

Documenting that Both Engel and Rothbarth Versions of Income Shares Cost Tables Overestimate Child Costs[©]

November 1, 2005

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Introduction

One issue that frequently is raised during child support guideline reviews and during legislative consideration of changes in child support guidelines is that of determining economically correct presumptive child costs. Typically, the presumptive cost issue is addressed in terms of designing or choosing a cost table that indicates “appropriate” child costs at varying income levels and according to the number of children. That is, in a typical presumptive child cost table, child costs rise as income rises and child costs rise with the number of children.

The most common method for a state to develop its presumptive child cost tables is to hire Policy Studies, Inc. (PSI) of Denver, CO. This company was co-founded by Robert Williams, one of the researchers hired by the federal government to update the concept of Income Shares. Robert Williams was the primary author of *Development of Guidelines for Child Support Orders*, a key federal document underlying a federal advisory panel’s support for states’ use of the Income Shares methodology.¹

What is not often recognized is that the Income Shares methodology has undergone several significant changes since its emergence on the national scene in the mid-1980s. The original Income Shares cost table espoused by PSI was based on the research of Thomas Espenshade.² That research was an adaptation of earlier research by Ernst Engel. While a number of Income Shares states implemented variations of the original Engel-based cost table, a consensus developed that the Engel-based cost tables were too high. At the same time, David Betson of the University of Notre Dame had developed a slightly different methodology for cost tables based on the research of Erwin Rothbarth. Additionally, Betson and PSI have changed the Rothbarth methodology from its original design in the early 1990s to a somewhat different technique starting with a 2001 study.

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¹ Robert G. Williams, *Development of Guidelines for Child Support Orders: Advisory Panel Recommendations and Final Report*, Parts II and III, Policy Studies, Inc., Denver, Colorado, under a grant to National Center for State Courts, Williamsburg, Virginia, submitted to U.S. Department of Health and Human Services, Washington, D.C., September 1987.

² Robert G. Williams, *Development of Guidelines for Child Support Orders: Advisory Panel Recommendations and Final Report*, pages II-19 through II-20.

During the academic debate over which methodology, Engel or Rothbarth, is best or most economically “correct” for determining presumptive child costs, a view developed by some policy makers that the Engel methodology established a ceiling on what child costs “really are” and the Rothbarth one established a theoretical floor.

To evaluate whether or not the Engel methodology establishes a ceiling on appropriate child cost tables and whether the Rothbarth methodology creates a floor, one must examine the actual methodologies and their assumptions. Such a review indicates that the Engel methodology indeed likely overstates child costs and that the claim that Rothbarth underestimates child costs has no credibility. To make the claim that the Rothbarth methodology understates child costs, two highly unlikely assumptions must be made:

- 1) Parents do not like sharing shared household goods with their children, and
- 2) Parents get no sense of well-being from their children.

More realistic assumptions for the Rothbarth methodology indicate instead that Rothbarth overestimates child costs.

Income Shares Uses an Indirect Methodology for Estimating Child Costs

Contrary to the belief of some policy makers, Income Shares Cost tables are not based on measures of actual prices for goods and services for children such as the price of a pair of jeans, or the cost of baby formula, or the price of a child’s hair cut. There are no specific prices by category built into an Income Shares cost table. Child costs are measured indirectly. The rationale for indirect measurement is that a number of goods and services expended on children are also shared by adults in the same household. For example, parents and children share the same living room, television, and kitchen. Even food is bought for the household and then allocated “at the table” between the parents and the children—how does one measure that?

The Engel and Rothbarth child cost methodologies look at economic measures of the well-being of the adults (parents) to estimate child costs. That is, how does some measure of adult well being change before and after having children? Then, how much income does it take to restore that measure of adult well being after having the children? These are the questions that these methodologies use in a statistical approach to measure child costs. It is alleged statistical flaws in these methodologies that underlie the claims that they either overestimate or underestimate child costs. Whether these alleged flaws actually exist as claimed determines the credibility of these claims.

The Engel Methodology

The Engel methodology of estimating child costs was the first incorporated into the Income Shares child support guidelines and cost table espoused by Policy Studies, Inc. Engel believed that one could look at a household’s spending patterns on food and non-food items to determine how economically well off various households were to each

other. Because food is a necessity, the higher the percentage of a family's spending is on food, the less economically well off that family is compared to a family that spends a smaller percentage of their total spending on food. The equivalent statement is that the higher the non-food shares of family spending, the higher the family's standard of living.

In 1895, Ernst Engel developed a methodology to measure the cost of children that was based upon the supposition that the standard of living of the household could be proxied by the share of total expenditures devoted to the consumption of food. Examining budget data, he found that as total household expenditures rose, the share of total expenditures devoted to food fell, i.e., the standard of living rose. He also found that as the family size increased, holding total expenditures constant the food share rose, i.e., the standard of living fell. Combining these two empirical facts, Engel felt that he had sufficient justification to declare that food shares were inversely related to standards of living.³

The corollary to this analysis is that when families of different sizes have the same share of spending on food, then those families are equally well off. This is the same as saying that when different families have the same share of total spending on non-food items, they are equally well off. Child costs are defined as the difference in total spending for two families of different size (with number of children being the difference in size) when both families spend the same share of their budget on food.

The Engel approach is explained by David Betson [Figure 2 in Betson's discussion is Figure 1 in this document]. Referring to the below figure:

If we let $\Theta(X, K)$ denote the relationship between the share of total expenditures spent on food, total expenditures (X), and the number of children (K), the Engel approach would compute the cost of a child (CC_E), where CC_E must satisfy the following relationship:

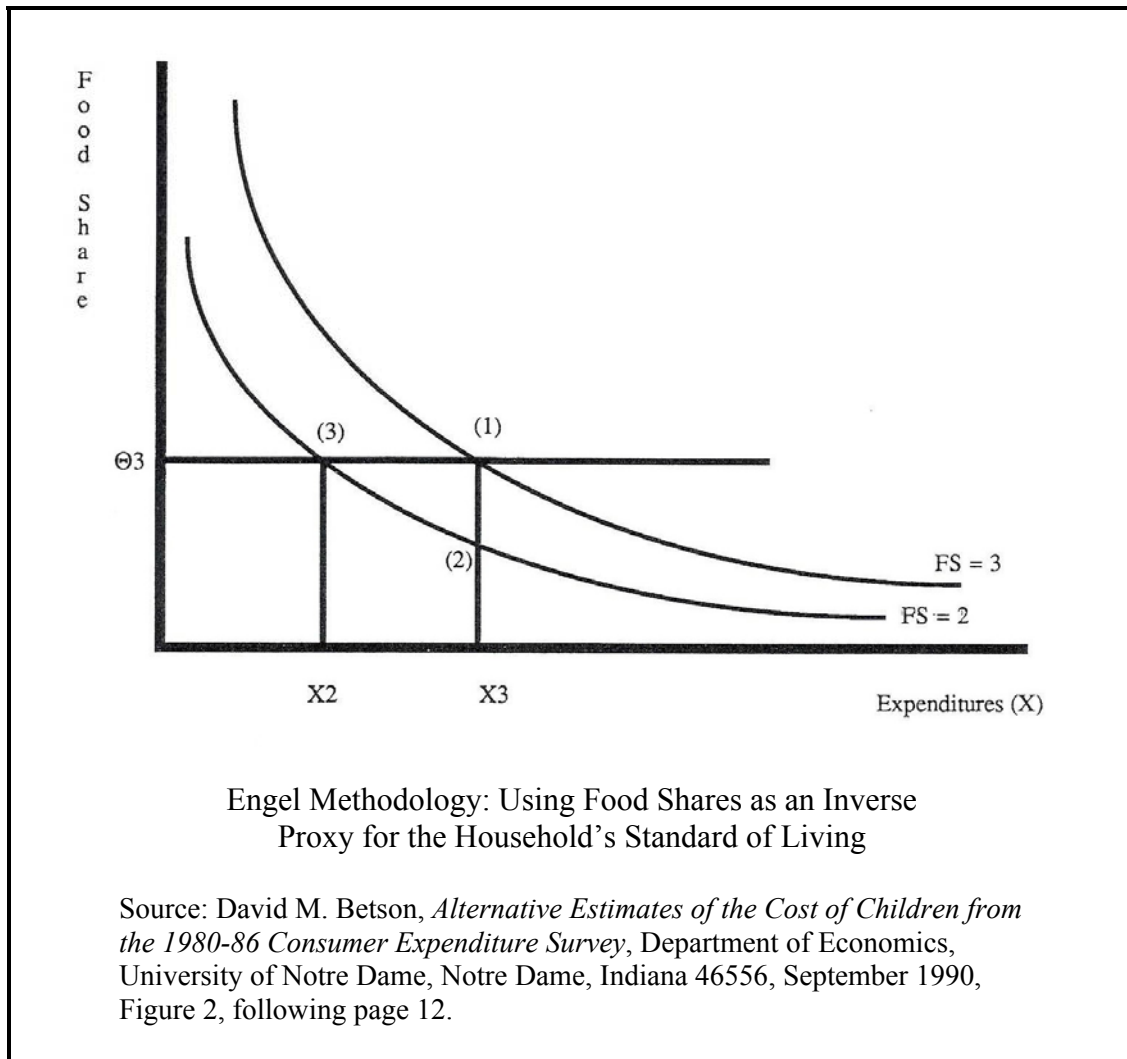
$$\Theta(X, K=1) = \Theta(X - CC_E, K = 0)$$

Figure 2 [in Betson's document but Figure 1 here] depicts the determination of the cost of a child under the Engel methodology. The two curves, representing the relationship between total expenditures and the share of total expenditures spent on food, are downward sloping, the share curve for a couple with a child ($FS = 3$) lying above the share curve for the household composed of two adults without a child ($FS = 2$). Both of these relationships correspond to the assumption that the budget share spent on food is inversely related to total expenditures and hence to the standard of living to the household. If the household with a child has total expenditures X_3 [point (1)], then Θ_3 will be spent on food. A couple with

³ David M. Betson, *Alternative Estimates of the Cost of Children from the 1980-86 Consumer Expenditure Survey*, Department of Economics, University of Notre Dame, Notre Dame, Indiana 46556, September 1990, pp. 11-12.

X_3 dollars of total expenditures without a child, however, will enjoy a higher standard of living [point (2)]. For this couple to enjoy the same level of living as the couple with the child, they would only require X_2 dollars of total expenditures [point(3)]. The difference in levels of total expenditures, $X_3 - X_2$, represents the cost of the child, CC_E .⁴

Figure 1.



In simplified terms, the child cost is the difference in total expenditures in families with and without the added child and in which both spend the same share of total expenditures on food.

⁴ David M. Betson, *Alternative Estimates of the Cost of Children from the 1980-86 Consumer Expenditure Survey*, Department of Economics, University of Notre Dame, Notre Dame, Indiana 46556, September 1990, p. 12.

Now that the theoretical model of the Engel approach to estimating child cost has been established, what is the basis for believing that the Engel approach overestimates child costs? Basically, the problem lies with a built-in assumption that adults (parents) and children consume the same shares of food relative to shares of non-food items out of the total household budget.

From the Lewin report:

The validity of the Engel estimator [of child costs] is critically dependent on the assumption that the percentage of the family's expenditures on non-food items that should be attributed to the family's children is the same as the percentage of the family's food expenditures that is attributable to the family's children. There is reason to believe that this assumption is invalid; children are probably relatively "food-intensive." That is to say, the percentage of the family's food that is consumed by children is probably greater than the percentage of non-food items consumed by children. If this is the case, then the Engel estimator overestimates [emphasis original] the true expenditures on children.⁵

Essentially, children have spending that is more basics than that of adults. Adults buy non-essential goods for the household that would be bought with or without children. Adults' food shares are typically smaller than children's food shares. Conversely, children are food intensive—food is a bigger share of what is spent on children. The outcome of this is that if children have a natural tendency to consume food as a greater proportion of total spending (as is generally believed), then the Engel methodology will require even greater levels of income to boost the family's overall spending on non-food items back to pre-child shares. This leads to overestimating child costs.

Dr. David Betson of the University of Notre Dame has added his voice to those finding the Engle methodology excessively high.

The Engel approach theoretically is believed to provide an upper bound estimate on the cost of raising children. The use of economies of scale in food consumption to estimate the average economies in other goods seems on the surface unrealistic in today's society. But given the high estimates that result from this methodology, even when compared to the per capita method, the estimates from the Engel method should be discounted.⁶

⁵ Burt S. Barnow et al., *Estimates of Expenditures on Children and Child Support Guidelines*, Submitted to Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services, Submitted by Lewin/ICF, Washington, D.C., October 1990, page 2-28.

⁶ David M. Betson, *Alternative Estimates of the Cost of Children from the 1980-86 Consumer Expenditure Survey*, Department of Economics, University of Notre Dame, Notre Dame, Indiana 46556, September 1990, pp. 55-56.

It is generally accepted that children are “food intensive” and as a result the Engel methodology overestimates child costs.

The Rothbarth Methodology

After it became apparent that the Engel-based guidelines imposed too great a burden on the child support obligor and also had serious flaws in its theoretical underpinnings, a methodology begun by Erwin Rothbarth gained favor and was adopted by Policy Studies, Inc. in its child cost studies. The version adopted by Policy Studies, Inc. was researched by David Betson of the University of Notre Dame. The Rothbarth methodology is similar to that of Engel and is an indirect estimation technique.

The Rothbarth methodology is based on measuring a household’s economic well-being based on the level of spending on selected goods consumed only by the adults in the household. The higher a household’s spending level is on these adult goods, then the higher the household’s economic well-being. The differences in Rothbarth and Engel methodologies are primarily: 1) that Rothbarth focuses on household changes in purely adult goods while Engel focuses on changes in changes in the jointly consumed good of food, and 2) Rothbarth looks at changes in the level (dollar amounts) of spending on target goods while Engel evaluates changes in percentage shares of the selected good.

With Rothbarth, for a given level of income, as children are added to the family, the amount of household spending on adult goods falls. So, the questions become how much income is needed to restore that level of spending on those adult goods and what is the difference in total household spending? When households of two different sizes (with children being the difference in size), child costs are the difference in total spending when both households spend the same amount on those adult goods.

The Betson approach is explained by David Betson [Figure 1 in Betson’s discussion is Figure 2 in this document]. Referring to the below figure:

[A]nother reasonable approximation to measuring expenditures on children is to observe how much adults reduce spending on themselves. Hence, we could measure the expenditures on a child by observing how the household reduced its spending on pure adult goods (A).

We can reformulate this observation into an estimation of the cost of children by first assuming that the parents’ standard of living can be proxied by how much is spent on adult goods. As we have already assumed, expenditures on adult goods should fall with the number of children in the household and hence is related to the reduction in the standard of living of the parents. However, holding the number of household members constant while increasing household income would raise both the standard of living of the adults and expenditures made on adult goods. Thus, to estimate the cost of the children in the household, we would first observe the level of expenditures made on adult goods in the household with children. We would then ask what level of income the

parents would need so that they would spend the same amount on adult goods when the children were not present. The difference between the actual total expenditures of the household and this hypothetical level would represent the cost of the children. This approach to cost estimation was proposed by Erwin Rothbarth and in the literature has been given his name.⁷

Betson continues with the explanation of the Rothbarth methodology:

Let $E_A(X, K)$ represent the relationship between the level of expenditures on adult goods and the household's level of total expenditures on all goods (X) and the number of children (K). Given the knowledge of this relationship, the Rothbarth approach would compute the cost of one child to be equal to CCR , where CCR solves the following relationship, holding the level of the standard of living constant:

$$E_A(X, K = 1) = E_A(X - CCR, K = 0)$$

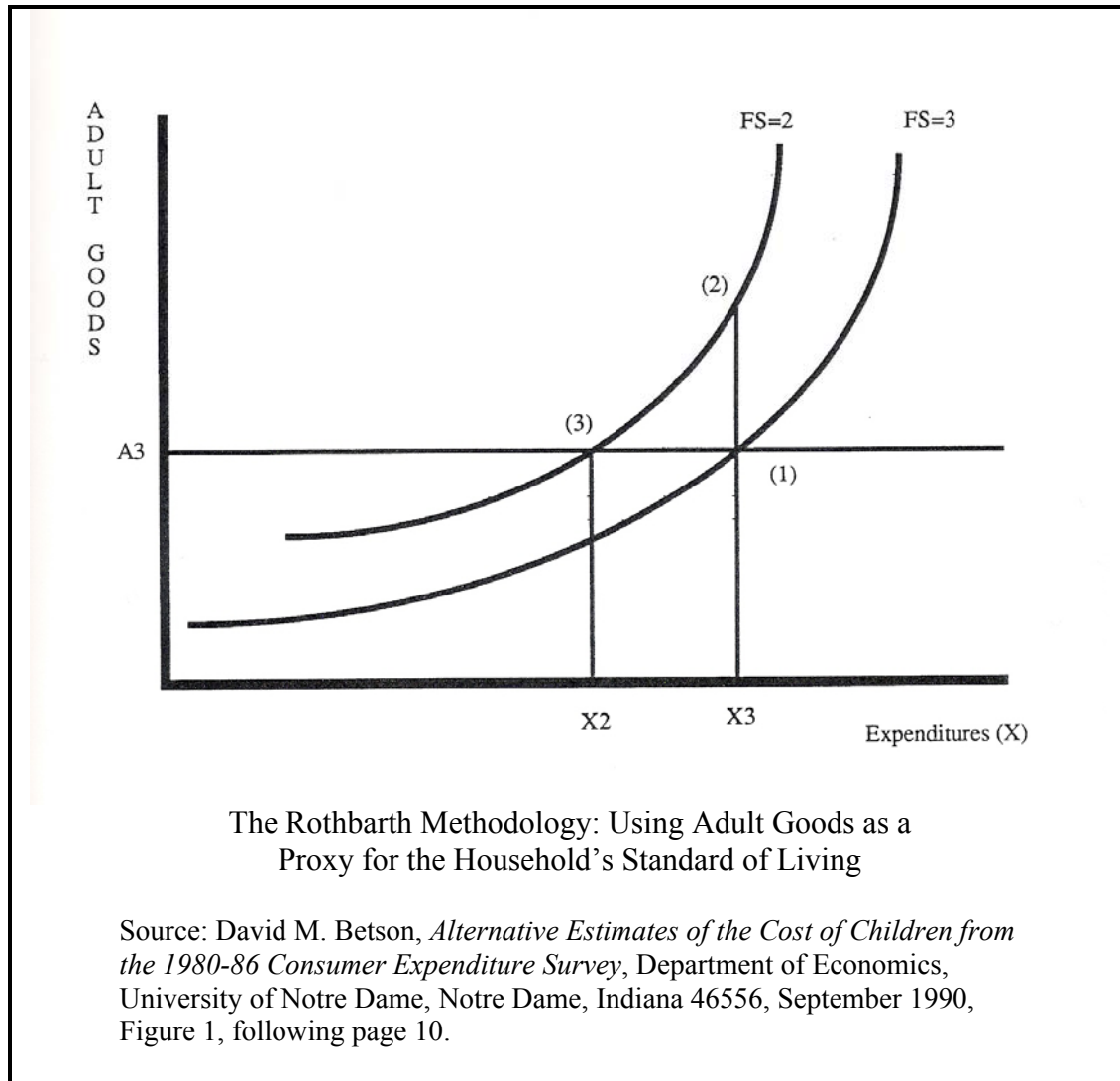
Figure 1 [in Betson's document but Figure 2 here] illustrates the Rothbarth methodology for the case of one child. The two curves in the figure represent the relationship between total expenditures (X) and expenditures on adult goods for a household of a couple without children ($FS = 2$) and a couple with a child ($FS = 3$). Note that the relationship is upward sloping, representing the positive relationship between expenditures on adult goods and the adults' standard of living. Second, the figures are constructed so that the curve for the household without children lies above the curve for the household with a child representing the assumption that for a given level of total expenditures, an additional person lowers the standard of living of the household. Now if the household with a child has total expenditures X_3 , it will spend A_3 on adult goods [point (1)]. If the child was not present in the household, the adults would reach a higher standard of living (spend more on adult goods) [point (2)]. For them to achieve [the] same standard of living of living in the absence of the child as with the child, Rothbarth assumes that the household should spend not more but the same amount, A_3 , on adult goods [point(3)]. The level of total expenditures for a household without children that is consistent with spending A_3 dollars on adult goods is X_2 .

⁷ David M. Betson, *Alternative Estimates of the Cost of Children from the 1980-86 Consumer Expenditure Survey*, Department of Economics, University of Notre Dame, Notre Dame, Indiana 46556, September 1990, pp. 9-10. Additionally, Betson's footnote number six appears at the end of the final paragraph in this quote. This footnote reads as follows:

Erwin Rothbarth, "Note on a Method of Determining Equivalent Income for Families of Different Composition." In *War Time Pattern of Saving and Spending*, edited by Charles Madge, Cambridge, Cambridge University Press, 1943.

The difference between these two level[s] of total expenditures ($X_3 - X_2$) is equal to the cost of the child (CCR).⁸

Figure 2.



One sees that the Rothbarth measure of child costs is based on comparing consumption levels of purely adult goods with and without children and the amount of income needed to restore pre-children spending levels. The alleged reason that the Rothbarth methodology understates child costs is that children affect adult use of shared household goods. Since adults have less use of shared goods, they change preferences to adult goods.

⁸ David M. Betson, *Alternative Estimates of the Cost of Children from the 1980-86 Consumer Expenditure Survey*, Department of Economics, University of Notre Dame, Notre Dame, Indiana 46556, September 1990, pp. 10-11.

[A]dults in households with children may have a tendency to substitute away from those goods which involve a large degree of sharing and into those goods that need not be shared (i.e., adult goods). In sum, adults in households with children, particularly those with large numbers of children, have an economic incentive to spend a disproportionately smaller percentage of their total expenditures on goods that are consumed by both children and adults, and a larger share on adult goods. While this type of “selfishness” strikes many observers (especially parents) as unlikely, it is, nonetheless, a possibility that should ideally be considered.⁹

This undocumented theoretical belief is again restated by Barnow in the Lewin study for U.S. HHS in 1990:

The Rothbarth estimator, on the other hand, is likely to underestimate [emphasis original] expenditures on children. The Rothbarth estimator does not account for the possibility that the presence of children in a household may lead to substitution from goods that must be shared with children toward goods consumed only (or mostly) by adults. If such substitution does occur, the Rothbarth estimator will indicate that relatively low levels of additional income are needed to restore the level of adult expenditures to that which would have prevailed in the absence of children.¹⁰

The required assumption in this claim is that adults behave in a “selfish” manner—preferring to maintain pre-child levels of consumption of adult goods. It requires that adults not like sharing shared goods with children. It is this expected “selfish” conduct that allegedly biases the statistical outcome of the Rothbarth methodology.

Importantly, Barnow, et al raise the issue that the Rothbarth methodology may actually overestimate child costs if adults do not behave selfishly related to sharing shared goods with children. From footnote 37:

There is, of course, the possibility that adults behave “selflessly,” and that the substitution mechanism works in the opposite manner of that which is

⁹ Burt S. Barnow et al., *Estimates of Expenditures on Children and Child Support Guidelines*, Submitted to Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services, Submitted by Lewin/ICF, Washington, D.C., October 1990, pp. 2-25 through pp. 2-26.

¹⁰ Burt S. Barnow et al., *Estimates of Expenditures on Children and Child Support Guidelines*, Submitted to Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services, Submitted by Lewin/ICF, Washington, D.C., October 1990, page 2-29.

outlined here. In this case, the validity of all the estimation procedures discussed here is called into question.¹¹

What does this mean using real life examples? Shared goods are such as bath rooms, living rooms, and the television. Based on the current version of the Rothbarth methodology, the claim that Rothbarth understates child costs means that parents realize they have to share the living room with their children and therefore decide to buy more adult clothes instead. The shift in preferences then biases the estimate of how much income is needed to restore pre-children spending on adult clothes—it takes less income to restore pre-children spending on adult clothes. However, there is no empirical study that validates the alleged theory behind Rothbarth estimates of child costs being “low” due to a shift in preferences to adult clothes after having children.

In fact, if one believes that after having children, the parents have a preference to spend more time with shared goods, then the Rothbarth methodology overestimates child costs. That is, if parents decide they want to spend Friday or Saturday nights with the children watching videos, then that likely leads to the Rothbarth methodology overstating child costs because there is now a parental bias toward the shared goods and away from adult clothing. It therefore takes more income to restore the pre-children level of spending on adult clothes.

What does this mean in terms of every day application? This issue has to do with how parents react to having children and then wanting to share the shared goods (and services) or not with the children. The argument that the Rothbarth methodology sets a floor for child cost estimates is based on the statistical need for an economic “fact” that parents do not want to share with their children the shared goods of the household. The Rothbarth methodology requires that parents have an aversion to sharing the shared goods with children in order for the claim to be valid that the Rothbarth methodology is an underestimate for child costs. If parents are selfless and actually want to share the household shared goods with children, the “floor” argument for Rothbarth not only is invalid but Rothbarth then becomes an overestimate for child costs.

One can claim that the Rothbarth methodology understates child costs only if one also claims that parents do not want to share household shared goods with children. If parents want to share household shared goods with children, then the Rothbarth methodology overstates child costs.

¹¹ Burt S. Barnow et al., *Estimates of Expenditures on Children and Child Support Guidelines*, Submitted to Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services, Submitted by Lewin/ICF, Washington, D.C., October 1990, page 2-26.

Rothbarth Assumes that the Parents Get No Sense of Well-Being from Their Children

Another key assumption in the claim that the Rothbarth methodology underestimates child costs is that parents do not get enjoyment from having children.

Finally, it is important to note that some researchers have argued that the standard approaches [such as Engel and Rothbarth] used to estimate expenditures on children are fundamentally flawed because the decision to have children usually is voluntary. [Added note: This would hold true in samples of intact families used for these studies.] If adults decide to have children and if they behave rationally, then the adults' well-being should be at least as much as when they were childless. ... All the methods for estimating expenditures on children [inclusive of Engel and Rothbarth] are based on the assumption that adding a child does not increase the well-being of the adults in the family.¹²

If indeed parents do enjoy having children this creates an upward bias in the Rothbarth methodology and one cannot claim that the Rothbarth methodology underestimates child costs. Given that the Rothbarth studies use data from intact families, it is more likely that parents gain well-being from having children than not gaining such satisfaction.

Summary

To make the claim that the Rothbarth methodology understates child costs, two highly unlikely assumptions must be made:

- 1) Parents do not like sharing shared household goods with their children, and
- 2) Parents get no sense of well-being from their children.

If these assumptions do not hold true, the Rothbarth methodology likely overstates child costs. This author believes that it is more likely that parents do like to share shared household goods with their children and also that parents do get a sense of well-being from their children. These are more realistic assumptions.¹³ Based on these more credible assumptions, the Rothbarth methodology likely overstates child costs. Importantly, embracing more realistic assumptions opens wide the door for true child

¹² Burt S. Barnow et al., *Estimates of Expenditures on Children and Child Support Guidelines*, Submitted to Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services, Submitted by Lewin/ICF, Washington, D.C., October 1990, page 2-32.

¹³ One might object to these assumptions by this author since child support guidelines are applied to families that are not intact. However, the estimation of child costs in the Incomes Shares methodology (Engel and Rothbarth) is based on data from intact families. Even in non-intact families (which do not affect the Income Shares estimates), it is more likely that this author's assumptions still hold true for the most part.

costs to lie below the estimates produced by the Rothbarth methodology. The claim that true child costs can only lie somewhere in between the Engel and Rothbarth estimates has no credibility.

Addendum: Rothbarth Economist Believes Rothbarth to be “Best” Estimate, Not an Underestimate

The foregoing analysis has focused on the issue of whether the Rothbarth methodology provides a floor for true child cost estimates, indicating that true costs allegedly are higher than Rothbarth estimates. It should be noted that the Rothbarth economist, David Betson, does not view Rothbarth as a low estimate but as a best estimate. That is, even if one does not accept the argument that the Rothbarth methodology overstates child costs, there is support for the argument that Rothbarth is true estimate rather than low estimate:

The others [child cost estimation methodologies] having been discounted or eliminated from consideration, the Rothbarth method remains the leading contender. In the first section of the report, this method, based on how adults reduced spending on themselves in favor of their children was considered a reasonable approach. The similarity of its results for one- and two-parent families, in comparison with the per capita apportionment of total expenditures [has the same ratio to per capita estimates], is striking. My own experience is that the marginal and average costs of children appear to fall with the number of children, while the percentage of total expenditures devoted to children remains constant. For these reasons, I have concluded that the Rothbarth method produces what I consider the “best” set of estimates of the cost of raising children.¹⁴

¹⁴ David M. Betson, *Alternative Estimates of the Cost of Children from the 1980-86 Consumer Expenditure Survey*, Department of Economics, University of Notre Dame, Notre Dame, Indiana 46556, September 1990, pp. 56-57.