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Abstract

Although it is generally agreed that a child whose parents live apart should have the same proportion of parental income he or she would have if the parents lived together, what that proportion is remains in doubt. The guidelines issued by the federal Office of Child Support Enforcement rest on the contention that as income rises, the percentage of family income spent for a child decreases. The Wisconsin percentage-of-income standard is based on the assumption that expenditures on children increase in proportion to increases in income up to very high income levels.

The economics literature on the topic of equivalence scales does not provide clear-cut answers. Further research is needed to develop more definitive tests to determine the cost of a child in relation to family income and the additional cost of additional children.

A new technique using data from the subjective Income Evaluation Question shows promise for further examination of this issue.

Child Costs as a Percentage of Family Income: Constant or Decreasing as Income Rises?

Child support refers to the transfer of income from a nonresident parent to the child's resident parent. The Child Support Enforcement Amendments of 1984 required all states to establish numerical standards for child support awards that courts may--but are not required to--use in establishing child support obligations. The Family Support Act of 1988 requires states to make their child support standards presumptive (required) for all cases, unless good cause for deviating from the standards is established in court. Furthermore, states must review their standards every four years.

A report commissioned by the federal Office of Child Support Enforcement (OCSE) for the purpose of providing guidance to the states in establishing child support guidelines recommends a standard based on the following normative proposition: The child should receive the same proportion of parental income that he or she would have if the parents lived together (Williams, 1987). Although we believe that this is an intuitively appealing place to begin, rather than a place to wind up, we will not focus on the normative underpinning of the report. (See Garfinkel and Melli, forthcoming.) Rather, our focus is on the scientific underpinning to its quantitative recommendations, a set of child support guidelines known as the "Income Shares Model." In particular, we focus on the extent to which there is good scientific evidence to justify the report's recommendation that child support awards, as a proportion of parental income, decrease as income rises. In technical terms, this recommendation rests on the contention that expenditures on children in intact families increase less than proportionally with income.[1] In view of the fact that 23 states have adopted standards based on the Income Shares Model, this scientific question has great policy relevance.

In the first section of the paper, we briefly summarize the methodologies used in the conventional economics literature on the costs of children, which are based on the application of the theory of equivalence scales to expenditure data. In the process, we demonstrate that the federal report draws upon a branch of that literature that has some questionable properties. Other studies in the literature suggest that expenditures on children increase in proportion to income up to very high incomes.

The second section discusses an alternative approach to measuring equivalence scales and the costs of children, which was developed by a group of Dutch economists and which is based on survey questions that ask people about their families' needs. The third section explains how the Dutch approach can be extended to test whether the proportion of income spent on children decreases as income rises, and the fourth describes the data we use. The results presented in the fifth section suggest that neither the hypothesis of proportionality nor the hypothesis of regressivity can be rejected by the data. The paper concludes with a brief summary, some suggestions for further research, and a few cautions to policymakers.

I. CONVENTIONAL METHODS USED IN ESTIMATING THE COSTS OF CHILDREN

The definition of the cost of a child (or, more generally, of any change in family composition) most favored in the economics literature is

$$(1) \qquad C = C(U, a) - C(U, a^0),$$

where C(U,a) is the "household cost function" which gives the cost of reaching welfare level U, given family composition, a; and a^0 is the composition of the reference household. Suppose, for example, the reference household is a childless couple. Then the cost of one child is the amount of extra income the family needs after the child is born to be as well off as before.

The "true household equivalence scale," m, is defined as

$$(2) \qquad m(U, a, a^0) = \frac{C(U, a)}{C(U, a^0)}.$$

The proportion of (compensated) family income spent on an additional family member is

$$(3) \qquad P = \frac{C(U, a) - C(U, a^0)}{C(U, a)} = 1 - \frac{1}{m}.$$

Thus a higher equivalence scale implies a higher proportion of family income spent on children, and we shall use the expressions interchangeably. In this paper, we seek to test the hypothesis that the proportion of family income spent on each additional child does not vary with income, i.e., that $dP/dy = 0$, where y is family income. If we assume that tastes and leisure time are the same for all families (an implicit assumption in all of this literature), this is equivalent to testing whether $dP/dU = 0$, or $dm/dU = 0$.

The models that have been used to estimate equivalence scales from observed expenditure data are based on the economic theory of consumer demand, as generalized from individuals to families, which assumes that families maximize a joint utility function.[2] In order to develop a model that is estimable, the researcher must make two important functional form assumptions. The researcher must specify both the form of the expenditure (or utility) function (and thus of Engel curves) for the reference household, and the way household composition is modeled. (The latter decision includes deciding what type of household should be the reference household.) It is not necessary for these functional form assumptions to restrict the sign of dm/dU, but, in practice, most researchers have chosen specifications that directly or indirectly impose assumptions on the data about the relationship between m and the utility level.

The oldest and most empirically tractable approach to the estimation of equivalence scales is to assume that two households with equal budget shares for food have equal welfare. Deaton and Muellbauer show that the assumption that equal budget shares means equal welfare implies that children have only income effects on their parents' consumption (or at least on their spending on food vs. other goods) (1980, pp. 193-195). The equivalence scale, m(U, a), can be interpreted as the number of "adult equivalents" in the household. If an adult (the "reference person") demands food in the quantity $q_f = q_f(y)$, then the household demand for food is $q^h{}_f = mq_f(y/m)$. The budget share for food (ignoring prices, which are assumed to be the same for everyone) is $\frac{q^h{}_f(y)}{y} = \frac{q_f(y/m)}{y/m}$. Thus households with equal budget shares have equal y/m, or "income per adult equivalent."

Suppose we seek to estimate $q^h{}_f = mq_f(y/m)$ from expenditure data. If we posit that m depends on family composition alone, we impose the assumption dm/dU = 0. If we allow m to depend on income as well, we can then test the assumption.

In practice, most researchers have specified $q^h{}_f = q(y,a)$ *a priori*, so that it is difficult to detect the assumptions they are imposing on m. For example, in Espenshade (1984), the study upon which the Williams report for OCSE is based, a quadratic Engel curve specification is used for the reference household, so that

(4) $$q_f(y) = b_0 + b_1y + b_2y^2.$$

We would expect Espenshade to set

(5) $$q^h{}_f(y) = mb_0 + b_1y + (b_2/m)y^2,$$

where m = m(a,y). Instead, he uses

(6) $$q^h{}_f(y) = c_0m(a) + c_1y + c_2y^2,$$

where only the intercept is allowed to depend on family characteristics. If $m = m(a)$, and does not depend on y, he would need to allow c_2 also to depend on family characteristics, for the model to be consistent. He is thus implicitly allowing m to depend on y.[3] It is possible to calculate the formula for dm/dy.[4] The only restriction on dm/dy that is obvious from the formula is that $dm/dy = 0$ if $c_2 = 0$. Other restrictions may be implicit. It seems preferable to choose a specification for m(a, y) directly so that one is only imposing the restrictions one wants to impose.

The other widely used method for including household composition effects in demand functions was first suggested by Barten (1964). The two major studies that use the Barten method are Muellbauer (1977) and van der Gaag and Smolensky (1981). Each uses a different utility function specification. Muellbauer's estimated equivalence scales declined with rising income, whereas van der Gaag and Smolensky's scales were the same over a wide range of income levels.

The Barten method allows children to have both price and income effects, because it allows for goods-specific equivalence scales, which are then averaged to get an overall equivalence scale (so that the needs of children relative to adults may be larger for some goods than for others). While family purchases of goods that children need relatively more of will tend to increase to meet these needs, there is also an effect in the opposite direction. The adult decision-makers perceive goods that they have to share in larger proportions as relatively more expensive, so they tend to substitute away from these goods. If the good with a large good-specific equivalence scale also has a large enough own-price elasticity of demand (larger than one in absolute value), purchases of the good will actually decline when children are added to the household. This counterintuitive result has led many economists to believe that the Barten method allows children to have excessively large price effects. One implication is that if purchases of goods with high price elasticities increase with family size, then the estimates of the goods-specific equivalence scales will be implausibly low--and can even be negative (Deaton and Muellbauer, 1980, p. 200).

It is not unusual for luxuries to have higher own-price elasticities than necessities. Muellbauer's PIGLOG utility function requires this to be the case (Muellbauer, 1977). Income and price elasticities tend to be roughly proportional for the linear expenditure system used by van der Gaag and Smolensky as well (Deaton and Muellbauer, 1980, p. 139). Luxuries will thus tend to have lower than average goods-specific equivalence scales. Because high-income households spend a larger proportion of their incomes on luxuries, the overall equivalence scale, m, will be lower for those households. Thus we find that the Barten specification implies $dm/dy \leq 0$. The extent of this effect depends on the demand function specification, as well as on the data. The difference between Muellbauer's regressive results and van der Gaag and Smolensky's proportionality finding may result from the different specifications of the Engel curves in the two studies.

In general, the estimation of household equivalence scales from expenditure data requires functional form assumptions. Most research in this area has not been concerned with the relationship between the costs of children and family income, and has thus imposed functional form restrictions that constrain this relationship. Espenshade's study (1984) is particularly ad hoc in its choice of functional form, and thus it is difficult to derive the precise restrictions it places on the relationship dm/dy. The Barten model of household equivalence scales imposes the assumption that the costs of children increase at a rate less than or equal to the increase in family income, and some results using this technique support proportionality.

II. EQUIVALENCE SCALES BASED ON SURVEY QUESTIONS ON FAMILY NEEDS

Another branch of the literature attempts to measure family cost functions by directly asking people about their own family's needs. By comparing the answers of families of different sizes, we can make inferences about the costs of children. These methods, developed by a group of scholars in the Netherlands, have been widely used to develop measures of poverty in Europe (Hagenaars, 1986; van Praag, Goedhart, and Kapteyn, 1980; van Praag, Hagenaars, and van Weeran, 1982).

One of these "direct" or "subjective" approaches starts by asking a random sample of the population of interest the minimum income question (MIQ). In the Wisconsin Basic Needs Study, the question was phrased as follows:

> Living where you do now and meeting the expenses you consider necessary, what would be the very smallest amount of income per month--after taxes--your household would need to make ends meet?

In order to derive an equivalence scale, we regress people's answers on their current family income (using a linear regression in logs of the variables). We define the poverty line as the income at which the regression line crosses the 45 degree line, because someone at this income level would see his or her current income as just sufficient to make ends meet. Those below this poverty line say they need more income to make ends meet, while those above say they need less. A separate poverty line is calculated for each family size (by including the log of family size in the regression), and an equivalence scale is then constructed by comparing the poverty-level income for various family sizes (Goedhart et al., 1977). This equivalence scale applies only to those at the poverty line, as defined by this technique; there is no reason to assume costs of children would be proportional for those with middle or high incomes.

The second of these "subjective" methods, known as the Welfare Function of Income (WFI), was devised by van Praag (1968). It involves asking the income evaluation question (IEQ), phrased as follows in our data set, the Wisconsin Basic Needs Study:

> I'm going to ask you to think about the amount of money per month--after taxes--that would make you feel terrible about your household's income; then we will work up to an amount that would make you feel delighted about your household's income. It may help if you look at this list with me while I ask the questions.

Let's start at the top with terrible. How much money per month and after taxes would leave you feeling terrible about your household's income? Now let's move to unhappy. As we move to each next level, each of your answers should be larger than the one before, of course.

	Amount
Terrible	$______
Unhappy	$______
Mostly dissatisfied	$______
Mixed	$______
Mostly satisfied	$______
Pleased	$______
Delighted	$______

This method rests on the assumption that phrases such as "delighted," "pleased," etc., can be given a welfare interpretation, and that these phrases mean approximately the same level of welfare to each respondent. The seven income levels which people fill in are then associated with equal quantiles on a 0-1 utility or welfare scale.[5] We thus have seven points, $(z_i, U_i = \frac{2i-1}{14})$, i = 1,...,7. Van Praag (1968) found that a log-normal distribution function with parameters μ and σ (i.e., $U_i = N((\ln z_i - \mu)/\sigma)$, where N is the standard normal cumulative distribution function (cdf)), fit these points very well. He estimated μ and σ for each person from the relation $\ln z_i = \mu + \sigma U^{-1}{}_i$, where $U^{-1}{}_i$ is the inverse of the normal cdf at the appropriate quantile.[6]

For any utility level, e.g., $U(y) = \alpha$, we can derive the income level, y, that corresponds for families of various characteristics, as follows: $U(y) = \alpha$ implies

$$(7) \qquad N\left(\frac{\ln y - \mu}{\sigma}\right) = \alpha$$

Thus,

$$(8) \qquad \frac{\ln y - \mu}{\sigma} = U_{\alpha}^{-1}, \text{ and}$$

$$(9) \qquad \ln y = \mu + \sigma\, U_{\alpha}^{-1}.$$

The level of income associated with the welfare level α is

$$(10) \qquad y_{\alpha} \text{ s.t. } \ln y_{\alpha} = \mu + \sigma\, U_{\alpha}^{-1}.$$

This income level could be different for each household, since we estimate a different μ and σ for each respondent. Much of this literature makes the assumption that σ differs across respondents only as a result of measurement error, and that μ depends on the log of after-tax current income and the log of family size but otherwise varies only as a result of measurement error. Thus, to derive a prediction of y_{α} for someone with known income (y) and family size (fs), we use the sample mean of σ, and we estimate a regression equation to predict the coefficients of the relation

$$(11) \qquad \mu = \beta_0 + \beta_1 \ln fs + \beta_2 \ln y + \varepsilon$$

under the assumption $\varepsilon \sim N(0,1)$. When predicted values are plugged in for μ, we derive

$$(12) \qquad \ln y_\alpha = [1/(1 - \beta_2)](\beta_0 + \beta_1 \ln fs + \sigma U_\alpha^{-1}).$$

It is easy to see that this specification of the WFI imposes the assumption that child costs are the same proportion of family income at each welfare level. One can determine equivalence scales by looking at $d(\ln y\alpha)/d(fs)$, which approximately equals the percentage increase in family income required when an additional family member is added, in order to maintain the family at welfare level α.[7] Because this derivative does not depend on $U^{-1}(\alpha)$, the equivalence scales are the same at each welfare level.

These methods also rely on theoretical assumptions to impart sufficient structure to the data to make it possible to make welfare comparisons. The assumptions of these models, however, can easily be relaxed in order to test the proportionality of child costs to family income at various welfare levels. The reinterpreted model of the answers to the IEQ which allows this test is outlined in the next section.

III. A NEW SUBJECTIVE APPROACH WHICH PROVIDES EVIDENCE ON THE PROPORTIONALITY ISSUE

In a recent article, van Praag and van der Sar (1988) suggest a new way to analyze the answers to the IEQ in order to compute equivalence scales at various welfare levels. This method actually makes it possible to test whether expenditures on children increase proportionally with income. Briefly, they apply the same technique normally applied to the answers to the

MIQ to the answers to the IEQ at each welfare level. They calculate household cost for various family sizes (and thus equivalence scales) at welfare levels "terrible" through "delighted."

If we can assume a word such as "delighted" means the same welfare level to different individuals, the amount of income one needs to feel delighted is a point on one's household cost function, c(delighted, a), where a represents family composition. In practice, it has been found in the literature that answers to the IEQ at each welfare level vary systematically with current income, y, as well as family composition, a. (This correlation was incorporated in the WFI by having μ depend on ln y.) One could interpret this as indicating that people do not accurately evaluate the amount of income they would need to achieve a welfare level higher or lower than their current level, because their perceived needs increase as income increases, a phenomenon which van Praag and Kapteyn (1973) call "preference drift." We assume people can accurately evaluate the welfare they derive from their current income, however. Thus if we can find the income level at which respondents characterize their <u>own</u> income as making them feel "delighted," we can call this c(delighted, a). More formally, van Praag and van der Sar (1988) characterize the answers people give by a "virtual" cost function, $\hat{c}$(delighted, a, y), and define the "true" cost function as y^* = c(delighted, a) such that $y^* = \hat{c}$(delighted, a, y^*). Those with incomes less than y^* would need more income to feel delighted, while those with incomes more than y^* would need less. The analogy with the method used to compute the poverty line from the MIQ should be clear; the only difference here is that we ask people not how much they need to reach the one welfare level of "making ends meet," but how much they need to reach various welfare levels.

In practice, for each welfare level i, we specify the virtual cost function as follows:

$$(13) \qquad \ln z_i = \beta_{0i} + \beta_{1i} \ln fs + \beta_{21} \ln y + \varepsilon_i, \qquad i = 1, \ldots, 7$$

and estimate the coefficients by linear regression. Under the assumption that the disturbances, ε_i, are mean-zero normally distributed measurement errors, we can derive consistent estimates of

$$(14) \qquad \ln y_i^* = \frac{\beta_{0i} + \beta_{1i} \ln fs}{1 - \beta_{2i}}$$

or

$$(15) \qquad c(u_i, fs) = \exp\left(\frac{\beta_{0i} + \beta_{1i} \ln fs}{1 - \beta_{2i}}\right)$$

Equivalence scales for welfare level u_i are derived by computing the ratio $c(u_i, fs)/c(u_i, fs_0)$, where fs_0 is the size of the reference family.

Van Praag and van der Sar also note that when one regresses the parameter μ (the average of the ln z_is) on ln fs and ln y, the coefficients will be averages of the coefficients in the seven regressions for the seven z_i levels. If the coefficients on ln fs and ln y were the same in each regression, we could accept the proportionality assumption embedded in the original formulation of the WFI. A statistical test for equality of these coefficients across the seven equations will be presented below.

There are three important advantages of the van Praag and van der Sar method for looking at the proportionality issue. First, it is easier and less expensive to ask the IEQ in a large survey than to collect detailed expenditure data. Second, data analysis is very straightforward: one only needs to run seven ordinary least squares regressions, and then perform some calculations to solve for the cost levels and equivalence scales. Third, this approach does not require the strong assumptions about the form of people's utility functions that are needed for the demand-theory/expenditure-data-based methods.

Many economists look with suspicion at all methods that involve asking people about their preferences rather than observing their behavior. It is always difficult to control for variation in how people interpret the wording of particular questions. Harold Watts, for example, finds the empirical patterns described in the literature on the WFI and MIQ of interest, but remains skeptical about the interpretation of these patterns (Watts, 1985). Van Praag and van der Sar note, however, that economists may be unfairly prejudiced against verbal behavior. Their use of the IEQ to derive household cost functions is a logical way to exploit the empirical regularities in how people answer these questions. Their technique, however, contains its own arbitrary assumptions about functional form. In particular, there is nothing in their theoretical discussion to mandate the log-linear functional form they use to specify their regressions.[8] This functional form assumes the elasticity of household cost (at a given welfare level) with respect to family size is constant--a strong assumption. It does, however, accord with our intuition that there are economies of scale in household expenditure, because it imposes the result that each additional child costs less than the one before. In contrast, a specification that is linear in all the variables imposes the implausible assumption that each child costs the same.

Van Praag and van der Sar do not attempt to control for variables other than family size and current income. In the next section, we describe how we attempted to control for family composition more carefully.

IV. DATA

The data used in this study are drawn from the first wave of the Wisconsin Basic Needs Study (BNS). The Basic Needs Study was undertaken in order to establish new AFDC benefit levels in Wisconsin for a variety of family sizes. The first wave consisted of a personal interview conducted in March through May of 1981. The interview included detailed questions about family composition, all possible sources of income and assets, as well as the MIQ and IEQ. The sample of households interviewed was composed of five subsamples: first, an area probability sample of Wisconsin households; second, a sample of households on AFDC drawn randomly from case records; and finally, samples of low-income, elderly, and female-headed households drawn by random-digit-dialing and then screened for eligibility.[9]

In the results presented below, we use an estimate of after-tax family income in 1980 for y, since the IEQ refers to after-tax income. We first computed gross family income by adding up income from all possible sources.[10] Our estimate of after-tax income was then derived by applying the 1980 tax tables to each household, under the assumptions that all income was fully taxable and that all households took the standard deduction.[11]

Most studies have used number of household members as the only family composition variable, without distinguishing the number of adults in a household or in any way controlling for the age (or relationships) of household members.[12] Because we were interested in using the IEQ to estimate expenditures on children in intact two-parent families, we decided we could use a family size variable only if we selected a subsample of two-adult, married couple families. If we used the entire BNS sample, which includes households with varying numbers of adults, we would be estimating the average percentage of household income spent on each additional household member at each welfare level. Since this estimate would confound the costs of adults with the costs of children, it would not be useful for determining child support standards.

We drew a subsample of all households in any of the BNS subsamples with no more than two adults in each household. We included married or cohabiting couples without children in order to compare them to households with one child and thus to better estimate the cost of the first child.

Originally, we had also wanted to control for the age of the adults. We were concerned that couples at different stages of the life cycle may perceive their needs differently. Unfortunately, a variable which measured the average age of the adults was so correlated with the family size variable that it was impossible to distinguish these effects from family size effects. It would require a sample which was specifically drawn to include large variations in family size at all ages (or at least a much larger sample) to sharply distinguish age effects from family size effects. We discovered, however, that more than half of the childless couples were over 65, and, not surprisingly, most of those over 65 had no children at home. Thus, we decided to exclude from the sample childless couples with any member over 65, about one-quarter of the original two-adult sample. This gave us a sample size of 262.

This sampling scheme remains only a partial step toward solving the problem of how to control for family composition. In particular, it does not provide reliable evidence on the expenditures on the second vs. the first adult. We estimated results using other subsamples, and, in general, found our results were sensitive to sample composition. In order to document this sensitivity, we will also present results for two other samples: all two-parent families, including the elderly childless couples; and all two-parent families except for childless couples with both adults over age 65.

Colesanto, Kapteyn, and van der Gaag (1984) provide a previous analysis of the IEQ based on the Wisconsin Basic Needs Study. They used the IEQ to estimate parameters of the Welfare Function of Income. They used all BNS observations, with appropriate weights for the five subsamples, so that their analysis includes households that had varying numbers of adults, although they excluded households with multiple families or unrelated adults. We will discuss below how our results compare in light of the different sample and model specification we use.

V. RESULTS

This section reports the results from estimation of the seven equations (13) in which the logarithms of the seven answers to the IEQ are the dependent variables, and the logarithms of family size and income are the independent variables in each equation, using the sample of two-adult families from the BNS with childless couples over 65 excluded. It also presents our statistical test for the proportionality of the equivalence scales at various welfare levels.

In order to gauge the strength of our evidence for or against proportionality of equivalence scales, we tested the joint null hypothesis that $\beta_{1i}=\beta_1$, for the welfare levels i=1,...,7, and $\beta_{2i}=\beta_2$, for i=1,...,7, which together would imply that the equivalence scales were the same at all welfare levels.[13] We performed the test by jointly estimating the seven equations both with and without imposing the null hypothesis, and using a likelihood-ratio test to compare the two specifications.

The seven equations were estimated using the method of "seemingly unrelated regressions" (SUR), in order to account for the possibility that the error terms in the seven equations would be correlated for a given individual, because any idiosyncrasies in tastes or measurement errors would affect all of an individual's answers to the IEQ (Johnston, 1984, pp. 330-341). Because the same explanatory variables appear in all seven equations, the unrestricted SUR estimates of the seven equations are the same as the ordinary least squares estimates; the restricted SUR estimates, however, are not identical to restricted least squares estimates. The estimates were generated using an iterated generalized least squares algorithm, which provides maximum likelihood estimates under the assumption the error terms are distributed multivariate normally.

A. Basic Results

The major results of this investigation are reported in Tables 1 and 2. Table 1 reports coefficient estimates for the unrestricted version of the model. It also reports the elasticity of the family cost function with respect to family size, $\beta_1/(1 - \beta_2)$, which we note actually increases at first, and then declines as the welfare level increases. Table 2 reports these results in a form that is easier to interpret. It contains both the values of the household cost function at each possible

Table 1

Estimation Results

Welfare Level	Coefficient Estimates: Intercept (β_0)	Family Size (β_1)	Income (β_2)	Elasticity $\beta_1/(1 - \beta_2)$
Terrible	2.90 (.563)	.224 (.0985)	.432 (.0739)	.394
Unhappy	2.84 (.494)	.229 (.0864)	.469 (.0648)	.431
Dissatisfied	3.00 (.475)	.242 (.0830)	.466 (.0623)	.453
Mixed	3.32 (.463)	.247 (.0809)	.445 (.0608)	.445
Satisfied	3.72 (.484)	.236 (.0845)	.421 (.0635)	.408
Pleased	3.97 (.532)	.168 (.0930)	.432 (.0698)	.296
Delighted	4.25 (.596)	.170 (.104)	.437 (.0782)	.302

Notes: N = 262. Log-likelihood = 244.10. Standard errors are in parentheses. The sample includes all two-adult married-couple households in the Wisconsin Basic Needs Study, except for childless couples with members over age 65. Households with missing data for any variable were excluded from the analysis. Estimates are both ordinary and general least squares estimates.

Table 2

Dollars Needed per Month and Equivalence Scales at Various WFI Welfare Levels, Two-Adult Families

Welfare Level	Number of Children				
	0	1	2	3	4
Terrible	$215	253	283	309	332
	1.00	1.17	1.31	1.44	1.54
Unhappy	$282	336	381	419	454
	1.00	1.19	1.35	1.48	1.61
Dissatisfied	$379	456	519	574	624
	1.00	1.20	1.37	1.51	1.65
Mixed	$535	640	728	804	872
	1.00	1.20	1.36	1.50	1.63
Satisfied	$820	967	1088	1191	1283
	1.00	1.18	1.33	1.45	1.56
Pleased	$1327	1496	1629	1741	1840
	1.00	1.13	1.23	1.31	1.38
Delighted	$2349	2655	2896	3098	3273
	1.00	1.13	1.23	1.32	1.39

Notes: Based on the results reported in Table 1.
WFI = Welfare Function of Income.

welfare-family size combination and the corresponding equivalence scales, which use childless couples as the "reference household." Tables 3 and 4 present the analogous results for the constrained model.

We could accept the proportionality hypothesis at the 10 percent significance level (the conventional significance level that is the strictest test of the null hypothesis) using a likelihood ratio test. In fact, the test statistic, 8.29 (-2 times the difference in the log-likelihoods), is much smaller than 18.6, the 10 percent critical value of the chi-squared distribution with 12 degrees of freedom, so that we could accept the null hypothesis even under a much stricter test. However, our small sample size implies the power of such hypothesis tests is limited; we could also accept the null hypothesis that costs of children at the "delighted" welfare level (as a percentage of family income) are 75 percent of the costs of children at the "terrible" welfare level, a finding which is consistent with the standards suggested in the federal report.[14]

The estimates of the costs of the first child derived from this sample imply that at the "terrible" welfare level, a family needs a 17 percent increase in income to be as well off after the first child is born, while at the "mixed" welfare level, a family needs a 20 percent increase in income to be as well off, and at the two highest welfare levels, a family needs a 13 percent increase in income to be just as well off.[15] The results indicate relatively modest economies of scale in having additional children. The fourth child, for example, costs about

Table 3

Estimation Results from Restricted Model

Welfare Level	Coefficient Estimates: Intercept (β_0)	Family Size (β_1)	Income (β_2)	Elasticity $\beta_1/(1 - \beta_2)$
Terrible	2.74 (.453)	.231 (.0791)	.452 (.0594)	.422
Unhappy	2.96 (.453)	.231 (.0791)	.452 (.0594)	.422
Dissatisfied	3.12 (.453)	.231 (.0791)	.452 (.0594)	.422
Mixed	3.28 (.453)	.231 (.0791)	.452 (.0594)	.422
Satisfied	3.49 (.453)	.231 (.0791)	.452 (.0594)	.422
Pleased	3.75 (.453)	.231 (.0791)	.452 (.0594)	.422
Delighted	4.07 (.453)	.231 (.0791)	.452 (.0594)	.422

Notes: N = 262. Log-likelihood = 239.95. Standard errors are in parentheses. The sample includes all two-adult married-couple households in the Wisconsin Basic Needs Study, except childless couples with members over age 65. Households with missing data for any variable were excluded from the analysis. Estimates are restricted general least squares estimates.

Table 4

Dollars Needed per Month and Equivalence Scales at Various
WFI Welfare Levels, Two-Adult Families
Restricted Model

Welfare Level	Number of Children				
	0	1	2	3	4
Terrible	$199	236	266	292	316
	1.00	1.19	1.34	1.47	1.59
Unhappy	$297	352	398	437	472
	1.00	1.19	1.34	1.47	1.59
Dissatisfied	$398	472	533	585	632
	1.00	1.19	1.34	1.47	1.59
Mixed	$533	632	713	784	846
	1.00	1.19	1.34	1.47	1.59
Satisfied	$781	927	1046	1149	1241
	1.00	1.19	1.34	1.47	1.59
Pleased	$1255	1489	1681	1847	1994
	1.00	1.19	1.34	1.47	1.59
Delighted	$2251	2671	3015	3312	3577
	1.00	1.19	1.34	1.47	1.59

Notes: Based on the results reported in Table 3.
WFI = Welfare Function of Income.

60 percent as much as the first child did (the amount varies somewhat with the welfare level).

B. <u>The Results in Context</u>

In order to assess the value of the evidence given by the van Praag and van der Sar technique on the proportionality issue, it is important to ask whether the technique gives reasonable results in other respects. In particular, we need to examine how the estimates of child costs derived from this technique compare to the range of estimates in the literature.

In his 1982 survey of a wide range of estimates of child costs, Jacques van der Gaag came up with a "best guess" figure of 25 percent for the proportionate increase in income necessary to compensate a family for the costs of a first child; our estimates are 13-20 percent. When we looked at studies that have come out since van der Gaag's survey, we found studies based on analysis-of-expenditure data almost invariably produced estimates that were greater than or equal to ours. The constant-food-share approach of Espenshade (1984) and Betson (1986) produced the highest estimates--ranging from 25 to 40 percent. Deaton and Muellbauer (1986) showed, however, that the food-share method tends to overestimate child costs under plausible assumptions. Studies using the Barten method of calculating equivalence scales calculated somewhat lower cost estimates; van der Gaag and Smolensky (1981) estimated the cost of the first child at 17 percent of family income, a result which is close to ours. Ranjan Ray's 1983 paper presented the lowest estimates of the cost of the first child--7-8 percent. Several features of his approach may have caused the estimates to be biased downward; he assumed first and later children cost the same and ignored housing expenditures because of data problems.

Van Praag, Spit, and van de Stadt (1982) compared equivalence scales derived from the WFI to those derived from the food-share method, using data from the same survey. They suggested two reasons why the "subjective" WFI method provides lower estimates of child costs than the food-share method: first, the subjective method, like the Barten method, allows for the possibility that families with children substitute away from child-intensive goods to some extent, while the food-share method does not allow such substitutions. Second, when people respond to questions about how much income they need to reach a given welfare level, they may incorporate into their answers some willingness to trade income for the pleasure they get from their children; none of the demand-theory/expenditure-data approaches allows for the utility people derive from their children.

When we compare our results to previous American studies which estimated equivalence scales from the answers to the IEQ or the MIQ, we find that our results are fairly close. Danziger et al. (1984) estimated the cost of a third family member (using a couple as the reference household) at 12 percent of family income, using the MIQ. The previous study using the BNS (Colesanto, Kapteyn, and van der Gaag, 1984) came up with an estimate of 19 percent using the MIQ, and 15 percent using the WFI. It is appropriate to compare the results from the MIQ to our results for the lower welfare levels, and results from the WFI to our results for the middle welfare level.

Unlike these previous works, we have confined our samples to married couples with or without children, because couples provide the appropriate sample from which to make inferences about child costs in intact families. We also did some exploratory estimates of the model for a sample of single-adult households from the BNS and for the entire BNS area probability sample. The equivalence scales estimated for the single-adult households were extremely regressive, while the scales estimated for the full area probability sample (which measure the costs of additional family members, not specifically children, as noted above) were somewhat progressive. The results of the van Praag and van der Sar technique thus appear sensitive to the types of households included in the sample.

We also restricted the sample to exclude childless couples with members over 65. In order to examine the sensitivity of our results to this restriction we estimated the SUR model for two other samples: the sample of all two-adult married-couple households and the sample of two-adult households excluding only childless couples in which both were over 65. The regression results and corresponding equivalence scales are presented in the Appendix, in Tables A.1 to A.4. The results with all childless couples included (regardless of age) also suggest the percentage cost of children first increases and then decreases as income increases, but estimates of child costs are lower at all welfare levels than in our preferred set of results. This suggests that elderly childless couples report needing more income to reach each welfare level than the younger childless couples. For the sample that excludes childless couples only when both are over 65, we find equivalence scales are constant at the four lower welfare levels and then decline gradually. The differences in the results for different samples may indicate that the results are sensitive to assumptions about household composition, but it is hard to distinguish this type of sensitivity from random changes in the results due to sampling variation, given these small sample sizes.

VI. SUMMARY AND CONCLUSIONS

The two major models for child support guidelines that have been adopted by the states are the Wisconsin standard, in which child support is set at a fixed percentage of the nonresident parent's income regardless of the level of income, and the income shares model recommended in the OCSE report (Williams, 1987), in which the proportion of income assessed for child support declines by about 25 percent as the nonresident parent's income increases. Twenty-three states have adopted a version of the income shares model, 13 states have adopted a fixed percentage-of-income model a la Wisconsin, and another 9 states have adopted a varying percentage-of-income model.

This paper has attempted to summarize and evaluate the evidence provided by the current literature on household equivalence scales on whether expenditures on children in intact families increase proportionally with family income, or less than proportionally. Most of this literature has been targeted at determining the poverty level for families of different sizes. We demonstrated that the most frequently used models in both the demand-theory/expenditure-data based literature and the "subjective" literature impose constraints, the effects of which are hard to assess, on how equivalence scales change at various income levels.

In addition, we have highlighted a new technique for using the data from the "subjective" Income Evaluation Question, which we believe shows promise for examination of this issue. We presented results from this technique using a small sample of married-couple households in Wisconsin. Our results suggest equivalence scales that do not decline monotonically as family income increases, unlike those suggested by the Williams report. However, the small size of our sample precludes very precise estimates; we could not reject either the hypothesis that equivalence scales are the same at all income levels or the hypothesis that they decline with increased income to an extent similar to the standards recommended in the federal report.

Based both on our review of the literature and the new results presented in this paper, policymakers should be wary of the claim in the federal report that the proportionality of the Wisconsin percentage-of-income standard is contrary to the economic evidence, whereas the regressivity of the income shares model is based on good scientific evidence (Williams, 1987).

Further research is needed in order to develop more definitive tests of how the costs of additional children as a proportion of family income change as family income increases. We would recommend that the Income Evaluation Question be added to a large nationally representative survey, such as the Survey of Income and Program Participation, to allow researchers to explore these issues with larger samples. We also urge consideration of how to test for the constancy of equivalence scales at various income levels within the context of traditional demand theory.

Appendix

Table A.1

Estimation Results for Full Two-Adult Sample

Welfare Level	Coefficient Estimates: Intercept (β_0)	Family Size (β_1)	Income (β_2)	Elasticity $\beta_1/(1 - \beta_2)$
Terrible	2.99 (.384)	.213 (.0807)	.422 (.0525)	.369
Unhappy	3.13 (.336)	.218 (.0707)	.433 (.0460)	.384
Dissatisfied	3.34 (.324)	.224 (.0681)	.425 (.0443)	.390
Mixed	3.59 (.317)	.232 (.0666)	.411 (.0434)	.394
Satisfied	3.73 (.334)	.220 (.0702)	.423 (.0457)	.381
Pleased	3.81 (.365)	.189 (.0767)	.450 (.0500)	.344
Delighted	4.05 (.451)	.153 (.0950)	.468 (.0619)	.288

Notes: N = 347. Log-likelihood = 246.34. Standard errors in parentheses. Th sample includes all two-adult married-couple households in the Wisconsi Basic Needs Study. Households with missing data for any variable were excluded from the analysis. Estimates are both ordinary and general least squares estimates.

Table A.2

Dollars Needed per Month and Equivalence Scales at Various WFI Welfare Levels, Two-Adult Families

Welfare Level	Number of Children				
	0	1	2	3	4
Terrible	$228	265	294	319	341
	1.00	1.16	1.29	1.40	1.50
Unhappy	$323	378	422	460	493
	1.00	1.17	1.31	1.42	1.53
Dissatisfied	$433	507	567	618	664
	1.00	1.17	1.31	1.43	1.53
Mixed	$585	686	769	839	902
	1.00	1.17	1.31	1.43	1.54
Satisfied	$835	974	1087	1184	1269
	1.00	1.17	1.30	1.42	1.52
Pleased	$1292	1485	1639	1770	1884
	1.00	1.15	1.27	1.37	1.46
Delighted	$2456	2760	2998	3197	3369
	1.00	1.12	1.22	1.30	1.37

Notes: Based on the results reported in Table A.1.
WFI = Welfare Function of Income.

Table A.3

Estimation Results for Two-Adult Sample Excluding Childless Couples When Both over 65

Welfare Level	Coefficient Estimates: Intercept (β_0)	Family Size (β_1)	Income (β_2)	Elasticity $\beta_1/(1 - \beta_2)$
Terrible	2.98 (.456)	.239 (.0886)	.418 (.0607)	.411
Unhappy	3.18 (.401)	.235 (.0780)	.423 (.0535)	.407
Dissatisfied	3.41 (.388)	.244 (.0755)	.411 (.0517)	.414
Mixed	3.70 (.382)	.247 (.0743)	.394 (.0510)	.408
Satisfied	3.97 (.398)	.243 (.0774)	.386 (.0531)	.396
Pleased	4.03 (.437)	.201 (.0850)	.418 (.0583)	.345
Delighted	4.39 (.513)	.187 (.0998)	.416 (.0684)	.320

Notes: N = 290. Log-likelihood = 233.10. Standard errors are in parentheses. The sample includes all two-adult households in the Wisconsin Basic Needs Study, except for childless couples when both are over age 65. Households with missing data for any variable were excluded from the analysis. Estimates are both ordinary and general least squares estimates.

Table A.4

Dollars Needed per Month and Equivalence Scales at Various WFI Welfare Levels, Two-Adult Families

Welfare Level	Number of Children 0	1	2	3	4
Terrible	$222	263	296	324	349
	1.00	1.18	1.33	1.46	1.57
Unhappy	$325	384	431	473	509
	1.00	1.18	1.33	1.46	1.57
Dissatisfied	$433	513	577	633	683
	1.00	1.18	1.33	1.46	1.58
Mixed	$591	697	784	858	925
	1.00	1.18	1.33	1.45	1.57
Satisfied	$848	996	1116	1219	1311
	1.00	1.17	1.32	1.44	1.55
Pleased	$1283	1476	1630	1761	1875
	1.00	1.15	1.27	1.37	1.46
Delighted	$2285	2601	2852	3064	3248
	1.00	1.14	1.25	1.34	1.42

Notes: Based on the results reported in Table A.3.
WFI = Welfare Function of Income.

NOTES

[1]The state of Wisconsin has adopted a child support standard which is proportional. Although the normative underpinnings of the Wisconsin standard are similar to those of the federal report, a review of the literature on the costs of children conducted for the state concluded that expenditures on children were proportional to income (see van der Gaag, 1982).

[2]Deaton and Muellbauer (1980, Ch. 8) present an excellent overview of the standard theory. Major critiques and extensions of the theoretical foundations of these models include Pollak and Wales (1979), Deaton and Muellbauer (1986), and Nelson (1988).

[3]In order to solve for m, we equate the right-hand sides of equations (5) and (6). Since this specification requires one to solve a quadratic equation for m, m is not necessarily unique. Usually, there will be a negative root one can discard.

[4] $$\frac{dm}{dy} = \frac{c_2 y}{c_0} \pm \frac{(2c_0\ m(a)\ c_2 y + 2c^2_2\ y^3 - 4c_0\ c_2 y)}{[(c_0\ m(a) + c_2 y^2)^2 - 4c_0\ c_2 y^2]^{1/2}}$$

[5]Note this idea of a utility index ignores leisure and non-material sources of utility. Even if individuals, when they answer the question, hold constant nonmonetary aspects of their situation, including the pleasure they get from their children, we cannot control for the level of utility derived from these sources when we compare different individuals.

[6]One can estimate μ and σ for each person by running a seven-

observation linear regression. A simpler, but still consistent, way to estimate μ is to average the values of the $\ln z_i$.

[7]This derivative is referred to as the elasticity of family needs with respect to family size.

[8]Watts also noted this.

[9]For more information on the BNS, see MacDonald (1985).

[10]The BNS extract we used did not allow us to differentiate those who have missing information from those who have zero income from various sources. We decided to exclude those with zero measured income (six observations) from the analysis, because the chances seemed good that such observations were in fact missing rather than true zeros. The results turned out to be sensitive to this decision, and when respondents with zero measured income were excluded, our results were much closer to those in previous studies.

[11]In the samples that include childless couples over 65, we also allowed for the additional exemption for the elderly.

[12]Kapteyn and van Praag's 1976 paper pioneered a more complex way of modeling family size effects. They developed a measure of family size which was weighted by age and birth order, and they estimated the weight functions simultaneously with the other coefficients. They found that needs increased with age for parents but not for children, but noted that multicollinearity led to problems in separating the two effects. This

specification was little used until the recent paper by Kapteyn, Kooreman, and Willemse (1988). They obtain more reasonable estimates of age effects, which they attribute to use of more accurate income measures, and find child costs decrease as a proportion of family income as income goes up.

[13]In fact, this hypothesis is sufficient but not necessary for proportionality of equivalence scales. All that is needed for proportionality is for the ratio β_{1i}/β_{2i} to be the same at all welfare levels.

[14]We tested this hypothesis by constraining the coefficients on log income in the two equations to be equal, constraining the coefficient on log family size in the "delighted" equation to be equal to .75 times the coefficient in the "terrible" equation, and performing a likelihood ratio test as above. In the child support standard proposed in the federal report, the proportion of income spent on a child at the highest income level is 75 percent as large as the proportion of income spent on a child at the lowest income level (Williams, 1987, p. II-70, Table 12).

[15]In an earlier version of this paper, we used before-tax rather than after-tax income. Not surprisingly, the estimates of child costs as a proportion of after-tax income are uniformly higher than the estimates of child costs as a proportion of before-tax income.

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