3

Adjusting Poverty Thresholds

The previous chapter focused on the derivation of a poverty threshold for a reference family of two adults and two children. A poverty threshold that is appropriate for this type of family, however, may not be appropriate for another type of family: a single person obviously needs less money than a family of four, and a family of eight needs more money. These differences are recognized in the current poverty measure, which uses different thresholds for different family types. And even for a given family type, the amount of money needed to stay above the poverty threshold will likely be different in a large city than in a small town, and it may also differ by region of the country. There is therefore an argument for adjusting the thresholds, not only for family size, but also for place of residence. This kind of adjustment is not made in the official poverty thresholds. In this chapter, we consider these adjustments and present our recommended procedures for adjusting the reference family threshold. We first discuss adjustments by family type and then by geographic area of residence.

ADJUSTMENTS BY FAMILY TYPE

The Concept of an Equivalence Scale

Equivalence scales are measures of the relative costs of living of families of different sizes and compositions that are otherwise similar. For example, if a family of two adults can live as well as a family of two adults and two children while spending only two-thirds as much, then relative to the reference family of two adults and two children, the equivalence scale value for a two-adult family is two-thirds. For the purpose of poverty measurement, the use of an

equivalence scale is to scale up or down the threshold for the reference family to provide corresponding thresholds for other family types.

The concept underlying such a scale appears straightforward and is similar in spirit to a standard cost-of-living index number. If it costs twice as much at one time to maintain a given standard of living as it did at an earlier date, then one needs twice as much money to reach the equivalent standard of living. The idea of an equivalence scale is the same, but instead of comparing two different sets of prices, one compares two different family types. In spite of this apparent simplicity, a precise characterization of equivalence scales is elusive, and the many scales proposed in the literature differ not only by the usual margin of empirical uncertainty, but also in their underlying conception: different authors are not always measuring the same thing. As a result, it is possible to find a wide range of scales, which have very different implications for the total number of people in poverty as well as for the distribution of poverty among families of different types. Depending on the scale used, the poverty rate can be substantially higher or lower, and the demographic composition of those considered poor can change dramatically.

Overview and Recommendation

One simple method of adjusting the reference family threshold by family type is to scale it in proportion to the number of people in a family. In the language of "equivalence scales," a single person would need one-quarter as much as a family of four, a married couple without children one-half as much as a family of four, and a family of eight twice as much as a family of four. Most people, including the members of the panel, regard this as an extreme position, since it makes no allowance for the fact that children are different from adults, nor for the economies of scale possible for larger families by sharing kitchens, bathrooms, and bedrooms or by buying products in bulk. This straight proportion rule clearly understates the needs of small families relative to large ones, and, hence, it will overestimate the number of poor people in large families relative to those in small families.

The opposite extreme is to make no adjustments for family type and to apply the basic poverty threshold to all families irrespective of size or composition. This "zero" adjustment for family size is as unpalatable as is the straight proportion adjustment of multiplying the threshold by family size. It assumes that one adult needs as much as a two-adult/two-child family and also that a four-adult family or a family of two adults and three or more children needs no more than the two-adult/two-child family. There is widespread agreement that the appropriate adjustment lies somewhere between the two extremes; however, there is much less agreement on exactly how much to adjust the threshold for children relative to adults or how to measure economies of scale for larger households.

We have reviewed the adjustments for family type that are embodied in the official poverty thresholds, as well as those that are implicit in other government programs. We have also considered numerous other proposals in the literature, including those that use empirical analysis in an attempt to establish an objective adjustment on the basis of comparing the behavior of families of different types. Although the empirical evidence helps determine the limits of what makes sense, there is no objective procedure for measuring the different needs for different family types. As with the determination of the reference family poverty threshold itself, for which empirical evidence can inform but not prescribe what is fundamentally a social or political judgment, so with the adjustments for different family types. Thus, similarly, we have opted for a procedure that, while taking into account the empirical evidence and previous experience, recognizes that the decision is based on judgment and seeks to make the process as transparent as possible.

Our recommended procedure follows from our conclusion that the equivalence scale implicit in the official poverty thresholds is problematic and should be replaced. We say "implicit" because the official thresholds were developed separately for each family type rather than by the application of a formal scale to a reference family threshold. The basis for the official thresholds was a set of estimates of different food requirements for adults and children of various ages in families of different sizes. The assumptions underlying the differences are questionable, as is the assumption that differences in food needs adequately capture differences in needs for housing and other goods. One particularly questionable assumption is that people aged 65 and older need less to eat and so should have lower poverty thresholds than younger people; this assumption underlies the official thresholds for unrelated individuals and members of two-person families. Also, the implicit scale (which can be calculated by comparing the differences among the official thresholds for various family types) exhibits a number of irregularities and anomalies: for example, the second child in a family adds more costs than the first child.

We propose that poverty thresholds for different family types be developed by applying an explicit scale to the reference family poverty threshold. The scale should distinguish the needs of children under 18 and adults but not make other distinctions by age; the scale should also recognize economies of scale for larger families. A scale of this type is the following:

$$\text{scale value} = (A + PK)^F ,$$

where A is the number of adults in the family, K is the number of children, each of whom is treated as a proportion P of an adult, and F is the scale economy factor. The formula calculates the number of adult equivalents ($A + PK$) and raises the result to a power F that reflects economies of scale for larger families. We recommend values for both P and F near 0.70; to be specific, we recommend setting P at 0.70 (i.e., each child is treated as 70% of an adult) and

F in the range of 0.65 to 0.75. To calculate the actual thresholds, the ratio of the scale value from the formula for each family type to the value for the reference family type is applied to the reference family threshold.

> **RECOMMENDATION 3.1. The four-person (two adult/two child) poverty threshold should be adjusted for other family types by means of an equivalence scale that reflects differences in consumption by adults and children under 18 and economies of scale for larger families. A scale that meets these criteria is the following: children under 18 are treated as consuming 70 percent as much as adults on average; economies of scale are computed by taking the number of adult equivalents in a family (i.e., the number of adults plus 0.70 times the number of children), and then by raising this number to a power of from 0.65 to 0.75.**

To explain the basis for our recommendation, we review types of equivalence scales, including the scale inherent in the official thresholds. In the discussion, we present our reasons for recommending that children be treated as needing 70 percent as much, on average, as adults, and for suggesting a range of 0.65 to 0.75 for the factor used to adjust for economies of scale for larger families.

The Current Equivalence Scale

During the 1960s, when there was keen interest in developing a poverty measure for the United States, one widely cited measure did not employ an equivalence scale. The 1964 report of the Council of Economic Advisers (CEA) set the poverty line for 1962 at $3,000 for a family (of any size) and $1,500 for unrelated individuals. It is hard to defend the proposition that a family of five can live as cheaply as a family of two, and although some might argue that parents who have chosen to have larger families should not be regarded as poor simply because of that choice, the same can hardly be said of the children, who played no part in their parents' decision. If one is to construct a sensible measure of poverty, some equivalence scale must be used.

Mollie Orshansky, working at the Social Security Administration in the early 1960s, developed the poverty measure that was ultimately adopted for official use. Her central poverty threshold for a family of four was about the same as the CEA family threshold of $3,000, but she developed a whole range of thresholds that took family size and composition into account (Orshansky, 1963, 1965a). She thereby defined an equivalence scale, not directly, but by constructing a set of thresholds for different family types. Orshansky's thresholds were derived from looking at food budgets, and the equivalence scale that is implicit in them is a consequence of her judgments about needs for food and other goods.

The underpinning for Orshansky's thresholds was the U.S. Department of

Agriculture (USDA) Economy Food Plan, which provided the estimated cost of a minimally adequate diet for adults and children of various ages and for families of different sizes. (The latter estimates reflect assumptions about economies of scale on food; see Peterkin et al., 1983.) Orshansky's food budgets were based on the USDA estimates, coupled with assumptions about the ages of the children in each size and type of family. She developed separate budgets for families on the basis of the sex of the family head, the family size, the number of family members under the age of 18, and, for one- and two-person units, the age of the family head (under age 65 or 65 and older).

According to the 1955 Household Food Consumption Survey, the average family of three or more spent approximately one-third of its after-tax money income on food. On the basis of this evidence, Orshansky created thresholds for families of three or more by multiplying her estimated food costs by three. She examined families of two separately, however, on the grounds that smaller families are less able to take advantage of economies of scale and so must absorb higher per capita fixed costs. The average family of two spent 27 percent of its income on food, so the multiplier for families of this size was set at 3.70 (1.00/0.27). Without using a food plan and a multiplier, she set thresholds for unrelated individuals, characterized by sex and age, at 80 percent of the corresponding threshold for two-person families.[1] This figure implies that two adults can live as well as one person on 125 percent as much income (1.0/0.8). Finally, she took 70 percent of her thresholds as the thresholds for farm families.

In 1969 the Bureau of the Budget adopted Orshansky's thresholds (and thereby her equivalence scale) for the official measure of poverty, with the modification that the farm thresholds were raised from 70 to 85 percent of the nonfarm thresholds. In 1981 the nonfarm thresholds were applied also to farm families; the thresholds for families headed by women and men were averaged; and the largest family size category for the thresholds was raised from families of seven or more to families of nine or more. With the exception of these fairly minor changes, the current equivalence scale comes directly from Orshansky's original work. Because of the way it was constructed, the scale has as many categories as the official poverty thresholds and is thus quite detailed. (There are 48 categories at present, reduced from 124 categories prior to 1981.) Most presentations summarize it using weighted averages: see Table 3-1, which expresses the weighted average thresholds for families of size two to size seven relative to the threshold for a single adult under age 65.

A key point to note is the essential arbitrariness of the equivalence scale

[1] Unrelated individuals aged 15 and older are treated as separate one-person "families" in the U.S. poverty measure. Some of them live alone in their own households, but others live with other people not related to them (e.g., they may board with a family or live with one or more unrelated roommates).

TABLE 3-1 Equivalence Scale Implicit in Official Weighted Average Poverty Thresholds for 1992

Family Size	Scale Value Relative to a Single Adult (Under Age 65)	Increment in the Scale for Each Added Family Member (Relative to Single Adult Under Age 65)[a]
One person under age 65	1.000	0.00
One person aged 65 or over	0.922	–0.08
Two persons, head aged 65 or over	1.163	+0.16[b]
Two persons, head under age 65	1.294	+0.29
Three persons	1.533	+0.24
Four persons	1.964	+0.43
Six persons	2.273	+0.31
Six persons	2.622	+0.35
Seven persons	2.958	+0.34

SOURCE: Bureau of the Census (1993c:Table A).

[a]The values in this column represent the marginal effect of adding one more person to a family. For example, the figure of 0.24 for a three-person family category is the added amount for the third person, computed as the difference between the aggregate scale values in the first column for three-person families and two-person families relative to the scale value for a single adult.

[b]The value shown is for the increment in the scale for the second person in an elderly family relative to a single adult under age 65. The increment in the scale for a second person in an elderly family relative to a single adult aged 65 or over is 0.24—the difference between the scale values of 1.163 and 0.922.

that underlies the current poverty measure. Even if one accepts the scientific validity of the Economy Food Plan—itself a controversial matter since the plan is based on a compromise between expert nutritional advice and actual behavior—the derivation of the thresholds, and hence the equivalence scale, rests on a chain of ad hoc adjustments. The scientific basis for them is elusive or controversial, and, consequently, the scale is largely arbitrary.

There are numerous specific criticisms of the current scale, that is, of the way in which the poverty thresholds vary across family types. For example, it seems unlikely that economies of scale in food are similar to those for other goods, especially given the presumption that many economies of scale operate through housing (see Nelson, 1993; Orshansky, 1968a). This criticism was especially pertinent for the pre-1981 thresholds for farm and nonfarm families, in which farm families, because they spend less on food on average than nonfarm families, had lower thresholds. This distinction would make sense only if less is also needed for all necessities other than food, such as clothing and shelter, something for which there is no clear evidence. Although the farm-nonfarm distinction no longer exists, a similar situation occurs for elderly

individuals living in one- and two-person units who have somewhat lower thresholds than do the nonelderly because they are assumed to need less food.

There are also a number of disturbing irregularities in the current scale. If there are economies of scale as family size increases, then the increment in the scale for an additional person should be lower for larger families. Yet as Ruggles (1990:66) has pointed out, this is not true of the current scale: on a weighted average basis relative to a single adult (as seen in Table 3-1), a second person in a family adds 0.29 to the scale, a third person adds only 0.24, a fourth person adds 0.43, and a fifth person adds 0.31. In some cases, single-parent families have higher thresholds than married-couple families of the same size, implying that children cost more than adults in certain size families. As one example, the child in a two-person single-parent family adds more to the family's costs than does the spouse in a married-couple family: see Figure 3-1, which graphs—separately for married-couple and single-parent families—the increment in the scale for each added family member relative to a single

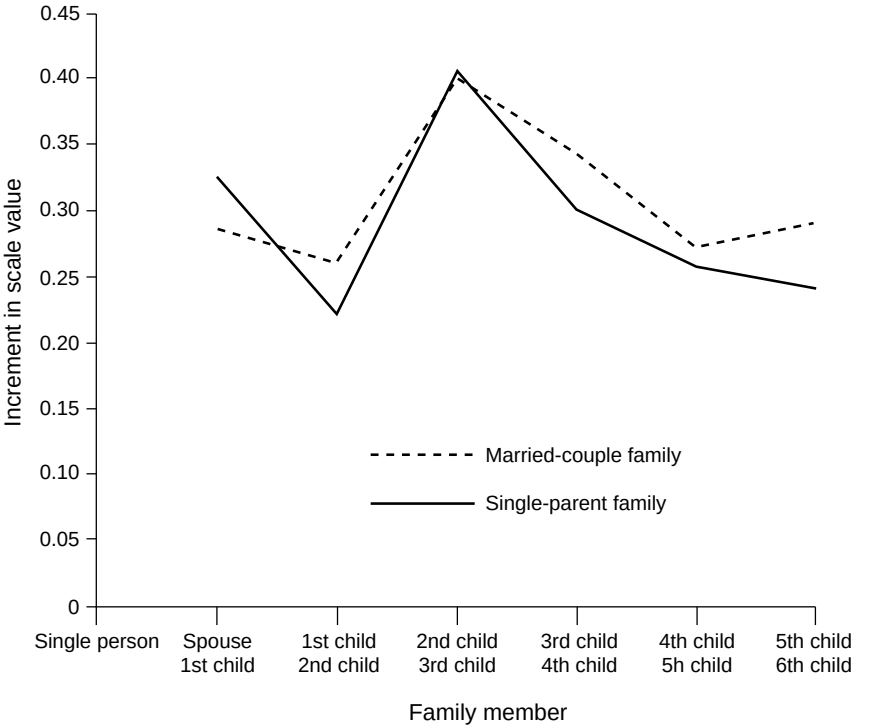

FIGURE 3-1 Equivalence scale implicit in the current poverty thresholds: increment for each added family member (relative to a scale value of 1.00 for a single adult under age 65). SOURCE: Data from Bureau of the Census (1993c:Table A).

adult under age 65. These irregularities come in part from the assumptions that Orshansky had to make about the ages of children in families when using the food plans.

We believe that these sorts of difficulties are always likely to be present in any method that is based on the construction of "ideal" or "expert" budgets for different family types, whether the budgets derive from food, as in Orshansky's procedure, or from a wider basket of goods as, for example, proposed by Ruggles (1990) and implemented by Renwick (1993a, 1993b).[2] Expert poverty budgets are inevitably the result of families' actual spending patterns and a series of adjustments that reflect judgments about what a low-income family "ought" to purchase. Because these budgets are always at least somewhat arbitrary, they impart no legitimacy to the equivalence scales that are implicit within them. We prefer a more direct approach that recognizes the arbitrariness by setting an equivalence scale formula directly and transparently and then using it to scale the threshold for a reference family type to derive poverty thresholds for other family types.

Alternative Equivalence Scales

Although there is wide agreement that different family types should have different poverty thresholds, that children have different needs from adults, and that larger households can benefit from economies of scale by sharing some items of consumption, there is little agreement about how the differences should be measured, and there is a wide range of scales in the literature. This section discusses some of these scales, as well as their conceptual and empirical basis.

Programmatic Equivalence Scales

In addition to the scale implicit in the official poverty thresholds, there are a number of other scales embodied in government programs or official pronouncements; see Table 3-2. The Bureau of Labor Statistics (BLS) estimated its own scale for the Family Budgets Program.[3] For this program, BLS estimated higher, intermediate, and lower budgets for two types of reference families: (1) a four-person family living in an urban area and comprising a husband aged 38 and employed full-time, a homemaker wife (no age speci-

[2] Renwick (1993b:Table 6) presents budgets for single-parent families of size two to size seven, consisting of separately developed estimates (including assumptions about scale economies) for food, housing, household operations, health care, transportation, clothing, and personal care. One key assumption that shapes her implicit equivalence scale is that a parent needs her or his own bedroom and that only two children can share a bedroom.

[3] BLS last respecified the family budgets for 1966-1967 and last published them, updated for price changes, for 1981.

TABLE 3-2 Selected Alternative Equivalence Scales: Increment in the Scale Value for a Spouse and Each Added Child (Relative to a Scale Value of 1.00 for a Single-Adult Family)

Source or Type of Scale	Family Size				
	2	3	4	5	6
Per capita	1.00	1.00	1.00	1.00	1.00
Official U.S. poverty thresholds[a]	0.29	0.26	0.40	0.35	0.27
Bureau of Labor Statistics Family Budgets Program[b]	0.67	0.61	0.50	0.50	0.56
U.S. Department of Agriculture (food only)[c,d]	0.83	0.80	0.70	0.63	0.80
Organization for Economic Cooperation and Development[e]	0.70	0.50	0.50	0.50	0.50
Canadian low-income cut-offs (LICOs) (1986 base)[f]	0.36	0.37	0.26	0.18	N.A.
Lazear-Michael (1980a)[g]	0.06	0.24	0.18	0.22	N.A.
Lazear-Michael (1988)[h]	1.00	0.40	0.40	0.40	0.40
Jorgenson-Slesnik[i]	0.76	0.60	0.73	0.34	1.28
Van der Gaag and Smolensky[j]	0.45	0.10	0.17	0.10	0.09
Income Survey Development Program (ISDP)[k]	0.47	0.18	0.16	0.13	0.11
Rainwater (1990)[c,l]	0.26	0.18	0.15	0.12	0.11
Statistics Canada[c,m]	0.17	0.27	0.23	0.00	N.A.

NOTE: Add values across, plus 1.00 for the first adult, to obtain the scale value for a particular size family.

[a]Calculated from the thresholds for a married-couple family of the specified family size compared to the threshold for an unrelated individual under age 65 (Bureau of the Census, 1993c:Table A).

[b]Derived on the basis of Engel curves and food shares. The scale values shown are for a family in which the head is aged 35–54 (in Sherwood, 1977:Table 7).

[c]Scale values do not distinguish between adults and children.

[d]Derived by adding the costs of individual food plans and adjusting for household economies of scale in the use of food (Peterkin et al., 1983:15).

[e]Derived on the basis that a second adult adds 70 percent to the single adult's budget and each child adds another 50 percent (Organization for Economic Cooperation and Development, 1982).

[f]Derived using a method similar to the iso-prop method (in Wolfson and Evans, 1989:55); see text.

[g]Derived using a variant of the Barten model.

[h]Derived using a variant of the Rothbarth model; see text.

[i]Derived using a variant of the Barten model, which also distinguishes by the age, race, and sex of the houshold head, geographic region, and farm-nonfarm residence. The scale values shown are for a family headed by a nonfarm white male between the ages of 25 and 34 and living in the Northeast (in Jorgenson and Slesnik, 1987:Table 2).

[j]A subjective scale applying to households in which the head is under age 65 (in Danziger et al., 1984:Table 2).

continued on next page

TABLE 3-2 *Continued*

[k]A subjective scale applying to households in which the head is under age 65, derived from the 1979 ISDP Research Panel by estimating the log of the answer to a survey question regressed on the log of income, the log of family size, and the age and sex of the family head (in Danziger et al., 1984:Table 2).

[l]A subjective scale derived from Gallup Poll data on the amount needed to get along by estimating the log of the annualized get-along income amount regressed on the log of income, the log of family size, and the respondent's age (Rainwater, 1990:19).

[m]A subjective scale based on 1986 data (in Wolfson and Evans, 1989:55).

fied), a girl of 8, and a boy of 13; and (2) a retired couple aged 65 or older, in reasonably good health and living independently. BLS developed an equivalence scale to adjust these budgets for other family types, by applying the Engel methodology (discussed below) to data from the 1960-1961 Consumer Expenditure Survey (CEX). The key assumption of this methodology is that families spending an equal proportion of income on food have attained an equivalent level of living.

The USDA also developed its own equivalence scale to determine adjustments to its food plans for the economies of scale of larger families. (The food plans themselves were constructed for adults and children of different sexes and ages.) The resulting scale values, applied to the cost of the Thrifty Food Plan for a reference family of four persons (husband and wife aged 20-54 and two children aged 6-8 and 9-11) are used in setting benefit levels in the Food Stamp Program. (The Thrifty Food Plan is the successor to the Economy Food Plan that formed the basis of the original poverty thresholds.) The USDA scale was originally developed in 1962 and revised in 1975 on the basis of data from a 1965 survey of food consumption of nonfarm households (Kerr and Peterkin, 1975). The scale has not been changed since 1975 because, according to an evaluation study (Greger, 1985:26), "the superiority of alternate adjustment factors was not clear." The USDA scale, which applies to food consumption only, is more generous for larger families than the BLS scale, which, in turn, is more generous than the scale implicit in the official poverty thresholds (see Table 3-2).

Other organizations have dealt with the equivalence scale issue by proposing simple formulas, in the same general spirit as our own recommendation. Most notably, the Organization for Economic Cooperation and Development (OECD) (1982) has used an administratively convenient scale in which the first adult counts as 1.0, an additional adult counts as 0.7, and children count as 0.5 of an adult (see O'Higgins and Jenkins, 1990, for an application of the OECD poverty measure). Although there is no explicit recognition of economies of scale in these numbers, they are built into the scale, most obviously in the "discount" for the second adult.

An even simpler scale underlies the poverty guidelines, which were originally developed by the Office of Economic Opportunity and are issued annually by the U.S. Department of Health and Human Services (see Burke, 1993:Table 12) and used to determine eligibility for many government assistance programs (see Chapter 7). They are constructed by smoothing the official thresholds for different size families: the resulting implicit equivalence scale counts the first adult as 1.0 and each additional adult or child as 0.35.

Behavioral Scales

Simple weighting schemes, like the OECD or our own recommendation, have the obvious merit of transparency, but they take no account of actual behavior except insofar as their plausibility is anchored in everyday experience. For at least a century, economists and others have tried to provide a more solid foundation for equivalence scales, analyzing patterns of household behavior in an attempt to measure the differential needs of adults and children, as well as economies of scale. At its simplest, one might attempt to measure the costs of children by looking at family budgets and identifying how much a poor family spends on such child-related expenditure items as food, clothing, and education. There are many such attempts in the literature: see, for example, Dublin and Lotka (1946), who wanted to calculate the "money value of a man" and needed to deduct the cost of bringing him to maturity; more recently, Lindert (1978) wanted to use child costs to predict fertility.

The fundamental problem with such attempts is that adding children to a family without adding additional resources can only cause the family to rearrange its purchases. If a family spends more on child goods, it must spend less on something else. Consequently, a complete accounting of the "additional" expenditures associated with children would lead to the inevitable conclusion that children cost nothing. Although the children come with needs, which cause additional expenditures on some goods, those needs are paid for out of the same resources, which makes the family as a whole worse off, causing a reduction in expenditures in other goods. If one is going to calculate the cost of the children from the data, one must compare families of different types but at the same level of living. That is, in order to calculate measures of the cost of the children, or, indeed, of the extent of household economies of scale, one must have some procedure for knowing when two families of different types are equally well off; only in that way will a comparison of their expenditure patterns reveal what is the cost of the children or the extent of economies of scale.

These arguments suggest that in order to calculate the equivalence scale by comparing expenditure patterns, one needs to know the equivalence scale to start with, so that one can be sure of comparing two households at the same level of well-being. If so, there is essentially no hope of using behavior to

calibrate the scales, a result that has been formally demonstrated by Pollak and Wales (1979). Although calculating the cost of a change in family size may appear to be analogous to the problem of calculating the money needed to compensate for a price change—something that is routinely done in applied economics—the two problems are not the same. In the case of a price increase, one can observe how much a family consumes and so get a good idea of how much a price increase will cost it. But when a child is added to a family, one does not know how much the child consumes (or how much the parents alter their own consumption accordingly) and so cannot price out its cost.

The situation is not quite hopeless. If one can devise a general rule that indicates when households of different compositions are equally well off, one can use it to calculate the scale. The discussion above showed that such a rule cannot be deduced from the data. In principle, postulating such a rule is not very different from picking a set of arbitrary but plausible values to constitute an equivalence scale, but it is easier to propose and defend a single rule than a whole set of scale values. The use of a single principle guarantees that the scale values for different family types are internally consistent, unlike the scale values implicit in the current official poverty thresholds. In the next two subsections, we discuss two different rules for determining when households are equally well off and the procedures for calculating equivalence scale values that are associated with each. (See Table 3-2 for examples of scales developed by these rules.)

The Engel and Iso-Prop Methods The most famous of the procedures for determining equivalence scales dates back to the work of Ernst Engel and uses the share of a family budget devoted to food as an indicator of living standards (E. Engel, 1895). Engel's Law, that the share of food expenditure in the budget declines as people become better off, is one of the earliest and most widely confirmed empirical generalizations in economics. It is also true that, at the same level of income or total expenditure, households with more children spend a larger share of their budget on food. Engel went beyond these two empirical facts to assert that the share of food in the budget correctly indicates the standard of living across families of different types. If one accepts this assertion, one has a simple and easily applied rule for detecting which of two families is better off, even when the families have different compositions. If the food share for two families is the same—that is, if they are on the same food "iso-prop" curve—they are equally well off. Hence, all one needs to do to calculate the cost of an additional family member is to calculate how much must be added to the budget to restore the family's food share to its original value.

Figure 3-2, which shows the relationship between the food share and family income for two families, illustrates how Engel's procedure works. Line

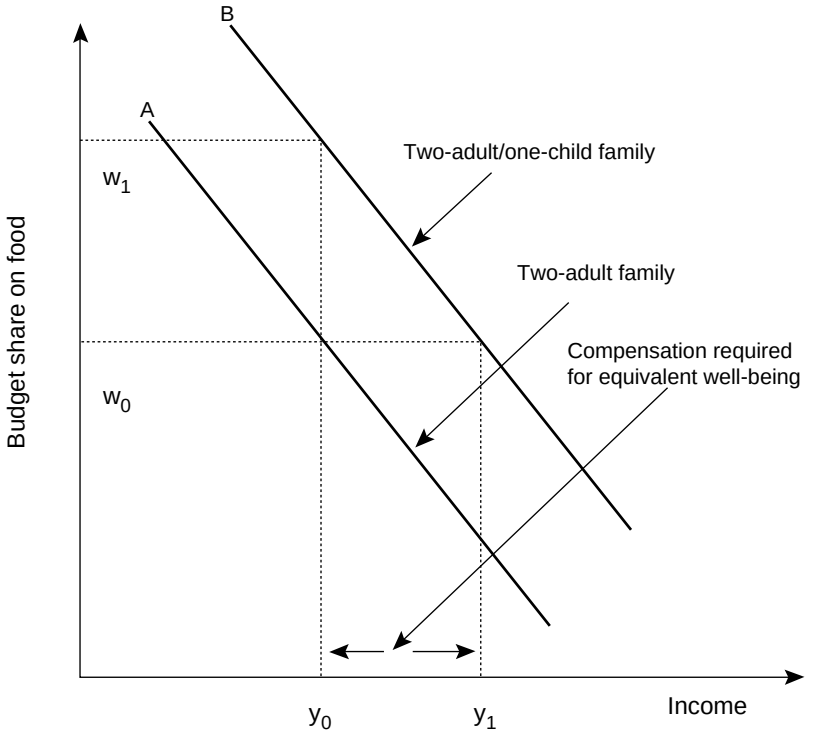

FIGURE 3-2 Engel method for equivalence scales. (See text for discussion.)

A is for a two-adult family, and line B is for that family with the addition of a child. Line B is higher at all levels of income: that is, more is spent on food at all income levels. In the original situation, the small family has income y_0 and food share w_0, which rises to w_1 after the addition of the child. According to Engel, this family is restored to its original standard of living when its food share returns to its original value. This would happen if the family's income was increased to y_1, or if the family received some compensation equivalent to $y_1 - y_0$. The equivalence scale value for a two-adult/one-child family relative to a two-person family is given by the ratio of y_1 to y_0.

In practice, the Engel method would be implemented, not diagrammatically, but by fitting an Engel curve in which food expenditures—or the share of expenditures on food—is linked to income and family characteristics. The estimated equation can then be used to calculate what increase in income is equivalent to an additional family member (of various types), and the equivalence scale values are calculated exactly as above. The example was cast in terms of two parents having their first child, but so long as one is prepared to accept Engel's basic assertion that food shares indicate welfare, the method can

be used to compare any family type with any other family type and so to produce a complete set of equivalence scale values. This method will presumably also capture any economies of scale so long as they are reflected in the food share, as they must be if the Engel assertion is correct.

It is also possible to extend the Engel method beyond the share of food to the share of other necessities; this iso-prop approach was introduced by Watts (1967; see also Seneca and Taussig, 1971) and underlies the Canadian low-income cut-offs (LICOs) (see Wolfson and Evans, 1989). When goods other than food are included, the assumption is that the share of those goods indicates family welfare. Hence, the procedure will work in the same way as does Engel's, provided that the share falls with income (because the goods are necessities) and rises with family size.

The Engel method and its iso-prop variants are only as good as the basic assumption that the food (or other necessity) share correctly indicates family welfare, which can be argued. Even if Engel's Law is correct, and even if larger families spend a larger share of their budget on food, there is no automatic implication that the food share is a valid indicator of the standard of living. Engel's Law says that richer families have lower food shares, so that, among families of the same composition, it makes sense to argue that families with higher food shares are poorer than families with lower food shares, which is no more than a restatement of the law. Larger families spend a larger share on food, as do poorer families, but it does not follow that larger families spend more on food because they are poorer or that one can measure how much poorer they are by calculating the income drop that would have produced the same effect.

Nicholson (1976) has convincingly argued that the food share is a poor indicator of the standard of living. Consider again a married couple who have their first child, and suppose for the purposes of the argument that one has managed to calculate the correct compensation and that the appropriate amount has been paid to the family. What will happen? The parents have been fully compensated and so are expected to spend, out of their share of family resources, the same fraction on food as they did before the birth of the child. But a child consumes mostly food and clothing, so this fully compensated family actually spends a larger share of its total budget on food. According to Engel, the family is worse off than it was before because its food share is higher, and it must be paid more to compensate it for the cost of the child. By this argument, the compensation calculated according to the Engel method assigns too large a cost to children. Nicholson's argument is a persuasive one, and we do not believe that the food (or necessities) share should be used to calculate equivalence scale values.

The Rothbarth and Other Methods Instead of using food share, Rothbarth (1943) used expenditures on adult goods as an indicator of the standard of

living, if not of the whole family, at least of its adult members. Using the same example of a married couple with a child, the argument is that the child brings needs but no resources and that those needs can be met only by making cuts elsewhere in the budget. If one can find some goods that children do not consume—alcohol, tobacco, and adult clothing being the most obvious and frequently used examples—their consumption should decline when a child is added to the family. The decline is caused by the diversion of income to the child, so that if one can calculate the reduction in income that would produce that same decline, one has calculated the amount of income diverted to the child, and, thus, its cost.

The mechanics of the procedure are similar to those of the Engel method and are illustrated in Figure 3-3. Again, there is curve A for the original family and curve B for the larger family containing the child, but now they slope upwards, since expenditure on adult goods is assumed to rise with income. And it is the lower curve, curve B, that is associated with the larger family because expenditures on adult goods are cut to make room for the additional expenses associated with the child. The original family with income y_0 spends a_0 on adult goods, which is reduced to a_1 in the presence of the child. If income is increased to y_1 from y_0, the original level of expenditure on adult goods is restored, and, according to Rothbarth, so are the living standards of the parents. The difference $y_1 - y_0$ is therefore the cost of the child, and the ratio of y_1 to y_0 is the equivalence scale value for the two family types.

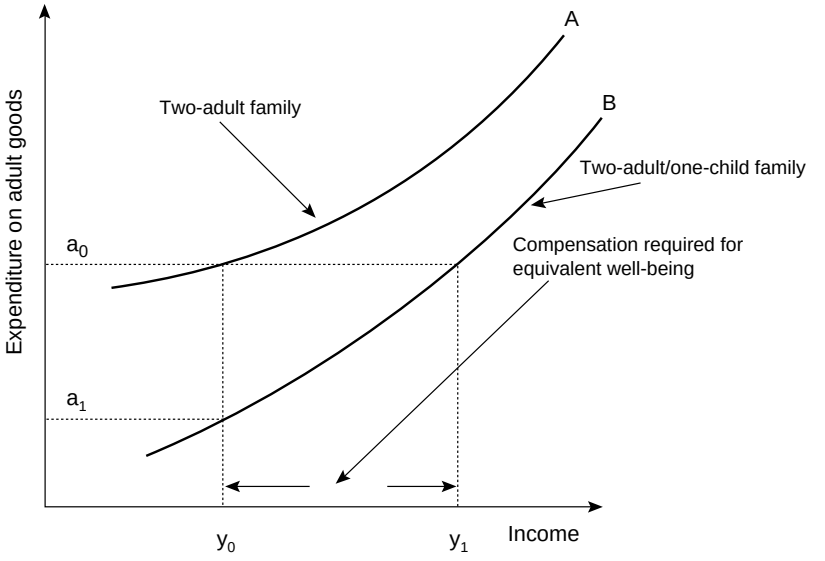

FIGURE 3-3 Rothbarth method for equivalence scales. (See text for discussion.)

The Rothbarth procedure does not suppose that adults derive welfare only from adult goods: adults and children share in the household expenditures on most goods—including food and shelter. The adult goods are special because they are not consumed by children, so that for them one observes the consequences of the resource diversion to the child uncontaminated by the additional expenditures generated by the child. The decline in expenditures in adult goods shows, not the decline in the living standards of the parents, but the amount of money that the parents have diverted to the child, which is the information needed.

It is possible to raise objections to the Rothbarth procedure, just as it was possible to object to the Engel procedure. In particular, although children do not consume adult goods, their presence may alter their parents' tastes for adult goods. For example, prospective mothers are advised neither to smoke nor to consume alcohol during pregnancy. Similarly, the presence of a child or children in the household is likely to change the way the parents spend their leisure time and "spare" cash. As a result, it may be difficult or impossible to find pure adult goods—goods for which family consumption is not directly affected by the presence of children. Rothbarth's method is also confined to measuring the cost of children; it makes no contribution to measuring the cost of additional adults or the size of economies of scale. These objections, although real, are a good deal less fundamental than Nicholson's criticism of the Engel method (see Deaton and Muellbauer, 1986, for further discussion). Rothbarth's method, or closely related variants, has been used in the United States by a number of researchers (see, e.g., Lazear and Michael, 1988).

Most of the several other methods for estimating equivalence scales that have been discussed in the literature in economics and econometrics (see Deaton and Muellbauer, 1980:Ch.8, and Browning, 1992, for reviews) are more ambitious than either the Engel or the Rothbarth procedures in that they attempt to measure the differential needs of adults and children on a commodity-by-commodity basis. They are also a good deal more complex than either the Rothbarth or the Engel methods, and, consequently, are much more difficult to interpret. In many cases, it is difficult to know what fundamental assumption is driving the results. For Engel, the food share indicates welfare, and for Rothbarth, adult goods indicate adult welfare, and it is these "identifying" assumptions that allow one to derive the scale. For the more complex schemes, the identifying assumptions are far from clear, which means that it is difficult to know exactly what is being measured or whether the concept is a sensible one.

Subjective Scales

If it is accepted that equivalence scales are based more on their plausibility than on empirical evidence, there is much to be said for simply asking people what

the scale should be. This has been done in a number of social surveys by asking respondents how much they would need to just avoid poverty and then linking the results to variations in family size.

The 1979 Income Survey Development Program (ISDP) Research Panel asked the following question: "Living where you do now and meeting the expenses you consider necessary, what would be the very smallest income you (and your family) would need to make ends meet?" The answers were converted to a logarithmic scale and regressed on the logarithm of family after-tax income, the logarithm of family size, and the age and gender of the head of the family. The coefficients from this equation were then used to predict an income that yielded a consistent level of well-being for families of different sizes and composition. The equivalence scale was created by dividing the predicted income for any size family by the predicted income for the reference family (Danziger et al., 1984); see Table 3-2.

Rainwater (1990:Table 5) analyzed Gallup Poll data on the "smallest amount of money a family of four needs each week to get along in this community," regressing the logarithm of the annualized amounts on the logarithm of income, the logarithm of family size, and the respondent's age. With one exception (the increment in the scale value for two-person families), the Rainwater and ISDP scales are remarkably similar considering the different questions, samples, and estimated equations (see Table 3-2). Statistics Canada, however, found that such scales are typically sensitive both to question wording and to the model estimated (Wolfson and Evans, 1989:41).

Subjective scales are attractive because they ask the opinion of the same people for whom the scales are devised. But it does appear that the precise question wording may affect answers, and people may take their "wants" into account as well as their needs. The scales often do not consistently decrease with each additional household member (see Table 3-2). These inconsistencies may reflect general difficulties with answers to subjective questions: respondents are being asked about topics that may be far from their everyday experience and to which they may never have given serious thought. And interviewers do not have any way of cross-checking absurd or nonsensical responses (see Bradbury, 1989, on problems with subjective equivalence scales).

Recommended Procedure

We do not believe that any of the published methods for adjusting poverty thresholds provide a fully defensible rationale for calculating the kind of equivalence scale that is needed for different family types. But we do believe that the poverty line must be adjusted for differences in family sizes and composition; we also believe that some correction is better than no correction; and we believe that it is possible to do better than scaling in proportion to the number of people in the family.

Our recommended procedure recognizes the differences between adults and children and allows for economies of scale so that the cost per adult equivalent falls as the number of adult equivalents rises. We explicitly recognize the arbitrariness that is inherent in all scales. We have selected a set of scale values for which internal consistency is guaranteed by their derivation from a single rule, but for which ultimate support comes from their transparency and plausibility. At the same time, we have tried to check that the scale values are at least roughly consistent with the Rothbarth procedure as applied to data from the CEX, because the Rothbarth method is the most defensible of existing methods.

We recognize that our proposed equivalence scale is crude and makes no allowance for the effects of relative prices, location, or variations in scale values that may relate to the level of living of the family. Nor does our procedure anchor economies of scale to the particular commodities—primarily housing—that generate them. However, we note that several of the adjustments that might conceivably be made through an equivalence scale (such as for child care or commuting expenses) are made on the resource side of the poverty measure, rather than to the thresholds, and are thus taken into account (see Chapter 4). But many omitted issues are left for future research, and we regard our recommendation as no more than a sensible way that is a clear improvement on current practice.

Our recommended equivalence scale—as well as the relationship to other equivalence scales—can be described through the use of the general formula introduced above (for a family with A adults and K children):

$$\text{scale value} = (A + PK)^F.$$

Both parameters P and F lie between 0 and 1.0. If P is set to 1.0, children and adults are assumed to consume the same amount at the poverty line. If F is set to 0, household economies of scale are assumed (unrealistically) to be so large that the scale values are unity for all family types, and the poverty line will be the same for all; a family of four would need only as much as a single individual. If F is set to 1.0. no economies of scale are assumed. Setting both F and P equal to 1.0 gives the per capita result in Table 3-2.

Ruggles (1990:77) recommends using the square root of family size as an equivalence scale short of extensive revisions in the current scale and, in conversation with the panel, Harold Watts also endorsed this approach. This proposal is a special case of the formula, in which P is unity and F is 0.5:

$$\text{scale value} = (A + K)^{0.5}.$$

Ruggles argues that setting F to 0.5 maintains the overall elasticity of the Orshansky scales while smoothing out some of the irregularities. Entering this recommendation into our general equation makes obvious the fact that the relationship of child to adult consumption is not directly addressed, although

since large families tend to contain a larger proportion of children, the economies of scale that come from the square root rule are coincidentally picking up the distinction between adults and children. The alternative is (as we propose) to make F larger and to compensate by setting K to less than 1.0, thus explicitly recognizing the distinction between pure economies of scale and family composition. Since we consider the needs of, say, five adult family members living together to be greater than the needs of a family of two adults and three children, we prefer our formula to that suggested by Ruggles.

The OECD equivalence scale (Organization for Economic Cooperation and Development, 1982) sets a single adult to be 1.0, each additional adult to be 0.7, and each child to be 0.5. This rule can be written in the same general way:

$$\text{scale value} = [1.0 + 0.7(A–1) + 0.5K]^{1.0}.$$

In this case, there is no adjustment for economies of scale beyond the family composition adjustment for the second and additional adults. A third adult adds as much to household needs as does a second or fourth adult. The OECD scale, in contrast to the square-root rule, puts all of the adjustment on adult and child differences, without an explicit recognition of economies of scale except for the difference between the first and second adult. In fact, the OECD scale can be well approximated by ignoring the distinction between adults and children and between the first and second adult and simply raising family size to the power of 0.72 (see Buhmann et al., 1988).

Betson and Michael (1993) provide estimates of the parameters in the general formula from work of Betson (1990), who estimated the cost of children by using the Rothbarth method and data from the 1980-1986 CEX; see Table 3-3. Betson (1990) reported the estimated percentages of total expenditures devoted to children (see first column of Table 3-3) and the proportional cost of children in one- and two-parent families (see second column of Table 3-3). For example, two parents with a child are estimated to spend 24 percent of their budget on their child and hence would need 31 percent more income than a childless couple to be equally well off. The estimates presented in Table 3-3 cannot be directly interpreted in terms of the relationship between the consumption needs of children relative to adults (P) nor the scale economy factor (F). To select which two parameters would best fit the information contained in Table 3-3, Betson and Michael (1993) chose the parameters that minimized the sum of squared deviations of the observed proportional costs of children (the five values in the second column of Table 3-3) from the fitted proportional costs of children expressed in terms of the panel's recommended equivalence scale formula:

$$\frac{\text{scale value}(A,K)}{\text{scale value}(A,0)} = \left(\frac{A + PK}{A}\right)^{F}.$$

TABLE 3-3 Estimates of the Cost of Children (Using Rothbarth Method)

Family Type	Percent of Family Budget Spent on Children (P)	Scale Value of the Family Type [1/(1–P)][a]
Single-Parent Family		
One child	0.307	1.443
Two children	0.496	1.984
Two-Parent Family		
One child	0.237	1.311
Two children	0.354	1.548
Three children	0.407	1.686

SOURCE: From Betson and Michael (1993); Betson (1990).

[a]The scale value in column 2 is derived as the inverse of 1 minus the estimate in column 1. Scale values for children in a single-parent family are expressed relative to a value of 1.00 for a single-adult family; scale values for children in a two-parent family are expressed relative to a value of 1.00 for a two-adult family.

The fitted parameters using these estimates are

$$\text{scale value} = (A + 0.70K)^{0.762}.$$

Thus, Betson and Michael's work suggests a scale in which children are treated as 0.70 of an adult and in which the number of adult equivalents is raised to a power of 0.76 to account for scale economies for larger families.

We recommend a scale in which children are treated as 0.70 of an adult (as in the Betson and Michael results) and in which the number of adult equivalents in the family is raised to a power in the range of 0.65 to 0.75 (similar to, but not exactly the same as, the Betson and Michael results). The high value of our recommended range represents the Betson and Michael result of 0.76 rounded down to 0.75. The low value of the range is suggested because this value does not make such a large difference for the poverty threshold for single-person families (compared with the official threshold—see below).

We believe that the general form of the proposed scale satisfies two critical criteria: it recognizes the differences between children and adults and adjusts for scale economies with increasing family size in a consistent manner. In addition, it is easy to explain and implement. Finally, the use of a scale formula of this type acknowledges the inevitable arbitrariness in adjusting the poverty thresholds for different family circumstances rather than disguising it in opaque econometric analysis.

Figure 3-4 shows the current scale, the square-root proposal, the proposed scale with scale economy factors of 0.65 and 0.75, and the OECD scale.

In comparing these scales, one can see that the current scale generally assumes the greatest economies of scale as family size increases while the OECD scale assumes the least economies of scale. (An exception is the square-root proposal, which assumes greater economies of scale for families of size five or larger.) We rejected the current scale because, as shown above, it is inconsistent across family types. Also, in our opinion, it assumes economies of scale that are too large for large families and for families of two in comparison with one-person families. The square-root proposal is an improvement but ignores the differences between adults and children and is even less generous to large

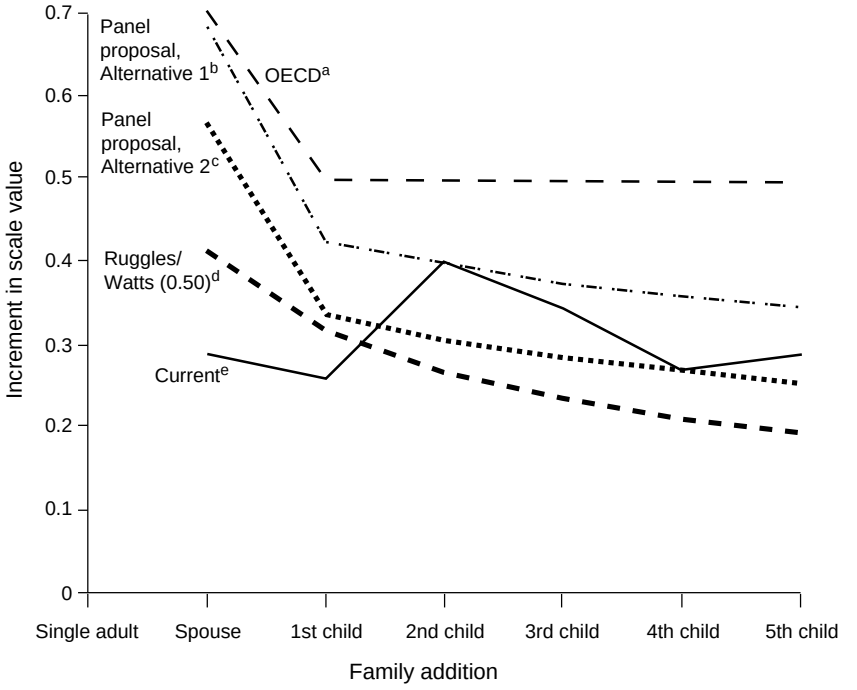

FIGURE 3-4 Alternative equivalence scales: increment for each added family member (relative to a scale value of 1.00 for a single adult). [a]The OECD scale adds 0.70 for each added adult and 0.50 for each child. [b]Each child is treated as 0.70 of an adult, and the number of adult equivalents in the family is raised to a power of 0.75. [c]Each child is treated as 0.70 of an adult, and the number of adult equivalents in the family is raised to a power of 0.65. [d]Suggested by Ruggles (1990) and Watts (in conversation with the panel): each child is treated as the equivalent of an adult, and the number of people in the family is raised to a power of 0.50. [e]The current scale is calculated by converting the 1992 threshold for each family type to the 1992 threshold for an unrelated individual under age 65; the threshold for two adults is the one in which the head is under age 65.

families. At the other extreme, the OECD method is straightforward and easy to use, but, in our opinion, it assumes economies of scale that are too small across the family size distribution. The range of scale economy factors that we recommend (0.65 to 0.75) produces results that are between the extremes and more consistent across family size.[4]

It is because the choice of an equivalence scale cannot avoid arbitrariness that we suggest a range for the scale economy factor, *F*. Judgment is also involved in setting the parameter *P* for the proportionate needs of children relative to adults, and we could have suggested a range for *P* as well as for *F*. However, it becomes difficult to grasp the implications of alternative equivalence scales across the family size distribution if both parameters are varied. Moreover, the two parameters are, as we have discussed, not independent. Thus, if *P* is set at 1.0, implying no difference between the needs of children and adults, then it is appropriate to set *F* closer to zero (as in the square-root proposal), because *F* then accounts both for economies of scale in the strict sense and also for the fact that larger families include more children. If, however, as we propose, children are assumed to need less than adults, then it is appropriate to raise *F* closer to a value of 1.0, although how much closer is, to repeat, a matter of judgment. For these reasons, we recommend a value of 0.70 for *P* and a range for *F* of 0.65 to 0.75, which is consistent with the value for *P*.

In reaching a judgment on the specific form of the equivalence scale for implementation, it will be important to consider the implications of a particular value of *F* in relation to the current scale. Although one wants to improve on that scale, there is an argument for making a choice that does not represent a great departure from the current implicit scale for particular population groups. In this regard, we note the importance of applying the scale to the poverty threshold for the reference family of two adults and two children rather than to the threshold for a one-person family. Because the current scale assumes such great scale economies in moving from one-person to two-person families, it is clear that the use of almost any other scale, including those that we propose, will produce significantly higher thresholds for two-person and larger families. The only exception, again, is the square-root proposal, which will produce larger thresholds for small families but smaller thresholds for large families than the current scale.

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[4] The low-income measure recently adopted on an experimental basis by Statistics Canada to supplement the low-income cut-offs uses an equivalence scale formula to adjust the reference threshold for a one-person family. The formula treats each added adult in the family as 0.40 of the first adult and each added child under age 16 as 0.30 of the first adult, with one exception: in a single-parent family, the first child is treated as 0.40 of the adult (see Statistics Canada, 1991:172-173). This scale gives results similar to the square-root proposal for families of size one to size five and results similar to our proposal with a 0.65 scale economy factor for larger families.

TABLE 3-4 Alternative Equivalence Scales, with Scale Values Expressed Relative to a Value of 1.00 for a Family of Two Adults and Two Children

	Type of Scale				
Family Type	Current Official[a]	0.50 Scale Economy Factor[b]	0.65 Scale Economy Factor[c]	0.75 Scale Economy Factor[d]	OECD[e]
One-person family[f]	0.513	0.500	0.451	0.399	0.370
Married couple	0.660	0.707	0.708	0.672	0.630
Plus one child	0.794	0.866	0.861	0.841	0.815
Plus two children	1.000	1.000	1.000	1.000	1.000
Plus three children	1.177	1.118	1.130	1.151	1.185
Plus four children	1.318	1.225	1.251	1.295	1.370
Plus five children	1.476	1.323	1.367	1.434	1.556

[a]The current scale is calculated by expressing the official 1992 threshold for each family type as a multiple of the 1992 threshold for a family of two adults and two children; the thresholds for unrelated individuals and two-adult families are those for people under age 65.

[b]Suggested by Ruggles (1990) and Watts (in conversation with the panel): each child is treated as the equivalent of an adult, and the number of people in the family is raised to a power of 0.50. The resulting scale value for each family type is converted to a ratio of the scale value for two-adult/two-child families.

[c]Each child is treated as 0.70 of an adult, and the number of adult equivalents in the family is raised to a power of 0.65. The resulting scale value for each family type is converted to a ratio of the scale value for two-adult/two-child families.

[d]Each child is treated as 0.70 of an adult, and the number of adult equivalents in the family is raised to a power of 0.75. The resulting scale value for each family type is converted to a ratio of the scale value for two-adult/two-child families.

[e]The OECD scale adds 0.70 for each added adult and 0.50 for each child. The resulting scale value for each family type is converted to a ratio of the scale value for two-adult/two-child families.

[f]Includes people living alone and with others in a household not related to them.

By applying the proposed scale to the threshold for the reference two-adult/two-child family, the differences from the current scale are reduced for families in most size categories; see Table 3-4 and Figure 3-5. Specifically, for a given value of the reference family threshold, the proposed scale with a scale economy factor of 0.75 produces very similar thresholds as the current scale for all family size categories except for one-person families, for which it produces a threshold value that is less than 80 percent of that produced by the current scale. The proposed scale with a scale economy factor of 0.65 produces thresholds that are reasonably close to the official thresholds for all categories—somewhat lower for one-person families and families of five to seven members and somewhat higher for families of two and three members. In our analysis with March CPS data (see Chapter 5), we explore the implications of the choice of a scale economy factor on poverty rates for families of different sizes and other population groups.

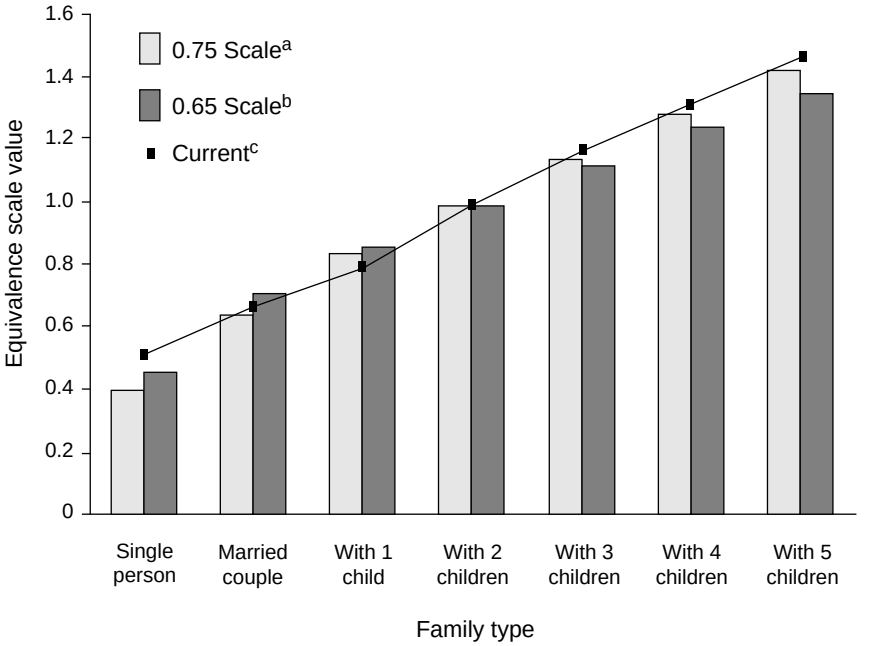

FIGURE 3-5 Current and proposed equivalence scales expressed relative to a value of 1.00 for a family of two adults and two children. [a]Each child is treated as 0.70 of an adult, and the number of adult equivalents in the family is raised to a power of 0.75. The resulting scale value for each family type is converted to a ratio of the scale value for two-adult/two-child families. [b]Each child is treated as 0.70 of an adult, and the number of adult equivalents in the family is raised to a power of 0.65. The resulting scale value for each family type is converted to a ratio of the scale value for two-adult/two-child families. [c]The current scale is calculated by converting the official 1992 threshold for each family type to the 1992 threshold for a family of two adults and two children; the thresholds for unrelated individuals and two-adult families are those for people under age 65.

ADJUSTMENTS BY GEOGRAPHIC AREA

Overview and Recommendations

There is wide agreement that it is desirable to adjust poverty thresholds for differences in prices. Indeed, the current official thresholds are regularly updated for changes in the Consumer Price Index (CPI) to keep them constant in real terms. However, no adjustment has been made for spatial differences in prices, not because the adjustment is necessarily undesirable in principle, but because of the practical difficulties of adequately measuring those differences. There are no geographic area cost-of-living indexes that corre-

spond to the CPI: BLS produces price indexes for a limited number of metropolitan areas, but not for rural areas. Moreover, the BLS indexes are designed to allow comparison of differences in price inflation across areas; they do not permit comparison of price *levels* across areas.

Yet there has been a substantial amount of empirical research on the issue, and we believe that it is important to make at least a partial adjustment for geographic cost-of-living variations. At this stage of knowledge, we recommend that the adjustment be made for the housing component of the poverty thresholds. Research indicates that housing (including utilities) is the item for which prices vary most across the country, and considerable effort has been devoted to estimating interarea housing cost indexes. We believe that data available from the decennial census will support an adequate adjustment for housing cost differences, which we recommend be implemented by size of metropolitan area within nine regions of the country. We recommend research on ways to update the housing cost index values for intercensal years. And we recommend further research, not only on geographic variations in housing prices, but also on cost-of-living differences more generally. Such research should be linked to the priority of improving the U.S. database on household consumption (see Chapter 5).

RECOMMENDATION 3.2. The poverty thresholds should be adjusted for differences in the cost of housing across geographic areas of the country. Available data from the decennial census permit the development of a reasonable cost-of-housing index for nine regions and, within each region, for several population size categories of metropolitan areas. The index should be applied to the housing portion of the poverty thresholds.

RECOMMENDATION 3.3. Appropriate agencies should conduct research to determine methods that could be used to update the geographic housing cost component of the poverty thresholds between the decennial censuses.

RECOMMENDATION 3.4. Appropriate agencies should conduct research to improve the estimation of geographic cost-of living differences in housing as well as other components of the poverty budget. Agencies should consider improvements to data series, such as the BLS area price indexes, that have the potential to support improved estimates of cost-of-living differences.

Feasibility and Desirability

The feasibility and desirability of adjusting the poverty thresholds for geographic cost-of-living differences has been the topic of repeated discussion and

analysis for a long time. A principal impediment to making any such adjustment has been the lack of adequate data, although there are also conceptual and measurement issues to resolve.

Some analysts have argued against the whole idea of adjusting the poverty thresholds for area price differences on the grounds that such differences are likely to be offset by income differences and, hence, do not represent real differences in life quality. Indeed, the available data suggest that areas with higher prices are also areas with higher income levels: for example, a cost-of-housing index that we calculated for states correlates highly with state median family income.[5] Economic theory suggests that, over the long run, measures of "quality of life" (taking into account both prices and wage levels) will equalize across areas because people will continually migrate to the more pleasant areas, causing prices to rise and wages to fall (see Bloomquist, Berger, and Hoehn, 1988; Roback, 1982; and Rosen, 1979).

The counterargument, with which we agree (see Ruggles, 1990), is that poverty is not measuring the "quality of life" in broad terms, but minimum levels of need. As such, the poverty thresholds should be higher in areas with higher prices—even if average incomes are also higher. Also, many spells of poverty are short (see Chapter 6), which argues for geographic adjustments of the poverty thresholds because families cannot be expected to quickly change location when they experience a decline in income (see Renwick and Bergmann, 1993, on this point).

Given that one wants to adjust the poverty thresholds for geographic price differences, the question is how to do it. It is sometimes suggested that interarea differences in income or wages be used as a proxy for interarea price differences. As noted above, there is a high correlation between area income levels and area price levels; however, income and wages are affected by factors other than prices, and it seems preferable to work toward measuring price differences directly.[6] One approach is to measure what it costs in different locations to purchase a fixed market basket of goods, that is, to develop a fixed-weight interarea price index. Under this approach, the same consumption items are included in the market basket for all areas of the country, and the same weight or fraction of the market basket is assigned to each item (e.g., vehicle purchases or winter clothing).

Another approach is to price different market baskets in different areas under the assumption that needs differ across areas. For example, the market

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[5] The rank-order correlation is .893, computed using Spearman's *r*. We estimated state cost-of-housing indexes for analysis of differences among states in eligibility and benefit standards for the Aid to Families with Dependent Children (AFDC) program (see Chapter 8).

[6] The use of interarea differences in income levels could overestimate differences in price levels: for example, the variation in state median family income is wider than the variation that we calculated in a state cost-of-housing index adjusted for the share of housing in the proposed poverty budget; see Table 8-4 in Chapter 8.

basket might include more winter clothing or home heating fuel in colder than in warmer climate areas, or the market basket might give a higher weight to vehicle purchase and maintenance costs in rural and other areas that lack public transportation. Such an approach seems to make intuitive sense; however, its implementation quickly leads to a host of difficult and hard-to-defend judgments. For example, higher air conditioning costs in warmer areas may offset lower heating costs; or, car owners in rural areas may get better gasoline mileage that lowers their vehicle use costs.

Even harder to develop and justify are the use of different market baskets that reflect consumption differences across regions that are not explained by such factors as climate differences. For example, on the basis of observed interregional differences in food consumption patterns, the BLS Family Budgets Program gave higher weight to less expensive foods—such as lard and pork—and lower weights to more expensive foods—such as butter and beef—in the budgets for areas in the South relative to the North (see Expert Committee on Family Budget Revisions, 1980; Sherwood, 1975, 1977). Although people in different regions may have different tastes for foods (or other items), it seems dubious to thereby conclude that such differences should be reflected in the market basket for pricing. To do so is to assume that Northerners "require" a more expensive diet than Southerners, or, alternatively, to assume that consumers would be equally satisfied with any one of the market baskets that is priced. We conclude that the fixed-weight type of interarea price index is preferable to an approach that attempts to specify "needed" or "appropriate" differences in area market baskets.

In this regard, the Expert Committee on Family Budget Revisions (1980:Chap. VII) recommended that a fixed-weight interarea price index be developed for the BLS family budgets and that the market baskets themselves not vary by area. The Committee found that people trade off housing and transportation costs so that the total for these two items does not vary importantly by region or city size; hence, the Committee recommended against interarea differences in the transportation component of the budget. The Committee also argued that regional differences in food consumption should not be used to develop different food budgets by region. Finally, the Committee suggested that, while estimates could be developed of additional expenditures for utilities and clothing needed for different climates, these estimates should not be reflected in the budgets themselves but rather in tabulations by area of the gross income needed to support the standard budget plus any climate allowance plus state and local taxes.[7]

[7] The Committee initially attempted to estimate area budgets representing equivalent levels of living by trying to find total expenditure levels that were consistent with average spending patterns and with spending enough on food to purchase the USDA Moderate Food Plan; however, the analysis failed to turn up consistent or robust findings.

The use of a fixed-weight interarea price index avoids the difficult problems of specifying differing regional market baskets, but many formidable definitional and measurement issues remain. One conceptual issue concerns the specification of the market basket for the purpose of adjusting the poverty thresholds: whether to use a basket with items and weights based on the expenditure patterns of typical families, as is done for the Consumer Price Index, or a basket that reflects the spending patterns of families at lower expenditure levels. We believe that a reasonable approach would link the market basket to spending patterns of families with expenditures somewhat below the median.

If one assumes that an appropriate market basket is specified, the next set of problems concerns data and measurement. In order to have an adequate fixed-weight interarea price index, the sample of prices must be large enough in each area for reliable estimation, and consistent definitions must be applied for all of the items that are priced (e.g., the same type and quality of new car or winter coat must be priced in the same type of sales outlet in each area).

Research Findings on Price Differences

Given all of the difficulties noted above, one might be tempted to give up on the task of developing an interarea price index for use in adjusting the poverty thresholds. Arguing for a continued effort to develop a reasonable approach is the evidence we have—admittedly imperfect—of important price differentials across areas.

As of fall 1981, the last year for which BLS published the family budgets, the relative cost of the lower consumption budget for a family of four, for urban areas in the 48 contiguous states, varied from about 113 percent of the national average in the San Francisco-Oakland and Seattle-Everett metropolitan areas to 91 percent of the average in nonmetropolitan urban areas of the South (Bureau of Labor Statistics, 1982:Table 4).[8] In general, relative costs were higher in metropolitan than in nonmetropolitan areas and in the West and Northeast than in the South.

As noted above, a problem with the BLS interarea price index for the Family Budgets Program is that it reflected varying market baskets across regions. Sherwood (1975:Table 1) compared the BLS index with a fixed-weight interarea index for the intermediate (or "standard") budget for fall 1973. He found the same general patterns; however, the relative cost of the standard budget in the South was not quite as low or that in the Northeast quite as high with the fixed-weight index as with the BLS index.

BLS has continued to publish consumer price indexes for regions, popu-

[8] Relative costs in Alaska and Hawaii were 146 and 126 percent, respectively, of the national average.

lation size classes of metropolitan areas, and the largest metropolitan areas. However, these indexes can properly be used only to compare rates of change in prices across areas—not price levels—because the data come from a probability sample of prices that is designed to produce the national CPI, and so there is no particular consistency across areas in items that are priced. Trends in price changes across areas over the past decade do suggest, however, that the regional and size-of-place price differentials measured in the old Family Budgets Program still persist and, indeed, may have increased. Thus, from 1983 (when the index in each region equaled 100) to 1992, prices increased by 47 percent in the Northeast and 42 percent in the West, compared with 36-37 percent in the Midwest and South (Bureau of the Census, 1993d:Table 761).

ACCRA (formerly the American Chamber of Commerce Researchers Association) publishes a fixed-weight interarea price index that in 1992 covered 300 metropolitan areas across the country.[9] The market basket applies to a "midmanagement" rather than poverty budget standard, but the relative cost patterns across areas are similar to those cited for the BLS Family Budgets Program index, although with an even wider dispersion. (In this regard, the BLS index for the higher budget showed similar patterns but somewhat more dispersion than the index for the lower budget.) Some higher cost areas in 1992 according to the ACCRA (1992:Table 1) index were New York City with an index value of 214 (relative to 100 for all areas), Boston with an index value of 137, and Los Angeles-Long Beach with an index value of 130; some lower cost areas were such small urban places as Moultrie, Georgia, with an index value of 87 and Kennett, Missouri, with an index value of 83.

Recently, economists at BLS have been reanalyzing the price data that are collected for the CPI for the 30 largest metropolitan areas, Anchorage and Honolulu, and samples of smaller metropolitan areas. In all, price data are collected in 85 geographic areas, most of which are grouped together (for publication) by region and city size class. The object of the reanalysis has been to develop a fixed-weight interarea price index that can be used to compare relative costs across areas, rather than just relative rates of change in prices (Kokoski, 1991; Kokoski, Cardiff, and Moulton, 1992, 1994). The approach uses hedonic regression methods (see below) to determine the contribution of geographic location to the prices of various items.

The BLS research is still in progress, and, for purposes of adjusting the poverty thresholds, it would be necessary to expand the price sample to cover rural as well as urban areas and to increase the sample size in urban areas to improve reliability. Nonetheless, the research is very promising. Moreover, the findings to date suggest an interim approach that would be an improve-

[9] Participating Chambers of Commerce price items for the index according to standards set by ACCRA.

ment over not adjusting the poverty thresholds at all for geographic price difference—to adjust the thresholds for differences in the cost of housing.

Overall, using BLS price data for the period July 1988-June 1989, Kokoski, Cardiff, and Moulton (1992) found little variation in prices by geographic area for many components of the CPI. For example, the index values for food at home (which accounts for 10% of the CPI market basket) ranged from 93 to 107 (with the geometric mean of all areas in the sample equal to 100). This range of values excludes Anchorage and Honolulu, for which the food-at-home index values were 126 and 139, respectively. However, for some categories of expenditures, Anchorage and Honolulu did not have higher costs than other areas. Index values for the category of private transportation commodities, which account for 16 percent of the CPI market basket (and include new and used vehicles, gasoline and oil, coolant and fluids, and automobile parts and equipment), ranged from 91 to 105. Greater variation was observed for clothing (index values of 67 to 154) and professional medical services (index values of 62 to 147), but these items account for relatively small proportions of the CPI market basket (6% and 3%, respectively). The component with the largest variation was shelter, with index values from 52 to 183. Utilities also showed considerable variation, with index values from 57 to 152. Together, these two components account for 33 percent of the CPI market basket (25% for shelter and 8% for utilities).

The 1976 Poverty Studies Task Force (Economic Research Service, 1976) reported the same finding as in the BLS research—that interarea price differences are greater for housing (including utilities) than for other commodities.[10] These results, coupled with the fact that housing is such a large component of spending, led us to look for a methodology that could provide a reasonable basis for adjusting the poverty thresholds for interarea housing cost differences. We found that considerable analytical effort has been expended to develop estimates of geographic differences in housing costs; the chief methodological challenge has been to devise methods that estimate differences in prices per se and not differences in the characteristics or quality of the housing being priced.

Estimating Geographic Variations in Housing Costs

Several methodologies have been used to estimate geographic housing cost differences, including:

- the methods used by the U.S. Department of Housing and Urban Development (HUD) to calculate fair market rents for metropolitan areas and nonmetropolitan counties;

[10] The 1976 study recommended against adjusting the poverty thresholds for geographic price differences because of the lack of adequate data.

- the methods used for the BLS Family Budgets Program; and
- hedonic regression methods, which attempt to isolate the contribution of individual characteristics of the housing unit to its price (geographic location is included as an independent variable of the regression in order to capture the effect of location controlling for all other characteristics of the unit).

HUD Fair Market Rents

For the administration of rental housing subsidies, HUD has developed a set of fair market rents, which vary by geographic location. Fair market rents are estimated annually for 2,416 counties that are outside metropolitan areas and all 341 U.S. metropolitan areas (Office of Policy Development and Research, 1992a).

Fair market rents are defined to equal gross rent (including utilities) at the 45th percentile of the rent distribution of standard quality rental housing units. HUD uses one of three data sources to make "base-year" estimates: (1) the American Housing Survey (AHS) provides estimates for 44 of the largest metropolitan areas, which include one-half of the nation's rental housing stock; (2) the decennial census; and (3) local random digit dialing telephone surveys. The base-year estimates are updated by using the shelter component of the local area CPI, where available, or estimates of price changes developed by the telephone surveys for HUD regions.

For fair market rents derived from AHS data, the sample for estimating the 45th percentile value for each bedroom size category consists of units occupied by recent movers, excluding public housing units, newly built units, noncash rental units, and units that lack certain characteristics indicative of housing quality. For rents derived from decennial census data, the sample for estimating the 45th percentile value is somewhat more heterogeneous because it is not possible to exclude public housing units, and there is less information with which to determine housing quality.

In 1989, the index values for HUD fair market rents for two-bedroom standard rental units relative to a U.S. average value of 1.00 ranged from 1.73 in San Francisco to 0.58 in nonmetropolitan areas of the Midwest. As expected, areas in the Northeast and the West had higher average rents than areas in the Midwest and the South. Areas in the Northeast and West also had higher rents relative to area median income than areas in the Midwest and the South (Kathryn Nelson, private communication).

There are some problems with the HUD fair market rents. First, they do not fully adjust for interarea differences in the quality of housing. Although all housing units sampled are said to be of "standard" quality, there may be a large variation within that category. Second, they are based on only one-third of the housing stock since only recent movers are surveyed. Rents for the other two-thirds may be lower as a result of a discount for long-term renters.

Finally, the rents in some areas are adjusted upwards because of legislative mandates.

At the same time, the methodology used to develop the fair market rents has advantages, chief among them that it is straightforward and can be applied to all areas of the country. Indeed, from the perspective of adjusting the poverty thresholds, there is an attraction to using the methodology with decennial census data. Although the census database is limited in content, it provides adequate sample sizes and an ability to estimate housing costs on a consistent basis for the entire nation (at least for the census year).

BLS Family Budgets Program

The BLS Family Budgets Program included an allowance for shelter costs in the intermediate budget that represented a weighted average of costs for a standard five-room rental unit, and a standard five- or six-room owned home that was purchased by the family 6 years prior to the budget reference date. The units that were priced met recommendations on essential household equipment, adequate utilities, and neighborhood location, originally made by the American Public Health Association and the U.S. Public Housing Administration (see Expert Committee on Family Budget Revisions, 1980). Weight variations between areas assumed varying quantities and types of fuel associated with climatic differences.

BLS developed shelter cost indexes for 40 metropolitan areas and the nonmetropolitan areas of the four census regions. Excluding Alaska and Hawaii, the BLS sample area with the highest shelter costs in 1973 was Boston, with an index value of 1.48; the area with the lowest shelter costs was Austin, with an index value of 0.68. When the measurement is limited to differences in *rental* costs, there was somewhat less dispersion in the index values across areas: in 1973 the BLS area with the highest rental costs was San Francisco, with an index of 1.44; the areas with the lowest rental costs were Austin and Baton Rouge, with indexes of 0.76 (Sherwood; 1975:14).

Like the HUD approach, the BLS approach to estimating shelter costs for the Family Budgets Program can be criticized for not controlling sufficiently for differences in the characteristics of the housing units for which cost data were obtained. Hence, it is likely that interarea price differences were affected by differences in quality, but, as Sherwood (1975) pointed out, how much variation is attributable to price differences and how much to quality differences is unknown. Also, it is not known whether the price differentials would have been the same for other specifications of units, such as larger or smaller units or homes purchased more recently than 6 years ago.

Rosen (1978) further criticized the BLS approach of specifying, a priori, a particular set of housing characteristics to use in developing interarea housing cost indexes. He argued that the BLS method ignores the possibility of factor

substitutions in housing production across cities. Moreover, the units that were priced and used in the BLS calculation might not be representative of units in a given community; also, there might be systematic differences across cities in the characteristics that were excluded.

Hedonic Models

Many analysts have taken another approach to estimating the price effects of various housing characteristics, including the price effect of geographic location. This approach is to develop a hedonic regression pricing model that relates observed market prices of housing to the implicit prices of the characteristics of the unit. In other words, hedonic models are used to isolate the contribution of individual housing characteristics to the price of housing. Examples of hedonic models include those developed by:

- Gillingham (1975), who analyzed microdata on individual housing units in 10 cities drawn from the 1960-1961 Comprehensive Housing Unit Survey conducted by BLS together with data on neighborhood characteristics from the 1960 decennial census;
- Blackley, Follain, and Lee (1986), who analyzed data from the 1975 and 1978 Annual Housing Survey to calculate housing cost indexes for 34 metropolitan areas;
- Thibodeau (1989), who created housing price indexes for 60 metropolitan areas using Annual Housing Survey data for 1974-1983; and
- Kokoski, Cardiff, and Moulton (1992, 1994), who produced interarea price indexes for consumer goods and services (including housing) as of 1989 for 44 areas (32 large metropolitan areas and 12 other region and city size classifications), using the CPI database (see also Moulton, 1992).

Hedonic models are subject to a number of criticisms. Rosen (1978) objected that the choice of characteristics to include in any model is arbitrary. He also pointed out that the rank order of the indexes for cities or metropolitan areas usually depends on which city is used as the reference city (i.e., which city is assigned an index value of 1.0). Gillingham (1975) documented this phenomenon in his work. He and other analysts also estimated large standard errors for area-specific indexes; further, they found that the size of the standard error was affected by the specification of the bundle of characteristics included in the particular hedonic model.

Kokoski, Cardiff, and Moulton (1992, 1994) attempted to correct for some of the problems with hedonic models in their analysis, which used the BLS CPI database for selected metropolitan areas matched with neighborhood characteristics data from the decennial census. This database has the advantage of relatively large sample sizes for the areas covered. The authors regressed the natural logarithm of the price of shelter on characteristic variables. (Their

TABLE 3-5 Hedonic Model Price Indexes for Rent and Rental Equivalence, and Combined Multilateral Index, Selected Areas, July 1988–June 1989

Area or Population Size	Index for Renters	Index for Owners	Combined Index	Rank
Northeast				
New York City	1.216	1.877	1.818	2
New York-Connecticut suburbs	1.404	1.711	1.830	1
New Jersey suburbs	1.329	1.514	1.635	6
Philadelphia-Wilmington-Trenton	1.000	1.000	1.117	13
Boston-Lawrence-Salem	1.326	1.613	1.712	3
Pittsburgh-Beaver Valley	0.726	0.698	0.786	36
Buffalo-Niagara Falls	0.783	0.821	0.903	25
Areas of 500,000–1,200,000	0.987	0.952	1.068	15
Areas of 100,000–500,000	0.786	0.758	0.850	28
Areas under 100,000	0.802	0.912	0.982	21
Midwest				
Chicago-Gary-Lake County	1.004	1.034	1.143	12
Detroit-Ann Arbor	0.928	0.873	0.985	20
Cleveland-Akron-Lorain	0.758	0.753	0.839	30
Minneapolis-St. Paul	0.954	0.886	1.004	18
St. Louis-East St. Louis	0.740	0.729	0.812	33
Cincinnati-Hamilton	0.765	0.742	0.833	31
Kansas City, Mo.-Kan.	0.713	0.702	0.784	37
Milwaukee	0.887	0.892	0.993	19
Areas of 500,000–1,200,000	0.716	0.707	0.789	35
Areas of 100,000–500,000	0.667	0.651	0.729	40
Areas under 100,000	0.522	0.449	0.518	44
South				
Washington, D.C.	1.049	1.165	1.266	11
Dallas-Fort Worth	0.673	0.745	0.807	34
Houston-Galveston-Brazoria	0.555	0.639	0.685	41
Miami-Fort Lauderdale	0.939	0.905	1.020	17
Atlanta	0.794	0.868	0.945	23
Baltimore	0.861	0.954	1.035	16
Tampa-St. Petersburg-Clearwater	0.755	0.684	0.782	38
New Orleans	0.776	0.810	0.892	26
Areas of 500,000–1,200,000	0.682	0.704	0.778	39
Areas of 100,000–500,000	0.557	0.583	0.642	42
Areas under 100,000	0.551	0.516	0.585	43
West				
Los Angeles County	1.427	1.551	1.690	4
Greater Los Angeles	1.375	1.286	1.462	9
San Francisco-Oakland-San Jose	1.423	1.535	1.676	5
Seattle-Tacoma	0.927	0.976	1.073	14
San Diego	1.153	1.426	1.498	8
Denver-Boulder	0.758	0.898	0.959	22
Portland-Vancouver	0.858	0.830	0.935	24
Honolulu	1.184	1.470	1.550	7

TABLE 3-5 *Continued*

Area or Population Size	Index for Renters	Index for Owners	Combined Index	Rank
West—*continued*				
Anchorage	1.004	1.219	1.289	10
Areas of 500,000-1,200,000	0.705	0.803	0.863	27
Areas of 100,000-500,000	0.727	0.774	0.848	29
Areas under 100,000	0.718	0.742	0.820	32
Low index value	0.522	0.449	0.518	
Median index value	0.798	0.871	0.952	
High index value	1.427	1.877	1.830	

SOURCE: Kokoski, Cardiff, and Moulton (1992:Table 2.4).

NOTE: Areas are ordered within region by population size as of the 1990 census; rankings are assigned to the combined index values from 1 (highest cost) to 44 (lowest cost).

equations included some 33 attributes of housing units and neighborhoods.) They created bilateral interarea price indexes from the resulting antilogs of the estimated coefficients on the area dummy variables, and then created "multilateral" indexes from the bilateral indexes. The authors claim that the resulting multilateral indexes are independent of the choice of reference area and, hence, that the rankings for areas are stable.

The results obtained by Kokoski, Cardiff, and Moulton (1992) for July 1988-June 1989 tend to accord with common expectations about the location and magnitudes of high- and low-cost areas; see Table 3-5. The major cities in the Northeast (Boston and New York City) and the West (Los Angeles, San Francisco, and San Diego) have the highest shelter costs, with index values between 1.46 and 1.83. Washington, D.C., Philadelphia, and Chicago have mid-range index values, while other major cities in the Midwest (e.g., St. Louis, Cleveland) and the South (e.g., Houston and Dallas) have substantially lower shelter costs, with index values between 0.69 and 0.84. Small urban areas generally have lower shelter costs than larger metropolitan areas in the same region. Indexes for rent and owners' equivalent rent tend to be highly correlated. In areas in which rent control is important (e.g., New York, Los Angeles, and San Francisco), the index for owners' equivalent rent is substantially higher than the rent index.

Discussion

What can one conclude from the work to date to develop interarea housing cost indexes? Clearly, there are no easy answers to the question of how to develop a reliable index. Not only does the use of different methods yield

different results, but researchers have also estimated differing index values for the same areas even when using similar methods and data (e.g., compare Blackley, Follain, and Lee, 1986, and Thibodeau, 1989). The work at BLS to extend and improve the hedonic methodology so that the results are more stable with respect to such factors as the choice of reference area or independent variables is very promising, but this effort is still developmental. Moreover, data problems remain: the data source with the largest sample size and coverage (the decennial census) has limited information on housing characteristics, while other data sources that are richer in content (the CPI database and the American Housing Survey) are smaller in size and restricted in the areas they cover.[11]

Yet despite all the methodological problems and uncertainties, it is clear that the cost of housing differs across geographic location. For example, HUD fair market rents differ significantly across areas even when they are adjusted for the median income of the area. Overall, we believe the findings support the importance of an adjustment of the poverty thresholds for geographic variations in housing costs.

Furthermore, despite the problems and uncertainties, the literature helps indicate the size of geographic area for which an adjustment would be feasible and appropriate. Data are not available with which to develop housing cost indexes for every city and town in the United States, but an adjustment for areas classified by population size within region would accord with findings that intraregional differences are highly correlated with population: larger cities or metropolitan areas within a region are more expensive than smaller areas. This pattern is evident in the results from Kokoski, Cardiff, and Moulton (1992, 1994), and in other studies as well (e.g., Thibodeau, 1989); Ruggles (1990) recommends an adjustment of this type.

Recommended Approach

At the current state of knowledge, we conclude that a feasible way to move toward a comprehensive interarea price index with which to adjust the poverty thresholds is first to develop an interarea price index for shelter. Not only are housing costs a large component of a poverty budget, but housing cost

[11] The national component of the American Housing Survey is conducted every two years and currently includes about 57,000 housing units; the sample is designed to produce national estimates, and the geographic identification made available to users is limited to four regions and central city-suburb and urban-rural classifications. The metropolitan component currently includes samples of about 5,000 housing units in each of 44 metropolitan areas; 11 areas are surveyed each year on a rotating cycle. The CPI database (described above) obtains price data for about 85 areas, most of which are combined for publication into size classes within each of four regions.

variations are also significant across areas, and there are data and methods available with which to develop a reasonable index. Such an index should take account of differences by region and size of place.

For constructing housing cost index values for the purpose of adjusting the poverty thresholds for all families, not just urban families or families in selected areas, we conclude that it is almost a necessity to turn to the decennial census, despite its limited data content. Given a decision to use census data, the HUD methodology for developing fair market rents has appeal. This methodology is subject to criticism because of its use of a limited number of characteristics to define a "standard" rental apartment unit for comparing rental costs across areas. But until more sophisticated methods are fully developed and, more important, improvements effected in the underlying database with which to apply these methods, the HUD methodology appears to offer a reasonable alternative that is easy to understand and straightforward to implement.

We implemented a modified version of the HUD approach with 1990 census data to determine whether we could develop interarea housing cost index values that accorded reasonably well with major findings in the literature.[12] We obtained a copy of an extract of 1990 census data for every U.S. county (originally prepared for HUD). This extract provided the distribution of rents for two-bedroom apartments that had complete plumbing facilities, kitchen facilities, and electricity and in which the occupant had moved in within the last 5 years. (Units for which no cash rent was paid or for which the rent covered one or more meals were excluded.)

Using these data, we first produced index values (relative to 1.0 for the nation as a whole) for each of the 341 metropolitan areas in the country and for nonmetropolitan areas within each state. Compared to the 32 metropolitan areas for which Kokoski, Cardiff, and Moulton (1992) also computed index values by using hedonic techniques with the CPI database, our index showed similar patterns, although less variation. For these 32 areas, our index values ranged from 1.67 to 0.88; the Kokoski, Cardiff, and Moulton values ranged from 1.83 to 0.69.[13] The rank-order correlation of our index values with those of Kokoski, Cardiff, and Moulton is very high (.897 computed using Spearman's *r*).

We next grouped the metropolitan areas into six population size categories within each of the nine census regions (divisions), aggregated the nonmetropolitan areas by region, and recomputed the index values. Following

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[12] The modification was that, for reasons of feasibility and consistency of estimates across the nation, we used decennial census data exclusively rather than a combination of census, AHS, and random digit dialing survey data.

[13] One reason for the difference may be that our index values included utilities, which Kokoski, Cardiff, and Moulton found in a separate analysis varied somewhat less than shelter costs per se.

TABLE 3-6 Cost-of-Housing Index Values (Relative to 1.00 for the United States as a Whole) by Region (Census Division) and Size of Metropolitan Area

Region and Population Size	Index Value
New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont)	
Nonmetropolitan areas	1.062
Metropolitan areas under 250,000	1.368
Metropolitan areas 250,000–500,000	1.290
Metropolitan areas 500,000–1,000,000	1.335
Metropolitan areas 1,000,000–2,500,000	1.321
Metropolitan areas 2,500,000 or more	1.475
Middle Atlantic (New Jersey, New York, Pennsylvania)	
Nonmetropolitan areas	0.797
Metropolitan areas under 250,000	0.771
Metropolitan areas 250,000–500,000	0.992
Metropolitan areas 500,000–1,000,000	1.045
Metropolitan areas 1,000,000–2,500,000	0.943
Metropolitan areas 2,500,000 or more	1.424
East North Central (Illinois, Indiana, Michigan, Ohio, Wisconsin)	
Nonmetropolitan areas	0.713
Metropolitan areas under 250,000	0.864
Metropolitan areas 250,000–500,000	0.906
Metropolitan areas 500,000–1,000,000	0.969
Metropolitan areas 1,000,000–2,500,000	0.988
Metropolitan areas 2,500,000 or more	1.133
West North Central (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota)	
Nonmetropolitan areas	0.630
Metropolitan areas under 250,000	0.817
Metropolitan areas 250,000–500,000	0.913
Metropolitan areas 500,000–1,000,000	0.956
Metropolitan areas 1,000,000–2,500,000	1.063
Metropolitan areas 2,500,000 or more	N.A.
South Atlantic (Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia)	
Nonmetropolitan areas	0.713
Metropolitan areas under 250,000	0.873
Metropolitan areas 250,000–500,000	0.911
Metropolitan areas 500,000–1,000,000	1.016
Metropolitan areas 1,000,000–2,500,000	1.097
Metropolitan areas 2,500,000 or more	1.270
East South Central (Alabama, Kentucky, Mississippi, Tennessee)	
Nonmetropolitan areas	0.564
Metropolitan areas under 250,000	0.757
Metropolitan areas 250,000–500,000	0.852
Metropolitan areas 500,000–1,000,000	0.878

TABLE 3-6 *Continued*

Region and Population Size	Index Value
East South Central—*continued*	
Metropolitan areas 1,000,000–2,500,000	N.A.
Metropolitan areas 2,500,000 or more	N.A.
West South Central (Arkansas, Louisiana, Oklahoma, Texas)	
Nonmetropolitan areas	0.617
Metropolitan areas under 250,000	0.780
Metropolitan areas 250,000–500,000	0.797
Metropolitan areas 500,000–1,000,000	0.868
Metropolitan areas 1,000,000–2,500,000	0.914
Metropolitan areas 2,500,000 or more	1.011
Mountain (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming)	
Nonmetropolitan areas	0.713
Metropolitan areas under 250,000	0.841
Metropolitan areas 250,000–500,000	0.946
Metropolitan areas 500,000–1,000,000	1.090
Metropolitan areas 1,000,000–2,500,000	1.006
Metropolitan areas 2,500,000 or more	N.A.
Pacific (Alaska, California, Hawaii, Oregon, Washington)	
Nonmetropolitan areas	0.891
Metropolitan areas under 250,000	0.978
Metropolitan areas 250,000–500,000	1.041
Metropolitan areas 500,000–1,000,000	1.063
Metropolitan areas 1,000,000–2,500,000	1.236
Metropolitan areas 2,500,000 or more	1.492
Low index value	0.564
Median index value	0.951
High index value	1.492

NOTE: Housing cost indexes calculated from 1990 census data on gross rent for two-bedroom apartments with specified characteristics; index values drawn from the 45th percentile of the gross rent distribution (see text).

N.A., Not applicable: no such areas in the region.

the HUD approach, the index values were based on the cost of housing at the 45th percentile of the value of the distribution for each area. The results of our calculations produced the expected findings of higher index values in the Northeast and West and higher index values for larger relative to smaller areas; see Table 3-6.

We further adjusted these index values for the estimated fraction of the poverty budget accounted for by housing (including utilities), which we set at 44 percent. In effect, we produced a fixed-weight interarea price index with two components—housing and all other goods and services—in which the

price of other goods and services is assumed not to vary.[14] This adjustment narrowed the range of index values (and, hence, the range of poverty thresholds: for example, the adjusted index value for metropolitan areas with 2,500,000 or more population in New England dropped from 1.475 to 1.209; conversely, the adjusted index value for metropolitan areas with 250,000-500,000 population in the West South Central division rose from 0.797 to 0.911. Finally, we collapsed the index values for geographic areas smaller than 250,000 population because of restrictions on area identification in the surveys that are available for estimating poverty rates (the Current Population Survey and the Survey of Income and Program Participation). The final set of 41 index values that we used for our analysis of the likely effects of implementing our proposed poverty measure is provided in Table 5-3 in Chapter 5.[15]

Before deciding on a set of index values by metropolitan area size category within region, we looked at index values produced in the same manner for each of the 50 states and the District of Columbia. There has been interest expressed in adjusting the poverty thresholds for state cost-of-living differences for such purposes as allocating funds to disadvantaged school districts under the Elementary and Secondary Education Act.

To compare the set of state index values and our proposed set, we assumed that the index values we originally calculated for each of the 341 individual metropolitan areas and for the nonmetropolitan components of each state were the "truth."[16] We then determined what fraction of the population would be misclassified—relative to the individual metropolitan and nonmetropolitan area index values—by using a single index value for the nation as a whole or separate index values for the nine regions (divisions), for states, and for the proposed classification by metropolitan area population size category within region.[17]

We found that the use of the national index value of 1.0 (i.e., not adjust-

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[14] The estimate of 44 percent comes from CEX tabulations of expenditures of two-adult/two-child families. We looked at families spending at the 35th percentile of the distribution on food, housing, and clothing, determined the share of housing of that total, and converted that share to a fraction of the total poverty budget, including food, housing, and clothing times a multiplier of 1.15. Clearly, one could derive somewhat different values of the fraction of housing in the budget, depending on the percentile or multiplier chosen.

[15] The figure of 41 index values represents nine regions (census divisions) by five size classes of metropolitan areas, minus four categories that have zero population: the West North Central, East South Central, and Mountain divisions lack any metropolitan areas larger than 2,500,000 population, and the East South Central division lacks any metropolitan areas of 1,000,000 to 2,500,000 population.

[16] In practice, however, we do not believe that it makes sense to develop such a large number of separate indexes for adjusting the poverty thresholds for several reasons: one is that there is a problem of small sample size for rental units with the specified characteristics in smaller metropolitan areas.

[17] The analysis was carried out using index values for the population size categories shown in Table 3-6 before any collapsing.

ing the poverty thresholds for cost-of-housing variations across areas) would result in 55 percent of the population having an index value that differed by more than 20 percent from its own metropolitan (or nonmetropolitan) area-specific index. The use of regional index values (for the nine census divisions) would result in 45 percent of the population having an index value that differed by more than 20 percent from its own area-specific index. The use of state index values would result in 33 percent of the population having an index value that differed by more than 20 percent from its own area-specific index. In contrast, the use of the proposed index values for metropolitan area size categories within regions would result in only 9 percent of the population having an index value that differed by more than 20 percent from its own area-specific index. In other words, a higher fraction of the population would be assigned a more accurate index value with our proposal than with a regional or state housing cost index. These results demonstrate the superiority of our proposal compared with the alternatives of adjusting solely for regional variations in the cost of housing or of adjusting for variations across states.[18]

The proposed procedure should not be viewed as the last word on the issue of adjusting poverty thresholds for area differences in the cost of living, but rather as a modest step in the right direction. The procedure only takes account of housing cost differences and, even for those differences, will assign index values to people in some areas that are considerably in error. The procedure also does not take account of housing cost variations *within* areas (e.g., differences in costs between central cities, suburbs, and exurbs of, say, large metropolitan areas). And it does not take account of special circumstances, such as significantly higher housing costs for areas in Alaska and Hawaii than are reflected in the index values for the Pacific region as a whole.[19] Finally, the proposed method is a crude instrument for attempting to measure housing price differences that do not also reflect quality differences. Nonetheless, within the constraints of available data, we believe that the proposed procedure is a significant improvement over the current situation of no adjustment. The methodology is understandable, operationally feasible, and produces results that conform well with other findings from research.

Updating the Housing Cost Index

The index values for cost-of-housing differences can readily be revised as necessary every 10 years as new decennial census data become available. How-

[18] For some purposes, it may still be desirable to use state index values to adjust poverty thresholds for differences in the cost of housing (or the cost of living generally). For example, this type of adjustment may make sense when the poverty thresholds are used as the need standard for such assistance programs as AFDC (see Chapter 8).

[19] It would certainly be possible to make some ad hoc adjustments to our index, but we did not believe it desirable for us to attempt such an effort.

ever, revising the index as infrequently as every 10 years could result in a blip in the poverty rates in many areas because of changing housing markets. For example, an area that was experiencing a housing "boom" at the time of one census could experience a housing "bust" at the next census and vice versa. It would be preferable to revise the index on a more frequent basis. Indeed, such a revision in the index values that we developed from 1990 census data would be desirable for the initial implementation of the proposed poverty measure.

HUD faces a similar need to update its fair market rents on a regular basis. To make annual adjustments, HUD uses data from several sources, (described above), including the American Housing Survey, local area CPI shelter cost indexes, and random digit dialing surveys. We encourage an assessment of the appropriateness of the HUD methods for updating the housing cost index values from the decennial census for use, in turn, in adjusting the poverty thresholds. We also encourage research on the usefulness and cost-effectiveness of other methods that could be considered.

Further Research

Obviously, the issue of how best to adjust poverty thresholds for geographic differences in the cost of housing and in the cost of living more broadly is an area for further research and development. We have argued that the proposed procedure for taking account of housing cost differences for metropolitan areas categorized by size of population within region represents an improvement over the current method of no adjustment at all. We have also noted the limitations of the procedure, which represents a step, but only a step, in the right direction.

We encourage appropriate agencies, such as BLS and HUD, to undertake research on improved methods for determining area price differences. Ideally, the research would include other goods besides housing and would consider such issues as the types of geographic areas (cities, counties, larger areas) for which an adjustment is feasible and appropriate. It would also address methodological issues, such as refinements to the hedonic regression models under development at BLS that appear so promising.

To effect much additional improvement in the methodology and the reliability of interarea price indexes, new data collection may be required. For example, expanding the sample for the American Housing Survey, which provides more detailed information on housing characteristics than the decennial census, would be one way to develop improved cost-of-housing indexes (whether using the proposed adaptation of the HUD methodology or hedonic methods). Even more broadly, expanding the BLS price samples for housing and other goods would be a way to develop comprehensive cost-of-living indexes that represent valid indicators of differences across areas in prices at a point in time and not just differences in the rate of price changes. However,

these kinds of expanded data collection efforts would entail considerable cost. We believe it is worth investigating the cost-effectiveness of additional data collection, in terms of the expected improvements in the data for such purposes as adjusting the poverty thresholds.

In general, we believe that data related to consumer expenditures and prices need to be improved in the United States. Not only is the CPI database limited in sample size and area coverage, but the CEX, which is used to determine the CPI market basket, is very limited—in sample size and in other ways—for purposes of measuring and understanding poverty, consumption, and savings. We discuss issues of needed data improvements for poverty measurement, including improvements in the CEX, in Chapter 5. Before that discussion, in Chapter 4, we consider an appropriate definition of family resources to compare with the poverty thresholds for determination of poverty rates for the nation, geographic areas, and population groups.