COMPUTING OPTIMAL INDIRECT TAXES FOR BRAZIL

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Resumo: *A natureza regressiva do sistema tributário brasileiro tem sido uma fonte de preocupação já há um longo tempo. A ênfase nos impostos indiretos como fonte de receita é amplamente aceita como sendo uma das principais causas das desigualdades geradas pelo sistema. Tentando lidar com esse problema, a Constituição de 1988 estabeleceu que o principal imposto indireto (ICMS) poderia ser seletivo de acordo com a "essencialidade" do produto. As tentativas de se utilizar um imposto seletivo têm sido modestas, entretanto, e não parecem ter ajudado a promover o objetivo de melhorar a eqüidade do sistema. Isso pode ser em parte explicado pelo caráter vago do "critério de essencialidade" e pela falta de um maior entendimento das conseqüências da seletividade para a eficiência econômica e para a receita do Governo. O objetivo deste trabalho é analisar a estrutura apropriada dos impostos indiretos para o Brasil, pela utilização de um modelo de impostos ótimos computável. Ele procura caracterizar a estrutura tributária indireta que poderia permitir ao Governo alcançar certos objetivos redistributivos e arrecadar uma receita suficiente para financiar seus gastos ao mínimo custo em termos de eficiência.*

Palavras-chave: *Arrecadação Tributária; ICMS; Brasil.*

1 INTRODUCTION

The regressive nature of the Brazilian tax system has long been a source of concern for both economists and the public at large. The heavy reliance on indirect taxes as source of revenue is widely believed to be a major cause of the inequities of the system*. In an attempt to deal with this problem, the 1988 Constitution established that the main Brazilian indirect tax - the tax on the circulation of goods and transportation and communication services (ICMS) - could be selective according to the "essentiality of the product".

The moves towards a selective ICMS have been modest, however, and do not seem always to advance the objective of improving equity. This may in part be due to the vagueness of the "essentiality criterion" and to a lack of a better understanding of the consequences of selectivity for economic efficiency and government revenue. Meanwhile, a proposal to create a new value-added tax on goods and services by merging the ICMS and the tax on industrial products (IPI) is at the center of current policy debates. If this new tax does not embody some degree of selectivity, it is expected to have a negative impact on the already unequal distribution of the tax burden and government revenue.

To the best of my knowledge, there has been only one study which addresses the problem of indirect tax reform in Brazil by applying the tools of modern tax analysis. It is SAMPAIO DE SOUZA (1993)[(19)], which makes use of the theory of marginal reform to identify directions of changes in the indirect tax system that would improve social welfare. The marginal reform approach, however, applies only to "small" tax changes, while it seems that the achievement of distributional goals is likely to require more substantial changes in the tax structure.

The purpose of this paper is to analyse the appropriate structure of indirect taxes for Brazil in the light of the theory of optimal taxation. More specifically, by using a computable optimal tax model, it attempts to characterise the indirect tax structure that would allow the Brazilian government to achieve certain redistributional objectives and raise enough revenue to finance its expenditure at the least possible cost in terms of efficiency. The model is solved under different assumptions about the extent

* Empirical support for this view is provided by ERIS *et al.* (1983)[(8)], who show that the amount of indirect tax paid by households as a proportion of their disposable income decreases drastically as the level of income increases.

of the government's concern with inequality, the constraints on its ability to tax, the preferences of households and the required level of revenue. This approach has the advantage of being specific about the directions as well as the magnitudes of the desirable tax changes.

2 OPTIMAL TAX DESIGN AND THE QUESTION OF UNIFORMITY

The optimal structure of commodity taxes was first investigated, in the context of a single-person economy (or equivalently, an economy of identical individuals) by RAMSEY (1927)[17]. The problem he examined was one of choosing a set of commodity taxes that raised a given amount of government revenue with the least possible reduction in consumer utility.

The analysis of optimal commodity taxes in a many-consumer economy began with the seminal work of Diamond and Mirrlees who extended Ramsey's formulation to take account of the redistributive effects of taxation. The optimal tax problem as set out by them essentially involves choosing the optimal tax rates to maximise a Bergson-Samuelson social welfare function subject to the government's budget constraint.

The period since the publication of this pioneering research has seen much progress in the theoretical and empirical analysis of the optimal tax problem and currently a voluminous literature exists on the subject*. A key feature of this literature is the discussion of whether or not a uniform system of commodity taxes - which applies the same percentage rate to all consumer goods and services - is preferable to a differential system**.

RAMSEY (1927)'s[17] results provide important insights into this question. The so-called Ramsey rule establishes that the optimal set of commodity taxes reduces the compensated demand for every commodity by (approximately) the same proportion***. Clearly, this rule stands in contrast to the conventional view that a uniform rate of tax on all consumer goods is necessarily best at promoting economic efficiency. There are only two cases where uniform taxation is consistent with the Ramsey criterion: first, where

* Comprehensive surveys of the theory of optimal taxation are AUERBACH (1985)[4], STIGLITZ (1987)[21]. A more introductory account of the theory as well as examples of its practical applications is NEWBERY, STERN (1987)[16].

** An account of the theoretical results and arguments concerning this issue is to be found in STERN (1990)[20].

*** This result depends on the optimal taxes being small.

labour (the untaxed "numeraire") is in completely inelastic supply*, and second, where labour (leisure) is implicitly separable from all goods** . Apart from these special cases, however, the Ramsey rule does not prescribe uniform taxation and instead indicates that taxes should be higher on goods whose demands are relatively insensitive to price changes. In fact, under the assumption of independent compensated demands for consumer goods, the Ramsey result simplifies to the so-called "inverse elasticity rule" which says that the tax rate should be inversely proportional to the price elasticity of demand of a commodity.

It has been recognized, however, that the imposition of efficiency cost-minimising commodity taxes will in general have a regressive impact on income distribution, for goods with price-insensitive demands are in many cases necessities such as food*** . This reinforces the argument that the single-consumer analytical framework is inadequate for the formulation of policy-relevant propositions.

The way distributional considerations modify the design of optimal commodity taxes is captured by the so-called many-person Ramsey rule (also referred to as the Diamond-Mirrlees rule). It says that the proportional reduction in compensated demand resulting from taxation should be lower for that good that is consumed more by people whose social marginal valuation of income is high (generally the poor)**** .

Thus, while efficiency considerations point towards the taxation of necessities, the introduction of distributional concerns indicates that some progression in the taxation of commodities may be desirable.

The case for employing commodity taxes to promote redistribution depends, however, on the extent to which income tax tools can be used to achieve the same objective. For it has been shown that under certain

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* In this case the classic rule is to tax labour alone, which is equivalent to taxing all goods at the same rate. See ATKINSON, STIGLITZ (1972)[3], for example, for a demonstration of the optimality of this solution.

** Implicit separability requires that the marginal rate of substitution between any two goods be independent from the demand for leisure at constant utility, and means that all goods complement leisure equally. The implication of this feature for the Ramsey rule is shown in DEATON (1981)[6].

*** Calculations of tax rates based on the RAMSEY (1927)[17] rule using empirically-estimated elasticities provide some evidence for this supposition. See ATKINSON, STIGLITZ (1972)[3], HARRIS, MACKINNON (1979)[12] and KAISER, SPAHN (1989)[14].

**** See ATKINSON and STIGLITZ (1972)[3] for the derivation of this rule.

circumstances the presence of an income tax implies that commodity taxes should be uniform. The conditions for uniformity, nevertheless, depend on the type of income tax available. If there is an optimal non-linear income tax, then uniform commodity taxation is optimal provided that individuals have identical preferences (differing only in their wage rates) and that goods are weakly separable from leisure*.

With an optimal linear income tax, which comprises a uniform poll subsidy or tax and a constant marginal rate of tax on wage income, DEATON (1979)[5] has shown that the optimality of uniform commodity taxes requires linear Engel curves for goods in addition to identical preferences and weak separability between goods and leisure** .

DEATON, STERN (1986)[7] have extended this result to show that if the government can make lump-sum transfers that vary with (observable) household characteristics, then the uniformity result holds also where households are allowed to differ in tastes, provided that the differences are fully captured by different Engel curve intercepts.

It is clear that it is not possible to derive general statements from optimal taxation rules about the desirable degree of non-uniformity in the tax system or about the commodities that should bear higher taxes than others. As the results stated above indicate, the answer for these issues depends crucially on the combination of four factors, namely:

a) the set of tax tools at the disposal of the government;

b) the way consumers differ from each other;

c) the structure of preferences;

d) the social weights assigned to the welfare of different consumers and income groups.

Further insights into the design of optimal taxation can be obtained by the specification and solution of numerical models whose structure and

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* Weak separability from leisure means that the marginal rate of substitution between any two goods is independent of leisure. This result is due to ATKINSON, STIGLITZ (1972)[3].

** This is a generalisation of the result obtained by ATKINSON (1977)[2] who established the desirability of uniform commodity taxation, given an optimal linear income tax, for the case where preferences are represented by the Linear Expenditure System.

parameters reflect particular assumptions concerning each of the factors enumerated above. Obviously, the choice of assumptions should be influenced by the specific circumstances of the country under consideration.

Following the approcah described above, our aim in this paper is to specify and solve a computable optimal indirect tax model for Brazil.

3 THE MODEL

The assumptions regarding the production side of the economy are kept deliberately simple in order to concentrate on the twin concerns of consumer welfare and revenue collection. Consequently, there are no profits and producer prices are constant. This means that the effect of commodity taxes on consumer welfare works entirely through changes in consumer prices, ignoring all effects from changes in factor prices and profits*. The behaviour of households and the taxation problem faced by the government are detailed below.

3.1 HOUSEHOLDS

The model distinguishes between urban and rural populations, a division that highlights two aspects of the dualism inherent in the Brazilian economy which may crucially influence tax design, namely: a) the severe constraints on the taxation of transactions within the rural sector, and b) the disparities in the living standards of rural and urban residents. The rural and urban populations are each divided into nine group's of households according to household expenditure. All households in a given expenditure group are assumed to be identical, so that each group's behaviour may be described by a "representative" household.

The absence of wage and earnings data makes it imperative to assume that each household takes consumption expenditure as exogenously

* Another reason for making these assumptions is the lack of reliable data on profits and factor returns. In the empirical literature in this area the traditional procedure used to exclude pure profits is to assume either constant returns to scale (and competitive conditions in production) or 100 percent taxes on profits. Although the constancy of producer prices involves more restrictive conditions (STERN, 1987)[20], the assumption of full shifting of commodity taxes into consumer prices is adopted in most incidence analyses, including the only one existing for Brazil, namely, ERIS *et al.* (1983)[8]. For a discussion of the role of these assumptions in optimal tax models, see STIGLITZ, DASGUPTA (1971)[22].

given. In addition, it is supposed that there are no savings, so that income and total consumption expenditure are interchangeable*. Further, it is assumed that, in addition to the income from their supply of labour, households may also receive lump-sum payments from the government, which are constrained to be the same for all households within a sector.

The model is now specified as follows. Urban households, indexed by "l", face a vector of urban consumer prices, "q", and rural households, indexed by "m", face a vector of rural consumer prices, "s". The budget constraint for each representative household in urban and rural areas then is:

$$\sum_{i=1}^{n} q_i x_i^{l} = y^{l} + I = Y^{l} \qquad (1)$$

and

$$\sum_{i=1}^{n} s_i x_i^{m} = y^{m} + I' = Y^{m} \qquad (2)$$

respectively, where:

i = index over the consumption goods;
x_i^l (x_i^m) = consumption of good "i" by household "l (m)";
y^l (y^m) = fixed labour income of household "l (m)";
I (I′) = lump-sum transfer received by each household in urban (rural) locations;
Y^l (Y^m) = total income received by household "l (m)".

Each household "l" and each household "m" is assumed to choose consumption goods so as to maximise their utilities subject to (1) and (2), respectively. This leads to the demand functions

$$x_i^l(q,I) \text{ and } x_i^m(s,I)$$

and the indirect utility functions

$$v^l(q,I) \text{ and } v^m(s,I).$$

* Together these assumptions imply that the supply of labour is inelastic.

3.2 GOVERNMENT

The government is assumed to be interested in using taxes both to raise a certain amount of revenue and to redistribute income. In view of the severe constraints faced by the Brazilian government on the implementation of a progressive and comprehensive system of income taxation*, the case where commodity taxes are the only policy instruments at the disposal of the government is emphasised. However, this situation will be compared with the more general case where, in addition to commodity taxes, the government can also grant lump-sum subsidies to households which may differ across rural and urban locations. It is interesting to note that allowing for poll subsidies to households (in addition to commodity taxation) is equivalent to allowing a linear income tax characterised by an exemption level and a constant marginal rate of tax both above and below this level** .

3.2.1 The Government's Social Welfare Function

It is assumed that the government's distributional objectives can be expressed through a social welfare function, "W", based on the households' utility levels. In keeping with most studies, it is supposed that this function has the following specific form:

$$W = \frac{1}{(1-\varepsilon)}\left[\sum_{l=1}^{9} h^l v^l (q, I)^{1-\varepsilon} + \sum_{m=1}^{9} h^m v^m (s, I')^{1-\varepsilon}\right] \qquad (3)$$

when "ε" is not equal to "1", and

$$W = \sum_{l=1}^{9} h^l \log v^l (q, I) + \sum_{m=1}^{9} h^m \log v^m (s, I') \qquad (3')$$

* This is reflected by the fact that of Brazil's 60 million economically-active individuals, it is estimated that just 6 million regularly report personal earnings, and, of that total, only 3 million effectively pay income tax (EXAME, 1993)[9].

** Since there are no savings, a uniform tax on all commodities is equivalent to a proportional tax on income. Below the exemption level this tax is lower than the poll subsidy received by a household, so that the scheme corresponds to a negative income tax.

when "ε" is equal to "1"

where:
$h^l(h^m)$ = fraction of households in the group represented by household "*l* (m)";
ε = a parameter reflecting the government's aversion to inequality (Atkinson, 1970), with "ε ≥ 0".

When "ε" is zero, (3) corresponds to the classical utilitarian welfare function, which places equal weights 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. For example, a value of "1" for "ε" implies that if the utility of household "*l*" is twice that of household "m", then a marginal increase in the utility of household "m" is worth twice the marginal increase in the utility of "*l*"; a value of 5 for indicates that a marginal increase in the utility of household "m" is worth 32 times a marginal increase in the utility of household "*l*". As "ε" approaches infinity, the social welfare function (3) approximates the Ralwsian "maximin" criterion, by considering the utility only of the worst-off household. Optimal taxes are computed for values of "ε" of 0.1, 0.5, 1, 2, and 5 in order to cover a broad range of distributional judgements.

3.2.2 The Government's Budget Constraint

Since the government raises revenue to cover its expenditures, "R", on some given activities, and also to finance the lump-sum payments to households, it faces a budget constraint:

$$R + I\sum_{l=1}^{9} H^l + I'\sum_{m=1}^{9} H^m = \sum_{i=1}^{n} t_i \sum_{l=1}^{9} H^l x_i^l + \sum_{i=1}^{n} t'_i \sum_{m=1}^{9} H^m x_i^m \quad (4)$$

where:
H^l (H^m) = number of households in group "*l* (m)";
t_i (t'_i) = value of the tax on good "i" in urban (rural) areas.

Under the assumptions of the model:

$$t_i = q_i - p_i \quad (5)$$

$$t'_i = s_i - p_i \quad (6)$$

for i = 1,...,n, where:
p_i = fixed producer price of good "i", which is to be normalised at unity.

3.2.3 Tax Restrictions

The model recognises that the government may not be able to tax all goods at will. In particular, it allows for the fact that the conventional features of agriculture in Brazil have effectively prevented the government from taxing internal trade within that sector*. In addition, it admits that due to the possibility of arbitrage between the urban and rural sectors the government may be constrained to tax certain goods in both sectors at the same rate. Accordingly, two kinds of restrictions on the possible structure of commodity taxes are considered: a) goods produced and consumed within the rural area cannot be taxed or subsidised, and b)some goods must be taxed at the same rate in rural and urban areas.

Following HEADY, MITRA (1986)[13], these restrictions are represented as:

$$Cs = Cp \qquad (7)$$

$$Dq = Ds \qquad (8)$$

respectively, where:

C and D = diagonal matrices with elements of "1" and "0", which select-the prices for which the restriction must hold.

In order to examine the effects of constraints on the government's ability to make lump-sum transfers, the following additional conditions are imposed:

$$I = I' \qquad (9)$$

$$I = 0 \qquad (10)$$

* The difficulties of taxing agriculture are associated with, among other things, the presence of a large number of small-scale farmers and own consumtpion of agricultural goods (because this does not involve market transactions).

Expression (9) reflects the case where the government is constrained to set the value of the poll subsidies uniformly across rural-urban locations, whereas the combination of (9) and (10) reduces the model to the case where no lump-sum transfers are possible.

3.2.4 The Government's Problem

The government's problem is then defined as one of choosing commodity tax rates (or, equivalently, consumer prices) and poll subsidies to maximise the social welfare function (3) subject to the budget constraint (4) and the tax restrictions (7), (8), (9) and (10).

The Lagrangian for this problem is:

$$L = \frac{1}{1-\epsilon}\left[\sum_{l=1}^{9} h^l (v^l)^{1-\epsilon} + \sum_{m=1}^{9} h^m (v^m)^{1-\epsilon}\right]$$

$$+\lambda\left[\sum_{i=1}^{n}(q_i - p_i)\sum_{l=1}^{9} H^l x_i^{\,l} + \sum_{i=1}^{n}(s_i - p_i)\sum_{m=1}^{9} h^m x_i^{\,m} - I\sum_{l=1}^{9} h^l - I'\sum_{m=1}^{9} H^m - R\right] \qquad (11)$$

$$+\phi^T[Cs - Cp] + \mu^T[Dq - Ds] + v\,[I - I'] + \omega I$$

where:

(5) and (6) have been substituted for "t_i" and t_i in (4), respectively;
λ, v and ω = scalar multipliers corresponding to (4), (9) and (10), respectively;
ϕ and μ = vectors of multipliers corresponding to (7) and (8), respectively;
T denotes the transpose operation.

The first-order conditions for "q_i", "s_i", "I" and "I'" are:

$$\frac{\delta L}{\delta q_i} = \sum_{l=1}^{9} h^l (v^l)^{-\epsilon}\left(\frac{\delta v^l}{\delta q_i}\right) + \lambda\left[\sum_{l=1}^{9} H^l x_i^l + \sum_{j=1}^{n}(q_j - p_j)\sum_{l=1}^{9} H^l\left(\frac{\delta x_j^{\,l}}{\delta q_i}\right)\right] \qquad (12)$$

$$+\mu_i d_i = 0, \qquad i = 1, \ldots, n$$

$$\frac{\delta L}{\delta s_i} = \sum_{m=1}^{9} h^m (v^m)^{-\epsilon} \left(\frac{\delta v^m}{\delta s_i} \right) + \lambda \left[\sum_{m=1}^{9} H^m x_i^m + \sum_{j=1}^{n} (s_j - p_j) \sum_{m=1}^{9} H^m \left(\frac{\delta x_j^m}{\delta s_i} \right) \right] \quad (13)$$

$$+ \phi_i c_i - \mu_i d_i = 0 \qquad i = 1,\ldots,n$$

$$\frac{\delta L}{\delta I} = \sum_{l=1}^{9} h^l (v^l)^{-\epsilon} \left(\frac{\delta v^l}{\delta I} \right) \quad (14)$$

$$+\lambda \left[\sum_{l=1}^{n} (q_i - p_i) \sum_{l=1}^{9} H^l \left(\frac{\delta x_i^l}{\delta I} \right) - \sum_{l=1}^{9} H^l \right] + v + \omega = 0$$

$$\frac{\delta L}{\delta I} = \sum_{m=1}^{9} h^m (v^m)^{-\epsilon} \left(\frac{\delta v^m}{\delta I'} \right)$$

$$+\lambda \left[\sum_{i=1}^{n} (s_i - p_i) \sum_{m=1}^{9} H^m \left(\frac{\delta x_i^m}{\delta I'} \right) - \sum_{m=1}^{9} H^m \right] - v_{\overline{i}} 0 \quad (15)$$

where:
$c_i = 1$, when the rural tax rate on good "i" must be zero and "c_i=0" otherwise;
$d_i = 1$, when good "i" must have the same consumer price in rural and urban areas and "d_i=0" otherwise.

4 HOUSEHOLD UTILITY AND DEMAND FUNCTIONS

The main set of results are derived using the Linear Expenditure System (LES) to specify the households' demand and utility functions. For purposes of comparison, some results for the Cobb-Douglas specification are also presented.

The demand equations corresponding to the LES can be written as:

$$q_i x_i = q_i \alpha_i + \beta_i \left(Y - \sum_{j=1}^{n} q_j \alpha_j \right), \quad i = 1, \dots, n \qquad (16)$$

where:
x_i = the quantity of the "i^{th}" good consumed, "q_i" its price;
Y = total expenditure on the "n" goods;
α_i and β_i = parameters that satisfy the constraints:

$$\sum_{i}^{n} \beta = 1, \qquad \beta i > 0, \qquad x_i . \alpha_i > 0$$

for all "i"*.

The indirect utility function, "v", for the LES is:

$$v = \frac{\left(Y - \sum_{i=1}^{n} q_i \alpha_i \right)}{\prod_i q_i^{\beta i}} \qquad (17)$$

Equation (16) is often interpreted as stating that the consumer first purchases "subsistence" or "committed" quantities of each good, "α_i (i=1,..,n)", on which a portion "$\Sigma q_i \alpha_i$" of total expenditure is spent. The remainder of the consumer's total expenditure, Y $-\Sigma q_i \alpha_i$, termed "supernumerary expenditure", is then spent among the "n" goods according to fixed proportions "β_i(i=1,...,n)"** .

* These restrictions are required for consistency with utility maximisation subject to a budget constraint.

** This interpretation allows the indirect utility function (17) to be seen as taking "real expenditure" as an indicator of welfare, in that it expresses utility as a function of supernumerary expenditure deflated by a price index, the latter calculated as the weighted geometric mean of the prices with the marginal shares "β_i" as weights.

If all of the "α_i's" equal zero, the model reduces to the Cobb-Douglas case, so that demands are given by:

$$x_i = \frac{w_i Y}{q_i}, \quad i = 1,...,n \tag{18}$$

where:
w_i = the (average) budget share of good "i";

and the underlying indirect utility function is of the form:

$$v = \frac{Y}{\prod_i q_i^{w_i}} \tag{19}$$

5 THE DATA

The data on household expenditure are obtained from "Estudo Nacional da Despesa Familiar" - ENDEF (IBGE, 1981). Thus, the expenditure levels that define household groups in the model are those used in the ENDEF classification.

The government's revenue requirement ("R" in equation (4)) is assumed to be equal to the net revenue raised from households in the year of the ENDEF survey, which was approximately 10 percent of the total sum of all household expenditures, as estimated from the 1975 Matrix of Intersectoral Transactions (FUNDAÇÃO IBGE, 1987)[11].

Consumption goods are classified in nine broad categories, namely: food, clothing, housing, durables, personal care, transport, recreation, beverages and tobacco, and miscellaneous. The "β" parameters of the LES, termed marginal budget shares, for each of those categories are calculated by using the average budget shares, ROSSI, NEVES (1987)[18] estimates of the expenditure elasticities, and the property of the LES that the expenditure elasticity for a given commodity equals the ratio of the marginal budget share to the average budget share for that commodity*. By their turn, the "α" parameters are derived, from equation (16), using the "β" estimates, consumer prices (estimated from the 1975 Matrix of Intersector Transactions), and assuming that per capita total committed expenditure ($\Sigma q_i \alpha_i$) for every household equals 90 percent of the per capita total expenditure of the poorest household** .

6 RESULTS

Among many different possible assumptions about the government's ability to tax, three cases have been selected to be presented here, which are described below. The sensitivity of the results to the form of household preferences and to the level of revenue raised is tested next.

6.1 CASE 1: THE RATE OF TAX FOR EACH COMMODITY IS THE SAME ACROSS RURAL-URBAN LOCATIONS

TABLE 1 presents the optimal tax rates for the case where, in view of the difficulties of avoiding tax arbitrage between rural and urban locations as well as due to concerns about the political acceptability of the tax system, the government chooses the same set of taxes for both rural and urban areas.

The lessons from this Table can be summarised as follows:

a) if the government is only slightly concerned with redistribution, food ought not to be taxed while there ought to be an approximately uniform tax on all other goods except beverages and tobacco, which should enjoy a significantly lower rate than those on the other taxed items;

* Some adjustments had to be made to ROSSI, NEVES[(18)], estimates since their commodity categories do not exactly coincide with those defined here.

** These correspond to those households in the lowest expenditure group in rural areas, which have the smallest total expenditure per head. Note that by fixing total committed expenditure in per capita terms, total committed expenditure per household is made proportional to household size - a phenomenon observed, for example, by LLUCH, POWELL, WILLIAMS (1977)[(15)] and one which is consistent with the subsistence interpretation of the "α 's". The procedure, however, ignores possible economies of scale.

TABLE 1
Optimal Tax Rates with Varying Degrees of Inequality Aversion: Case 1
(percent)

Commodity Group	*Degree of Inequality Aversion ∈*				
	0.1	0.5	1.0	2.0	5.0
Food	-0.5	-31.5	-56.7	-74.7	-77.7
Clothing	13.3	20.4	26.5	34.5	36.7
Housing	14.8	24.7	29.5	31.1	31.7
Durables	17.8	39.4	56.9	65.2	63.1
Personal care	13.9	22.7	29.8	38.1	41.0
Transport	16.5	32.6	43.6	51.3	52.5
Recreation	16.4	31.5	41.3	48.4	49.8
Beverages & Tobacco	8.1	-0.7	-5.1	4.9	13.9
Miscellaneous	15.6	28.1	35.0	38.6	38.6

b) if there is a stronger concern for inequality, food should be subsidised and the tax rate on beverages and tobacco should be still lower, the revenue being recovered by increasing the taxes on all other goods, particularly on durables, transport, and recreation*;

c) *with an increase in inequality aversion, the rate of subsidy for food* should increase while the rate of tax should increase for all the other goods. These rates, however, are fairly insensitive to increases in the degree of inequality aversion as the parameter

* It may be appropriate to observe that the result that alcoholic beverages and tobacco should be lightly taxed is based solely on equity considerations, ignoring the negative effects associated with the consumption of these goods (on which grounds the heavy taxes commonly levied on them are justified).

becomes greater than 2.0. This probably indicates that when the rates are those for the optimum at "$\in = 2.0$", there is little scope to promote *further redistribution through rate differentiation.*

These results suggest that the whole weight of the equity-improving aspect of the indirect tax system should be borne by food subsidies. This reflects the outmost importance of food in the consumption outlays of poorer households.

6.2 CASE 2: FOOD IS UNTAXED

TABLE 2 reports the results for the case where, in addition to the impossibility to discriminate between rates on locational grounds, the government cannot tax or subsidise food. This additional restriction is meant to reflect the practical difficulties of taxing food within the rural sector.

The effect of food being untaxed can be seen by comparing TABLES 1 and 2. At a low level of inequality aversion, "$\in = 0.1$", the optimal tax estimates are virtually the same in the two tables since the rate of food even in the absence of the restriction is very close to zero.

On the other hand, at higher levels of inequality aversion, the inability to subsidise food permits a large reduction in the tax rates on all the other goods. It also implies a higher degree of rate differentiation across taxable items. In TABLE 2, for "$\in = 0.5$", for example, the subsidy on beverages & tobacco is much higher than it is in TABLE 1 and the ratio between the highest and the lowest (positive) tax rates is 5:1 compared with 2:1 in TABLE 1. This represents an attempt to transfer to beverages & tobacco, housing, clothing, and personal care some of the redistributive role associated with food subsidies in CASE 1, by switching taxation from these goods to those with higher degree of luxury. Note, however, that only in the case of housing does the rate decrease monotonically with increasing inequality aversion. The rates on clothing personal care decline initially as "$\in$" increases, reaching their lowest values at a moderate level of inequality aversion ($\in = 1.0$), and then they increase with "$\in$". Correspondingly, the subsidy on beverages & tobacco is highest for "$\in = 1.0$" and decreases for higher values of the parameter.

TABLE 2
Optimal Tax Rates with Varying Degrees of Inequality Aversion: Case 2
(percent)

Commodity Group	Degree of Inequality Aversion				
	0.1	0.5	1.0	2.0	5.0
Food	0.0	0.0	0.0	0.0	0.0
Clothing	13.0	5.9	0.4	1.8	2.6
Housing	14.6	11.3	5.3	-1.0	-1.3
Durables	17.5	29.2	43.9	49.4	47.4
Personal care	13.7	9.5	7.1	11.2	12.9
Transport	16.3	24.2	34.0	41.5	41.9
Recreation	16.2	22.9	30.7	37.0	37.5
Beverages & Tobacco	7.9	-19.7	-44.6	-38.6	-28.6
Miscellaneous	15.5	20.5	24.7	26.1	25.4

This is because beverages & tobacco, personal care, and in particular clothing, are more important in the consumption bundle of middle-income households. Consequently, as aversion to inequality reaches a level where one is primarily concerned with the welfare of the very poor, there is a shift in taxation towards those goods and away from housing, which figures heavily in the budget of low-income households.

Meanwhile, the tax rates on the categories that are chiefly consumed by high-income families (i.e., durables, transport, recreation, and miscellaneous) become very high with increased inequality aversion. Nevertheless, they are lower than the corresponding rates in TABLE 1, indicating that the impossibility to subsidise food has reduced the redistributive power of the tax system.

6.3 CASE 3: THE GOVERNMENT CAN PAY A UNIFORM SUBSIDY TO ALL HOUSEHOLDS

The results for the case where the government can make uniform lump-sum tranfers to households are presented in TABLE 3. Comparison of this TABLE with TABLE 1 shows that, as expected, the payment of an *optimal subsidy to all households requires a* substantial increase in all the tax rates and simultaneously drastically reduces the difference among them. This is because lump-sum subsidies are more efficient instruments to achieve redistribution (they are actually non-distortionary, by definition) than are differential commodity taxes, and hence *it is desirable to rise* commodity taxation in order to finance lump-sum subsidies to households. Nevertheless, at higher levels of inequality aversion, food should still be subsidised.

TABLE 3

Optimal Tax Rates and Poll Subsidy with Varying Degrees of Inequality Aversion: Case 3 (tax rates in % and poll subsidy in thousands of 1974 cruzeiros per year)

Commodity Group	Degree of Inequality Aversion		
	0.1	1.0	2.0
Food	10.4	-8.3	-14.7
Clothing	29.7	45.1	48.5
Housing	30.6	46.0	48.3
Durables	35.0	65.2	70.9
Personal care	30.6	47.8	51.4
Transport	33.1	55.2	59.5
Recreation	32.8	53.4	57.2
Beverages & Tobacco	26.8	36.9	40.0
Miscellaneous	31.3	48.3	50.8
Poll subsidy	3.956	6.821	7.143

6.4 THE EFFECT OF USIG COBB-DOUGLAS UTILITY FUNCTIONS

The optimal taxes for the Cobb-Douglas specification of the households' preferences are reported in TABLE 4. A comparison of this TABLE with TABLE 1, where the linear expenditure system is used, shows that the same basic lessons emerge from it. For instance, as in TABLE 1, the results in TABLE 4 indicate that for moderate and high levels of inequality aversion the optimal tax system involves a subsidy for food, a low tax on alcoholic beverages and tobacco, and high taxes on all other commodities, particularly on durables, transport and recreation.

6.5 THE EFFECT OF INCREASING REVENUE REQUIREMENT

TABLE 5 shows the optimal tax structure for two different levels of the government revenue requirement, corresponding to 15 percent and 20 percent of the households' total expenditure. The results in this TABLE and those in TABLE 1 (where an amount of revenue equal to 10 percent of total household expenditure is raised) are qualitatively similar for all values of the inequality aversion parameter, though, as one would expect, larger revenue requirements bring about a reduction in the subsidy for food and increase the rate of tax for the other goods.

TABLE 4

Optimal Tax Rates with Varying Degrees of Inequality Aversion: Case 1 with Cobb-Douglas Utility Functions (percent)

Commodity Group	Degree of Inequality Aversion		
	0.1	1.0	2.0
Food	5.8	-27.0	-49.3
Clothing	10.3	15.8	24.7
Housing	11.6	22.7	28.3
Durables	14.3	44.4	62.3
Personal care	10.8	19.5	29.7
Transport	14.0	45.7	66.8
Recreation	14.0	43.6	63.0
Beverages & Tobacco	8.0	-0.6	0.7
Miscellaneous	14.0	42.7	60.6

TABLE 5
Optimal Tax Rates with Varying Degrees of Inequality Aversion and for Different
Revenue Requirements Case 1 (percent)

Commodity Group	Degree of Inequality Aversion ∈					
	0.1		1.0		2.0	
	I	II	I	II	I	II
Food	4.6	9.6	-48.8	-40.9	-64.0	-53.2
Clothing	18.4	23.7	31.6	36.8	38.8	43.0
Housing	19.9	25.1	33.7	37.9	35.0	39.0
Durables	22.9	28.2	61.9	67.0	68.2	70.9
Personal care	19.0	24.3	34.6	39.5	42.1	46.2
Transport	21.4	26.5	46.8	50.1	53.3	55.3
Recreation	21.3	26.3	44.5	47.8	50.6	52.8
Beverages & Tobacco	13.7	19.5	5.5	17.2	18.9	33.5
Miscellaneous	20.6	25.7	38.6	42.1	41.4	44.1

NOTE : Case I refers to 15 percent of expenditure while Case II refers to 20 percent of expenditure.

7 FINAL REMARKS

It should be noted that since the optimal tax system represents a large departure from the current tax structure and may thus involve high administrative and political costs, its full implementation may be undesirable or infeasible. However, the optimal tax estimates can still be useful as a guide to the formulation of politically - and administratively - acceptable tax reforms. Therefore an interesting exercise that complements the present analysis, but due to lack of space has to be postponed to a later paper, is the investigation of the welfare effects of alternative partial reform packages elaborated in the light of the results presented here. A comparison of the distributional effects of such reforms with the effect of imposing a flat rate of tax on all commodities can provide an idea of what is to gained in terms of social welfare from a selective indirect tax system.

Abstract: The regressive nature of the Brazilian tax system has long been a source of concern. The heavy reliance on indirect taxes as source of revenue is widely believed to be a major cause of the inequities of the system. In an attempt to deal with this problem, the 1988 Constitution established that the main Brazilian indirect tax (ICMS) could be selective according to the "essentiality" of the product. The moves towards a selective tax have been modest, however, and do not seem always to advance the objective of improving equity. This may be in part due to the vagueness of the "essentiality criterion" and to a lack of a better understanding of the consequences of selectivity for economic efficiency and government revenue. The purpose of this paper is to analyse the appropriate structure of indirect taxes for Brazil by using a computable optimal tax model. It attempts to characterize the indirect tax structure that would allow the Brazilian government to achieve certain redistributional objectives and raise enough revenue to finance its expenditure at the least possible cost in terms of efficiency.

Key Words: Tax Revenue; Indirect Taxes; Brazil.

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