"MEASUREMENT OF RESOURCE TRANSFERS FROM AGRICULTURE:
BRAZIL, 1950-1974" *

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SUMMARY

This article provides a measure of the substantial role Brazilian agriculture has played in the formation of urban capital during the Import Substitution Industrialization period as a result of implicit transfers. These implicit transfers were associated with divergences between the Intersectoral Terms of Trade and their shadow-value. The work shows that as industrialization intensified, from the mid 50's on, these divergences increased, so that a very large transfer of resources from agriculture took place.

A highly subsidized rural credit policy (for modern input purchase) has been in operation since the mid 60's. However, while the policies affecting the agricultural product prices have taxed all producers evenly, the credit policy has only benefited the already well-off and most technologically advanced sections within agriculture.

Thus, the rapid capital formation and the implicit tax burden, which the product price and input credit policies implied, have been highly selective and discriminatory, not only between agricultural and non-agricultural sectors as is usually admitted "a priori", but also within agriculture.

* This paper was presented at "The XXI International Summer Seminar" at the Bruno Leuschner University, Berlin (GDR), June, 1984.

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SUMÁRIO

Este artigo fornece uma medida do importante papel que a agricultura brasileira desempenhou na formação do capital urbano durante o período de Industrialização Substitutiva de Importações, através de transferências implícitas de recursos. Estas transferências implícitas decorreram de divergências entre os Termos de Troca Intersectoriais e os seus respectivos valores-sombra. O trabalho mostra que quando a industrialização se intensificou, a partir de meados dos anos 50 em diante, essas divergências aumentaram, de tal modo que ocorreu uma considerável transferência de renda da agricultura.

Uma política de crédito rural altamente subsidiada (para insumos modernos comprados) foi acionada a partir de meados da década de 1960. Contudo, enquanto as políticas que afetavam os preços dos produtos agrícolas taxavam todos os produtores uniformemente, a política de crédito beneficiava apenas as seções já abastadas e tecnologicamente mais avançadas dentro do setor agrícola.

Assim, a rápida formação de capital e a incidência da taxaço implícita, que resultaram das políticas de preço de produtos e de crédito de insumos, foram altamente seletivas e discriminatórias, não apenas entre os setores agrícola e não agrícola, como tem sido usualmente admitido "a priori", mas também dentro da própria agricultura.

1. INTRODUCTION

The objective of this paper is to measure intersectoral resource transfers in Brazil which result from trade policies and other market "distortions". It concerns the size and direction of the net flow of resources which has taken place between agriculture and the non-agricultural sector during the process of industrialization from 1950 to the mid 70's.

Brazilian agriculture played a substantial role in the formation of urban capital over that 25 year period as a result of implicit transfers associated with divergences between the intersectoral terms of trade and their shadow value. This work shows that as industrialization intensified from the mid 50's onward, these divergences increased, so that a very large transfer of resources from agriculture took place.

Traditional export agriculture was most heavily penalized by this implicit taxation. This is specially the case of coffee, cocoa, cotton, tobacco, castor-beans, sisal and carnauba-wax crops. Due to substitution effects, however, agricultural production for the domestic market also suffered substantial implicit taxation.

A highly subsidized rural credit policy (for modern input purchase) was in operation after the mid 60's. However, while the policies affecting the agricultural product prices taxed all producers equally, the credit policy only benefited the already well-off and most technologically advanced sections within agriculture. Thus, the rapid capital formation and the implicit tax burden, implied by the product price and input credit policies, were highly selective and discriminatory, not only between agricultural and non-agricultural sectors, as is usually admitted "a priori", but also within agriculture.

Intersectoral transfers may be visible in the accounting magnitudes and/or implicit in the price mechanism. The visible transfers can take form of: a) voluntary financial flows of capital between sectors, which occur through banking and non-banking financial institutions; b) direct taxation, both on sectoral income (income tax) and wealth (land tax).

Earlier evidence shows, for the period under analysis, that net visible transfers are quantitatively insignificant in Brazil, both in terms of current agricultural income and as a source of government revenue^{1/}.

Implicit income transfers are a result of "distortions" (exchange rate overvaluation, tariffs, quantitative controls on trade, indirect taxes, etc.) imposed by trade policies and other market policy interventions on the domestic price structure. In fact, this was the most significant channel of intersectoral income (resource) transfers in Brazil during the period.

2. METHODOLOGICAL PROCEDURE FOR MEASURING INCOME TRANSFERS

One can define the effective rate of implicit tax incidence, v_j^E , on the income of farmers producing product j as:

$$v_j^E = (R_j^e - R_j) / R_j^e \quad (1)$$

where $R_j = y_j - c_j$ is the "value added" by the process j (i.e. its net income); y_j and c_j are, respectively, the total revenue ($\sum_i P_i Q_i$) and the total cost ($\sum_i P_i Q_i$) of process j . P_j and Q_j are the domestic price in cruzeiros and the quantity of j produced. The "shadow" value of the variable is indicated by the superscript e , and inputs by the subscript i .

¹ Oliveira (1981).

One can also define the implicit exchange rate^{1/}, respectively received

where π stands for the world dollar price. Thus, if all trade distortions were removed, $P_j^e/\pi_j = P_i^e/\pi_i = r^e$, $R_j^e = R_j$; and so, $V_j^E = 0$. In this case r^e would stand for the unique economy-wide free-trade equilibrium exchange rate.

Now assume: 1) fixed coefficients of production, i.e. $c_j^e/y_j^e = (\sum_i P_i^e Q_{ji}) / (P_j^e Q_j) = \sum_i b_{ji}$ (where b_{ji} 's are constant); 2) the trade distortion does not affect Q (i.e. $Q = Q^e$). Substituting these definitions and assumptions in (1), one obtains:

$$V_j^E = \{ (1 - r_j/r^e) - \sum_i b_{ji} (1 - r_i/r^e) \} (1 - \sum_i b_{ji})^{-1} \quad (2)$$

Thus, the problem of intersectoral income transfer via distortion of the price structure can be converted into and analysed through the divergences of r_j and r_i from r^e ^{2/}. In terms of the foreign exchange market, these divergences are represented by the two components in the numerator of expression (2). The first component, $(1 - r_j/r^e)$, is the rate of implicit tax incidence on the product (i.e. V_j). The second, $(1 - r_i/r^e)$, is the rate of implicit tax incidence on the input i (i.e. V_i). The difference between these two rates weighted by the j 's production process value added (i.e. $(1 - \sum_i b_{ji})$) equals V_j^E above defined.

¹ This is not necessarily the current exchange rate, but the rate which is ultimately perceived by farmers.

² In principle, any tax (explicit or implicit) which shifts domestic relative prices away from their shadow values implies transfer of resources, either between the private and public sectors or between the private ones. But taxes which are not relative-price-distortive, as might be thought to be the case for inflationary tax, would not imply resource transfer between private sectors. In practice, however, also inflationary tax, due to the existing rigidities in the economy, tends to affect relative prices. In such a situation the government is not the only collector of such an implicit indirect tax. The magnitudes involved in these tax shifts between sectors, however, are largely dependent on respective supply and demand elasticities.

Expression (2) above is a similar formula to that resulting from the "Effective Protective Rate" concept^{1/} g_j ; and it has, in principle, the same problems. These problems are in part due to the three basic assumptions made in the derivation of both v_j^E and g_j : i) the small country assumption; ii) the fixed coefficient assumption; iii) the assumption that traded volume does not change with protection (i.e. $Q = Q^E$). On the other hand, the problems are also a result of the presence of non-price controls on trade, redundant protection and non-traded goods.

The small country assumption does not of course hold in the case of Brazilian coffee. The maintenance of that assumption for coffee would lead to a biased estimated r^E , and so to biased v_j , v_i and v_j^E . To avoid these biases, our empirical procedure was to exclude coffee from the estimate of r^E ^{2/}. The implicit assumption in this procedure is that coffee policy would remain the same whatever changes there might be with respect to other products.

Yet with respect to formula (2), one may enquire into the relevant foreign exchange rate which can serve as a factor to convert foreign and domestic prices to a comparable basis. Certainly the actual exchange rate (i.e. the equilibrium exchange rate conditioned to all trade restrictions) is not the right one. Due to the prevailing market distortions, only by mere coincidence would it coincide with the relevant "shadow exchange rate", r^E .

Many different criteria exist for estimating r^E ^{3/}. It is here considered more adequate the approach of the free-trade exchange rate, using the basic framework proposed by Bacha & Taylor (1971).

In brief, this approach considers a small, open economy with trade distortions on both sides: on imports (tariffs, advance import deposits, quantitative controls, licencing requirements etc.), t , and on exports (taxes, subsidies, etc.), s . It enquires into

1 Corden (1966) and (1971); Balassa (1971).

2 Consequently it is assumed that the trade balance adjustments via price mechanisms would be brought about by the non-coffee exports.

3 Oliveira (1981), Chapter 1.

the exchange rate variation, $\hat{r}$, which would be necessary to maintain the equilibrium of the balance of payments in its Current Account. The solution of the system is^{1/}:

$$\hat{r} = \frac{dt \cdot (1 + s) - Z \cdot (a/b) \cdot ds \cdot (1 + t)}{(Z \cdot (a/b) - 1) \cdot (1 + s) \cdot (1 + t)} \quad (3)$$

Where $a = (1 + \eta_x) \cdot \epsilon_x \cdot (\eta_x - \epsilon_x)^{-1}$

$$b = (1 + \epsilon_m) \cdot \eta_m \cdot (\epsilon_m - \eta_m)^{-1}$$

$$Z = (X \cdot \pi_x) / (M \cdot \pi_m)$$

η and ϵ stand for the price elasticities of demand for and supply of exports (when the subscript is x) and imports (when the subscript is m). Z is an index for the "Current Account Deficit Coefficient", X and M are export and import quantities, and π_x and π_m are export and import dollar prices.

Expression (3) relates the variations in trade distortions and the consequent change in the exchange rate overvaluation. a synthesizes the conditions on the export side, and represents the foreign exchange supply elasticity. b does the same on the import side, and represents the foreign exchange demand elasticity.

Apart from the fiscal distortions reflected by s and t , formula (3) also considers the disequilibrium Z of the current account of the Balance of Payments.

Integrating (3) and noting that under the free-trade assumption (i.e. $t = s = 0$) the value of the constant of integration, c , is straightforwardly obtained as $c = r_e$, where r_e is the free-trade equilibrium exchange rate^{2/}, results in:

$$r_e = r \cdot (1 + t)^{1/(1 - Z \cdot (a/b))} \cdot (1 + s)^{Z \cdot (a/b)/(Z \cdot (a/b) - 1)} \quad (4)$$

¹ Oliveira (1981), Chapter V. Similar treatment of the problem is found in Basevi (1968), Balassa & Schydowsky (1968), Floyd (1965), Dornbush (1973) and (1974), and in Bacha and Taylor (1971).

² Bacha & Taylor (1971).

where the powers of t and s are the weights of the respective distortions. The sum of the weights equals unity, and their distribution depends on the price elasticities of the demand for and supply of foreign exchange, $\underline{a}$ and $\underline{b}$, adjusted by the index of the current account deficit, Z .

The conclusion is that when $t > 0$ and/or $s > 0$ we always have $r_e > r$. Thus, when trade distortions tax imports and/or subsidize exports the market equilibrium exchange rate always overvalues the "free-trade equilibrium exchange rate". When distortions act in different directions the final result will depend upon the weight distribution according to (4).

The variable r referred to in formula (4) is the actual market rate which equilibrates the Balance of Payments when the distortions are present.

Based on the most important import and export categories Bergsman (1970) and (1972) computed an annual average non-coffee export exchange rate (including bonuses), r_x , and an annual average import exchange rate (including protection), r_m , as well as an annual basic import exchange rate (i.e. the import exchange rate excluding protection - e.g. tariffs, premiums, surcharges, advance deposits adjustments etc.), r_B , for the period the multiple exchange rate regime prevailed^{1/}.

The difference between r_m and r_B can be considered as the equivalent, average nominal rate of tax on imports (i.e. $t = (r_m/r_B) - 1$). On its turn the difference between r_x and r_B can be considered as the equivalent, average rate of tax on exports (i.e. $s = (r_x/r_B) - 1$)^{2/}.

¹ Two distorting effects (omission of quantitative restrictions on trade and tariff redundancies), acting in opposite directions, are possibly present in these estimates.

² All these data series can be found in Oliveira (1981), Chapter V.

r_e is also dependent upon the ratio of foreign exchange supply and demand elasticities; the former being a function of export supply and demand price elasticities, and the latter a function of import supply and demand price elasticities. This work considered $\epsilon_x = 1$, $\eta_x = -\infty$, $\epsilon_m = \infty$ and $\eta_m = -0.63^{1/}$.

The trade deficit coefficient, Z , has almost systematically been smaller than one, $Z < 1$, indicating a persistent deficit in the Current Account.

Thus, based on (4) r_e series was computed. This series was used as the "Reference Exchange Rate" to which the implicit exchange rates were compared for the computation of the sectoral implicit tax (subsidy) incidence.

3. INCIDENCE OF IMPLICIT TAXATION ON AGRICULTURAL PRODUCE

The rate of implicit tax incidence, $(1 - r_j/r_e)$, can be computed for each specific year, independently of any base-year. Thus, the reference which the "implicit" current price structure is compared to is the current "shadow" price structure of the same year^{2/}. Nevertheless, to minimize the effect of possible errors and omissions in the process of adjustments of the original data, a base-year (1950) was chosen.

The estimate of the domestic producer's price index was obtained from the domestic wholesale price series discounting the explicit indirect tax rate.

¹ Oliveira (1981), Chapter V, sections 3.3.4 and 3.3.7.

² For the computation of r_j , P_j is net of domestic, explicit taxes, and π_j , net of international transport and insurance costs. P_j and π_j were estimated to reflect FOB prices of exportables and CIF prices of importables both at Brazilian ports. Oliveira (1981), Appendices VI. A and VI. B.

Aggregate indices of Implicit Exchange Rates, Ir_a , for distinct groups of agricultural products were computed taking the current value of domestic production of each product in each year as the weighting basis. The prices and values of the original production series data were all transformed according to 3-year moving averages.

A striking outcome resulting from the comparison of the main Aggregate Implicit Exchange Rate Index to the Reference Exchange Rate Index, is that up to 1955 the Aggregate Agricultural Implicit Exchange Rate Index had moved in a very similar fashion to that of the reference rate. After that, however, they began systematically to diverge from each other.

Most of the time the aggregate index of agricultural exports and that of agricultural production for the domestic market moved very close to each other, and to the aggregate index for agriculture as a whole. The most significant divergence from this general path of agricultural implicit exchange rate evolution was observed in the case of agricultural importables. Right from the beginning of the 50's the aggregate index of agricultural importables systematically diverged downwards from the rest of agriculture.

These findings suggest that the problem of Brazilian trade policy discrimination against agriculture during the ISI period is greater than is usually admitted. Relative to 1950, resources have been sucked out of the sector through the product price mechanism, not only in relation to exportables, but also in relation to goods produced for the domestic market.

It does not seem, therefore, that the country has actually sustained any consistent import substitution policy for food through product prices during the period.

The results from the product price data do not seem to contradict the hypothesis^{1/} that agriculture in Brazil during the whole

¹ Leff (1967) and (1968).

ISI period performed the role of supplying both cheap foreign exchange for the importation of industrial capital goods, and, also, cheap food and raw-materials which permitted the industrial sector to avoid wage share increases in the industrial product.

In accordance with the methodology above presented:

$$v_j^t = (1 - Ir_j^t / Ir_e^t) \quad (5)$$

where Ir_j^t and Ir_e^t are the indices of the implicit and reference exchange rates, respectively, and v_j^t is the relative rate of implicit tax incidence on product j in the year t .

Table I, column (1) shows the computed v_a 's, with 1950 as the base-year. It was also alternatively computed the whole series changing the base for 1948 and 1955. The results did not change significantly^{1/}. The whole series of v_a for aggregate agriculture was also alternatively computed both including and excluding coffee. Although in the first case the computed rates were larger than those in the second, the general pattern of evolution of the aggregate relative rate is not affected at all and its level still remains high when coffee is removed^{1/}.

In any case the evolution of the aggregate relative rate can unmistakably be seen in the following way: the indirect implicit taxation on the agricultural product borne by agricultural sector in Brazil after the late 50's has been substantially higher (around 25 percentage points in average) than it used to be in the late 40's and early 50's.

The results also permit us to identify at least three clear phases in the recent history of indirect implicit taxation on Brazilian agriculture. The first is the period from 1953 to 1961/4, when the tax-rate incidence on the sector increased steadily and significantly. At the end of that period it was around 40 percentage points higher than it was at the beginning of the period. The

¹ Oliveira (1981), Chapter VI.

second phase, which runs from 1965 to 1970, is characterized by a reverse movement. During this period the relative rate fell to almost half the level reached in 1961/4. And the third phase, from 1971 onwards, is
ce rate.

Table 1

RELATIVE RATE OF IMPLICIT TAX INCIDENCE ON AGRICULTURE
(in percentage)

Base year 1950		(Aggregate by Product Groups)*				Based on 3 Year moving average data		
YEAR	AGRICULTURE	EXPORT AGRICULTURE			AGRICULTURE FOR DOMESTIC MARKET			
	TOTAL	TOTAL	TRADITIONAL	NON-TRADITIONAL	TOTAL	RAW-MATERIAL	FOOD	IMPORTABLES
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1947			- 5				15	2
8	1	0	- 6	5	2	- 6	5	- 7
9	- 3	- 2	- 6	1	- 2	- 8	- 1	- 8
1950	0	0	0	0	0	0	0	0
1	0	- 1	6	-10	- 2	7	- 4	9
2	- 2	- 5	12	-22	- 5	11	-10	12
3	- 2	- 7	11	-24	- 6	6	- 9	9
4	3	0	15	-14	- 1	5	- 3	13
5	3	3	16	- 9	- 2	4	- 3	21
6	12	11	25	- 1	7	13	6	32
7	16	13	26	3	11	11	12	33
8	27	26	37	18	22	20	23	42
9	28	30	37	23	22	18	23	42
1960	35	36	43	30	29	27	30	49
1	39	38	47	30	35	35	36	51
2	38	35	48	25	34	37	33	51
3	39	36	44	30	37	36	37	47
4	42	40	42	39	39	30	42	45
5	35	35	37	34	32	22	34	41
6	31	29	30	27	27	13	30	39
7	27	23	29	19	24	14	26	41
8	28	23	31	18	25	17	26	45
9	26	23	30	18	23	19	23	47
1970	24	24	31	19	20	21	19	49
1	27	25	32	20	23	25	22	52
2	26	28	29	27	23	28	22	55
3	35	36	36	35	34	41	32	57
4	34	37	40	35	33	45	29	59

* The aggregate is $v_a = 1 - \left(\frac{1}{j} \sum_{t=1}^n \frac{p_{jt}^t}{p_{jt}^t} \right) \times \left(\frac{1}{j} \sum_{t=1}^n \frac{p_{jt}^t}{p_{jt}^t} \right)^{-1} \times 100$, where j stands for crop j , t stands for the year, and the variables are defined according to the text.

Data Source: OLIVEIRA (1981) its Tables 6a-1, 6a-2, 6a-3, 6a-4 in Appendix VI.A and Tables 6b-1 in Appendix VI.B. The criteria for adjustment of the original prices for indirect taxes and ocean freight are also explained in Oliveira (1981), Appendices VI.A and VI.B.

NOTES: (the following numbers in parentheses refer to the corresponding columns)

- (1) Includes the 76 agricultural products listed in (3), (4), (6), (7) and (8) below.
- (3) Includes: coffee, cocoa, cotton, sisal, jute, tobacco, castor beans, carnauba-wax, sugar-cane and bananas.
- (4) Includes: corn, beef, soy-bean, orange, rice, peanuts, and wool.
- (6) Includes: cotton, sisal, jute, tobacco, sugar-cane, soy-bean, peanuts and wheat.
- (7) Includes: corn, beef, orange, rice, bananas, cassava, sweet-potatoes, dried-beans, onions, tomatoes, pineapple, wheat and milk.
- (8) Includes: Irish-potatoes, onions, wheat and milk.

The increasing taxation in the first phase is explained mainly by the successive shifts in the domestic price structure provoked by the trade policies of the mid and late 50's which aimed to protect industry. Since the 1961 exchange reform, agricultural taxation due to fiscal policies tended to fall, but the acceleration of inflation from the late 50's had the opposite effect, i.e. the increasing overvaluation of foreign exchange rate, induced by the fixed exchange rate policy. After 1964 the fall in the inflation rate also reduced the implicit taxation on the sector. The mini-devaluation policy after 1968 may have had, at the beginning, the effect of reducing the implicit taxation on agriculture. But from the early 70's the under-adjustments of the exchange rate, the acceleration of inflation and the increase in the quantitative controls in trade explain the new increasing trend in taxation on agriculture.

The relative rates of implicit tax incidence on agricultural exportables and agriculture for the domestic market moved in a very similar fashion throughout the period. However, the latter index was pushed upwards by the influence of the "importables" (wheat, milk, onions and Irish potatoes)¹/. Thus, the production of non-importable agricultural commodities for the domestic market was in general less heavily taxed than the exportables and importables.

The tax borne by traditional exports systematically and significantly increased from the immediate post-World War II period up to 1961/62, when a peak tax level of almost 50 percentage points higher than that prevailing in 1950 was reached. This evolution was a consequence of the fact that their domestic prices (measured in dollars, converted at the reference exchange rate) fell more sharply than world prices, especially in the second half of the 50's (and had increased less until the mid 50's).

¹ Their share in the total value of agricultural production, for the period 1945 to 1975, varied around an average of 14% - with a standard deviation of 2.08 percentage points.

The exchange-rate reforms and the post-1964 outward trade-policy orientation seem to have had an important impact on reducing taxation on agricultural exports; but only until the late 60's. Up to the early 60's the fiscal trade distortions introduced from the mid 50's shifted the whole structure of tax incidence on exports upwards. During the whole period a fixed exchange rate policy with high inflation overvalued the average exchange rate. From the early 70's, world price increases were not entirely transmitted to export agriculture, and a highly discriminatory export subsidy policy tended to overvalue the market exchange-rate received by exporters of agricultural products.

In the first half of the 1950's food production (except for importables) benefited from a certain stabilization (the case of corn, rice) or smaller increase (the case of beef) in world prices relative to prices in the domestic market^{1/}. The domestic demand for food was already increasing very fast by that time, and the mechanism of official food price controls were rather relaxed, when compared with the situation prevailing after 1953/54.

Up to the mid-50's, taxes on food producers were much lower than that on raw-material producers, mainly because the latter suffered the automatic price control entailed in the absolutely fixed exchange rate in force up to 1953. After that, the quantitative controls on food exports in combination with the official food price controls (particularly from the early 60's) implied higher implicit taxation on food production^{2/}. From the late 50's and early 70's the tax incidence on raw-material production again increased faster than that on food, owing to the fact that the domestic prices of the former did not succeed in following the same rate of growth observed in the world raw-material market. Quantitative controls strongly affected those raw-materials competing with exports, since the policy's aim was first to supply domestic industry fully, in order to avoid idle industrial capacity.

¹ Oliveira (1981), Appendices VI.A and VI.B.

² Leff (1968) and Veiga (1974).

4. INCIDENCE OF THE IMPLICIT TAXATION ON AGRICULTURAL INPUTS

In terms of implicit (r_i) and reference (r_e) exchange rates, this section of the paper estimates the size of the relative implicit tax (subsidy) incidence on agriculture which results from the purchased input price distortions (i.e. $v_i = (1 - Ir_i/Ir_e)$).

In general explicit indirect taxation on agricultural inputs in Brazil has been quite small and has diminished during the period under analysis. Thus, it follows that most of the overall tax incidence measures (on inputs) obtained in this paper can actually be attributed to non-explicit forms of taxation.

The main trait of Brazilian trade and foreign exchange policies during the period, towards agricultural inputs, was to push the import substitution industrialization to its limits^{1/}. Certainly in the long-term, productivity increased considerably in some of the industrial branches; the evidence for it is in a decreasing trend in their relative prices^{2/}. However, it is undeniable that in the process the economic policies also exerted strong inflationary pressures on the economic system as a whole. The eventual payers of such an inflationary tax may have been mainly the small landless agricultural producer (without easy access to subsidized credit for buying modern inputs) and the urban unskilled labourer.

It was possible to construct two basic input price series, one for chemical inputs used by agriculture and the other for agricultural machines; both for domestic and comparable "world" prices, which allowed for estimates of indices of the respective implicit exchange rates.

But those farmers who succeeded in using subsidized credit^{3/} for buying modern inputs may not in fact have eventually paid the

¹ For detailed analysis of the trade and exchange rate policies on this respect, see Oliveira (1981).

² Oliveira (1981), Appendix VIII.A, Tables 8a-1 and 8a-3.

³ On the evolution and distribution of the agricultural subsidized credit in Brazil, see Oliveira (1981), Appendix VIII.B.

market prices. Actually, the real, ultimate farmer's input price, P_b , is the market price, P_m (i.e. the amount of financing per unit involved), with the credit subsidy discounted, i.e.

$$P_b = P_m (1 - \theta_i) \quad (6)$$

where θ_i is the subsidy rate ($\theta_i = x - x_i$, where x is a proxy for the nominal opportunity cost of capital for the economy as a whole and x_i is the actual nominal interest rate charged to farmers on the rural credit).

Thus, the effect that the credit subsidy policy has on the overall rate of incidence of the implicit tax (subsidy) owing to all input market distortions, v_i (including those of the credit policy), can only be obtained after the due adjustment of P_m by θ_i . The relevant domestic price to compute r_i in v_i is P_b .

Using the price P_b , the relative rate of incidence of the implicit tax (subsidy) on inputs due to all input market distortions (including the effects of subsidized credit), v_i , can be computed.

The data used to compute θ_i were: the annual estimates of the Brazilian inflation rate $\dot{P}$, the real opportunity cost of capital, ρ , and the average nominal rate of interest, x_i , charged to farmers by official agricultural credit lines available for input i ^{1/}. It was supposed that: a) 100% of the input market price, P_m , could be financed on those lines; b) loans for chemical (fertilizers, pesticides, etc.) were all taken at the beginning and all paid (principal plus interest) at the end of the crop year - with a loan term of 10 months on average^{2/}; c) the loan term for machines^{3/} is longer than one year and usually is made in instalments. It was assu-

¹ The source for $\dot{P}$ is FGV/CE (1975), (1977^a), (1979), for ρ is Langoni (1974) and Bacteria et al. (1971), and for x_i is Adams (1977) and Banco do Brasil (1978). For details on dealing with those data see Oliveira (1981), Chapter VII and App. VI I.A.

² As an alternative experiment, and using a distinct approach, Adams (1977) took the average period of financing as being 6 months, while SIACESP (1978) took it as 10 months. Actually, according to the Banco do Brasil (1978) the period of the financial operation for working capital ("crédito de custeio") varies from 1 crop period (which is more frequent) for the annual crops, to 2 or 3 years depending on the characteristics of the perennial crops.

³ Which could, to a certain extent, also be a proxy for financing condition of "perennial crop formations" and "rural constructions".

med an average 6 year loan term, with amortization made in 6 equal annual payments, R (comprising interest on the outstanding principal and the rest to reduce the debt), starting at the end of the first year.

The rate of relative incidence (clearing the market prices from the nominal subsidy) is shown in columns (12) and (13) of table II.

The chemical inputs for agriculture always benefited zilian trade policy, especially in terms of easy access to an extremely overvalued exchange rate (during the multiple exchange rate system period), total tariff exemption (particularly for its raw-materials), and the creation of special funds and subsidies for domestic industry (which were emphasized after the tariff reform of 1957 and the exchange rate unification in the early 60's). The role of the agricultural credit subsidy on chemical inputs was to ensure and expand demand, but until the early 70's it only marginally added to the implicit relative subsidies that agriculture was already capturing from trade and industrial policies. With the relative openness of the economy in the late 60's and the increase in the costs of raw-materials parallel to the expansion of demand the relative benefits usually captured by agriculture fell drastically. The inefficiency of domestic industry in this context was revealed by a faster increase in the domestic price (converted at the shadow exchange rate) when compared with its international counterpart. The increase in the fertilizer subsidy via credit, which was launched in 1974 to rescue the sector through demand maintenance, was not passed on to agriculture to any significant extent^{1/}.

As far as machines are concerned, agriculture was, because of the industrial and trade policy, taxed until the early 70's, when it started to benefit from the productivity gains in domestic industry. The subsidized agricultural credit for machine buyers which increased enormously in the late 50's and early 60's as a

¹ Oliveira (1981), Chapter VII and Table 7-5.

Table 11

THE OVERALL RELATIVE RATE OF IMPLICIT SUBSIDY INCIDENCE ON INPUT BUYERS, η_i

THE OVERALL RELATIVE RATE OF INCREASE OF INPUT PRICES													
FERTILIZERS													
Year	Nominal Grs Prices Subsidy Discounted		Price Indices		Implicit Exchange Rate Index $Tr_1 = P_1/P_1^*$	Nominal Grs Prices Subsidy Discounted		Price Indices		Implicit Exchange Rate Index $Tr_1 = P_1/P_1^*$	Reference Base Index (C) Year Moving Average $1960-1964$	Relative Rate of Incidence of the Implicit Subsidy on Input Buyers	
	$P_{0,1}^*P_{0,1}^*(1-\tau_i)$		$I_{1,1}$			$P_{0,1}^*P_{0,1}^*(1-\tau_i)$		$I_{1,1}$					
	Annual	3 Year Moving Average	3 Year Moving Average	3 Year Moving Average		3 Year Moving Average	3 Year Moving Average						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1948	18.6	18.3	96	96	100	25.7	25.7	100	100	100	87	-8	0
1949	18.0	19.1	100	100	100	27.8	28.0	109	103	106	100	4	3
1950	18.2	20.4	107	102	105	30.6	31.3	145	107	136	122	15	-11
1951	21.1	20.7	108	104	104	33.4	34.0	232	105	222	147	24	-82
1952	21.8	21.5	113	102	111	35.4	36.0	274	106	253	194	32	-82
1953	21.9	21.5	115	103	132	38.0	38.2	300	109	282	34	-82	-53
1954	23.8	25.9	136	104	162	42.6	43.1	348	114	325	42	-53	-44
1955	35.0	32.1	168	106	187	45.6	46.1	358	118	350	51	-20	-53
1956	37.4	37.9	198	106	194	48.5	49.0	368	122	368	51	-4	-4
1957	41.6	41.6	206	107	206	51.5	52.0	378	126	378	70	12	28
1958	41.6	41.6	206	107	206	54.5	55.0	388	126	388	71	40	40
1959	45.2	45.2	233	108	233	57.5	58.0	408	126	408	66	35	19
1960	60.1	72.1	377	109	377	60.5	61.0	418	126	418	53	-4	-4
1961	110.9	122.3	641	109	588	63.5	64.0	428	126	428	50	-12	-12
1962	198.3	206.7	1,031	109	984	66.5	67.0	438	126	438	47	-31	-31
1963	295.0	316.5	1,875	109	1,875	69.5	70.0	448	126	448	50	-12	-12
1964	558.2	750.1	3,875	111	5,203	72.5	73.0	458	126	458	50	-12	-12
1965	1,371.0	1,403.1	5,775	111	5,203	75.5	76.0	468	126	468	50	-12	-12
1966	1,384.1	1,420.1	5,775	112	5,203	78.5	79.0	478	126	478	50	-12	-12
1967	1,555.1	1,588.7	8,318	112	7,427	81.5	82.0	488	126	488	50	-12	-12
1968	1,846.4	1,871.9	9,801	108	9,075	84.5	85.0	498	126	498	50	-12	-12
1969	2,213.9	2,180.9	11,418	105	10,874	87.5	88.0	508	126	508	50	-12	-12
1970	2,462.1	2,478.2	13,498	105	12,855	90.5	91.0	518	126	518	50	-12	-12
1971	3,038.7	3,129.1	16,383	108	15,189	93.5	94.0	528	126	528	50	-12	-12
1972	3,486.5	3,590.4	20,413	112	18,279	96.5	97.0	538	126	538	50	-12	-12
1973	4,409.1	4,632.4	31,727	130	26,713	99.5	100.0	548	126	548	50	-12	-12
1974	11,208.0	11,900.1	69,909	170	28,770	102.5	103.0	558	126	558	50	-12	-12
1975	12,471.2	12,305.1	64,843	203	29,944	105.5	106.0	568	126	568	50	-12	-12
1976	13,471.1	13,305.1	64,843	222	29,944	108.5	109.0	578	126	578	50	-12	-12

Source: Oliveira (1981), chapter VII.

function of inflation, more than compensated for the trade distortions, particularly after 1958. From the mid 60's on, the reduction of the credit subsidy levels, because of the relative success of inflation controls and the significant increase in market distortions due to the protection of the infant industry from the early 60's, meant that agriculture was again relatively taxed until the end of the 60's at least. After that, however, agriculture started to capture increasing benefits from the mature tractor industry, with a sharp decrease in domestic prices when it came up against international competition with the opening of the economy in the late 60's. Acceleration of inflation in the 70's has emphasized the credit subsidy to agriculture and shown an upward trend.

From Brazil's experience of the role of agriculture during the protected industrialization process, two main points must be grasped. The first, derived from the intersectoral relationship, shows that dynamic industrial efficiency counts for a great deal in agricultural modernization, which is fundamental if any additional contribution is to be expected from agricultural performance. The Brazilian fertilizer industry has not been able to pass a test of efficiency (through world competition) after more than 15 years of high and intensive protection. On the other hand, although oligopolized, the machine industry managed to do so rather successfully.

The second point is that a credit subsidy in an inflationary environment is something volatile and the control of its levels is an illusion. This is so because the subsidy rates accrue endogenously.

5. EFFECTIVE TAXATION ON AGRICULTURE AND ITS SIGNIFICANCE

The aim of this section of the paper is to put together the empirical findings of the previous sections and to see what general conclusion can be drawn from the results.

From the statistics now available, it can be obtained the time path of:

- a) the net implicit tax incidence on agriculture (v_n), which can be defined as:

$$v_n = v_a - \sum_i c_i v_i \quad (7)$$

i.e. the incidence rate of the tax on agricultural produce net of the tax (subsidy) rate on its purchased inputs, where c_i 's are the purchased input cost coefficients;

- b) the effective tax incidence on agriculture (v_E), which can (from expression (2)) be rewritten as^{1/}:

$$v_E = v_n (1 - \sum_i c_i)^{-1} = (v_a - \sum_i c_i v_i) (1 - \sum_i c_i)^{-1} \quad (8)$$

i.e., the net implicit tax incidence measured in terms of agricultural value added.

v_n can be interpreted as a net rate of the income lost by the sector in a given year due to distortions in both the product and the input markets, measured in terms of the product price. v_E is the same rate, but measured in terms of the value added in the agricultural production process.

Both these measures, relative to 1950, are plotted in Figure 1, alongside v_a ^{2/}.

Until the late 50's the estimated v_n and v_E did not show any significant divergence, since the technical coefficients of modern inputs (the purchased inputs) were too small to affect v_E significantly. But, even so, a significant divergence between these rates and v_a is observed from 1953 to 1956. Despite the already prevailing implicit subsidy on fertilizers, the extremely high implicit taxation on capital goods, provoked by the introduction of the for

¹ Oliveira (1981), Chapter VIII.

² For the estimates of c_i 's, see Oliveira (1981), Table 8-3 and Chapter VIII.

Figure 1:

IMPLICIT TAX (v_a), NET IMPLICIT TAX (v_n) AND EFFECTIVE IMPLICIT TAX (v_E)

Source: Table III, columns (7), (8) and (9), in Appendix

exchange auction market, had the final effect of pushing upwards the net and the effective implicit tax incidence on agriculture.

v_E follows the same pattern as v_n . But they are quite close to each other at the beginning of the series, and quite far apart at the end; which is exclusively explained by the increase in the size of technical coefficients. Thus, it is important to note that even when Brazilian agriculture is considered in the aggregate, the usual assumption^{1/} that purchased input price distortions are not very relevant to the explanation of intersectoral income transfers is not valid for the post-1960 period. During this period, agricultural income (value added) has borne a much higher rate of tax than v_a or v_n .

Figure 2 is the result of a simulation constructed with the parameters within the range of variation we have previously obtained^{2/}. It was designed to show how sensitive the effective tax, v_E , borne by the individual producer, or producer group, is to the variations in the size of input subsidies. A uniform subsidy rate, v_i , was assumed for all purchased inputs; with a fixed v_a , of 25%^{3/}.

Hypotheses (a) would approximately reflect the conditions of production of the small and poorest producers, which actually encompass a very large section of Brazilian agricultural producers. They are the producers of rice in the frontier areas of Maranhão (mainly squatters and tenants), beans and manioc throughout the country, and many other products, in general of food, of which they produce a surplus for the market. Hypotheses (d) and (e) would represent the conditions of production of the most technically advanced southern and southeastern agriculture. They are mainly the producers organized in cooperatives in the south, like those producing

¹ See, for instance, Kalil (1973).

² Oliveira (1981), Chapter VIII; and table IV in Appendix.

³ Which is approximately the minimum level of average implicit tax incidence on agricultural produce observed from the early 60's onwards.

Figure 2:

SENSITIVITY OF EFFECTIVE TAXATION ON AGRICULTURE (v_E)
TO DISTINCT LEVELS OF INPUT SUBSIDIZATION (v_i)

The same 45% input subsidy and
25% product tax, yield:

Technique of production	$v_E = (v_a - c_i v_i)(1 - t_c)^{-1}$
(a) $c_i = .05$	> 0
(b) $c_i = .10$	> 0
(c) $c_i = .40$	> 0
(d) $c_i = .60$	< 0
(e) $c_i = .70$	< 0

Source: Oliveira (1981), Table 8-5, and Table IV in Appendix

wheat, sugar, rice and soy-bean; and the large ones and those of average size mainly producing export crops like coffee, cotton and cattle^{1/}.

It is quite clear that the v_E for the first referred groups of producers is almost insensitive to variations in purchased input subsidies, even for large variations, since their technical coefficients of purchased inputs, $\sum_i c_i$, are very small. But it is interesting to observe that for more technically advanced agriculture v_E becomes increasingly sensitive to variations in the input subsidy level. For the larger levels of subsidies (such as those which have prevailed since the late 60's), more modern agriculture (i.e., with high $\sum_i c_i$) can very easily transform the tax on the product into a net subsidy for its production process, as it can fully exploit the use of the subsidized credit policy. This seems to be the process which is behind the successful and quite rapid capitalization of a large section of southern agriculture. Unfortunately, it also explains the process through which the weakest producers were thrown into misery, owing to a credit subsidy policy which has been justified by, but cannot properly offset, the devastating effect of the distortions created in the product market.

Therefore, price distortions, both in the product and in the input markets, are a highly selective mechanism of agricultural taxation and income transfer between sectors in Brazil. They have taxed resources heavily and removed them from the less capitalized and weakest rural groups (small peasants and landless workers) to the benefit of both urban and rural capitalist groups.

The results of the studies carried out in this section of the paper fully support the hypothesis that agriculture has significantly contributed to the general growth of the Brazilian economy in the post-World War II period. The share of agriculture in domestic income has been greatly understated, and the income transfers from

¹ For the distribution of wealth, technology and credit in Brazilian agriculture, see Oliveira (1981), Appendices II.C, II.D, VIII.A and VIII.B.

agriculture by means of implicit taxation are indeed quite significant, when measured both in terms of agricultural income and in terms of the rate of national capital formation^{1/}.

6. CONCLUSIONS

The relevant intersectoral income transfer in Brazil took place by means of heavy implicit taxation on agriculture. The latter manifested itself in the effects on agricultural income of the fiscal policies, both on trade and the domestic market (indirect taxes, tariffs, quantitative controls, product and input price controls), and of the interest rate and exchange-rate policies.

The results of the analysis of the implicit tax incidence on agricultural produce were that: a) traditional agricultural exports were the most heavily and increasingly taxed during the period, with a peak in 1961/2; b) taxation borne by non-traditional exports has been in general less severe and a more recent phenomenon.

The analysis of the implicit subsidy (tax) incidence on agricultural inputs (incorporating the effects of the rural credit subsidies) showed that chemical inputs have always been subsidized, but machinery has periodically been taxed and periodically subsidized. These taxes and subsidies varied substantially during the whole period, according to the intensity and variations in both the import substitution policies towards the industrial branches producing inputs and the subsidized rural credit policy.

The rate of effective tax incidence on agriculture increased very fast to substantial levels with the beginning of the conscious phase of the Import Substitution Industrialization process in the mid/late 50's. This rate grew steadily, reaching a peak of 48% in 1964. After that, until 1974, it fell somewhat and oscillated a-

¹ Oliveira (1981), Chapter VIII, section 3.

round an average level of 35%. By the end of the period it tended to increase, due to world price increases not entirely passed on to domestic producers and also due to an increase in purchased input coefficient.

This average rate of tax, however, affected producers unevenly. After the late 60's, those already with higher technical coefficients of purchased inputs and easy access to official subsidized agricultural credit were largely able to compensate for the effect of the heavy implicit taxation on the product price. The others were the ones who actually bore the net transfers.

Thus, in this last phase of the period income transfers occurred basically from one section of agriculture towards both urban areas and the already more advanced and capitalized sections of agriculture. In this sense it is not strictly correct to talk about taxation on or subsidization of the agricultural sector in Brazil.

It must be emphasized, therefore, that the effective taxation on agriculture and the net capital resources outflow from agriculture are two distinct phenomena; the relation between them depending on the product tax and input subsidy distribution among farmers.

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APPENDIX

Table III
NET IMPLICIT TAX INCIDENCE (v_n) AND EFFECTIVE IMPLICIT
TAX INCIDENCE (v_E)

in %

Year	Input Coefficients			Relative Rate of Implicit			Implicit Tax Incidence	
	Chemicals c_1	Na-chines c_2	Buildings c_3	Subsidy on inputs			Net $v_n = \frac{3}{1} \sum c_i v_i$	Effective $v_E = \frac{3}{1} \sum c_i v_i$
				Chemicals v_1	Na-chines v_2	Buildings v_3		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1949	1.27	3.30	2.38	-8			-3	
1950	1.38	3.48	2.51	0	0	0	0	0
1	1.51	3.66	2.65	4	3	3	0	- .3
2	1.65	3.86	2.80	15	-11	-11	-2	-1.6
3	1.80	4.07	2.95	24	-51	-51	-2	1.3
4	1.96	4.28	3.12	32	-82	-82	3	9.3
5	2.14	4.51	3.29	34	-82	-82	3	9.7
6	2.34	4.75	3.48	42	-53	-53	12	17.2
7	2.55	5.01	3.67	51	-20	-20	16	18.5
8	2.78	5.27	3.87	63	-4	-4	27	29.1
9	3.03	5.55	4.09	70	12	12	28	28.3
1960	3.31	5.85	4.32	71	29	29	35	34.3
1	3.61	6.16	4.56	68	40	40	39	37.7
2	3.94	6.49	4.82	66	35	35	38	37.1
3	4.30	6.84	5.09	65	19	19	39	40.5
4	4.69	7.20	5.39	53	-4	-4	42	48.4
5	5.12	7.59	5.67	50	-12	-12	35	41.7
6	5.58	7.99	5.99	47	-31	-31	31	40.7
7	6.09	8.42	6.32	50	-37	-37	27	37.1
8	6.64	8.87	6.67	51	-40	-40	28	39.6
9	7.25	9.34	7.05	51	-26	-26	26	34.8
1970	7.91	9.84	7.44	51	-12	-12	24	29.4
1	8.63	10.37	7.86	49	-1	-1	27	31.4
2	9.41	10.92	8.29	44	6	6	26	29.0
3	10.27	11.50	8.76	29	24	24	35	39.2
4	11.20	12.12	9.25	35	39	39	34	32.3

Sources: Columns (1), (2) and (3): Oliveira (1981) its Table 8-3

Columns (4), (5) and (6): Oliveira (1981) its Table 7-7

Column (7): Oliveira (1981) its Table 6-7 (Column (1)).

Table IV

SENSITIVITY OF EFFECTIVE TAXATION ON AGRICULTURE (v_F)
TO DISTINCT LEVELS OF INPUT SUBSIDIZATION (v_i)

Simulated Technique of Production	i c_i *	in percentage					
		v_i **					
		05	10	20	30	40	50
(a)	.05	26	26	25	25	24	24
(b)	.10	27	27	26	24	23	22
(c)	.40	38	35	28	22	15	8
(d)	.60	55	48	33	18	3	-13
(e)	.70	72	60	37	13	-10	-33

NOTES: * technical coefficient for purchased inputs.

** see Table III, columns (4), (5) and (6).

v_a = 254.