..\ditt.doc

Horizontal Equity And Differences In Income Tax Treatment: A Reconciliation

Xavier Ramos and Peter Lambert
Universitat Autònoma de Barcelona and University of York

1. Introduction

In recent years, we have seen the move from the very high marginal rates of income tax of the 1970s, with accompanying reliefs for those hardest hit, to a simpler income tax code in which the rates are lower and the reliefs have been restricted. The trend of the 1990s is towards further tax simplification, in which the gap between comprehensive income and taxable income will continue to be trimmed. The prime motivation for this trend is surely to squeeze horizontal inequity out of the system, and at the same time to tone down the vertical stance of the income tax.

Notwithstanding this trend, many of the tax breaks appended to the typical income tax formula do, or did, serve respectable long term social goals. For example, deductions for charitable giving are meant to foster a caring society; for life assurance and medical expenditures, to reduce people's dependency on the state; for mortgage interest, to promote social stability through increased homeownership, and so on. Changing fashion may be squeezing this sort of deduction out of the tax system, but this could be happening at a cost yet to be assessed.

Other tax breaks can be seen quite differently, as serving the goals of the tax administrators and of special interest groups. Consider, for example, the different tax

treatment of the employed and self-employed,[1] of labour and capital income, and of urban and rural incomes especially in developing countries. Even evasion and non-compliance are, it could be argued, to some extent sanctioned by the tax administrators in the name of cost-effectiveness.

In this paper, we present a model in which the tax breaks appended to the income tax formula are categorised into two types, those with deserving social goals and those which are for the sake of convenience or to satisfy a lobby. Whilst such a categorisation may not be indisputable—indeed, different classifications could typically be argued from different standpoints[2]—once we have made the distinction, a second question arises, which should concern the tax policymakers and the administrators alike: *how costly is each type of break in terms of foregone equity?* This is what the chapter is all about.

As the unique tax instrument through which the government approaches its citizens directly, the income tax is particularly subject to criteria of equity. Classical horizontal equity, henceforth **HE**, demands that like individuals be treated alike, and can be seen as a minimal rule of fairness, offering protection against arbitrary discrimination and reflecting the basic principle of equal worth. Vertical equity, **VE**, is a command to differentiate appropriately among unlike individuals, and its degree is a matter of social taste and political debate.

The equals or like individuals in the **HE** command are typically those with the same utility (Feldstein, 1976), and the **HE** command extends to households and families too: “households who obtain equal utilities in the pre-tax situation should obtain equal

---

[1] See Freedman and Chamberlain (1997) for a detailed examination of this issue with respect to the UK.

[2] For example, it might be argued that the *form* of support for the family in an income tax system (through marriage- and family-size related allowances and/or credits) suits the administrators, but that the *act* of supporting the family in this way is plainly in support of a long term social goal. Or that to encourage life assurance—or white immigration—is not, after all, in society's interest. We pay particular

utilities after the tax is imposed" (Manser, 1979, p. 224). In principle, these utilities may arise out of a model in which household objectives including different leisure times of their members are specified, and a complex optimisation problem is solved (Rosen, 1978), but more typically a straightforward equivalisation procedure is employed to determine households' utilities as per-equivalent-adult living standards.[3]

The widely adopted **HE** command is that those with the same equivalent income should pay the same tax, denominated in units of equivalent income. In recent studies,[4] all departures of the income tax from an ideal tax on equivalent income thus get lumped together and counted as horizontal inequity (henceforth **HI**). Such an approach clearly does not serve our purpose here. We pose instead a "modified **HE**" requirement, legitimising differential tax treatment of those at the same living standard on the basis of tax-relevant attributes in the socially-deserving category. Modified **HE** is weaker than classical **HE**: it says only that those with the same equivalent income *and* socially deserving tax-relevant attributes should pay the same tax.[5] As between income units with the same living standard but *different* realisations of the socially deserving attribute(s), society has sanctioned a difference in tax treatment, in pursuit of its long-term social goals. We see such differentiation—among the *unequals* according to modified **HE**— as acts of (similarly modified) **VE**. This perspective has not been seen in the income tax literature before, and it yields up a measurement system in which socially-deserving

---

attention to the family size issue in what follows, and will also investigate fully the implications of "recategorising" a tax break.

[3] See Steuerle (1983) and Gravelle (1992). Steuerle cites "passive public policy toward dependents of taxpayers" as a primary cause of growing **HE** violation at the family level in the US federal tax system since the late 1940s (*ibid.*, p. 73)

[4] See Habib (1979), Aronson *et al.* (1994) and Lambert and Ramos (1997).

[5] This modified principle is similar in spirit to that of Jenkins (1988), who, however, argues against equivalising. As we do here, Jenkins sees the business of identifying the equals as an essentially multidimensional issue, and adopts a partial approach in which he refrains from making identifications across distinct socio-economic subpopulations. He captures **HI** in terms of rerankings, a line we do not take here.

differential tax treatments result in a measurable loss of **VE**, whilst non-deserving differentiations result in a measurable degree of **HI**.

The organisation of the paper is as follows. In Section 2, we present our model which embodies the modified **HE** and **VE** principles through a specified ideal income tax system. In Section 3, we derive the central result, already anticipated, which enables us to characterise fully the income tax system's vertical and horizontal stance. We also show here how the 'cost' of any specific form of differential tax treatment may be assessed. In Section 4 we discuss implementation, adapting the methodology slightly to enable a resolution of the identification problem. Section 5 contains an empirical illustration to the US income tax system for 1990, and Section 6 contains concluding comments.

2. The Model: Modified HE and VE

Let x be the pre-tax money income of a family or household of size n and let z_n be the equivalence scale deflator for households of this size. Then $e = x/z_n$ is the household's pre-tax equivalent income, or living standard. Note that, with no change in notation, additional characteristics of the household may be subsumed in n; for example, to distinguish between the number of adults A and children C in the household, we could write n as a vector, $n = (A, C)$, etc.; z_n would then be an equivalence scale taking family composition into account.

We shall suppose that both money income x and family size or composition n are relevant for income tax purposes. Whilst this is not always the case, many income tax systems explicitly allow for marriage (*c.f.* the UK married couple's allowance) and for children (*c.f.* the French *quotient familial*). Family support more typically comes through the social security system, which is administratively separated from the income tax.

However, by a slight abuse of terminology, we may interpret the expression 'income tax' henceforth as meaning the *net* tax, or combined tax-benefit system, thereby bringing family support into play.

Let the income tax of the household, in money terms, be written as $t(x,n,d,u) + e$. In this, d is a vector of household attributes regarded as meriting differential tax treatment in pursuit of social goals (henceforth we shall call these "*equity-relevant*" *attributes*), and u is a vector of additional attributes, regarded as tax-relevant by the authorities, but not enjoying our support as socially deserving (d = deserving, u = undeserving). The e is a catch-all term, allowing for the effects of evasion, assessment error, capriciousness on the part of the 'tax office', etcetera.[6]

For equity, our household's income tax, in money terms, should take the form $z_n(x/z_n,d)$. Here, $t(e,d)$ is the equitable income tax, charged *in units of equivalent income* on the basis of living standard e and equity-relevant attributes d.[7] This ideal embodies our modified **HE** principle, through the chosen arguments for $t(\bullet,\bullet)$: tax units with the same pre-tax living standard e *and* equity-relevant attributes d should pay the same tax in equivalent income terms—and thereby have the same post-tax living standard. This ideal $t(\bullet,\bullet)$ also embodies modified **VE**. It tells us, through its first argument, how to tax people at different living standards e (these are classical unequals), and also, through its second argument, how to tax people at the same living standard but having different realisations of the attributes d (for example, the homeowners and non-homeowners). The degree of **VE** which society sanctions or condones is thus fully specified through $t(\bullet,\bullet)$.

---

[6] In particular, we make no distinction in this model between the household's tax liability and its tax payment.

[7] The form $z_n t(x/z_n,d)$ can also be interpreted in light of Ebert's (1997) proposal that, for coherence with the transfer principle, household welfare analysis should be conducted in terms of the *equivalent adult*,

Variables within the vectors d of deserving and u of undeserving attributes can be either categorical (homeowner/non-homeowner, waged/non-waged) or scalar (size of mortgage, life assurance premium). In Figure 1 we illustrate the model assuming d has one variable with two values d_1 and d_2. Think of (e,d_1) and (e,d_2) as the equitable taxes on equivalent income e for homeowners and non-homeowners respectively. The equivalent-income-denominated actual taxes of households, $[t(x,n,d_i,u) + e\ ]/z_n$, $i = 1$ and 2, are scattered around the lines (e,d_1) and (e,d_2) for several reasons. For one thing, the e causes departures, for another the undeserving tax breaks do, but also family size may not be taken into account in the income tax formula using the equivalence scale z_n, indeed using any equivalence scale:[8] tax design inadequacies can result in departures of $t(x,n,d_i,u)/z_n$ from a tax on $e = x/z_n$ too.

[FIGURE 1 HERE]

If we would reclassify the homeownership attribute d_i ($i = 1,2$) in Figure 1 as undeserving, or 'import' another tax-relevant variable from u into d, (for example arguing that, in addition to homeowners, holders of certain forms of government bonds enjoying tax-exempt interest are also socially deserving), then the lines drawn in Figure 1 would change, as would our depiction of the equals groups (circled), but the dots, representing data points, of course would not. Thus only our 'rationalisation' of the data—or, to put it another way, our use of it to characterise the vertical and horizontal

---

of which there are supposed to be z_n in a household of size n. Then the ideal tax amounts to $t(x/z_n,d)$ per equivalent adult.

[8] Although family support through the benefit system is typically determined using an equivalence scale, the presence of the married lump sum tax allowance and/or child exemptions/credits in the income tax *per se* means that the net tax is typically *not* consonant with an equivalence scale. The French *quotient familial* provides a notable exception.

stance of the income tax system—would actually be varied by a change in the classification of tax-relevant attributes. Later, we shall explore the measurement consequences of such reclassifications.

For any given pre-tax living standard e_0, there are, in the example of Figure 1, two distinct groups of equals for the modified **HE** command. We have shown these as $S(e_0,d_1)$ and $S(e_0,d_2)$ in Figure 1, by circling the relevant collections of post-tax incomes. In general, we shall denote by $S(e,d)$ the group of households with pre-tax living standard e and deserving attribute(s) d. According to our model, the post-tax living standards of the members of $S(e,d)$ are dispersed around $e - t(e,d)$ if there is **HI**. Let $\bar{T}(e)$ be the mean tax payment of a household with e before tax, where the averaging is across the equals groups $S(e,d')$ for all possible realisations d' of the deserving attributes.

Unlike our modified **HE** principle, classical **HE** demands that all households with the same pre-tax living standard e should pay the same tax. Lambert and Ramos (1997) used the averaged schedule $\bar{T}(e)$ to measure **VE** and the dispersion of taxes around $\bar{T}(e)$ to measure **HI**.[9] Such an approach assigns all non-equivalent-income-based tax differences to the measure of (classical) **HI**. As we shall show below, a richer characterisation of the income tax can be attained by distinguishing the effects of the socially deserving and undeserving tax breaks. The effect of the d's must be counted into (modified) **VE**, as we have already argued; only the u's (along with other factors, such as poor tax design, assessment error, capriciousness and evasion) are responsible for (modified) **HI**. By means of this division, we can determine, for example, which type of tax break it is costlier to maintain, and exactly how costly the one is relative to the other.

---

[9] Musgrave (1990) first proposed explicitly to measure **VE** with reference to the hypothetical income distribution "assuming the actual distribution among but equal division of the burden within each group of equals" (p. 118).

3. Vertical Equity and Horizontal Inequity

To summarise the previous discussion, the equals group $S(e,d)$ comprises families of all sizes n whose money income is $x = ez_n$ and whose deserving attributes are d. The average across such income units, of the actual income tax $[t(ez_n,n,d,u) + e]/z_n$ in equivalent income terms, is $t(e,d)$. Further, the average tax across *all* income units having e before tax is $\bar{T}(e)$.

Let the inequality in before and after tax living standards be J^b and J^a respectively, measured according to some inequality index J. Then the redistributive effect of the income tax system is:

(1) $$RE = J^b - J^a$$

We may conceptualise this inequality effect of introducing the tax system as occurring in three stages. First, the overall averaged schedule $\bar{T}(e)$ of Figure 1 is applied; this preserves equality of living standards where such exists before tax, and (for example, if $\bar{T}(e)$ is progressive), reduces inequality between those with different pre-tax living standards. Second, $\bar{T}(e)$ is replaced by the socially ideal tax $t(e,d)$. This introduces some inequality among people at each living standard e, on the basis of socially deserving attributes d, but (according to our model assumptions) has no effect on average between different pre-tax living standards. Finally, $t(e,d)$ is replaced by the actual tax system $[t(x,n,d_i,u) + e]/z_n$. The effect at this third stage is to introduce further inequality at each living standard e, due to the tax breaks for undeserving attributes u, to the tax treatment of family size n if this is not in accord with the equivalence scale z_n, and to other factors represented by the catch-all e.

These three distinct inequality effects may be captured by indices as follows. First, let inequality after tax if the overall averaged schedule $\bar{T}(e)$ were applied be $\bar{J}^a$. The vertical redistribution that would take place were this schedule to be applied is:

(2) $$VR_e = J^b - \bar{J}^a$$

Second, let $J_{e\text{-}t}$ be the inequality introduced among those with e by application of $t(e,d)$. If p_e is the proportion of households in the population having e before tax, then the weighted average:

(3) $$VC_d = \sum_e p_e J_{e-t}$$

is an obvious (if *ad hoc*) summary measure of the inequality cost of tax treatments associated with the deserving attributes. Third, let the inequality of living standards after application of the actual tax system among all those with e before tax be $J_{e\text{-}(t+e)/z}$, to use an obvious notation. The inequality effect at e in going from the ideal to the actual tax system is $J_{e\text{-}(t+e)/z} - J_{e\text{-}t}$, and this can be summarised as:

(4) $$H = \sum_e p_e \left[J_{e-(t+e)/z} - J_{e-t} \right]$$

overall, using the same weighted average form as in (3).

The three terms VR_e, VC_d and H in (2), (3) and (4), all defined in terms of a chosen inequality index J, can be used to describe the vertical and horizontal stance of the income tax system. The averaging in (3) and (4) has no evident normative significance at this stage. However, for one particular inequality index J, this problem is overcome and there is also a further advantage. Quite generally, VR_e reveals the redistributive effect achievable by adhering to classical **VE** and **HE** through the schedule $\bar{T}(e)$. As the following Theorem shows, if the mean logarithmic deviation is the chosen inequality index, then VC_d reveals the loss of equity which comes from admitting the socially deserving tax treatments into the tax code for reasons of modified **VE**, and H

becomes a measure of pure **HI** in the classical mould, revealing the loss of equity which comes from the presence of socially undeserving tax treatments in the tax code, and from design and other shortcomings, all of which violate modified **HE** :

Theorem 1. In the case of the mean logarithmic deviation inequality index, the redistributive effect of the income tax system is given by:

$$RE = VR_e - VC_d - H$$

and then:

$$H = \sum_e \sum_d p_e q_{e,d} J^a_{S(e,d)}$$

where $q_{e,d}$ is the proportion of those having e before tax who belong to the equals group $S(e,d)$, and $J^a_{S(e,d)}$ is post-tax inequality among the members of $S(e,d)$.

Proof: Using the decomposability property of the mean logarithmic deviation, we may explain after tax inequality J^a in terms of post-tax inequalities between and within the groups of people at different levels of pre-tax equivalent income e, *i.e.* across the disjoint partition of subgroups $A(e) = \cup_d S(e,d)$. Noting that by construction the average tax within $A(e)$ is $\bar{T}(e)$, we have:

$$J^a = \bar{J}^a + \sum_e p_e J_{e-(t+e)/z}$$

This can be written:

$$J^a = \bar{J}^a + VC_d + H$$

in view of (3) and (4), and reduces to the first result claimed in the theorem upon subtraction from J^b, using (1) and (2). For the second result, for each subgroup $A(e)$ decompose after tax inequality across its constituent equals groups $S(e,d)$:

$$J_{e-(t+e)/z} = J_{e-t} + \sum_e q_{e,d} J^a_{S(e,d)}$$

The alternative expression for H comes by substituting from this into (4). ***Q.E.D.***

The first part of this Theorem establishes that the forms chosen for the measures VC_d and H, to summarise the local inequality effects of, respectively, introducing the ideal tax system $t(e,d)$ and then replacing it by the actual one, are not after all *ad hoc* in the case of the mean logarithmic deviation (henceforth MLD). They reveal the equity costs of the socially deserving tax treatments (a loss of vertical equity for the sake of modified **HE**) and of the undeserving tax treatments, design and other shortcomings in the tax code (sources of **HI**), as subtractions from the redistributive effect achievable by following classical **VE** and **HE**. The second part of the Theorem confirms that, in the case of the MLD, H is an index of pure **HI**, in the tradition established by Musgrave (1990). That is, H is a weighted average of the inequalities introduced by the tax system locally (among members of each of the equals groups $S(e,d)$), the weights being such that the importance attributed to a local **HE** violation does not depend upon the income level at which it is experienced.[10]

The MLD is the unique decomposable index of relative inequality whose weights for the constituent subgroups are proportions. Other members of the generalised entropy class[11] could be used in defining the summary indicators VC_d and H, provided the weights in (3) and (4) are changed to take the form $p_e^{1-a}n_e^{a}$ for some $a \neq 0$, where n_e is the mean after tax living standard of those having e before tax. An analogous decomposition of redistributive effect would obtain, but the resultant H would not be an

[10] Musgrave (1990) suggested the business of devising a local measure and then aggregating: "**HE** measures which are applicable to particular groups do not suffice. To assess the **HE** quality of the entire system and to permit comparison with other burden distributions, an overall measure of **HE** is needed. The construction of such an index is awkward .... an overall picture [must be] given while inappropriate comparisons between unequals are avoided" (pp. 117-8).

index of pure **HI** and, as we shall see, serious empirical problems would also ensue. In Lambert and Ramos (1997), the MLD is used to derive the decomposition of redistributive effect which is appropriate for the case in which society's norms are those of classical **VE** and **HE** (*i.e.* no differential tax treatments are sanctioned). In that case, the result is:

$$RE = VR - HI.$$

where, in the present notation, $VR = VR_e$ and $HI = VC_d + H$: all departures of the income tax from the (ideal) tax $\bar{T}(e)$ on equivalent income are lumped together and counted as **HI**.[12] The present analysis clearly goes much further, enabling the different kinds of tax break typically present in the tax code to be characterised and their equity sacrifices to be separately costed, as we claimed at the outset.

Suppose, for example, that we would re-classify a tax relevant attribute from within the vector *d* of socially deserving ones to the vector *u* (or *vice versa*). Nothing in the data would change; nor, consequently, would the averaged schedule $\bar{T}(e)$. Hence both *RE* and VR_e are invariant to reclassifications of tax breaks between the deserving and undeserving categories. But, of course, the equals groups $S(e,d)$ would change, and so, in consequence, would VC_d and *H*. That is,

$$\Delta VC_d = - DH \tag{5}$$

We may expect ΔVC_d to be positive (*i.e.* VC_d to increase) if an undeserving tax break were imported into the deserving category, and $\Delta H > 0$ for a reclassification in the opposite direction. However, as the empirical application to the US tax system in Section 5 shows this is not always the case, and indeed it is not possible to sign ΔVC_d *a priori*.

---

[11] On which, see Cowell (1980), Shorrocks (1980) or, for a less technical and very readable treatment, Jenkins (1989).

For instance, if those taxpayers who benefit from a given tax break constitute a subgroup of taxpayers who benefit from another tax break, the change in vertical cost of reclassifying the former tax break from, say, *d* to *u* would be zero if the latter tax breaks is already a member of *d*. The reason being that the equals groups $S(e,d)$ do not change, and so neither does VC_d.

The magnitude of change in VC_d is readily calculated, simply by recomputing the inequality indices $J_{e\text{-}t}$ using the new equals groups (recalling that, according to our model, the average across an equals group $S(e,d)$ of actual taxes is $t(e,d)$). Then, from (3):

$$\Delta VC_d = \sum_e p_e \Delta J_{e-t} \tag{6}$$

Evidently, the value of the impact ΔVC_d on redistributive capacity for a change in the classification of a particular tax break depends on what other tax breaks are currently assigned by the analyst to the deserving class. This is a familiar 'index number problem', illustrated by our empirical analysis of the US tax system in Section 5. We leave theoretical attention to this issue for future research.

4. Implementation

There are typically few exact equals in sample microdata, but there may be plenty in the population from which the sample is drawn. **HI** may thus be under-estimated, and the sample function $t(e,d)$, computed by averaging, will not be a reliable description of the underlying ideal. This is the so-called identification problem. But our methodology can be refined to cope with this, along the lines already indicated in Lambert and Ramos (1997). Specifically, if pre-tax equivalent incomes *e* in the sample are banded, and 'close

[12] A similar approach, but using the Gini coefficient, is to be found in Aronson *et al.* (1994), in which

equals groups' formed, the measures VR_e , VC_d and H of Theorem 1 can be adapted into "pseudo-measures" to capture inequality effects within and between bands and close equals groups, keeping the decomposition of Theorem 1 intact.

Brief details are as follows. First, select a partition of pre-tax living standards into bands. Let $0 = a_1 < a_2 < ... < a_{k+1}$ be the values delineating the bands, and let $S_i(d)$ be the 'close equals group' comprising people with deserving attributes d and living standards before tax in the range $a_i < e \leq a_{i+1}$. That is, $S_i(d) = \cup_{a_i < e \leq a_{i+1}} S(e,d)$. Let $J^b_{S_i(d)}$ and $J^b_{S_i(d)}$ denote inequality before and after tax in $S_i(d)$. The increase, aggregated over close equals groups:

(7) $$PH = \sum_i \sum_d r_{i,d} \left[J_i^a - J_i^b \right]$$

provides a measure of "pseudo-**HI**" (where $r_{i,d}$ is the proportion of the population in $S_i(d)$). The measure VR_e can be adapted into a pseudo-measure of redistributive effect between bands, by forming artificial distributions in which the living standards of the people in each band are equalised at the mean, both before and after tax. If J^{b*} and J^{a*} denote the MLD in the artificial distributions so formed, the pseudo-VR_e index is:

(8) $$PVR_e = J^{b*} - J^{a*}$$

A similar modification of VC_d can be defined, or this can be determined by subtraction, for the same decomposition as in Theorem 1 holds between the pseudo-measures:

(9) $$RE = PVR_e - PVC_d - PH$$

and the finer the partition, the closer PVR_e, PVC_d and PH are to VR_e, VC_d and H respectively.[13]

---

the (implied) weights in the index of classical **HI** are non-pure.

[13] The proof rests upon decompositions of pre- and post-tax inequality across the sets $A_i(e) = \cup_d S_i(d)$ and further decompositions across the constituent close equals groups within each $A_i(e)$, following the

The accuracy of the pseudo-estimators for small samples is investigated in Lambert and Ramos (1997), using simulation, and found to be encouraging. The identification problem, then, need not prevent the estimation of (vertical and) horizontal characteristics of an income tax from sample microdata.

5. Empirical Illustration to the US Income Tax System, 1990

This section uses tax data from the US 1990 Tax Model File to illustrate our methodology[14]. The 1990 US Tax Model File is a data set consisting of some 22000 US individual tax records for 1990. Like other western tax systems the US tax system favours some activities or personal attributes by means of tax breaks. We concentrate on some of these tax breaks and estimate their 'cost' in terms of foregone equity as outlined in Sections 3 and 4. We also assess the change in foregone equity (ΔPVC_d) of reclassifying some tax-relevant attributes from the vector d of socially deserving ones to the vector u of undeserving attributes. To take account of the 'identification problem' incomes are banded in groups of $5000 and the analysis is performed in terms of pseudo-measures. To convert income into utility, we deflated money income using the following equivalence scale, z_n, with parameters Φ and q set to one half[15]

$$z_n = (A + \Phi C)^q \qquad 0 \leq \Phi \leq 1,\ 0 \leq q \leq 1$$

where A is the number of adults and C is the number of dependent children in the family. The value of $q = 0$ corresponds to not equivalising; for $q > 0$ economies of scale are

---

steps laid out in Lambert and Ramos (1997), with suitable modifications. As shown there, the proof would fail if *any other decomposable inequality index than the* MLD were used to measure inequality: the MLD is the only member of the Generalised Entropy family which allows pseudo-indices.

[14] We would like to thank Professor Richard Aronson and Don Tripper for the data and for their very helpful comments on the US tax system.

[15] This exercise is merely illustrative but a more detailed analysis including sensitivity analysis to changes in the equivalence scale parameters, Φ and θ, as well as to changes in the income interval which defines the 'close equals' groups is on our research agenda.

assumed, which reduce as q is increased. The parameter Φ determines the importance of children. For $\Phi = 0$ children are not taken into account, and for $\Phi = 1$ they count the same as adults. Individual income taxes were also equivalised using the same equivalence scale.

Before tax inequality (as measured by the MLD) in the US is 0.6117 in 1990, while inequality after tax is 0.5400. Thus the redistributive effect of the US tax system in 1990 is 0.0717 (which is similar to the *RE* of the Spanish tax system for the same year, 0.0621; see Lambert and Ramos, 1997). All the relevant estimates are shown in Table 1. 'Classical' vertical redistribution, PVR_e, is 0.0718. That is, the redistributive effect would have been 0.19 per cent larger than its actual value if not for the loss caused by horizontal inequity and the differential treatment given to some activities through tax breaks, *i.e.* if the averaged schedule $\bar{T}(e)$ had applied (again, this estimate is close to that for Spain, where PVR_e is 100.65% of *RE*).

What percentage of this (small) loss in vertical redistribution is due to 'deserving' tax breaks and what percentage can be attributed to 'modified' HI? First, note that if all tax breaks appended to the tax code were regarded as socially undeserving, then all the loss in redistributive effect would be due to violations of the 'classical' horizontal equity principle. In this case $\bar{T}(e) = t(e, d_i)$ for all i (since category d is empty) and the decompositions of the *RE* in Theorem 1 in Lambert and Ramos (1997) and this paper's Theorem 1 are equivalent since $VC_d = 0$.

In the US, some activities, for example donating to charities, receive a different tax treatment, *i.e.* contributors to charities are allowed to deduce a percentage of their charitable contributions out of the income tax. By regarding such an activity as not being socially deserving of differential treatment we are assessing the tax break given to charity

contributors as capricious discrimination. Alternatively, we may think that charity contributions are worthy of social recognition and thus should be rewarded through the tax system. The assessment of its equity implications requires the 'modified' HE principle and thus the new decomposition proposed in Theorem 1.

As we have seen, to legitimate differential treatment through tax breaks has its cost, and this is measured by PVC_d. Row 5 in Table 1 shows that, although in levels the cost of legitimating tax breaks related to charity contributions ($PVC_{d=1}$) may seem small, it actually represents 72.4 per cent of the total loss of vertical redistribution (PVR_e - RE). This implies that 'modified' HI is only 27.6 per cent of what it would have been had we adopted the 'classical' HE principle.

Let us, now, consider the changes in PVC_d of reclassifying attributes between deserving and undeserving groups. When assessing the cost of tax breaks due to charitable contributions, above, we classified all the other tax breaks as undeserving. Suppose we want to reclassify one of those tax breaks from undeserving to deserving. In particular, consider reclassifying the tax break associated with having paid regional or local taxes (henceforth the regional tax break). What is the cost of these two deserving tax breaks, and how does this cost differs from that of having the tax break due to charity contributions as the only deserving tax break? Row 7 in Table 1 shows that when the regional tax break is imported to the deserving class, $PVC_{d=2}$ increases to 80.6 per cent of the total loss of vertical redistribution. In other words, the vertical cost, $PVC_{d=2}$, increases by 11.3 per cent with respect to the previous cost , $PVC_{d=1}$, of having the charitable contributions' tax break as the only member of the deserving class. As noted in Section 3, however, not all tax break reclassifications from the undeserving to the deserving classes increase the vertical cost. If in addition to the two deserving tax breaks (*i.e.* charitable contributions and regional tax) we include the health related tax breaks

into the deserving class, $PVC_{d=3}$ drops by 5.6 per cent of its previous value ($PVC_{d=2}$), to 76.1 per cent of the total loss of vertical redistribution. May be that health related tax breaks are going more to those whose income net of charitable deductions are lower; that is, if not to the poor, then at least to those amongst the rich who are significantly altruistic to be giving to charity.

Finally, the dependence of ΔPVC_d upon the analyst's sequencing of the tax breaks can be seen by comparing the effects of reclassifying the regional tax break from the undeserving, *u*, to the deserving, *d*, class when the deserving class is only composed by the tax break due to charitable contributions (*i.e.* d=1) and when d includes tax breaks related to health and charitable contributions (*i.e.* d=4); that is, by comparing ΔPVC_d brought about by the reclassifications (d=1 $\rightarrow$ d=2) and (d=4 $\rightarrow$ d=3). For the former reclassification (d=1 $\rightarrow$ d=2), we have seen that $PVC_{d=2}$ increases by 11.3 per cent of its previous value ($PVC_{d=1}$), whereas for the latter one, (d=4 $\rightarrow$ d=3), $PVC_{d=4}$ increases by only 7.9 per cent of its previous value ($PVC_{d=3}$). The difference lies in having, or not having, health related tax breaks as currently assigned tax breaks in the deserving class.

In sum, 'modified' HI is much smaller than 'classical' HI. This, in turn, means that 'classical' HI is largely due to differential treatment by the tax designer on the basis of attributes or factors which may be argued (by others) as socially deserving of such a treatment.

Table 1. *RE*, PVR_e, PVC_d, and *PH* for the US, 1990

	Value	$\%RE^a$ or $\%(PVR - RE)$
Pre-Tax Income Inequality	0.6117	
Post-Tax Income Inequality	0.5400	
RE	0.0717	
PVR_e	0.0718	100.2
{*d*=1}:= {charity contributions}		
$PVC_{d=1}$	0.00009971	72.4
PH	0.00003805	27.6
{*d*=2}:= {charity contributions, regional taxes}		
$PVC_{d=2}$	0.00011104	80.6
PH	0.00002672	19.4
{*d*=3}:= {charity contributions, regional taxes, health related}		
$PVC_{d=3}$	0.00010481	76.1
PH	0.00003295	23.9
{*d*=4}:= {charity contributions, health related}		
$PVC_{d=4}$	0.00009716	70.5
PH	0.00004060	29.5

[a]: Only applies to PVR_e.

We have illustrated the 'index number problem' and have noticed that not all tax breaks reclassifications work in the same direction. In particular, for the 1990 US tax, health related tax breaks decrease the vertical cost associated to their legitimisation whenever the deserving set of tax breaks, *d*, was not empty.

A more detailed analysis where more years and tax breaks could be analysed should provide interesting results for tax legislators and policymakers, and for future tax reforms in the US. Specially interesting would be to assess the effects on the vertical cost and modified HI of the 1986 US Tax Reform.

6. Summary and Conclusions

According to the classical norms of horizontal and vertical equity, living standard alone is regarded as the proper determinant of a family's income tax treatment. However,

society typically wishes to use the income tax to reward certain forms of economic activity, (we have cited homeownership, charitable giving and private health care provision, among others), and in this case a modified set of equity criteria are required. To tax away a specified part of each family's living standard without regard to these socially deserving factors would not be equitable according to the modified equity norms we suggest here, but there is a price to pay in inequality terms for adopting the modified criteria.

In the decomposition $RE = VR_e - VC_d - H$ of Theorem 1, the term VC_d quantifies the cost of having a fairer income tax than that merely based on living standard, and expresses the trade-off between rewarding social merit and the redistributive capacity of the tax. The term H captures the negative impact on redistributive capacity of any tax treatments which are *not* in furtherance of society's goals, and of poor tax design, assessment error, capriciousness and so forth: it quantifies the further reduction in inequality that would obtain if all individuals with the same living standard e and deserving attributes d were treated equally.

Individual tax breaks (such as the homeownership relief) may be seen as rewards for social merit, or not: it can be a matter of opinion. Our methodology provides the means to assess the equity cost of each such break, this being either in terms of foregone vertical redistribution if the break is held to be socially deserving, or as a pure **HI** cost if not. We have rendered the entire approach immune to the identification problem and left one remaining issue, that of the dependence of the derived measures upon the analyst's sequencing of the breaks, for future investigation. For the 1990 US income tax our methodology shows that when some tax breaks are regarded as socially deserving 'modified' HI is much smaller than 'classical' HI. This difference reflects the equity cost of those tax breaks. In particular, we have found that the equity cost of tax breaks

related to charity donations is 72 per cent of the total loss of vertical redistribution. When, in addition to this tax break, other tax breaks related to regional taxes are also included in the deserving class, *d*, the equity cost increases by 11.3 per cent.