Artigos

Redistributive effects of alternative indirect tax reforms for Brazil

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RESUMO

Este artigo investiga em que medida objetivos redistributivos podem ser alcançados no Brasil por meio do sistema tributário indireto. A medida variação equivalente do excedente do consumidor é usada para estimar os ganhos e perdas de diferentes grupos de famílias resultantes de reformas tributárias alternativas. O efeito total de cada reforma é avaliado com base numa função de bem-estar social do tipo Bergson-Samuelson. Os resultados sugerem que seriam necessárias mudanças substanciais na atual estrutura de alíquotas particularmente a introdução de subsídios para alimentação - para assegurar melhorias significativas de bem-estar para as classes de renda mais baixas.

Palavras-chave: reforma tributária, distribuição, bem-estar social.

ABSTRACT

This paper investigates the extent to which redistributive goals can be reached in Brazil through the indirect tax system. The equivalent variation measure of consumer surplus is used to estimate the gains and losses of different household groups resulting from alternative tax reforms. The overall effect of each reform is evaluated on the basis of a Bergson-Samuelson social welfare function. The results suggest that substantial changes in the existing rate structure - particularly the introduction of food subsidies - would be required in order to secure significant welfare improvements for low income classes.

Key words: tax reform, distribution, social welfare.

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1 Introduction

The heavy reliance on indirect taxes as a source of revenue has long been considered a major cause of the inequities of the Brazilian tax system.[1] This led the 1988 Constitution to establish that the rates of the main Brazilian indirect tax - the tax on the circulation of goods and transportation and communication services (ICMS) - should vary according to the importance of the product. Thus, in addition to its traditional role as a source of revenue, the indirect tax system can now be used as an instrument to promote greater equity.

To the best of my knowledge, there have been only two studies which address the problem of indirect taxation in Brazil in the light of the modern theory of tax analysis. One is that of Siqueira (1995b), which is concerned with the computation of optimal taxes; the other is that of Sampaio de Souza (1992), which uses the theory of marginal reform to identify directions of changes in the indirect tax system that would improve social welfare.The marginal method, however, applies only to "small" tax changes, leaving out of the analysis more substantial changes normally associated with actual reforms.

The study of non-marginal tax reforms requires a more detailed framework of analysis than that of marginal reforms since it must take into account the general equilibrium effects of the tax changes. Another important aspect of non-marginal methods of analysis is that they can provide information on the distribution of welfare gains and losses among households. The change in a household's welfare from a proposed tax reform is commonly measured using the Hicksian equivalent or compensating variations, which are based on the household's utility function. Examples of recent studies utilizing these measures are Ahmad and Stern (1991) and Hossain (1994), who respectively investigate the distributional impact of indirect taxes in India and Bangladesh. In order to evaluate alternative reform proposals and identify the most socially desirable, distributional weights need to be assigned to the change in the welfare of different households. This is equivalent to using an explicit social welfare function as suggested by Rosen (1976) and King (1983, 1987).

This paper employs the equivalent variation measure of consumer surplus to estimate the likely effects of changes in the Brazilian indirect tax structure on the welfare of households in different income groups. The overall effect on society of each reform is evaluated on the basis of a Bergson-Samuelson social welfare function. The analysis is intended to shed some light on the question of the extent to which indirect taxation (including subsidies) can contribute to the achievement of redistributive goals in Brazil.

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1 See, for instance, Eris *et alii* (1983).

The plan of the paper is as follows. The next section presents the methodology. Section 3 describes the data used in the analysis. Section 4 reports the results for alternative partial tax reforms - that is, reforms that fall short of taking the tax system to a position where social welfare is maximized. Section 5 is concerned with the effects of implementing the welfare maximizing (optimal) tax structure.[2] Section 6 explores the sensitivity of the results to the specification of household preferences. The final section summarizes the main lessons emerging from the analysis.

2 Methodology

The measure used in this paper to assess the impact of a tax reform on household welfare is the equivalent variation (EV), defined as the amount of income that would have to be given to a household in the pre-reform position to produce a change in its utility equivalent to the change caused by the reform. It is defined in terms of the expenditure function $e(\mathbf{q},v)$ - which gives the minimum expenditure required to achieve a specified level of utility v for a particular set of prices $\mathbf{q}$ - as:

$$\begin{aligned} EV &= e(\mathbf{q}_0, v_1) - e(\mathbf{q}_0, v_0) \\ &= e(\mathbf{q}_0, v_1) - Y_0 \end{aligned} \qquad (1)$$

where subscripts 0 and 1 refer to the pre- and post-reform positions, respectively, and Y denotes expenditure level.[3]

The main set of results in the present paper assumes that the demands of households can be represented by the Linear Expenditure System (LES). The indirect utility function which underlies these demands is:

2 It is likely that only partial reforms are feasible, since optimal tax structures represent great departures from existing tax systems and may thus face severe administrative and political constraints. However, it may still be interesting to have an idea of what could be achieved in terms of redistribution in the absence of such constraints. See Stern (1984) for a discussion of the relationship between partial tax reform and optimal tax design.

3 As defined in equation (1), the equivalent variation may incorporate changes in prices as well as in income. It coincides with King (1983)'s "equivalent gain" measure.

$$v = \frac{\left(Y - \sum_{i=1}^{n} q_i \alpha_i\right)}{\prod_i q_i^{\beta_i}}, \qquad \sum_i \beta_i = 1 \tag{2}$$

For purposes of comparison, we also present results for Cobb-Douglas preferences, which can be represented by the following indirect utility function:

$$v = \frac{Y}{\prod_i q_i^{w_i}}, \qquad \sum_i w_i = 1 \tag{3}$$

The expenditure function can be obtained by inverting the indirect utility function. Thus, equations (2) and (3) yield, respectively:

$$e = v \prod_i q_i^{\beta_i} + \sum_i q_i \alpha_i \tag{4}$$

and

$$e = v \prod_i q_i^{w_i} \tag{5}$$

Hence, the equivalent variation measures for the LES and Cobb-Douglas specifications are:

$$EV = \left(Y_1 - \sum_i q_{1i} \alpha_i\right) \prod_i \left(\frac{q_{0i}}{q_{1i}}\right)^{\beta_i} - Y_0 + \sum_i q_{0i} \alpha_i \tag{6}$$

and

$$EV = Y_1 \prod_i \left(\frac{q_{0i}}{q_{1i}}\right)^{w_i} - Y_0 \tag{7}$$

respectively. We shall express equivalent variation as a percentage of the household's total expenditure in the pre-reform position (i.e., (EV/Y0) x 100).

In order to evaluate and rank alternative reform proposals, we need a measure of overall variation in social welfare. The method employed here is that proposed in Rosen (1976), which translates a change in a social welfare function index into an equivalent change in household expenditures by using the concept of "uniformly distributed income" (UDI).[4] This is analogous to the concept of equivalent variation and is defined as the amount of income which, if uniformly distributed over all households in the initial position, would produce a level of social welfare equal to that obtained in the post-reform position. Formally, for a Bergson-Samuelson social welfare function W and H households in the economy, we have

$$W\left[v^1(q_0, Y_0^{\,1}+UDI),\ldots,v^H(q_0, Y_0^{\,H}+UDI)\right]= W\left[v_1^{\,1}(q_1, Y_1^{\,1}),\ldots,v_1^{\,H}(q_1, Y_1^{\,H})\right] \quad (8)$$

We calculate the UDI value of a tax change using a social welfare function of the form:

$$W = 1/(1-\varepsilon)\sum_{h=1}^{H} v^h(q, Y^h)^{1-\varepsilon} \qquad \text{when } \varepsilon \neq 1 \quad (9)$$

and

$$W = \sum_{h=1}^{H} log\ v^h(q, Y^h), \qquad \text{when } \varepsilon \neq 1 \quad (9')$$

where h is an index for households, and $\varepsilon \geq 0$ is a parameter representing the degree of aversion to inequality (Atkinson, 1970). When ε is zero, (9) corresponds to the classical utilitarian welfare function, which places equal weight on the utility changes of all households. As ε increases, higher weights are attached to changes in the utilities of the less well-off households. Hence, when ε approaches infinity, the social welfare function approximates the Rawlsian "maximin" criterion, by considering only the utility of the worst-off household. Clearly, the value of ε will affect the UDI value of a tax change and sensitivity to this parameter is analyzed below.

[4] See also Feldstein (1974) for an earlier use of the notion of uniformly distributed income.

3 Data

Our analysis distinguishes between urban and rural populations and in each sector the population is divided into nine groups of households according to household expenditure. The data on household expenditure are obtained from Estudo Nacional da Despesa Familiar - ENDEF (IBGE, 1981) and refer to 1974/1975. Accordingly, the expenditure levels that define household groups in this study are those used in the ENDEF classification.

The ENDEF tables identify nine major categories of consumption goods.[5] Although this study also adopts a nine-commodity classification, the commodity groups here do not coincide in every case with those of ENDEF. In order to obtain what seems to be a more adequate classification for tax purposes, some of the ENDEF categories and subcategories have been recombined. The names given to the commodity groups used in this paper are: food, clothing, housing, durables, personal care, transport, recreation, alcohol & tobacco, and miscellaneous. Their relationships with the ENDEF categories are as follows.

The paper category "food" excludes alcoholic beverages, while "housing" is the sum of three of the ENDEF housing subcategories, namely, rent and other housing charges, household maintenance, and cleaning products. "Durables" is a combination of the two other ENDEF housing subcategories, namely, furniture and household articles, and motor vehicles. The category of alcoholic beverages is added to the ENDEF category tobacco to obtain our category "alcohol & tobacco", while "miscellaneous" includes education. The categories not mentioned in this paragraph correspond exactly to the ENDEF classification.

The prices and effective tax rates faced by households in the pre-reform position are estimated using the 1975 Matrix of Intersector Transactions (IBGE, 1987). The effective tax rate faced by households on a given commodity is calculated as the ratio of the total net tax payment to total expenditure (including tax) on that commodity. This requires a prior aggregation of consumption categories of the transaction matrix according to the paper's nine-commodity classification, before adjusting the data to make them compatible with the definition of expenditure used in the ENDEF survey. The correspondence between the classification of the matrix and the paper's commodity groups is shown in the appendix. The adjustment to the

5 These are: food, clothing, housing, personal care and health expenses, transport, education, recreation and reading, tobacco, and miscellaneous expenditures.

matrix data mainly involved the inclusion of rent and non-monetary expenditure. To impute rent, the ratio of the expenditure on rent to total expenditure on housing was calculated from the ENDEF tables and then applied to the matrix data. Similarly, non-monetary expenditure was imputed using the proportion of non-monetary to monetary expenditure for each commodity group provided in the ENDEF tables. Consumer prices are calculated by normalizing producer prices to unity and using the estimated effective tax rates. The procedure assumes that all taxes are fully shifted to consumers.

All tax systems considered in this paper yield an amount of revenue equal to that raised from households by the pre-reform (effective) tax rates, which was estimated at approximately 10% of the total sum of all household expenditures.

The β parameters of the LES, termed marginal budget shares, are calculated for each of these categories and for each household group by using average budget shares, Rossi and Neves (1987)'s estimates of expenditure elasticities, and the property of the LES that the expenditure elasticity for a given commodity equals the ratio of the marginal budget share for the average budget share for that commodity.[6]

The α parameters, often interpreted as "subsistence" or "committed" consumption, are derived from the LES demand equations using the β estimates, consumer prices, and assuming that per capita total committed expenditure ($\Sigma q_i \alpha_i$) for every household equals 90% of the per capita total expenditure of the poorest household group.

4 Partial tax reforms

This section analyses the welfare implications of replacing the actual indirect tax system by the following alternative structures:

1) two rates of value added tax - VAT (5% and 20%), in addition to a zero rate on food in rural areas, combined with excise duties on alcoholic beverages and tobacco;

2) three rates of VAT (5%, 15% and 30%), in addition to a zero rate on food in rural areas, combined with excise duties on alcoholic beverages and tobacco;

3) three rates of VAT (5%, 15% and 30%), in addition to a zero rate on food in both rural and urban areas, combined with excise duties on alcoholic beverages and tobacco;

6 Some adjustments had to be made to Rossi and Neves's estimates since their commodity categories do not exactly coincide with those defined here (They use the ENDEF's categories). Details are provided in Siqueira (1995a).

4) three rates of VAT (5%, 15% and 30%), together with a food subsidy and excise duties on alcoholic beverages and tobacco;

5) a proportional rate of VAT, a zero rate on food, coupled with excise duties on alcoholic beverages and tobacco; and

6) a proportional VAT on all goods.

Proposals (1) to (4) move the tax system in the direction of the welfare maximizing tax structure, which combines equity and efficiency objectives.[7] At the same time, by being only partial moves, they attempt to take into account administrative convenience and political acceptability.[8] Proposals (5) and (6), on the other hand, represent the kind of reform recommendation that often arises in tax policy discussions when administrative issues play a central role in the argument.

In order to be revenue neutral, and thus allow meaningful welfare comparisons, the proposed tax rates must be adjusted. This is accomplished by specifying the government budget constraint and then multiplying the tax rates proposed by the same scalar until, by a process of interaction, they raise the required revenue. Behavioral responses are allowed for through the linear expenditure system described in Section 2.

Table 1 below shows the adjusted tax rates associated with each proposal. Notice that in all but proposal (6) the tax rate on the category alcohol & tobacco remains the same as the pre-reform rate. This is because while optimal tax estimates indicate that alcoholic beverages and tobacco should be taxed at a reduced rate on grounds of equity, in practice these items are heavily taxed for reasons such as paternalism and the negative effects associated with their consumption.

The pre-reform tax structure, to which each of the above reform proposals is to be compared, is estimated from two different assumptions: (a) rural and urban households face the same rate of tax on food, and (b) rural households face a zero rate of tax on food. The latter is on account of the impossibility to tax people's consumption of the agricultural goods

7 See next section, Table 6, for the optimal tax system.

8 These proposals are broadly consistent with those of other authors concerned with the distributional aspect of indirect taxation in Brazil. For instance, Rezende (1993).

they produce, since this does not involve market transactions. A comparison of the welfare effects of the tax changes for the two reference structures can provide an idea of possible overstatements of the impacts of the reforms. The first two columns of Table 1 show the reference tax structure in the two versions, which are called Base Case A and Base Case B respectively.

Table 1
Pre-reform Taxes and Reform Proposals (percentage)

Commodities	Pre-reform Taxes		Reform Proposal					
	Base Case							
	A	B	(1)	(2)	(3)	(4)	(5)	(6)
Urban Food	7.2	10.2	4.8	4.3	0.0	-10.0	0.0	10.1
Rural Food	7.2	0.0	0.0	0.0	0.0	-10.0	0.0	10.1
Clothing	13.7	13.7	4.8	4.3	4.8	6.5	13.3	10.1
Housing	4.5	4.5	4.8	4.3	4.8	6.5	13.3	10.1
Durables	18.4	18.4	19.1	25.8	29.0	38.9	13.3	10.1
Personal care	14.3	14.3	19.1	12.9	14.5	19.4	13.3	10.1
Transport	12.9	12.9	19.1	25.8	29.0	38.9	13.3	10.1
Recreation	12.9	12.9	19.1	12.9	14.5	19.4	13.3	10.1
Alcohol & Tobacco	60.5	60.5	60.5	60.5	60.5	60.5	60.5	10.1
Miscellaneous	1.7	1.7	19.1	12.9	14.5	19.4	13.3	10.1

4.1 Impact on household welfare

Tables 2A and 2B below report the impact on the household welfare of each reform proposal in Table 1 when Base Case A is taken to be the original position. As expected, except for proposal (6), all reforms have a progressive impact on the welfare distribution (or real income), in that, both in urban and in rural areas, the derived benefit is greatest for the lowest expenditure class and declines continuously up to the highest class. In fact, for the last expenditure classes (the last four in most cases) the reforms have a negative effect and generate a welfare loss.

Not surprisingly, proposal (4), which involves a food subsidy, is by far the most progressive. The results suggest that implementing this reform would improve the welfare of the poorest urban households by the equivalent of increasing their expenditures by 7.1%, while the welfare of the richest urban households would be reduced by the equivalent of a decrease of 8.21% in their expenditures. The corresponding figures for rural groups are 9.2 and 11.44%.

Table 2A
Equivalent Variations as a Percentage of Expenditure for the Reform Proposals in Table 1
- With Base Case A as the Initial Position: Urban Households

Urban Household Group	Reform Proposal					
	(1)	(2)	(3)	(4)	(5)	(6)
1	1.14	1.75	3.67	7.10	1.50	-0.85
2	1.03	1.48	3.22	6.16	1.73	-0.17
3	0.69	1.01	2.36	4.31	1.26	0.40
4	0.34	0.62	1.58	2.59	0.65	0.57
5	0.00	0.23	0.89	1.18	0.22	0.59
6	-0.52	-0.48	-0.25	-1.10	-0.28	0.70
7	-1.14	-1.46	-1.71	-3.89	-0.64	0.82
8	-1.70	-2.33	-3.11	-6.63	-1.29	0.67
9	-2.28	-2.84	-3.97	-8.21	-2.29	0.10

Table 2B
Equivalent Variations as a Percentage of Expenditure for the Reform Proposals in Table 1
- With Base Case A as the Initial Position: Rural Households

Rural Household Group	Reform Proposal					
	(1)	(2)	(3)	(4)	(5)	(6)
1	4.80	5.02	4.59	9.20	3.34	-1.30
2	4.69	4.96	4.47	8.81	3.59	-0.71
3	4.15	4.47	3.88	7.43	3.23	-0.27
4	3.20	3.50	2.75	5.04	2.56	0.29
5	2.48	2.48	1.52	2.39	1.98	0.67
6	1.43	1.01	-0.24	-0.91	1.80	1.23
7	0.67	-0.83	-2.52	-5.49	1.72	2.07
8	-0.68	-2.08	-3.93	-7.95	0.87	1.94
9	-2.28	-3.85	-5.94	-11.44	-0.30	1.61

Proposal (5), which sets a zero rate on food but applies a proportional rate of VAT on the other commodities, appears to be the least progressive. Yet it still yields a gain for the three poorest rural groups equivalent to an increase in expenditure of more than 3%.

Proposal (6), on the other hand, which imposes a uniform rate of tax on all commodities, is clearly regressive, generating a welfare loss for the lowest expenditure classes, though, it should be recognised that the various groups neither gain nor lose very much from the reform.

Tables 3A and 3B below show the distributional impact of the reforms when it is assumed that in the initial position rural households pay no tax on food, while urban households face a rate of 10.2% (Base Case B). It is clear that in this case all reforms in Table 1 involve a significant shift of the tax burden from the urban to the rural sector. As a result, apart from proposal (4), the reforms benefit only urban households and reduce or in some cases maintain the welfare of rural residents.

Table 3A
Equivalent Variations as a Percentage of Expenditure for the Reform Proposal Table 1
- With Base Case B as the Initial Position: Urban Households

Urban Household Group	Reform Proposal					
	(1)	(2)	(3)	(4)	(5)	(6)
1	2.92	3.60	5.55	9.02	3.34	0.96
2	2.81	3.26	5.03	8.00	3.51	1.59
3	2.27	2.60	3.95	5.93	2.85	1.97
4	1.71	2.00	2.96	3.98	2.03	1.95
5	1.23	1.46	2.13	2.41	1.45	1.83
6	0.52	0.56	0.79	-0.07	0.75	1.75
7	-0.29	-0.60	-0.86	-3.04	0.22	1.69
8	-1.08	-1.71	-2.49	-6.02	-0.66	1.30
9	-1.86	-2.43	-3.55	-7.80	-1.87	0.52

Table 3B
Equivalent Variations as a Percentage of Expenditure for the Reform Proposals in Table 1
- With Base Case B as the Initial Position: Rural Households

Rural Household Group	Reform Proposal (1)	(2)	(3)	(4)	(5)	(6)
1	-0.24	-0.03	-0.45	4.01	-1.66	-6.15
2	-0.24	0.02	-0.46	3.76	-1.31	-5.49
3	-0.39	-0.09	-0.65	2.81	-1.29	-4.72
4	-0.79	-0.49	-1.22	1.02	-1.41	-3.64
5	-0.93	-0.93	-1.87	-1.02	-1.42	-2.71
6	-1.57	-1.99	-3.22	-3.89	-1.21	-1.77
7	-1.71	-3.19	-4.87	-7.82	-0.67	-0.31
8	-2.60	-3.99	-5.83	-9.83	-1.05	0.01
9	-3.55	-5.11	-7.19	-12.68	-1.57	0.33

It is worth noting, however, that the losses suffered by the poorest rural groups from proposals (1), (2), or (3) are quite small. This suggests that if rural households in fact do pay some tax on food (even if this tax is much lower than that paid by urban households) then proposals (1)-(3) would make the poorest rural households better off.

A comparison of Tables 2A and 2B and 3A and 3B provides an idea of the extent to which the gains for rural households may be overstated and those for urban groups understated when it is assumed that urban and rural households face the same pre-reform price of food.

4.2 Impact on social welfare

Tables 4 and 5 below display the social valuation in terms of uniformly distributed income (UDI) of each reform option in Table 1 for different values of the inequality aversion parameter, with respect to Base Cases A and B, respectively. They also rank reform proposals according to their UDI value.

Table 4
Uniformly Distributed Income (UDI) and Ranking for Reform Proposals in Table 1 - With Base Case A as the Initial Position (1974 cruzeiros per year)

Reform Proposal	Degree of Inequality Aversion (ε)					
	0.1		1.0		2.0	
	UDI	Ranking	UDI	Ranking	UDI	Ranking
(1)	18.62	3	150.36	4	141.56	4
(2)	-1.06	4	163.14	3	150.24	2
(3)	-22.31	5	171.35	2	144.38	3
(4)	-124.00	6	332.25	1	293.43	1
(5)	45.31	2	122.81	5	102.26	5
(6)	78.62	1	-25.11	6	-38.22	6

Table 4 shows that, for moderate and high levels of inequality aversion ($\varepsilon = 1.0$ and $\varepsilon = 2.0$), all but proposal (6) result in a preferable after-tax distribution of real income, generating rather large social gains. These gains are roughly of the same magnitude for proposals (1), (2) and (3) and are roughly equivalent to giving to each family in the population 150 cruzeiros per year at 1974 prices.[9]

As expected, proposal (4) yields the most substantial welfare improvement when the government shows a significant concern for redistribution. In Table 4, this improvement is about twice as large as those from the first three proposals and about three times as large as with proposal (5).

Table 4 also makes it clear that there is a fairly strong trade-off between equity and efficiency in that, for instance, at $\varepsilon = 0.1$ the most progressive reform proposal (i.e., proposal (4)) results in significant welfare loss whereas the uniformity option (i.e., proposal (6)) is welfare-improving at this level of inequality aversion but results in a loss at higher levels. This observation is reinforced by the fact that the ordering of reform options according to the amount of UDI they represent is completely reversed as ε changes from 0.1 to higher levels.

9 This corresponds to approximately 40% of the montlhy minimum wage prevailing in 1974, which was CR$376.80.

Table 5 shows that, with Base Case B, except for proposal (4) all other proposals in Table 1 are not capable of generating significant improvements in social welfare when one is strongly concerned with redistribution. Proposals (1), (2) and (3) yield somewhat significant gains only for moderate inequality aversion. This is not very surprising given that Tables 3A and 3B showed that the benefits from the reforms (with Base Case B) accrue mainly to the richer urban sector. At the same time, a comparison of Table 4 with Table 5 indicates that the gains reported in Table 4 are primarily due to the exemption of food in rural areas.

Table 5
Uniformly Distributed Income (UDI) and Ranking for Reform Proposals in Table 1 - With Base Case B as the Initial Position (1974 cruzeiros per year)

Reform Proposal	Degree of Inequality Aversion (ε)					
	0.1		1.0		2.0	
	UDI	Ranking	UDI	Ranking	UDI	Ranking
(1)	1.55	3	32.24	4	5.45	4
(2)	-18.12	4	45.11	3	14.13	2
(3)	-39.35	5	53.36	2	8.27	3
(4)	-141.08	6	214.69	1	156.82	1
(5)	28.20	2	4.52	5	-33.89	5
(6)	61.47	1	-145.30	6	-175.15	6

5 Optimal tax designs

This section investigates the distributional consequences of implementing the optimal system of indirect taxes, that is, the tax system that would allow the government to achieve its redistributive objectives and raise the required revenue with the least possible loss of efficiency. Optimal indirect taxes for Brazil are calculated in Siqueira (1995b) by maximizing a social welfare function of the form given by equation (9) subject to the government's budget constraint and the constraints on the government's ability to tax. As to the tax constraints, three cases are considered here:

Case 1: the government has to choose the same set of taxes for both rural and urban areas;

Case 2: the government cannot tax or subsidize food (due to the difficulties associated with taxing food within the rural sector);

Case 3: the government can use revenue from indirect taxes to finance a uniform lump-sum transfer to all households.

It is interesting to note that a uniform sales tax accompanied by a uniform payment to all households is equivalent to a linear income tax with an exemption level and a constant marginal tax rate, so that people with income below the exemption level receive a transfer payment from the government. This means that in Case 3 we have the equivalent of a negative income tax.[10]

Since our primary interest here is in assessing the potential distributive impact of indirect taxation, we shall consider the welfare effects of implementing the optimal tax system in each of the cases above, when there is a strong commitment to equity, that is, assuming that the government's degree of inequality aversion, represented by ε in equation (9), is 2.0. The optimal taxes for $\varepsilon = 2.0$, for the different tax restriction cases mentioned above, are shown in Table 6 below. [11]

Table 6

Optimal Tax Designs Associated with Cases 1, 2 and 3 for $\varepsilon = 2.0$

Commodity Groups	Optimal Tax Designs		
	I(Case 1)	II (Case 2)	III (Case 3)
Food	-74.7	0.0	-14.7
Clothing	34.5	1.8	48.5
Housing	31.2	-1.0	48.3
Durables	65.2	49.4	70.9
Personal care	38.1	11.2	51.4
Transport	51.3	41.5	59.5
Recreation	48.4	37.0	57.2
Alcohol & Tobacco	4.9	-38.6	40.0
Miscellaneous	38.6	26.1	50.8
Poll Subsidy			7,143.00

Note: The poll subsidy is in 1974 cruzeiros per year. It may be convenient to compare its value with the 1974 minimum wage, which was approximately CR$4,500.00 per year.

10 However, there is no explicit income tax proposal. All the revenue is raised by the sales taxes, which accounts for their high rates (see Table 6), but could equivalently be raised by an income tax and a lower level of sales taxes.

11 It may be appropriate to remark that the indication in Table 6 that alcoholic beverages and tobacco should be lightly taxed or subsidised is based solely on equity considerations, for the share of these commodities in the budget of the poor is higher than in the budget of the rich. The optimal tax model ignores the negative effects associated with the consumption of these commodities.

5.1 Impact on household welfare

The impact of each of the tax designs in Table 6 on households, with Base Case B taken to be the pre-reform position, is presented in Tables 7A and 7B below.

Design I has about the same distributional consequences for urban and rural groups. In both sectors, the beneficiaries are the lowest four expenditure groups, and the two poorest groups enjoy a welfare gain equivalent to an increase in expenditure of approximately 16%. On the other hand, the richest group in each sector suffers a loss equivalent to a decline in expenditure of about 30%.

Comparing the welfare effects from Design I with those from Design II, it is clear that the inability to subsidise food markedly reduces the redistributive impact of the optimal taxes. Only urban households in the lower expenditure classes benefit significantly from Design II, with the highest gain (of 8.9%) accruing to the poorest group.

The last column of Tables 7A and 7B shows that the presence of a poll subsidy considerably increases the system's ability to transfer real income from richer to poorer households.[12] The impact of Design III is very much the same in both sectors. The first four expenditure classes experience a substantial welfare improvement, with the poorest group gaining the equivalent of an increase in its total expenditure as great as 175.81% in the urban sector and 166.62% in the rural sector. On the other hand, the five highest classes suffer losses that range from the equivalent of a reduction in expenditure of about 4% (for the fifth expenditure class) to more than 40% (for the richest group).

Table 7A

Equivalent Variations as a Percentage of Expenditure for the Tax Designs in Table 6 With Base Case B as the Initial Position : Urban Households

Urban Household Groups	Optimal Tax Designs		
	I	II	III
1	16.48	8.90	175.81
2	15.86	7.96	68.40
3	10.15	6.43	26.53
4	3.94	4.77	6.52
5	-0.59	3.17	-4.11
6	-7.21	0.33	-14.03
7	-14.48	-3.55	-23.28
8	-22.67	-7.49	-33.01
9	-28.61	-9.70	-40.58

12 The result that direct payments are more effective than selective indirect taxes (and subsidies) in achieving distributional goals is consistent with the findings of the optimal tax literature. See, for instance, Heady (1996).

Table 7B
Equivalent Variations as a Percentage of Expenditure for the Tax Designs in Table 6 - With Base Case B as the Initial Position : Rural Households

Rural Household Groups	Optimal Tax Designs		
	I	II	III
1	16.25	0.98	166.62
2	16.94	1.12	68.51
3	13.05	0.79	28.51
4	6.48	-0.31	8.78
5	-1.07	-2.45	-3.93
6	-8.48	-6.15	-14.40
7	-19.92	-11.77	-26.72
8	-24.99	-13.82	-33.30
9	-32.14	-17.27	-41.70

5.2 Impact on social welfare

Table 8 reports the potential social welfare gain in terms of UDI from implementing the optimal tax system for different assumptions about tax restrictions (corresponding to Cases 1, 2 and 3) and for different degrees of inequality aversion, with Base Case B as the initial position.

Table 8
Uniformly Distributed Income (UDI) Associated with Optimal Taxation for Different Tax Restriction Cases (1974 cruzeiros per year)

Tax Restriction	Degree of Inequality Aversion (ε)		
	0.1	1.0	2.0
Case 1	94.44	574.04	574.46
Case 2	94.37	133.99	64.46
Case 3	366.15	2,842.51	3,975.25

Note: Each entry in this Table shows the UDI value of a particular optimal tax structure reflecting a given assumption about taxation possibilities and for a given level of inequality aversion. See Tables 1,2, and 3 in Siqueira (1995) for the tax structure corresponding to each entry. Note that for the last column of the table above, the associated tax system is also given in Table 6 of the present paper.

Given that at $\varepsilon = 0.1$ the optimal tax structure in Cases 1 and 2 are very similar, it is not surprising that the social gain associated with each of these structures is approximately the same at this level of ε. However, as the degree of inequality aversion increases, the impossibility of subsidising food (Case 2) greatly reduces the potential welfare gain from optimal taxation.

On the other hand, the presence of uniform lump-sum transfers to households (Case 3) results in a remarkable social improvement, which increases with aversion to inequality. At $\varepsilon = 2.0$, for example, the social gain from implementing the optimal system of taxes and transfers (given in the last column of Table 6) is approximately equivalent to giving each family the equivalent of the annual minimum wage at 1974 prices. It should be emphasised that this is a pure welfare gain, with the government's net expenditure (after the lump-sum transfers) being unaffected.

A comparison of Table 8 with Table 5 shows that there is substantial scope for improvements on the reform proposals in Table 1 with respect to their effects on social welfare. It must, however, be noted that when only commodity taxes are available and food cannot be subsidised (Case 2), the social gain is modest for higher levels of inequality aversion, even with optimal taxes.

6 Sensitivity of the results to preference specification

This section presents the welfare effects of reform proposals in Table 1 when it is assumed that household preferences are of the Cobb-Douglas form. Tables 9A and 9B display the welfare change for each household group in urban and rural areas, respectively, and Table 10 shows the overall effect on social welfare. The pre-reform position is taken to be Base Case B.

A comparison of Tables 9A and 9B and Tables 3A and 3B shows that variations in household welfare are generally larger in the Cobb-Douglas model than in the LES. This results from the fact that the Cobb-Douglas formulation is more elastic than the LES one. Note that for the uniform rate proposal (6) the welfare effects are more favourable in the Cobb-Douglas model than in the LES since, due to its higher elasticity, the efficiency advantage of uniformity is greater in the former case. The differences between the two tables are quite small, however, and in almost all cases there is an agreement about who gains and who loses.

The differences between Tables 10 and 5 may be understood by considering the differences between Tables.9A and.9B and Tables 3A and 3B. For $\varepsilon = 0.1$, all reforms except the uniformity option (proposal (6)) cause more damage or are less beneficial in the Cobb-Douglas

preferences than in the LES case, whereas at higher levels of ε the social welfare effects are more favourable in the Cobb-Douglas model. Reform proposal (6), on the other hand, results in greater gain at ε = 0.1 and in lower loss at higher levels of inequality aversion in the Cobb-Douglas model than in the LES model. Again, this reflects the fact that the efficiency cost of rate differentiation is larger in the former system.

The rankings of reform proposals for the two demand systems are identical for ε = 0.1 and ε = 1.0.[13] On the other hand, for ε = 2.0, Table 5 indicates that one should be more or less indifferent to reform proposals (1), (2) and (3) and Base Case B (the pre-reform position) and that Base Case B is preferable to proposal (5), while Table 10 suggests that at that level of inequality aversion all but proposal (6) would improve social welfare. Further sensitivity analyses should be made in order to determine the desirability or otherwise of these proposals when there is strong aversion to inequality. It is fairly clear, however, that they should not be expected to have a substantial effect on social welfare.

Table 9A
Equivalent Variations as a Percentage of Expenditure for the Reform Proposals in Table 1 - With Base Case B as the Initial Position and Cobb-Douglas Preferences for Urban Households

Urban Household Group	Reform Proposal					
	(1)	(2)	(3)	(4)	(5)	(6)
1	3.80	3.84	5.85	9.68	3.58	1.59
2	3.42	3.47	5.26	8.38	3.68	2.03
3	2.69	2.74	4.08	5.99	2.93	2.43
4	2.04	2.09	3.00	3.76	2.03	2.41
5	1.48	1.53	2.12	2.02	1.41	2.29
6	0.54	0.60	0.71	-0.68	0.64	2.19
7	-0.65	-0.58	-0.99	-3.83	0.06	2.10
8	-1.80	-1.72	-2.69	-7.00	-0.89	1.60
9	-2.59	-2.50	-3.86	-9.08	-2.14	0.73

1 Note that although the UDI value of proposal (1) at ε = 0.1 has a positive sign in Table 5 and a negative sign in Table 10, the impact of this proposal at this level of ε is negligible both with the Cobb-Douglas and with the LES formulations.

Table 9B
Equivalent Variations as a Percentage of Expenditure for the Reform Proposals in Table 1 - With Base Case B as the Initial Position and Cobb-Douglas Preferences for Rural Households

Rural Household Group	Reform Proposal					
	(1)	(2)	(3)	(4)	(5)	(6)
1	0.04	0.06	-0.36	4.78	-1.62	-5.69
2	0.06	0.08	-0.42	4.25	-1.34	-5.33
3	-0.08	-0.06	-0.68	3.03	-1.37	-4.66
4	-0.52	-0.48	-1.31	0.97	-1.53	-3.52
5	-0.96	-0.92	-1.98	-1.29	-1.59	-2.60
6	-2.02	-1.96	-3.33	-4.27	-1.41	-1.59
7	-3.22	-3.14	-4.97	-8.30	-0.91	-0.12
8	-4.02	-3.94	-5.95	-10.43	-1.32	0.26
9	-5.13	-5.04	-7.32	-13.44	-1.87	0.54

Table 10
Uniformly Distributed Income (UDI) and Ranking for the Reform Proposals in Table 1 - With Base Case B as the Initial Position and Cobb-Douglas Preferences (1974 cruzeiros per year)

Reform Proposal	Degree of Inequality Aversion (ε)					
	0.1		1.0		2.0	
	UDI	Ranking	UDI	Ranking	UDI	Ranking
(1)	-5.17	3	63.38	4	51.20	4
(2)	-26.22	4	77.30	3	66.29	3
(3)	-59.75	5	97.93	2	87.27	2
(4)	-245.00	6	230.84	1	266.57	1
(5)	5.67	2	49.39	5	26.92	5
(6)	128.22	1	-41.84	6	-100.58	6

7 Summary and conclusions

The present study has attempted to shed some light on the question of to what extent selective indirect taxes can promote distributional goals in Brazil. The results indicate that the power of commodity taxation (and subsidization) for redistributing real income and improving social welfare essentially depends on the possibility of subsidizing food. In addition, considerably greater progress on income distribution and welfare improvement might be achieved if the government could use revenue from commodity taxation to finance transfer payments to households in a scheme equivalent to a negative income tax system.

The simulations also show that if the food subsidy or direct payments proposals are to be revenue neutral, substantial increases in the level of taxes on goods other than food are required. On the other hand, provided that some food subsidies or transfer schemes are in operation, only a few different rates of tax would be necessary to adequately accommodate redistributional considerations.

In short, the analysis may be seen as suggesting that a tax system based on two or three rates of VAT plus some food subsidies and/or direct income support for certain household groups supplemented by excise on luxury goods could effectively advance the objective of greater equity. Such a system does not appear to involve great administrative complexity. While true lump-sum transfers of the kind considered in the model may not be currently feasible, some support in the form of food coupons, for example, could very probably be operated satisfactorily. There are, of course, administrative and corruption problems associated with coupon schemes. Nevertheless, the analysis indicates that the welfare gains from implementing such a scheme are sufficiently large to offset these other considerations.

The conclusions of this study have been shown to be robust with respect to the specification of household preferences. One should bear in mind, however, that choices between work and leisure have not been allowed for, and hence effects of the tax changes proposed on work effort have been ignored. It should also be noted that the data used refer to 1975, and although in many respects they still may be seen as a reasonable representation of the current state of affairs (concerning income distribution and the tax structure, for example - at least for the broad classification of households and goods we have adopted), the proportion of the population living in urban areas has increased significantly, from about 60% in 1975 to about 75% in 1990. Nevertheless, it is expected that the calculations made and the conclusions reached in this study may provide a better understanding of the relationship between indirect tax policy and redistribution in Brazil and stimulate further research on food and income support programs.

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APPENDIX

Correspondence Between our Commodity Categories and the 1975 Intersector Transactions Matrix Categories

Our Categories	Code Numbers from the Matrix			
Food	0101091	0102001	0203001	0204001
	0205002	0206001	0291003	0291004
	0291005	0291006	0291008	0291091
	0301002	0302001	0302002	0303091
	2601001	2602001	2603001	2604001
	2605001	2605002	2607101	2607104
	2607191	2608001	2608002	2608003
	2608004	2609001	2610001	2610002
	2610091	2611001	2611093	2612001
	2613001	2613002	2614001	2614002
	2614003	2691001	2691091	2702001
Clothing	1999001	2402002	2402003	2404002
	2501001	2502091		
Housing	0101002	0101003	2001001	2003106
	2003193	2003203	2007002	2091001
	2091092	2299002	2302003	4001001
	4101001	5301001	5502001	0502092
Durables	1002091	1005102	1105091	1107001
	1191001	1191002	1191091	1207001
	1207002	1301002	1303001	1305002
	1305003	1307002	1308001	1308002
	1401001	1491001	1502003	1601001
	1602001	1802002	2302091	2491001
	2491002	2501003		
Personal Care	2199002	2299001	5504001	
Transport	1403002	1801001	2002001	2003101
	2003104	5204002	5502002	5503003
Recreation	1702091	1703091	2901002	2902001
	3099001			
Alcohol & Tobacco	2701101	2701201	2701301	2801001
	2802001			
Miscellaneous	2615001	2901001	5503001	5503005
	5503006			