after 1973, when inflation rates averaged 40% a year. Finally the data in this sample refers to flows of income, cash income, new loans obtained, amortization payments that took place in 1971, while the questions of the previous section, refers to stocks of loans, of liquid assets and of investible funds.

The sample is composed of farms scattered over all Brazilian states, except S.Paulo (the richest state of Brazil). It is composed of different size farms, which are almost equally distributed across different class sizes (5 sizes, size 1 being the smallest). Farmers were classified in terms of liquidity (an index of cash income minus cash payments divided by cash payments, called L and a coverage ratio index labeled C defined as cash income minus

cash expenses over interest rate payments), profitability (profits over total value of assets).

The sample provided informations on the total amount of expenses of each farm, per year, including investment (plus stock changes) current expenses, and non cash payments (basically expenses with subsistence, estimated as the regional wage of the region times the number of family numbers, counting women as part time workers). The information on new loans obtained, divided by total expenses was called share of debt in total finance. Long run credit was estimated as new credit obtained in that year minus amortization paid in that year. And short run credit was estimated as amortization. The results are presented in the table below which shows the F test of the variance analysis for different classification of farms, as defined above.

The F test shows that it is not possible to reject the hypothesis that larger farmers have a larger share of debt to finance their expenses. Short run credit is evenly distributed: the null hypothesis that there is no significant difference for different size farms is accepted. The calculated F for long run credit rejects the null hypothesis: long run credit is more concentrated in large farms.

Farms classified according to different levels of profitability do not have different shares of debt to finance their expenses. The differences are statistically significant, only when farms are classified according to liquidity measured by the coverage ratio.

Thus, as far as distribution of rural credit is concerned, one can conclude that there are empirical evidences that rural credit is concentrated in larger and more liquid farms,

TABLE 4
SHARE OF DEBT AND OWN RESOURCES IN TOTAL EXPENSES
OF FARMS ACCORDING TO DIFFERENT FARM CLASSES

Size	Total Credit	Short Run	Long Run
1	24.3	8.9	13.6
2	34.9	10.9	24.0
3	35.0	11.0	24.0
4	43.0	11.9	31.2
5 (largest)	48.0	11.3	29.6
F	9.6496	1.695	6.596
Degrees of Freedom	(4;1681)	(4;1681)	(4;1681)
<u>Profitability</u>			
L01	33.6	8.1	25.5
L02	39.5	12.1	29.4
L03	30.5	11.3	19.0
L04 (most profitable)	33.1	11.1	22.0
F	3.6283	5.5554	2.4030
Degrees of Freedom	(3;1682)	(3;1682)	(3;1682)
<u>Liquidity</u>			
CO1	31.0	2.2	23.8
CO2 (most liquid)	41.1	15.0	26.0
F	22.4855	94.9587	1.0959
Degrees of Freedom	(1;1684)	(1;1684)	(1;1684)
General Average	35.5	10.9	24.8

SOURCE: IPE - ABCAR Sample, 1971.

particularly when long run credit is considered. The result is limited by the quality of the sample and the estimates used for total and long run credit.

A multiple variance analysis was made with regressions and dummy variables. The intercept of the estimated regression lines represent the average of the smallest, most illiquid and least profitable class of farms. Two groups of regressions were estimated. The dependent variable of the first group is the share of long and short run debt in total expenses. The dependent variable of the second group was the percentage of total expenditure that went into investments and into current expenses. Investments expenses were also classified as purchase of new vehicles, fertilizers, salt and livestock feeding, items which are considered roughly as "modern inputs".

The table below shows the largest estimated values of the coefficient of dummy variables when they were statistically different from zero.

From the data of the table one can see that while credit resources represented for the average 35.5% of the expenses of the farms, they represented only 19.7% in the case of the smallest, least liquid and least profitable farms. Most liquid farms could obtain as much as 22.0% more than the intercept case, receiving credit to finance as much as 57.5% of the expenses (35.5 + 22.2).

The second part of the table shows how these expenses were divided among different items as purchase of new land, new vehicles, fertilizer, etc. The results show that more liquid, larger and more profitable farms were also spending a larger share in investment. The most profitable farms were those with lower

TABLE 5

MULTIPLE VARIANCE ANALYSIS LARGEST ESTIMATED VALUES OF
THE DUMMY VARIABLES FOR DIFFERENT FARM CLASSES

	Debt	Shurt Run	Long Run	Withdrawal	Effectiveness
Average	35.5	10.7	24.8	48.8	67.2
Intercept	19.7	5.9	15.5	- 30.0	142.9
Liquidity	+ 22.0	+ 7.0	+ 11.9	+ 113.0	- 93.6
Profitability	- 11.7	+ 2.3	8.2	+ 82.0	- 77.1
Size	+ 14.7	+ 0	+ 23.6	+ 8.0	- 14.7

	New Land	Vehicles	Fertilizer	Salt	Investments
Average	4.3	3.7	4.5	0.7	50.4
Intercept	3.3	0.1	6.3	7.9	28.9
Liquidity	+ 3.0	+ .6	+ 0.8	+3.0	+42.6
Profitability	+ 3.0	+ 1.6	+ 1.3	-3.1	-18.4
Size	+ 2.3	+ 4.9	- 0.5	+3.7	-21.9

share of investments, indicating that our measure of profitability is a short run measure, and underestimates the true rate of return in the long run.

We have summed up all the resources available to the farmers at the end of an agricultural year and considered it as available funds to finance current and investments expenses next year. Available funds were taken as the sum of the value of production and new loans obtained. All current and investment expenses (including the expenses not paid, as stock changes and family work) were subtracted from the total amount of available resources. The difference between the amount of available funds and total expenses was called withdrawal and taken as an estimate of the amount of funds that could be invested in the sector and were not because of the availability of alternative sources of finance. This measure divided by total flow of new assets bought by the farm was taken as a measure of effectiveness, i.e. of how many dollars of new loans were effectively and in liquid terms invested in agriculture.

In the table one can see that smaller and least liquid farms invested an amount of resources larger than what they obtained, generating measure of effectiveness larger than one. More liquid farms on the other hand, substituted (according to our measure) rural credit funds for their own and had an estimate of effectiveness as low as 49.3 indicating that for each dollar of new loans they invested only 49 cents in the agricultural sector. The difference (51 cents), has been either invested in financial assets (as saving accounts) or in other sectors. It is interesting to observe that the purchase of new land which is not allowed by rural credit rules, represents up to 6 cents of those 49 cents in a given year.

VI. SUMMARY AND POLICY CONCLUSIONS

It has been argued in this paper that rural credit as well as other special credit programs have minor effects in the pattern of investments of the private sector. The argument is very simple and based on the fungibility of credit resources, but has important consequences. It points out that Brazilian reliance on special credit programs has small effects on the allocation of resources, on the choice of technology and can not help the adjustment of the Brazilian economy to the new international conditions⁽¹⁴⁾.

The results are also negative when one considers the effects of development banking on income distribution. The paper has argued that relying on rural credit programs is not only almost innocuous from an allocative point of view but has also negative results in terms of income distribution. Moreover, it has been argued that the negative effects on income distribution can not be corrected by higher nominal interest rates because of specific characteristics of the banking business.

The empirical results presented do not reject the basic hypothesis of the argument. The effectiveness of rural credit is estimated to be as low as 40% in the case of largest and most liquid borrowers.

Further research is needed to compare "planning through credit" as defined in this paper, and "planning through prices". The question is relevant not only for agricultural policy, but also when one considers energy pricing policy and the drastic changes in the pattern of investments that are required after 1974. The questions of reliance on "higher energy prices" or alternatively on "larger supplies of credit" are questions similar to those analysed in this paper. It is not true that credit is not an effective policy measure in this case.

NOTES

- (1) The literature on Brazilian financial markets is extense. See Maria da Conceição Tavares, Da Substituição de Importações ao Capitalismo Financeiro: Ensaio sobre a Economia Brasileira, (Editora Zahar, Rio de Janeiro, 1972), for the period before 1973 and for the recent crises see Adroaldo Moura da Silva, Intermediação Financeira no Brasil, IPE-USP, mimeo, 1979.
- (2) Data obtained in João Sayad, "Real State Investments and Financial Markets", Brazilian Economic Studies, n.4, IPEA/INPES, Rio de Janeiro, 1978, pp.21-52 and Adroaldo Moura da Silva, op.cit.
- (3) M. Kruegel Guimarães, Enfoques da Política Agrária Brasileira, (Editora Nobel, S.Paulo, 1974).
- (4) See a good summary of the Brazilian economic problems in Pedro Malan, "A Economia Brasileira: Os Caminhos para os anos 80", Revista da Anpec Economia, Ano 1, n.2, pp. 11-17.
- (5) Fernando Homem de Mello e Maria Helena P. Zockun, "Exportações Agrícolas, Balança de Pagamentos e Abastecimento do Mercado Interno", Estudos Econômicos, vol. 7, n.2, pp. 9-50 and João Sayad, "Inflação e Agricultura", Pesquisa e Planejamento Econômico, 9 (1), april 1979, pp. 1-32.
- (6) See Bailey, Martin, J., "The Welfare Costs of Inflationary Finance", Journal of Political Economy, 1956, and Edmund S. Phelps, "Anticipated Inflation and the Welfare Costs of Inflationary Finance", Journal of Political Economy, 1965.
- (7) Milton Friedman, Price Theory. A Provisional Text, Chapter 13, The Theory of Capital and the Rate of Interest (Aldine Publishing Company, 1968, Chicago).
- (8) Eris, Ibrahim, Política Fiscal e Distribuição de Renda, FIPE-MF, mimeo, 1979.
- (9) Akerlof, G., "The Market for Lemmons, Qualitative Uncertainty and the Market Mechanism", Quarterly Journal of Economics, LXXXIV (3), August 1970, pp. 488-500.
- (10) J.F. Modigliani, and E.M. Jaffee, "A Theory and Test of Credit Rationing", American Economic Review, 59, December 1969, pp. 850-892.
- (11) See Akerlof, op.cit.
- (12) Assume there are two income classes. Class A is rich and B, poor. W_a and W_b represent the wealth hold by each class, r the rate of return on this wealth and s_a and s_b the savings rate of each class. Without a financial system, the growth rate of wealth is given by

$$\hat{W}_a = S_a r \qquad \hat{W}_B = S_B r \qquad \hat{W}_a > \hat{W}_B$$

where a circumflex over the variable represents the growth rate. If there is financial sector that distributes loans for each class as a proportion of wealth hold each class, one obtains

$$L = l_a W_a + l_B W_B = s_a W_a + s_B W_B$$

assuming no multiplier effect. l_a and l_B measure the collateral requirements. After the operation of the financial system, the growth rate of wealth will be

$$\hat{W}_a = l_a (r_a - i) \quad \hat{W}_B = l_B (r_B - i) \quad \text{where } i \text{ is the financial}$$

sector interest rate.

$\hat{W}_a > \hat{W}_B$ if $l_a > l_B$, that is if banks lend more dollar per dollar of wealth for the rich than for the poor.

- (13) Guilherme Leite da Silva Dias, "Avaliação do Serviço de Extensão Rural - Considerações sobre a Amostra e Impacto da Extensão Rural", Trabalho para Discussão Ampla, n.8, IPE, 1974, mimeo
- (14) From an analytical point of view this result has implications for some of the results on effective rates of subsidy (or protection) given to export sector. There are authors that consider part of the subsidy to exports the subsidized interest rate paid to the firms. But if the results of this paper are valid, these calculations should not include the interest rate subsidies since they do not increase the production or the investment in the export sector.