SIMULATING BRAZIL'S TAX-BENEFIT SYSTEM USING BRAHMS, THE BRAZILIAN HOUSEHOLD MICRO-SIMULATION MODEL

1. INTRODUCTION

Despite raising an amount of taxes that represents nearly 37% of the country's GDP and spending over half of this revenue on social programmes, the Brazilian government has not been able to significantly alleviate inequality and poverty. In fact, Brazil is among the 10 most unequal countries in the world and about 33% of its population still lives in poverty (some 15% in extreme poverty).[1] Brazil is an exception to the observed international pattern, where high income inequality is generally associated with low levels of tax revenue as a proportion of GDP. In Figure 1[2], we notice that the United Kingdom and Spain, for example, with a similar tax burden to that of Brazil, have much lower income inequality as indicated by the Gini coefficient. On the other hand, Mexico and Chile, with Gini coefficients close to that for Brazil, have a much lower tax burden.

A number of studies have provided evidence that, to a great extent, this situation is due to the inadequate targeting of public expenditures[3]. The distributive impact of the financing of these expenditures, however, has received less attention. In particular, there are few studies that estimate the *net* redistributive effect of the tax and benefit policies.[4] This issue is particularly important for a country such as Brazil where tax revenues are raised mainly from taxes which fall indiscriminately on all households.

This paper, thus, investigates the redistributive impact of taxes and government cash transfers among households in Brazil. In order to highlight the need of reforming the Brazilian tax-benefit system, we also compare its redistributive performance with that of some countries with a similar tax burden as a percentage of GDP. The paper is structured in four sections. After this introduction, section 2 discusses the method used in this paper, microsimulation modelling. Section 3 briefly describes the taxes and cash transfers considered in this study and the main procedures and data used in our calculations. Section 4 presents and discusses the results. Section 5 concludes.

2. METHOD: MICROSIMULATION

In order to evaluate the redistributional impact of the Brazilian tax-benefit system, one needs information about how taxes and benefits operate at the individual level. Because the necessary information is often not available in survey data, it is necessary to simulate these variables. For this we use a tax-benefit microsimulation model. In this section we consider the steps necessary to create such a tax-benefit model.[5]

[1] See Barros et al., 2000.
[2] All figures and tables in this paper are displayed at the end of the text.
[3] See, among others, Amsberg et al, 2000; Barros and Foguel, 2002; Hoffmann, 2001, Ramos, 2000.
[4] To the best of our knowledge, the only studies in Brazil that analyse the distributive impact of public policies simultaneously taking account of both sides of the budget – taxes and spending – are Siqueira, Nogueira e Levy (2002a, 2002b).
[5] In this paper we draw upon model development lessons learned by a number of the authors as part of the EUROMOD project and described in Immervoll and O'Donoghue (2001).

Microsimulation Modelling

Due to the great diversity observed among the population and the complexity of the Brazilian tax-benefit system, the redistributive analysis of the impact of social and fiscal policies requires that a high level of disaggregation be used in order to capture in fine detail their effects on the various types of individuals, families and households. Ultimately, it is the social and economic diversity typically found in the national populations that determines how economic agents will be affected by the tax and benefit rules. On the other hand, as different social programs interact with each other and with the tax system, it is crucial to take explicitly into account the interdependencies within the whole tax-benefit system.

Typically hypothetical families have been used to examine the operation of taxes and benefits and the impact of reforms. Although a useful method for illustration purposes and for comparison across countries, the approach is not very satisfactory for looking at tax-benefit policy in a country as usually families which are considered "typical" form in fact only a very small proportion of the population. It is desirable therefore to look at the population as a whole using representative micro-datasets.

An approach that follows this method is microsimulation modelling. Recent advances in information technology and the availability of large-scale datasets have allowed and stimulated the development of these models. Microsimulation models are computer programs that calculate tax liabilities and benefit entitlements for individuals, families or households in a nationally representative micro-data sample of the population. The model calculates each element of the tax-benefit system in the legal order so that interactions between different elements of the system are fully taken into account. Calculations for each individual, family or household are weighted to provide results at the population level.

By incorporating the interactions of different elements of the tax-benefit system and by taking full account of the diversity of characteristics in the population, this approach allows a very detailed analysis of the revenue, distributional and incentive effects of the individual policy instruments and the system as a whole. In particular, they give a great deal of flexibility to analysts. For example:

- They simulate policy instruments that may not already exist in the micro-datasets on which they are based. As micro-data is not necessarily collected every year and may take time for the data to be available to researchers, microsimulation models can be used to simulate more up to date policy rules. Therefore they have the capability of looking at the incidence of existing policy on an existing population and can examine the efficiency of anti-poverty measures in actually reducing poverty.
- As a simulation mechanism, they are also well placed to look at the incentive impact of existing policy. Although the model framework described here is a static framework, it is possible to measure the pressures on behaviour such as marginal tax rates and replacement rates[6].
- The primary advantage of microsimulation models however is that they can simulate policy reform. They can thus be used to compute the first round revenue effects of reforms. Moreover, containing both social protection programs and taxation instruments, models of this kind can look not only at changes to social policy programs but also examine different methods of financing.

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[6] See for example, O'Donoghue and Utili, (2001), who study both the distributional and incentive effects of the impact of reforms targeting low wage workers in Europe.

- The first round distribution of resulting winners and losers particularly with reference to particular target populations can also be found. Moreover, capturing the heterogeneity of government law, they can examine the interaction of different instruments.
- Incorporating micro-data, they can also be used to look at the distributional impact of policy reform. Thus it is possible to see how reforms are incident on households of different incomes and examine horizontal redistribution by focusing, for example, on families with children, the elderly or the sick. Exploiting the hierarchical nature of households, they can also focus in gender dimensions by looking at within household sharing and the impact of government policy.
- The user-friendly nature of such models makes them suitable for a variety of uses and users, both governmental and non-governmental, informing the debate of social and economic policy, and making policy decisions more transparent in terms of their impacts on the population.

The use of microsimulation models therefore, can greatly contribute to improved design and efficacy of policies (Atkinson et al., 2002), providing a powerful tool to policy designers and analysts, allowing the simulation of changes in the existing tax-benefit system, performing "what if" experiments and examining their distributional and revenue implications (Redmond, Sutherland and Wilson, 1998). The development of microsimulation models involves the construction of a software environment to handle the data, policy simulation and output routines, the transformation and matching of existing micro-datasets into definitions and structures required to simulate tax-benefit laws and the translation of the law itself into a computational framework.

Microsimulation Modelling in Developing Countries

One of the issues this paper must consider is the fact that circumstances, systems and data may not necessarily be the same in developed economies where the technique has been utilised and in emerging economies. Atkinson and Bourguignon (1990) carried out a study of the lessons of tax-benefit modelling in OECD countries for emerging economies. They found that, although often more difficult to implement, simulating tax-benefit systems for these countries should "lead to a comprehensive, powerful and yet simple instrument for the design of an efficient redistribution system adapted to the specificity of developing countries". Focusing on Brazil as a case study, they found that much of the redistribution in the existing Brazilian system in the 1980's relied on instruments that were less important in OECD countries. For example, indirect taxes, subsidies and the provision of targeted non-cash benefits such as public education and subsidised school meals were found to be more important. Instruments more important in OECD systems and often the main instruments in tax-benefit models (personal income taxes, social insurance contributions and pensions), were largely confined to the modern sector in Brazil and thus of less importance to policy makers. Nevertheless they argued that sufficient data existed at the time to simulate many of the Brazilian specific instruments in addition to the "classic" ones. They stressed however that merging of data from different datasets may be necessary for this purpose. As a consequence of recent advances in the analysis of related data-sets (see Deaton, 1998) as well as improvements in the availability of data for less developed countries, the use of tax-benefit modelling techniques needs no longer be limited to countries where such models have been in use for some time.

Atkinson and Bourguignon's paper set the scene for the construction of tax-benefit models for less developed countries. The objective of our study is to go beyond this and actually focus more on the practical issues of constructing a tax-benefit model by reference to the precise rules of the tax-benefit systems and the detail of the available micro-data.

The Design of a Microsimulation Model

A microsimulation framework adopts a hierarchical view of a country's tax-benefit system. In modelling a country's system, it is desirable to match the "real" system's hierarchy as closely as possible so that the logical representation provides a good intuitive equivalent of the original. Figure 2 below gives an example of this hierarchical structure. Each tax-benefit system is made up of individual policies. These are elementary collections of tax-benefit instruments such as Income Tax, Social Insurance Contributions or Social Assistance Benefits. The policy spine is a list of policies indicating the sequence by which they are applied in the tax- benefit system. For example, if social insurance contributions are tax deductible, then the entry Social Insurance Contributions would have to appear *before* Income Tax. On the other hand, if social assistance benefits depend on after-tax income, then the entry Social Assistance Benefits would have to appear *after* Income Tax since income tax is a necessary input for calculating social assistance benefits.[7] At the lowest level is the tax-benefit module, which performs the calculation of a certain part of the tax or benefit (e.g., a deduction, or applying a rate schedule to a tax base) on each fiscal unit.

A modular structure allows one, as the model develops, to create a library of modules. These can be used as "building-blocks" so that when it is necessary to incorporate a new tax or benefit instrument, it will often not be necessary to program any new tax-benefit rules. Instead, it may be possible for existing modules to be used. They can be re-arranged in any order necessary. A high level of parameterisation ensures that the same modules can be used for a multitude of different purposes. Concepts that a user may want to change in the model and thus should be parameterised for ease of use include:

- Updating of dataset to year of simulation. As the year of the dataset may not necessarily be the same as the year of simulation (the year policy rules are taken from), it will be necessary to update the dataset to account for differences in the intervening period. For this purpose external information will be needed. Updating which may be required includes allowance for inflation/income growth by variable or allowance for changing population structure by altering the weights.
- The definition of the fiscal unit (e.g., individual, household, married couple, families with children - including the definition of a "child") which is relevant for the module and of the income concepts (e.g., the definition of taxable income, "means" for a means-tested benefit, etc.). In order to simulate the effect of widening the tax base or of incorporating new policies in a particular income concept such as disposable income, users may want to alter with ease the definition of these concepts.
- All relevant amounts (such as thresholds, limits, allowances, rates, number of tax bands, etc.) necessary for applying the relevant tax or benefit rules should be parameterised to enable non-structural policy reforms to be simulated with ease.
- Behavioural Response

As a static modelling framework, the model only measures the day after effect. However it is clear that reforms may have a behavioural response. For example the introduction of the *Bolsa*

[7] In a few cases, it might be desirable to deviate from a purely linear sequence of policies. If there are optional policies, which the tax payer/benefit recipient can choose from, it would be necessary to simulate all the individual options (e.g., individual or joint taxation) and then apply some rule for choosing between them (e.g., by assuming a decision which would maximise disposable income).

Escola program in a number of Brazilian cities, which gives cash benefits to poor families whose children continue on in school, saw school dropout rates decrease and school attendance increase (Schiefelbein, 1997). Incorporating dynamic processes like this would be beyond the scope of an initial stage of construction of a microsimulation model. It would require extra algorithms to be coded in the framework and in addition, *a priori*, the micro-behavioural information required would not have been available for a reform of this kind. However, as an alternative, sensitivity analyses could be carried out. It would be possible for analysts to vary the proportion of those eligible for the new instrument. Routines of this kind are analogous to the implementation of marginal tax-rate calculators. On this point some effort may also be necessary to specify appropriate definitions of marginal tax calculations in the framework for a Brazilian perspective.

Validation

Once the tax-benefit system has been coded the data are passed through the model. At this stage, one discovers whether all the variables required by the model algorithms have in fact been included in the dataset and whether they are in the correct format. Once this works, one must determine whether all the interactions between the simulated components operate correctly. The validation process is therefore one of the largest components in building a microsimulation model.

Typically the first stage in this process is to compare the output of the model for sets of hypothetical households against manually calculated taxes and benefits. Although the rules may in fact be correctly coded, simulated aggregates may not necessarily match official aggregates. The next stage of the validation process is therefore to compare the aggregate outputs against those in official statistics. Useful external sources of data for validation include official figures, other studies, other survey data, existing models, etc.

3. BUILDING THE PROTOTYPE

In this study we implement a prototype tax-benefit microsimulation model for Brazil, the Brazilian Household Microsimulation System (BRAHMS). The model simulates household sector taxes and cash transfers based on the 1999 household survey *Pesquisa Nacional por Amostra de Domicílios* – PNAD[8], Brazil's main nationally representative microdata source of demographic and socio-economic household characteristics. However, PNAD does not contain expenditure data. Information for household expenditure comes from the *Pesquisa de Orçamentos Familiares* (POF) 1995/96, Brazil's major expenditure survey.

The main direct and indirect taxes are simulated in the model. The taxes that are simulated by the model include the following income-based revenue raising instruments: The personal income tax and the employee and the employer social security contributions. In the case of the personal income tax and the social insurance contributions, for which there is no direct information in the PNAD, the values are simulated applying the legislation of the tax system to each individual or family in the PNAD microdata set. The estimates are then compared to available administrative data and adjusted to better reflect the effective incidence on taxes and benefits. The simulated amounts, validated against administrative data were found on average, to be about 90% of the administrative data.

[8] The authors are already working in the updating of the model's micro-dataset to the PNAD2001.

In addition the following indirect taxes are also simulated: Taxes on the circulation of goods and services (ICMS), taxes on industrialised products (IPI), the contribution to the financing of the social security (COFINS) and contributions to the social integration programs (PIS/PASEP). Because there are no expenditure data in the PNAD and because of the time limitations in the present study preventing us from doing a statistical match between the datasets, an imputation mechanism has been used to simulate indirect taxes.

The amount of indirect taxes paid by households was calculated as follows:

- The effective tax rates on final goods and services were estimated using input-output techniques[9];
- The estimated tax rates were applied to the 1995/96 household expenditure survey POF to calculate the amount of indirect taxes paid by POF households as a proportion of their incomes;
- These proportions were then used to estimate the payment of indirect taxes by the PNAD households groups defined in this paper. It was assumed that their incidence was fully shifted to the final consumer.

It should be noted that, since POF covers only metropolitan areas, this procedure assumes that the tax burden on a household elsewhere in the country is the same as that on a metropolitan household with the same income. In addition, it is assumed that the definitions of income in POF and PNAD are compatible.

BRAHMS simulates the following cash transfer programs: Pensions (regarding both the civil servants and private employees regimes), the old age assistance benefit, the unemployment benefit, the wage bonus, the family benefit (*salário-família*) and the *Bolsa-Escola* programs.[10] For the *Bolsa-Escola* programs, we have opted in the present paper to simulate the coverage defined in the 2002 Federal Government budget rather than the 1999 situation. This is because expenditure on these programs has increased drastically since 1999 – yet it still represents only about 2% of the total benefits allocated. Thus, the benefits of these programs were imputed in our data on the basis of their 2002 coverage, with values deflated to 1999.[11]

4. RESULTS

In this section we present results about the incidence of different types of government transfers and taxes on households using the BRAHMS prototype model. To do this, we use a set of income concepts. The starting point is initial income, which is the total annual income of all members of the household before the deduction of taxes or the addition of any state benefits. Cash benefits are added to initial income to obtain gross income. Personal income tax and employers and employees contributions to social security are deducted from gross income to give disposable income. Indirect taxes are then deducted to give final income.

[9] Details on the methodology are presented in Siqueira, Nogueira and Souza (2001).

[10] The *Bolsa Escola* programs are cash transfer schemes targeted at families with children, conditioned to school attendance for school-aged children. The term actually refers to three different programs, the *Bolsa Escola*, the *Bolsa Alimentação*, and the *Bolsa Criança Cidadã*, which were grouped together for purpose of presentation in this paper.

[11] A set of social expenditure items that so far have not been included but which are often relatively more important in developing countries is non-cash social spending, such as health and education benefits. This is especially important for households outside the modern sector as they are often excluded from coverage of social security benefits. This is another future development of this model.

To an extent, the relatively low Gini coefficients of developed countries found in Figure 1 reflect the impact of their tax and benefit systems.[12] By contrast, Brazil has not been able to use tax and transfers policies effectively to reduce income inequality. This is illustrated in Table 1, which summarises the estimated impacts of cash transfers and direct taxes on the distribution of income in Brazil. It shows that the richest 10% of households (according to per capita gross income) receive 45.9% of all initial income. This compares with only 0.7% for households in the bottom decile group.

The distribution of gross income, which includes government cash transfers, shows a very similar pattern as the distribution of initial income. In particular, the top decile's share remains virtually the same (45.7%), while the share appropriated by the first decile remains below 1.0%. Thus, there is only a small reduction in ratio of the income share of the top 20% to the share of the bottom 20%, from 27 to 25.

The third column of Table 1 shows that the personal income tax and the employer and employee social security contributions, altogether, reduce the share of the richest 10% to 44.8% and increase the share of the poorest 10% to 1.0%. This effect reflects the fact that almost all personal income taxed (97%) and about 38% of social security contributions are collected from the top income decile, while the average burden of direct taxes on the first decile is insignificant. The final column of table 1 incorporates the impact of indirect taxes. As we shall see below indirect taxes are regressive and so the gap between rich and poor widens as the top decile now receives 46.6% of all final income and the top quintile receiving 22.8 times the final income of the bottom quintile compared with 21.4 times for disposable income.

Progressivity of Instruments

In this section, we consider the redistributive effect and the progressivity of the individual instruments of the tax-benefit system. We use measures based on the Lorenz Curve to examine the degree of redistribution and progressivity.[13] The Lorenz Curve for pre-tax market income is simply a graph of the cumulative population share versus the cumulative income for the population ranked by order of their income. The Gini coefficient is a standard index of inequality, defined in equation (1):

$$G_M = 1 - 2\int_0^1 L_M(p)dp \qquad (1)$$

where p is the cumulative population share and $L_M(p)$ the Lorenz Curve at point p.

The index used here to measure redistribution is the Reynolds-Smolensky index, which is defined as the difference between the Gini coefficients for "base" income (initial income) and post-instrument income. The Reynolds-Smolensky index of redistribution can be decomposed into the redistributive effect before reranking (the difference between the Lorenz curve for market income and the concentration curve for post instrument income) and the reranking effect of the instrument (the difference between the concentration curve and the Lorenz curve).

Progressivity is a measure of the difference between the level of redistribution of an instrument relative to an instrument with the same revenue effect but where the effect is

[12] See, for instance, Beer et al. (2001).
[13] The methods described here are standard methods for examining the degree of redistribution and progressivity in tax-benefit system (See, for example, Palme 1996).

proportional to income. It is therefore a measure of the incidence of an instrument. If an instrument is disproportionally focused on the lower (upper) half of the distribution, then it is *regressive* (*progressive)*. If an instrument is regressive (progressive), the concentration curve for the instrument will fall outside (inside) the Lorenz curve of market income. If the instrument is proportional to income, the concentration curve will be exactly the same as the Lorenz curve for market income.

In terms of income taxes, progressivity relates to the ability-to-pay principle, whereby those with higher incomes are more able to pay higher taxes. A progressive income tax is therefore redistributive and thus inequality reducing. On the other-hand, benefits are redistributive if they are regressive, so that those with lower incomes receive higher benefits. In this paper we use the Kakwani index of progressivity, which is the difference between the Lorenz curve for income and the concentration curve for the instrument in question.

If a policy instrument is based on characteristics other than income then income units may have a different order of incomes before and after the operation of the instrument. For example, pension is targeted at households with elderly people and so households with elderly people will receive subsidies while other households will not. This type of redistribution is known as horizontal redistribution. Changes in the order of income units in a distribution will result in the Lorenz curve of post instrument income being different to its concentration curve. The Atkinson-Plotnick reranking index, which is the difference between the Lorenz and concentration curves, is the measure of horizontal equity we use. The redistributive effect of a policy instrument depends upon the size of the instrument and the progressivity or degree of targeting. For example, a well-targeted low value instrument may have a lower degree of redistribution than a poorly targeted high value instrument.

The distribution of taxes, as a proportion of the household gross income, is shown is Figure 3a. Although the income tax is usually at the centre of the tax policy debate in Brazil, one can observe that it is indirect taxes and payroll taxes that accounts for most of the tax burden borne by households. Personal income taxes only account for 3.7% of initial income compared with total taxation of 31.1%. Personal income tax is important only to the households in the top decile group, representing, in average, 6% of their gross income.

In Table 2 we decompose the amount of the redistribution due to each of the instruments. We consider first how targeted expenditure is utilising the Kakwani progressivity index. A positive sign on this index indicates that the instrument is targeted proportionally more on those in the top of the initial income distribution than the bottom, while a negative sign indicates proportionally more of the instrument targeted at the poorest deciles. A progressive tax will therefore have a positive sign, while a benefit targeted on the poor will have a negative sign.

Reflecting progressivity patterns found throughout the world, personal income taxes are the most progressive of the taxes with a Kakwani index of 0.251. The social security contributions shown in Figure 3a include those paid by employees and employers, assuming that the latter shift the tax on to the former through lower wages. Overall, the burden of social security contribution borne by households is higher than the income tax burden, even for the top decile group. Social insurance contributions, because they are levied on employee incomes, which are proportionally higher in the income distribution, are progressive, but because of their flat rate structure are much less progressive (0.023 for employee and 0.044 for employer contributions) than the increasing marginal tax rate bands of the personal income tax system. We notice that social contributions as a percentage of initial income increases up to the seventh decile group, falling in the top decile. This reflects the existence of a ceiling in the contribution of private employees. One should also note that the low level of social security contribution in the first deciles reflects the fact that there is a sizeable proportion of informal workers in these income groups.

Indirect taxes are levied on consumption and because poorer households tend to have lower savings rates than richer households, they consume a higher proportion of their income and so pay proportionally more indirect taxes. As a result indirect taxes have a regressive effect. However, the income saved today by the rich will be spent in a future date, when it will then be taxed. Thus, to measure the incidence of indirect taxes in terms of current income tend to overestimate the regressivity of these taxes.[14] Independently of how the indirect tax burden varies among the decile groups, it is important to stress that the burden borne by the low-income groups is quite high, representing about one quarter of the consumption spending of households in the bottom decile group (Figure 4a). ICMS, the taxation on the circulation of goods and services, is the most important of the indirect taxes in revenue terms. On the other hand, although PIS/PASEP is quite small, it is the most regressive of the taxes.

Combining the size of the instruments (column B) with the knowledge we have about their progressivity (column C), we can determine how redistributive each instrument is. Personal income taxation although of relatively low importance, has the highest redistributive effect, driven primarily by the strength of the progressivity effect. However because indirect taxes are regressive and because they are of greater importance than direct taxes, the total redistributive effect of taxes is marginally negative. In Table 1 where we report the Gini for gross and final incomes, we see that the net impact of taxation is marginally positive in reducing inequality. The difference results from a different base for comparison (initial income versus gross income). However, the direction of redistribution in either case is very small and so we can therefore conclude that taxation is approximately neutral.

Figure 3b shows the distribution of government cash transfers among the different household decile groups. Pensions are the most important category of transfer at 21% of initial income, with all other benefit types being less than 1% of initial income (see table 2). Each of the transfer types is proportionally more targeted at the poorest deciles. However we must note that the ranking measure used by these statistics is initial income, in other words income before transfers and taxes. The inclusion of the transfer in household income may move a poor household measured on this income up the income distribution. We see this effect in the Atkinson-Plotnick reranking index, where pensions induce the largest reranking of households of any instrument. When we rank by final income, as the case in Figure 3b, we notice that the targeting of pensions is reduced or even eliminated by this reranking, with pensions distributed fairly evenly across decile groups with a peak in the centre of the distribution.

Unemployment benefits are the next biggest transfer group with progressivity similar to that of pensions. Reranking is hardly present. The wage bonus and the family benefit are the least targeted transfers, while old age and *Bolsa Escola* instruments are very targeted, with Kakwani indices of respectively -1.394 and -1.189.

[14] From a life-cycle point of view, consumption is considered to be a better basis for the analysis of the distributive effect of indirect taxes than income. Siqueira, Nogueira and Souza (2000) provides estimates of the incidence of indirect taxes for Brazil based on consumption.

Turning to the redistributive impact of the instruments, we see that on the whole redistribution is quite small, reducing inequality by about 6% points. Most of this is driven by the pension system

Total Redistribution

How does the redistribution observed in Brazil compare with redistribution in other countries? In this section we contrast redistribution in Brazil with that observed in a number of Industrialised countries.[15]

Figure 4 describes the Gini coefficient for different income concepts for the six countries considered. The size of the levelling of income distribution through the benefit and tax system can be measured by means of the Gini coefficient. The difference between the Gini coefficients of the different income concepts is indicative of the degree of redistribution inherent in the difference between incomes. We notice that the reduction in the Gini coefficient due to benefits (moving from initial to gross income) and due to direct taxes/contributions (moving from gross to disposable income) is much smaller in Brazil than in the other countries. While direct taxes have a relatively small redistributive effect in the industrialised countries, reducing the Gini coefficient by 5-6%, in Brazil the effect is even smaller at less than 2%. The biggest difference however is in the lack of redistributive power in the benefit system. While it is the most important set of redistributive instruments in Brazil, reducing the Gini coefficient by 6%, it has a much smaller effect than instruments in the industrialised countries where, with the exception of the USA and Australia, there are reductions of 14-20%. Even the industrialised countries with lowest redistribution, Australia and the United States, have double the reduction of Brazil. Therefore it is the lack of redistributive power in the transfer system that primarily drives the lower redistribution in Brazil compared with other countries.[16]

Poverty Efficiency of Benefits

Although the reduction of income inequality is one of the objectives of taxation and transfer systems, a more focused objective is the reduction of poverty. Here we consider how effective Brazilian transfer instruments are at reducing poverty. In table 3, we describe a number of measures (see Weisbrod (1970) and Beckerman (1979)) of the poverty efficiency of transfers in Brazil compared with means-tested instruments in Southern European countries, as reported in O'Donoghue et al. (2003), for each of the schemes mentioned before. Figure 5, due to Beckerman, describes the impact of transfers on disposable income. The measures we use to examine the target efficiency of social assistance are based on this diagram:

- The first measure is Vertical Expenditure Efficiency (VEE), meaning the share of total expenditure going to households who are poor before the transfer and is equal to *(A + B)/(A + B +C)* from Figure 5.

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[15] See Baldini et al (forthcoming) and Beer et al (2001)

[16] A recent study (Hoffmann, 2003), that decomposes the household income in its various components, concludes that income derived from pensions is more concentrated amongst the relatively rich households than the income obtained from all sources together. In fact, while the overall Gini index is 0.59, the concentration ratio of pensions is 0.60. Thus, income from pensions has actually contributed to increase inequality in Brazil. This is especially true of the pension system for public-sector workers, which pays pensions that can be more than ten times the ceiling for private-sector pensioners and allows workers to retire unreasonably early, often in their 50s.

- The next indicator of Poverty Reduction Efficiency (PRE) is the fraction of total expenditure allowing poor households to reach the poverty line without overcoming it and is defined as *(A)/(A + B +C)*.
- The Spillover index (S) is a measure of the excess of expenditure with respect to the amount strictly necessary to reach the poverty line, *(B)/(A + B)*. Combining we can see that the VEE (1 - S) = PRE.

In fact, these three measures are not sufficient to evaluate how good a transfer system is in fighting poverty. A transfer program could be very efficient in reaching the poor, but its amount could be too low to produce a significant increase in the living standards of the beneficiaries. We thus need another indicator, the Poverty Gap Efficiency (PGE), which shows how effective a cash benefit is in filling the poverty gap, *A/(A+D)*. The measures compare the effectiveness of instruments in closing the pre-transfer poverty gap defined in terms of disposable equivalent income before transfers, and the poverty line is given by 60% of median post-transfer disposable equivalent income.

Table 3 reports the target efficiency results for Brazil and for the Southern European countries. The Brazilian instruments can be divided into two groups, (i) the pension, unemployment benefit and wage/family benefit and (ii) the *Bolsa-Escola* and the old age benefit. In the first group, the poverty efficiency is very low. In fact only 15% of pension expenditure reduces poverty with the remaining proportion bringing people who would be below the poverty line (measured as 60% of median disposable income) above the poverty line or in the case of 60% of the instrument going to households above the poverty line even in the absence of the instrument. For the other two instruments in this group, 70% of the benefit goes to families above the poverty line pre-transfer. These instruments exhibit far less targeting than other means-tested benefits in the Southern European countries. The group (ii) instruments however exhibit a high degree of targeting, with PRE's of nearly 90%, indicating that they are very efficient anti-poverty instruments. However because these instruments are relatively unimportant in terms of expenditure they reduce poverty by less than pensions despite their low targeting.

It has often been argued, especially in Southern Europe, about the inability of the administrations to deliver targeted programs due to the "softness of state institutions" (Ferrera, 2001). What these results illustrate however is that the Government administration in Brazil is capable of delivering highly targeted policy instruments. Given the level of public expenditure in Brazil there is significant room within the Government budget constraint to redirect expenditures towards the very poor without the requirement of raising more resources. It is therefore a matter of political will rather than administrative capacity to improve the anti-poverty and redistributive impact of the Brazilian tax-benefit system.

5. CONCLUSIONS

This study offers additional evidence to the conclusion reached by Chu et al (2002) that the redistributive effects of tax-benefit systems in developing (and transition) countries are much less expressive than those observed in developed countries. In the case of Brazil, however, the problem cannot be associated to a low tax-to-GDP ratio, but to the fact that social spending bears little relation to need. This is particularly true of social security pensions, which are concentrated on the most well-off households. Although assistance programs like *Bolsa-Escola* are well focused on the most vulnerable population, the budget devoted to these programs is still a minuscule share of total social spending.

Many researchers and policy-makers in Brazil have argued that the tax side of the budget should play a more significant redistributive role. However, the predominance of indirect taxes and the way the progressivity of the personal income tax interacts with the highly unequal income distribution render the tax system a poor redistributive tool. Furthermore, experience has shown that the most affluent groups have managed to benefit most from tax breaks and allowances or indeed from any opportunity for tax reduction (or evasion) provided by the tax legislation in Brazil.

In a society as unequal as the Brazilian one, political economy considerations should be central to any proposal intended to improve the way tax and benefits are distributed amongst its population. Our view is that the tax-benefit system should be as simple and transparent as possible, with the expenditure side of the budget as the fundamental redistributive instrument – primarily through the provision of basic services and well-targeted direct transfers to households. We think that the visibility and understanding of the tax and benefit system is a key condition to motivate and empower people to demand, through the democratic process, more effective redistributive policies.

In this paper, in addition to the policy implications of this study we have also addressed a number of potential technical modelling developments that are desirable and as such create an agenda for future work:

- In order to aid future policy reform analysis, it would be desirable to extend the number of instruments simulated in the model to include as many benefit instruments as is technically possible. This would allow analysts to evaluate benefit design changes.
- Part of the revenue raised by some of the taxes included in the present study is used to finance government services that have an important effect on household living standard, such as health and education. However, this study has focused on the impact on current monetary incomes. A more comprehensive approach, simulating non-cash welfare services would result in a more significant impact of the Brazilian tax-benefit system on the welfare of the lower income groups**.**
- As the most important revenue source, indirect taxation is a large potential area for reform and analysis. However because our data source does not incorporate expenditure information, the analysis thus far has relied on relatively crude imputation methods. It is planned to improve our capacity for analysis of indirect taxation reform by statistically matching household expenditure information from other surveys into our base survey.
- Finally our analysis has avoided a detailed discussion about the importance of tax evasion, again relying on relatively crude methods for adjustment. One of our next pieces of work plans to relate survey analysis with data provided by the fiscal authorities to assess and model the degree and incidence of tax-evasion.

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TABLES AND FIGURES

Table 1 – Percentage shares of household income, ratios of share of the top 20% to share of bottom 20% and Gini coefficients

	Percentage share of income			
	Initial Income	Disposable Income	Gross Income	Final Income
Decile Group				
Bottom	0.7	0.8	1.0	0.9
2nd	1.5	1.7	1.9	1.8
3rd	2.3	2.5	2.7	2.5
4th	3.2	3.4	3.6	3.4
5th	4.2	4.5	4.6	4.4
6th	6.0	5.9	6.0	5.6
7th	8.2	8.1	8.1	7.7
8th	11.3	10.9	10.9	10.5
9th	16.7	16.5	16.5	16.5
Top	45.9	45.7	44.8	46.6
All households	100	100	100	100.0
Ratio of share of top 20% to bottom 20%	29.2	24.4	21.4	22.8
Gini coefficient	0.642	0.581	0.564	0.579

Notes:
1. Households Ranked by Equivalent Income. All Incomes expressed per adult equivalent, where the equivalence scale used is 1 for the principle adult, 0.7 for other adults and 0.5 for children aged under 18.
2. Initial Income - total annual income of all members of the household before the deduction of taxes or the addition of any state benefits.
3. Gross Income – Initial Income plus State Benefits.
4. Disposable Income – Gross Income minus direct taxes and contributions.
5. Final Income – Disposable Income minus Indirect Taxes.

Table 2. Progressivity and Redistributive Effect of Brazilian Tax-Benefit Instruments

	Rate	Progressivity - Kakwani	Redistribution - Reynolds Smolensky	Reranking - Atkinson Plotnick
	A	B	C	D
Taxes				
Personal Income Tax	-0.037	0.251	0.008	0.001
Social Contribution - Employee	-0.037	0.023	0.001	0.000
Social Contribution - Employer	-0.097	0.044	0.003	0.002
Direct Taxes	-0.171	0.084	0.013	0.004
ICMS	-0.083	-0.109	-0.010	0.000
IPI	-0.014	-0.150	-0.002	0.000
COFINS	-0.040	-0.087	-0.004	0.000
PIS/PASEP	-0.003	-0.366	-0.001	0.000
Indirect Taxes	-0.140	-0.111	-0.018	0.000
Total Taxes	-0.311	-0.004	-0.007	0.005
Benefits				
Pension	0.212	-0.678	0.048	0.070
Unemployed Benefit	0.007	-0.610	0.004	0.000
Wage Bonus and Family Benefit	0.003	-0.491	0.001	0.000
Old Age Benefit	0.004	-1.394	0.004	0.001
Bolsa-Escola Programs	0.003	-1.189	0.004	0.000
Total Benefits	0.228	-0.686	0.061	0.069

Notes:
1. All incomes have been equivalised using the scale described in table 1.
2. The base income used is initial income. In other words the progressivity of an income is expressed relative to the progressivity of initial income. The rate refers to the instrument as a proportion of initial income and redistribution measures the change in the distribution of income through the inclusion of the instrument in question.

Table 3. Poverty Efficiency of Brazilian Benefits compared with Social Assistance Instruments in Southern European Countries

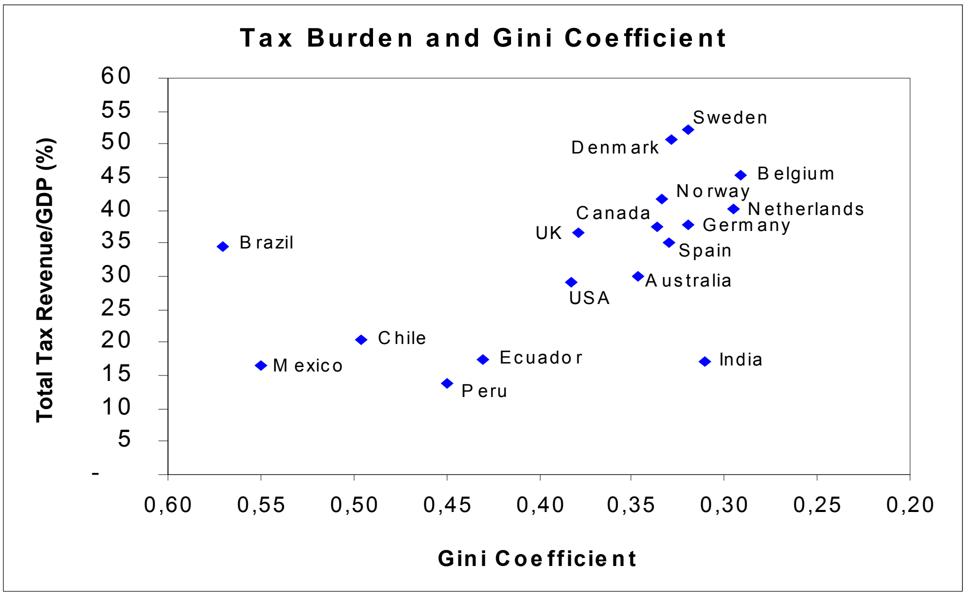
	VEE	PRE	S	PGE
Brazil				
Pension	39.7	15.4	61.3	33.5
Unemployed Benefit	30.6	26.6	13.0	4.4
Wage Bonus and Family Benefit	30.4	28.7	5.6	3.0
Old Age Benefit	94.0	88.1	6.2	2.7
Bolsa-Escola Programs	90.7	89.5	1.4	12.7
Social Assistance (Means-tested Child Benefits)				
France	45.5	36.5	19.8	41.9
Greece	26.2	24.3	7.2	4.4
Italy	63.4	56.3	11.2	19.9
Portugal	33.2	32.5	2.0	15
Spain	55.9	51.7	7.5	6.8
Social Assistance (Other Means-tested Benefits)				
France	60.0	43.2	28.0	72.5
Greece	55.3	47.2	14.6	23.9
Italy	51.9	39.3	24.4	14.4
Portugal	60.5	46.4	23.3	30.9
Spain	53.5	39.9	25.4	33,0

Source: Brazil - Authors' Calculations; Other Countries – O'Donoghue et al. (2003)

Notes:

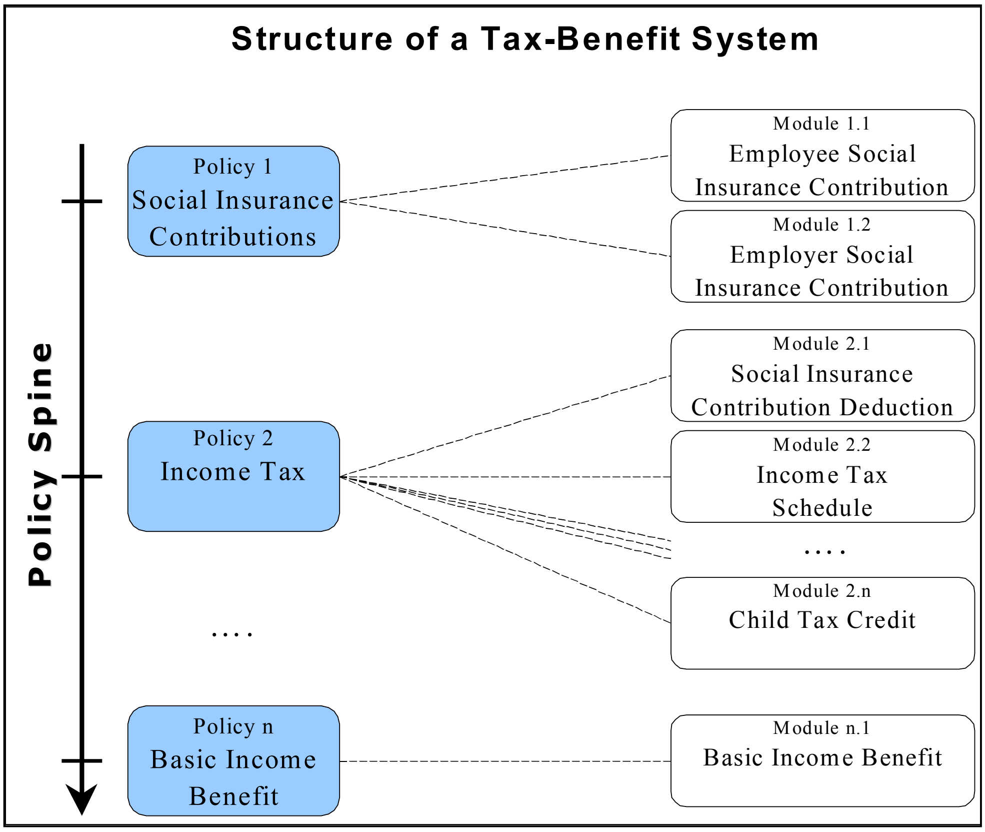
1. Poverty Headcount as a percentage of total population.
2. Poverty Line in terms of Median Equivalised Disposable Income (Equivalence Scale, 1, 0.7, 0.5/Head, Other Adult/ Children Aged 17-).
3. VEE - Vertical Expenditure Efficiency, PRE - Poverty Reduction Efficiency, S - Spillover Index, PGE - Poverty Gap Efficiency.

Figure 1



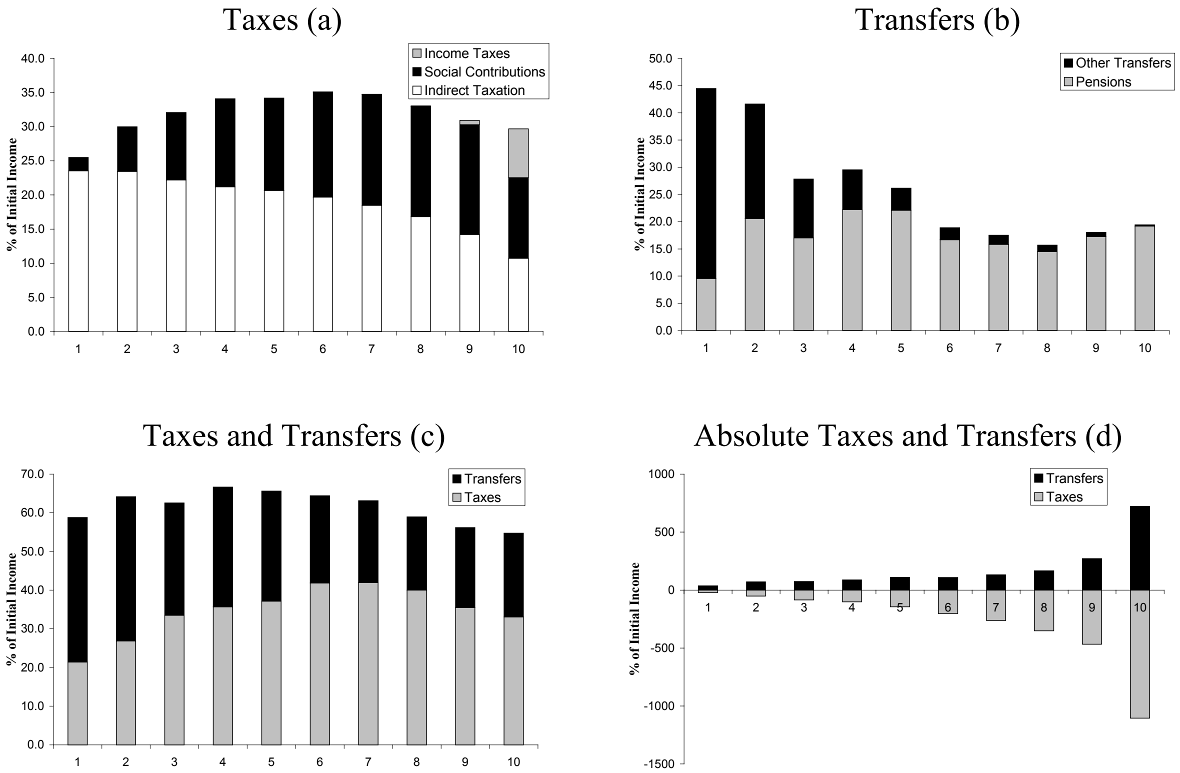
Source: Dalsgaard, 2000.

Figure 2



Source: Immervoll and O'Donoghue (2001)

Figure 3 - Taxes and Transfers as a % of Initial Income (a-c) and in absolute terms (d) by decile group[17]



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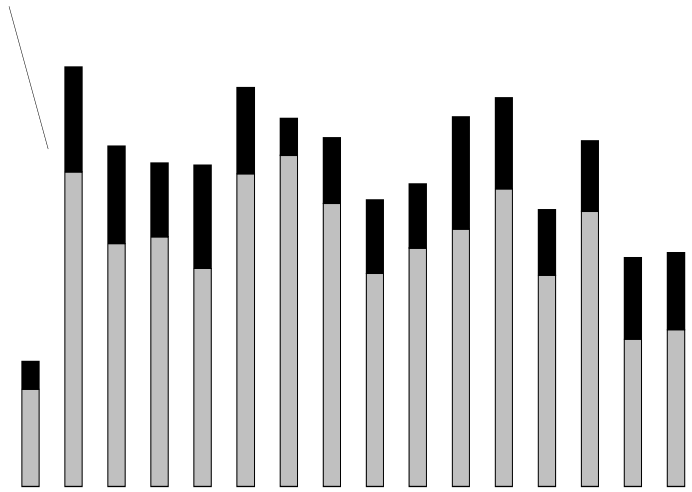
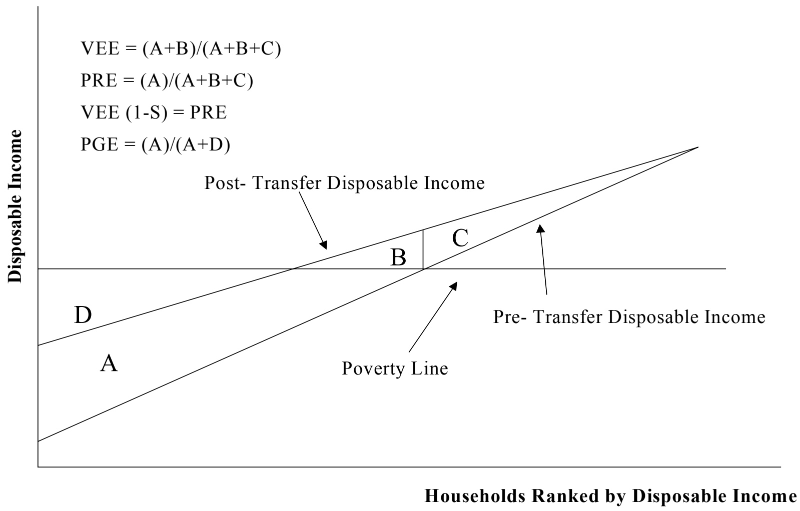
[17] Source: Authors' Calculations. Households ranked by equivalised final income decile as defined by the equivalence scale in table 1. Unequivalised Incomes in figures a-c defined as a percentage of household initial income. Incomes in figures d defined as absolute average annual equivalised instrument value.

Figure 4. The Reduction in the Gini Coefficient due to Direct Taxes and Benefits



Source: Baldini, Mantovani and O'Donoghue (forthcoming); Beer et al (2001)

Figure 5. The Efficiency of Social Assistance



Source: Beckerman (1979)