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**EQUIVALENCE SCALES,  
THE INCOME DISTRIBUTION,  
AND FEDERAL TAXES**

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Abstract

Alternative measures of income generate significantly different ordering of families and individuals in the income distribution, and therefore can yield differing conclusions about the distributional effects of government policies. This paper compares six alternative measures of income based on different adjustments for family size, all of the form  $(A+cK)^e$ , where A is the number of adults, K the number of children, c the weight attached to children, and e a factor measuring economies of scale. Although the various measures rank families and individuals in different orders, the adjustment chosen has little effect on measures of effective tax rates across income categories over the last two decades or on the effects of federal taxes on the distribution of after-tax incomes.

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## Equivalence Scales, the Income Distribution, and Federal Taxes

In nearly every year of the last decade, the Congress has considered changes to the federal tax code. Many arguments raised for and against the changes under consideration have revolved around the impact of the changes on taxpayers in different parts of the income distribution. Claims that particular legislation would favor the rich or harm the poor have had considerable force in arguments against tax proposals.

Distributional analysis, however, is hardly as straightforward as its users would lead their audiences to believe. Alternative measures of income may lead to quite different conclusions about a policy's potential effects, as will the time period over which the effects are measured. Alternative analytic methods of ranking families and individuals by income—and thus of showing distributional effects of proposals—can also lead to different conclusions about particular policies. Because no single method is clearly preferred over others, arguments based on a specific measure of income and method of ranking of families are open to question.

This paper compares alternative methods of ranking families and individuals by income to determine the influence of using a particular method to examine policy options. It does not explore the issues of alternative measures of income or the effects of considering different time periods. The first section defines six alternative measures that could be used to rank families and individuals. The second section compares those different measures to determine their effects on rankings of particular

units and thus the potential for choice of measure to lead to varying conclusions about the effect of policy options. The third section demonstrates that while alternative measures yield different income rankings, they have little effect on measures of effective tax rates across income quintiles. Finally, we show that the choice of ranking has little effect on conclusions about changes in the distribution of taxes over the last two decades or the effects of federal taxes on the distribution of after-tax income, although it may matter for the evaluation of certain tax policies.

### Vertical Equity and Equivalence Scales

A major concern of tax policy analysts is whether a particular policy is vertically equitable—that is, how the policy distributes tax burdens across tax units with different abilities-to-pay. In particular, vertical equity is generally taken to mean that units with greater ability-to-pay bear a larger share of the tax burden than units that are less well off. Although the concept of vertical equity may generate little controversy in the abstract, its definition leaves unstated just what constitutes an equivalent ability-to-pay. The most frequently used indicator is simply cash income, but other measures rank families and individuals in different orders and may thus lead to conflicting conclusions about the distributional effects of policy alternatives.

A tax unit's ability-to-pay varies because of many factors, such as family size and composition, location, and number of workers. Cash income alone fails to recognize those differences, and may thus fail to capture differences in ability-to-pay across families and individuals. From an analytic perspective, a wide range of alternative methods could adjust for differences among families and individuals to provide more accurate measures of well-being and thus ability-to-pay taxes. It is difficult, however, to correct fully and consistently for all differences among tax units.

Most analyses have focused on family size as the most important and measurable characteristic to use in adjusting income to assess ability-to-pay.

One approach to adjusting incomes for differences in family size involves dividing family incomes by an equivalence factor of the form  $(A+cK)^e$ , where A is the number of adult family members, K is the number of children in the family, c is the relative weight assigned to children, and e a parameter that determines the relative abilities-to-pay of families of different sizes.<sup>1</sup> More specifically, we define equivalent family income (EFI) to equal family income (FI) divided by the equivalence factor:

$$EFI = FI / (A+cK)^e$$

Both the elasticity of need with respect to family size, e, and the weight attached to children, c, can vary between 0 and 1. For this analysis, we use six alternative equivalence scales based on values of e and c (see Table 1).

- **Family Cash Income (FCI):** At one extreme, when e is 0, equivalent family income is simply a family's cash income, with no correction for family size. While analysts often use this measure to assess well-being and ability-to-pay, it takes no account of the greater needs of larger families and thus overstates the well-being of larger families relative to smaller ones.
- **Per Capita Income (PCI):** At the other extreme, when both e and c equal 1, equivalent family income equals per capita income. This measure assumes that a family's needs are directly proportional to its size, but fails to take account of any economies that come from people living together and sharing costs. Ignoring such scale economies understates the well-being of large families relative to smaller ones.

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1. This discussion draws from David M. Cutler and Lawrence F. Katz, "Rising Inequality? Changes in the Distribution of Income and Consumption in the 1980's," *American Economics Association Papers and Proceedings*, May 1992, pp. 546-551 and Frank Sammartino and Robertson Williams, "Family Structure and Federal Tax Burdens," *Proceeding of the Eighty-Fourth Annual Conference of the National Tax Association*, 1992, pp. 257-264.

- **Per Adult Income (PAI):** An alternative approach entirely ignores the presence of children by setting  $c$  equal to 0. The value of  $e$  is set to 1, so that PAI equals cash income per adult. This measure derives from the view that families choose to have children and therefore the presence of children must make them better off, even if children reduce the average resources available per person. The measure takes no account of scale economies in household production ( $e = 1$ ), but does recognize that families with more adults need additional income to reach a given level of well-being.
- **Weighted Per Capita Income (WPCI):** This measure falls between per capita income and per adult income by setting  $c$  to one-half. Again,  $e$  is set to 1. This alternative acknowledges that children require additional resources, but not the same amount as adults. Again, with  $e$  equal to 1, the measure ignores any economies deriving from shared household consumption.
- **Adjusted Family Income (AFI):** Setting  $e$  equal to 0.5 and  $c$  to 1 provides a measure intermediate to family cash income and per capita income. This measure recognizes both the greater needs of larger families and their scale economies of sharing costs. As indicated in Table 1, it roughly approximates the equivalence scale implicit in the official poverty thresholds used by the Bureau of the Census to assess the poverty status of families and individuals.
- **Weighted Adjusted Family Income (WAFI):** The final measure sets both  $e$  and  $c$  to 0.5. Like AFI, this measure takes account of the larger families' greater needs and economies of scale. Setting  $c$  to one-half acknowledges the smaller consumption requirements of children relative to adults.

An important question is whether equivalence scales should vary across income levels. Although a poor family of four might require twice the income of a single person to be equally well (or poorly) off, higher-income families might require larger or smaller multiples of income to attain equivalence as family size increases. For example, wealthy families whose members all get their own bedrooms may not be able to capture the same level of scale economies in housing that poor families can get in more crowded units. The various adjustments examined in this paper remain constant across income classes, and thus may fail to represent accurately the relative needs of families at all income levels.

Other factors that may affect the income needs of families are also absent from the analysis. Families with otherwise equal incomes but who face different prices for the goods they consume will not have the same abilities to pay taxes. In the same way, families that require two workers to earn a given level of cash income will be less well off than otherwise similar families with only one worker. In spite of the potential importance of these issues, this paper ignores all factors that may influence well-being other than family composition.

#### Distribution of Families and Individuals Under Alternative Equivalence Scales

The alternative equivalence scales generate different distributions of families across income percentiles in exactly the ways that would be anticipated. Measures that ignore or downplay the presence of children rank families with children higher in the distribution than do measures that count children like adults. At the same time, because they have fewer members on average, elderly families rank higher when the equivalence scale used takes greater account of family size. Units that have neither elderly nor child members also rise in the distribution when equivalence scales incorporate family size.

The percentile distributions in this paper generally show counts or percentages of families, but each percentile category is defined on the basis of the distribution of people. Thus, although each quintile contains one-fifth of all people, quintiles may include more or less than one-fifth of families because of differences in family size.<sup>2</sup> In particular, quintiles that contain larger families will have

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2. The term “families” as used in this paper includes both families as defined by the Bureau of the Census—two or more related people living together—and individuals not living with relatives, who are counted as “one-person families.” Under this definition, the term “families” is simply shorthand terminology for what the Census would call “families and unrelated individuals.”

fewer families than those that contain smaller families.

Under the traditional Family Cash Income (FCI) ranking, the lower income quintiles contain more families than the upper quintiles, particularly for elderly and childless families (see Table 2 for the distribution of families in 1995, the most recent year for which we have actual data).<sup>3</sup> Because smaller units tend to have lower income than larger units, they are ranked lower in the distribution, and it thus takes more families to comprise a given percentage of the population in the lower quintiles. As a result, using the cash measure, 26.5 percent of families were in the lowest quintile in 1995 and only 15.5 percent were in the top quintile.

A reverse pattern holds when people are ranked by Per Capita Income (PCI). Under this measure, the higher incomes of larger families are more than offset by their increased size, and they thus fall lower in the income distribution than do smaller families. Consequently, fewer families make up the lower quintiles and more are in the upper percentiles: 16.5 percent of all families were in the lowest quintile in 1995 under the per capita measure, compared with 25.8 percent in the top quintile. That pattern is stronger for elderly families, which tend to be smaller: in 1995, only 8.5 percent of elderly units were in the lowest quintile defined for per capita income, while 24.4 percent were in the top quintile. In contrast, the larger average size of families with children causes them to be disproportionately represented in the lower quintiles. Nearly 27 percent of families with children were in the bottom quintile in 1995 and only about 10 percent were in the top quintile.

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3. For comparison purposes, Table A-1 in the appendix shows the distribution of people—rather than families—under alternative equivalence scales. Both Table 2 and Table A-1 are for 1995, but other years show similar patterns.

The other equivalence scales—Adjusted Family Income (AFI), Weighted AFI (WAFI), Per Adult Income (PAI), Weighted Per Capita Income (WPCI), and Weighted Adjusted Family Income (WAFI)—fall between the two extremes of cash and per capita incomes. Both PAI and WPCI discount children in adjusting incomes for family size, and thus have smaller effects than the per capita measure. AFI counts all family members equally, but adjusts income less for differences in family size than the per capita measure by dividing income by the square root of family size rather than by family size itself. WAFI both discounts children and adjusts income less for family size than per capita measures. Again, Table 2 shows the effects of the alternative measures on the distribution of families.

Except for AFI and WAFI, the equivalence scales exhibit consistent patterns of ranking families that derive from their counting differences in family size successively more heavily in adjusting incomes. With no adjustment for family size, the cash measure falls at one extreme, followed by PAI counting only adult family members, WPCI counting children at half the weight of adults, and PCI counting all family members equally. AFI and WAFI fall between the two extremes, but follow no clear pattern with respect to the other two measures.

Tables showing how families move among income quintiles under the various measures provide another look at the effects of different equivalence measures on the distribution of families. Table 3a shows the movement of all families among quintiles when the equivalence scale shifts

between cash and each of the other five measures.<sup>4</sup> Again, shifting from cash to AFI or WAFI generally moves families up in the distribution, largely because both alternative measures raise the incomes of smaller families relative to larger ones. As would be expected, the effect of changing to WAFI is smaller than that of changing to AFI. Moving from a cash measure to a per capita or weighted per capita measure pushes families further up the distribution for similar reasons. Measuring income on a per adult basis is similar to AFI for all families as a group, with upward and downward shifts roughly in balance.

Tables 3b through 3d show the differences in quintile rankings of families with children, elderly families, and other families, respectively, with values representing the percentages of all families in each quintile for each income measure, not the percentages of each family type.<sup>5</sup> In general, families with children again rank higher under the cash or per adult measures than under AFI or WAFI, and lower under the per capita and weighted per capita measures. The reverse pattern holds for elderly families (Table 3c) and other families (Table 3d).

#### Effective Federal Tax Rates

The choice of equivalence scale clearly affects not only the ranking of families but also the observed

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4. Because quintiles are defined on the basis of persons while Tables 3a through 3d show the ranking of families, the quintiles in those tables generally do not contain equal numbers of families. In addition, because of rounding, the distributions of families in those tables may not agree completely with other tables.
  5. Appendix Tables A-2a through A-2c parallel Tables 3b through 3d but show percentages of the particular type of family rather than percentages of all families.