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THE PRICE, COST, CONSUMPTION AND VALUE OF CHILDREN

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Abstract

Though they are related, the price, cost, consumption and value of children are not the same. This paper explores two aspects of the relationship between these concepts.

Even if we restrict attention to the domain of commodity consumption, the cost of children is not the same as children's consumption. In this context, the cost of children to their parents is often described with a consumer equivalence scale. It is shown here that, under reasonable assumptions, children's consumption of market goods is less than the 'equivalent income' of the household, but more than the 'cost of children'.

Expenditure costs, however, are only part of the cost of children. This paper uses a variant of the 'adult goods' method to estimate the full costs of children, including both expenditure and time costs. Adult personal time (comprising pure leisure, sleep and other personal care) is used as the adult good. Preliminary estimates using Australian data suggest a very large cost of children. The paper discusses the limitations of the estimation approach and considers the broader welfare implications of these costs.

1 Introduction

This paper has two main goals. The first is to elucidate the relationship between several inter-related and often confused concepts associated with the expenditure of time and money on children. The second is to show how time use data can provide insight into the total cost (in both time and money) of children.

Raising children requires the investment of substantial financial resources from both parents and the state, and most importantly, the input of parental caring and home production time. In thinking about these resource flows, we need to distinguish four different concepts.

- The *price* of a child is the commitment of resources required to raise a child of given ‘quality’. It is the relevant concept when thinking about the factors that might influence fertility decisions.
- The *cost* of a child is a measure of the actual amount of resources committed to child-raising. Ignoring public goods and household public goods, we can think of this as the expenditure of time and money on children. Taking household public goods into account, the cost to the parents can be defined as the additional income needed by a household in order to maintain parental living standards when they have an additional child. The monetary cost to the parents (relative to their income) is often expressed in the form of a *consumer equivalence scale*, and used when comparing the welfare level of different types of household – though this use is not without controversy.

Neither the price nor the cost of a child are the same as child consumption or, lest I be accused of adopting Jonathan Swift’s “innovative” policy solution,¹ *children’s consumption*. Most child welfare policies are intended to increase children’s consumption in general, or some particular aspect of this (such as education). Because children can share in the consumption of household public goods, they can consume more than they cost their parents.

Finally, all these concepts are related to, but do not determine, the social *value* of children. In deciding whether society should devote more or fewer resources to children (or parents), we need to consider the impact on parental welfare of the costs of children, our quantitative and ethical valuations of children’s consumption, and also a range of externality issues associated with the optimal size and quality of the population. These include concerns about environmental congestion, the financing of pensions, as well as broader values about the type of society that we want to leave behind us.

Though all four of these concepts are important, the focus of this paper is restricted to a narrower set of issues concerned with the intra-household allocation of resources, the cost of children to parents, and children’s consumption.

In the next section, the time costs of children are ignored and the focus is on the intra-household allocation of consumption goods. This section discusses the valuation of children’s

¹ Swift’s (satirical) proposal was that the ‘Irish problem’ could be solved by selling children to be consumed (eaten) by the rich. “I grant this food will be somewhat dear, and therefore very proper for landlords, who, as they have already devoured most of the parents, seem to have the best title to the children.” Jonathan Swift (1729).

consumption, and shows how children's consumption is related to the costs of children to parents.

Children's consumption of market goods will generally be greater than the cost of children to their parents because children can share in the consumption of household public goods. That is, there are 'economies of sharing' in households. On the other hand, children will usually receive a smaller share than adults of household commodity consumption because parents value children's needs as less. If we use household equivalent income as the indicator of parental consumption, this implies that children's consumption will be less than household equivalent income.

These valuation concepts are useful when we come to combine children's consumption financed through the household with the value of services provided directly via the state. For example, in their study of the cross-national distributional impact of non-cash services, Smeeding et al. (1993), add estimates of per-capita noncash services to household equivalent income to obtain an index of the living standards of household members. The argument presented in Section 2 suggests that this approach under-estimates the relative importance for children's consumption of state-provided services.

The discussion of child costs and children's consumption in Section 2 is confined to the commodity-based resources consumed by children. However, the most important services consumed by children are the childcare services provided by their parents. Section 3 thus turns to consider the full costs of children to their parents – including both the time and money costs of raising children. These costs, of course, must be set against the benefits of parenthood. Nonetheless, it is useful to separate costs and benefits.

Section 3 introduces a model which shows how adult time use patterns (in conjunction with labour supply information) can be used to estimate the full costs of children. This model is a variant of the 'adult goods' method sometimes used for the estimation of child expenditure costs. The adult good in this paper is adult leisure and personal time. Using time-use data from Craig and Bittman (2003), approximate estimates are made of the full costs of children. Children are *very* expensive.

2 Children's Consumption

One of the most important reasons for looking at the intra-household allocation of resources is because we are interested in children's consumption. Children consume some of the commodities purchased by the household, they receive care and 'domestic services' provided by their parents and receive services directly provided or subsidised by the state (eg education and health).

There is a long tradition of research examining the cost of children from the perspective of the additional expenditures made by their parents. In this section I examine how this concept of commodity cost is related to the consumption of commodities by children.

In addressing these questions, I ignore for the moment the role of the time costs of children and the parenting care that children receive. This is done so as to permit a linkage with the previous literature on the costs of children and household equivalence scales (all defined within the context of commodity consumption). Many of the principles discussed here will carry through to a broader understanding of child costs, though issues associated with the valuation of adult time costs might make this difficult in practice.

Consider a simple one-period model, with one adult and one child. (This can be generalised to multiple adult and child families in a straightforward way). The parent is assumed to maximise a ‘household welfare function’, $W(u_A, u_C)$, where $u_A = U_A(x_A, x_P)$ and $u_C = U_C(x_C, x_P)$, subject to a budget constraint $x_A + x_C + px_P \leq Y$. The function $W(u_A, u_C)$ is a summary of the parent’s decision of how much weight to give to the (consumption-based) welfare of the adult (u_A) vs the welfare of the child (u_C). The parent allocates her income Y between three goods, x_A , adult consumption of a private good, x_C , child consumption and x_P public consumption. Public consumption occurs when each unit can be consumed by both adult and child (eg the purchase of a dwelling in a ‘good neighbourhood’). Adult welfare depends on the household’s consumption of x_A and x_P and child welfare on x_C and x_P . To help focus on the issues of interest here, I simplify and assume that the private goods both have the same price (normalised at unity) and the public good a price of p .

This decision process might be considered to be one part of a wider parental welfare function which also takes into account the time costs to the parent and child care benefits to the child, as well as possibly other factors such as the benefits of parenthood. The assumption of this section, nonetheless, is that that this sub-component of expenditure allocation is of interest – even if this is only because it might be more concretely measurable and amenable to policy intervention.

This simple model captures the two key issues considered in the equivalence scale literature on the costs of a child. The ‘economies of sharing’ arise from the fact that each unit of x_P is consumed by both parent and child. The relative needs of children vs adults arise from the relative weights given to u_A and u_C in the overall welfare function.

To economists, this model will also be recognised as identical to the model used in the ‘pure’ theory of public goods as developed by Samuelson (1954,1955). The household welfare function $U(u_A, u_C)$ can be considered as an equivalent of the social welfare function, with the household decision maker (the parent) being the arbiter of the optimal distribution of consumption-based welfare for the household members.²

From Samuelson’s public goods theory we know that the optimal consumption of the public good x_P will be that amount which ensures that the sum of the marginal rates of substitution for the adult and child is equal to the price, p . In the household with the child the public good is effectively cheaper since both adult and child can consume each unit of the commodity.

What does this simple framework imply for the valuation of child and adult consumption? There are three possible ways to value children’s consumption. In the household, the child consumes an amount x_C of the private good and x_P of the household good. The first approach is to simply value this consumption at market prices. Total consumption by the child is thus $x_C + px_P$ (adult consumption is $x_A + px_P$).

However, this assumes that each member values the public good identically. Conceivably, the public good could be something that the parent values, but the child does not – even if they

² When adults and children have identical welfare functions, this model simplifies to the Barten equivalence scale model (See Nelson, 1988).

still consume it (eg an expensive work of art, or possibly a water view). Moreover, the sum of marginal rates of substitution condition implies that consumption of the household good will be increased above the level that any individual would have chosen (unless the other individual obtains zero marginal utility from the good). The marginal value to each individual is thus less than the price of the good when purchased in the market.

An alternative approach, therefore, is to value the household good at this lower marginal value. This marginal valuation approach is used by Lazear and Michael (1988). The effective price of the household good is set equal to the marginal rate of substitution in the child's utility function (and similarly for the adult's). However, the sum of these marginal rates of substitution must equal the market price. Since all household members are consuming the same amount of the household good, x_p , this method implies that the sum of the value of consumption of each household member must equal the total household expenditure on the household good. In other words, this approach simply allocates the expenditure on the household good to the different household members in proportion to their relative shadow price valuations. Because this approach does not value the intra-marginal value that each household member places upon the household good, it ignores the economies of sharing.

A more appropriate way to value the consumption of individual household members is to ask the counter-factual question: How much would it cost to reach the welfare level achieved when living in the household if the person were to live alone and face market prices? This is an example of a *situation comparison* (Pollak and Wales, 1992). For the child, where living alone is not feasible, this becomes a hypothetical question of how much would it cost for them to reach their given standard of living (as defined by their parents) if their parents had to purchase the child's consumption goods on the market.

Table 1 Different Welfare Indicators

<i>Adult consumption:</i> The cost of reaching welfare level u_A if the adult were to live alone.	$c_A(u_A, p)$
<i>Child consumption:</i> The corresponding cost of reaching welfare level u_C if the children's consumption goods were purchased at market prices.	$c_C(u_C, p)$
<i>Equivalence Scale:</i> Ratio between the income in the household with child to the income when the adult is alone (such that both lead to the same adult welfare level u_A)	$m = \frac{Y}{c_A(u_A, p)}$
<i>Equivalent Income:</i> Income divided by the equivalence scale = adult consumption	$Y / m = c_A(u_A, p)$
<i>Cost of children:</i> Additional expenditure required so that the parent can maintain their living alone welfare level (the equivalence scale in difference form)	$Y - c_A(u_A, p)$ $= Y(1 - \frac{1}{m})$

In the Appendix, it is shown that this approach leads to a valuation of consumption that is in-between the market and shadow price valuations. The Appendix also shows how this valuation of child consumption is related to the concepts of the equivalence scale and the costs of children. These relationships are summarised in Table 1 for a household with income

Y facing a market price of p and with a within-household allocation process that leads to an adult welfare level of u_A and child welfare of u_C .

Starting from these relationships, it is relatively straightforward to derive upper and lower bounds for child consumption. An upper bound is obtained from the assumption that per-adult consumption will be greater than the consumption of each child. This seems to be a generally reasonable assumption, but might be violated for young children who are in expensive childcare. Bearing this caveat in mind, this assumption, together with the relationships with equivalent income shown in the table, implies that child consumption will be lower than equivalent income.

A bound from the opposite direction arises from the result that children's consumption will be greater than the cost of children to the adults, because there are public goods in the household which the children can consume without incurring additional costs for the parents.

In summary: *Cost of children* \leq *Children's consumption* \leq *Equivalent income*, or in terms of the equivalence scale m and income Y , $\left(1 - \frac{1}{m}\right)Y \leq \text{Children's consumption} \leq \left(\frac{1}{m}\right)Y$. The left-hand inequality stems from the existence of public goods in the household, and the right-hand from the assumption that children consume less than adults. If, for example, we are comparing a single adult household with a sole parent with children, and we assume that the equivalence scale is 2.0, then these inequalities become equalities, since this implies that there are no economies of sharing and that children consume as much as adults. Otherwise, the bounds may be quite wide.

This result only applies to children's consumption of purchased commodities within the household. If we were to extend this model to include the consumption of childcare and home production services by children, then only some of this reasoning would still apply. The impact of public goods is likely to be unchanged; there are public elements to home production in the same way as there are household public goods. Hence, children's consumption, more broadly defined, will still be greater than the cost of children. However, when we take home production into account, we cannot now assume that children consume less than adults, and so the right-hand inequality will no longer apply.

3 The Time and Money Costs of Children

There is a large body of research attempting to estimate the cost of children.³ This concept of cost is most clearly understood as a 'situation comparison'. It is a measure of the additional income required so that the parents can obtain the same living standard as they had when there were no children in the household, but does not take into account any direct benefits of parenthood. This cost to parents will be a function of the social norms for the raising of children, as well as the extent of support received from outside the household. For example, a reduction in state subsidies to education will increase the cost of children to parents (other things equal).

Most research on the cost of children is undertaken within the commodity expenditure context. That is, it estimates the increase in income that would permit the parents to have the

³ For introductions to the literature see Deaton and Muellbauer (1980) and Buhmann (1988).

same level of commodity consumption as they would have in the absence of children. As well as money, however, children also require substantial time inputs from their parents. As Apps and Rees (2002) argue, to restrict attention to monetary costs alone, misses out on a key aspects of the cost of children.⁴

This section therefore explores the estimation of the full costs of children, using an adaptation of the ‘adult good’ method for the estimation of child costs.⁵ As will be seen, there are formidable difficulties in the estimation of such a model, both theoretical and econometric. The estimates here should therefore only be considered as indicators of likely magnitudes and as pointers to the issues that need to be resolved when estimating the full costs of children.

The essence of the conventional adult goods approach is that expenditure on goods consumed only by adults (eg adult clothing, tobacco, alcohol) is used as an indicator of the commodity-based welfare of the adults. An equivalence scale can then be estimated which shows the (money) income required by a family with children so that the adults can have the same living standard as when they do not have children in their household.

This paper modifies this approach by using adult leisure and personal time as the adult good. The relationships between this good, family size and full income can similarly be used to obtain estimates of the full costs of children – subject to the caveats outlined below.⁶

To justify the use of the adult good method, we use a similar household welfare model to that used in Section 2. However, in this case we introduce time allocation as the key household decision variable and simplify the model by ignoring the impact of public goods. The possible bias introduced by this simplification is discussed later. As before, I begin by discussing the costs of a single child for a lone parent.

The parent divides their total time, T , between labour market work, h_M , home production for the adult, h_A , home production for the child (including both direct childcare and housework on account of having a child), h_C , and leisure/personal time for the adult, h_L . They receive a wage income $w h_M$, and have fixed income from other sources of Y (note the change in definition from the previous section). Their income is used to purchase goods consumed by the adult, x_A , and by the child, x_C .

If the parent devoted all their time to market work, their total income would be $F = Y + w T$. This ‘full income’ is an index of the total resources available to the household. The allocation of time and expenditure described in the previous paragraph means that we can decompose this full income into adult and child components, F_A and F_C where $F_A + F_C = F$,

$F_A = x_A + w h_A + w h_L$ and $F_C = x_C + w h_C$. The adult component of household full income

⁴ One counter-argument is that we are often primarily interested in the costs of children for parents whose labour market participation is constrained (eg the unemployed). Even here, however, it seems extreme to assign a zero marginal value to their time.

⁵ Sometimes called the ‘Rothbarth’ method after Rothbarth (1943). See Deaton and Muellbauer (1986), Bradbury (1994) and Nelson (1992) for further discussion.

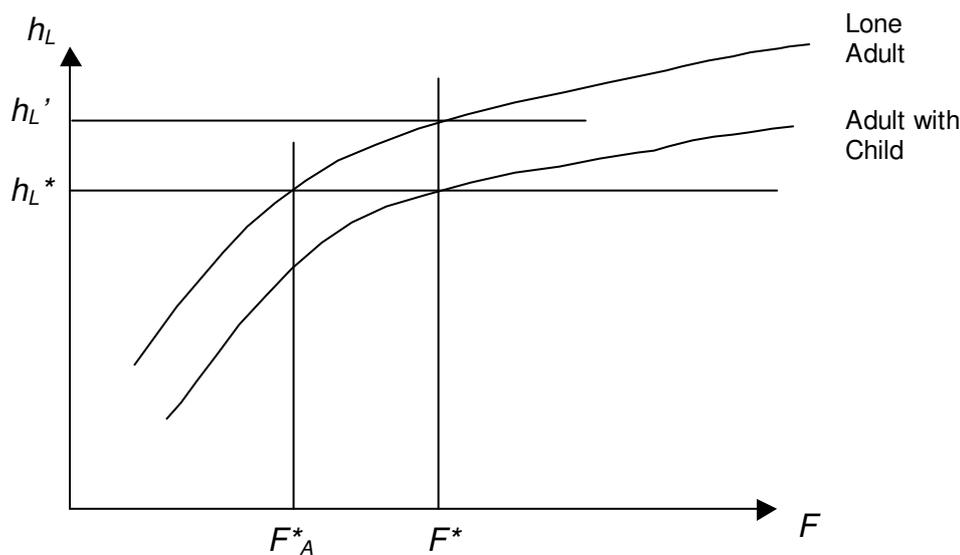
⁶ The closest antecedent in the literature appears to be Apps and Rees (2002) use of adult leisure in the identification of their child costs model, though their estimation approach is quite different to that used here.

(F_A) comprises expenditure on the adult, plus time spent on adult home production and on adult leisure, with both of these valued at the wage rate.

As in the previous section, it is assumed that the parent makes decisions about time and expenditure allocations so as to maximise a household welfare function $W(u_A, u_C)$ where $u_A = U_A(x_A, h_L, h_A)$ and $u_C = U_C(x_C, h_C)$. This separable structure means that we can employ the ‘adult goods’ method to estimate the full cost of children (see Bradbury 2004). This approach uses expenditure on an adult good as an indicator of the standard of living of the adult. Here, the only adult good which can be clearly identified as such is h_L , time spent on personal care, sleep, and leisure activities for the adult. We describe this here as ‘adult leisure and personal’ time. Figure 1 illustrates how the demand function for this can be used to estimate the full costs of children.

We pick some reference amount of adult leisure hours, h_L^* and find the full income levels in the families with and without children that lead to this level of leisure being consumed. The (full) cost of children is then given by $F^* - F_A^*$. This is the amount by which the family’s full income must be higher in order for adult consumption (and hence adult welfare) in the single adult and family households to be identical.

Figure 1 Adult Goods Estimation of the Full Cost of Children



As can be seen in Figure 1, the estimation of this cost requires information on both the slope of the adult leisure/personal hours function as a function of full income (holding wage rates constant), and the vertical distance between the curves in the two family types.

It is generally difficult to estimate both these relationships within the same dataset. In Bradbury (2004) I show that this cost difference can be approximated as

$$F^* - F_A^* \approx w(h_L^* - h_L') / \alpha e \quad (1)$$

$$\text{where } \alpha = \begin{cases} 1 \text{ or,} & \text{(zero home production income elasticity)} \\ \left(1 + \frac{\bar{h}_A}{\bar{h}_M}\right) & \text{(home production elasticity equal to labour supply elasticity)} \end{cases}$$

and where \bar{h}_A and \bar{h}_M are the mean hours of home production and labour market time for the no-child household respectively. The parameter e is the ‘total income elasticity’ (Pencavel, 1986), defined as $e = w \frac{\partial h_M}{\partial Y}$. It describes the increase in earnings associated with a one-unit increase in non-wage income (if non-work is a normal good, e is negative). The two alternative assumptions for α represent plausible upper and lower bounds of how home production might change as non-wage income changes.

The ‘full’ cost of children in this simple model is thus the wage rate times the drop in adult leisure personal hours, divided by a scaling of the total income elasticity of labour supply. The absolute value of the total income elasticity is substantially less than 1 and so this scaling increases the estimate of costs. If we were not dividing by the total income elasticity, this measure would simply be the opportunity cost of lost leisure, valued at the (net) market wage rate.

This opportunity cost measure is similar to the estimates calculated in Folbre (2004). The inclusion of the income elasticity scaling is the main reason why the estimates in this paper (shown below) are much higher than Folbre’s. She also uses lower wage rates. More fundamentally, however, the question she addresses in her paper is closer to the question addressed in Section 2 – how to value children’s consumption – rather than the cost of children to the parents (though she addresses both expenditure and caring/home production consumption by children).

Dividing by the total income elasticity leads to a more comprehensive estimate of the full impact of children on adult’s consumption. The reduction in parental leisure is only one impact of the presence of children in the household. There may also be reductions in adult consumption of commodities (x_A) as well as home production for the adult (h_A). The maintained assumption of this model is that the diversion of resources to children’s consumption will have an income effect on all these aspects of adult consumption rather than on just the one (leisure) that we can easily observe. This seems reasonable in general, even if the separable structure of the welfare function that produces this result might not be a precise reflection of actual behaviour patterns. (The limitations and relevance of this model are discussed at the end of this paper).

Under this model, the relative cost of the child is higher when there is a large drop in adult hours associated with the presence of a child and higher when the (absolute value of) the labour supply income response is lower. The impact of the labour supply response can be observed in Figure 1. A low total income elasticity of labour supply means that the curves will be flat. Holding the vertical distance between the curves constant, it can be seen that equality of adult hours will be achieved when there is a large difference in income levels in the two family types.

This model can be readily extended to couple families in several ways. First, we might simply treat the adults and children as the adult and child is treated in the above discussion. That is, we have a welfare function for the adults and a welfare function for the children. The

results flow through, but now we compare the situation of a couple with no children with a couple with a specified number of children. Alternatively, we might add in welfare functions for each adult. In this case we look at the change in the non-labour hours for each adult, compare it with their own wage and total income elasticity and arrive at the costs of children borne by each adult.

How would we expect these costs of children to vary with household characteristics such as parental wage rates, the ages of the children, the patterns of childcare used in the household, and the magnitude of state support for families? There is little evidence of systematic variation in the total income elasticity between different groups (see below), and so I assume this is constant across groups.

Wages

The wage rate enters equation (1) explicitly: children cost more when parents have a higher wage rate (unless there are strong offsetting leisure hours responses). However, if we express child costs as a proportion of money income there is no clear pattern. For example, if all household income is from wages then the cost of children as a proportion of money income is given by

$$\frac{F^* - F_A^*}{wh_M} \approx \left((h_L^* - h_L') / h_M \right) / \alpha e \quad (2)$$

That is, the change in leisure hours as a proportion of market work hours, divided by the total income elasticity. If we are prepared to assume e constant, then this will only vary with the wage rate if the change in leisure hours (as a proportion of market work) is different for high and low wage workers. It is difficult to predict in which way this might vary.

Gender

Since men have higher average wages than women, the above discussion implies that the costs of children will be *higher* for men than for women (other things equal). However, as we shall see below, the drop in leisure hours is generally greater for women (at least for young children). This also assumes that the total income elasticity of labour supply is equal for men and women, and that the home production derivative is identical (there is little evidence on either of these issues).

Age

Older children require less time parental time, suggesting that the drop in adult leisure and personal time will be less for older children. However, older children also require greater monetary expenditures than younger children. This lowers the parents' living standards. In response, they might reduce their leisure and increase their labour supply. The associated drop in adult personal time could, in principle, be large enough for us to find that older children cost more than younger children.

This example emphasises the fact that though this approach is derived from time-use data, it provides an estimate of *total* child costs including those that find expression in commodity expenditures.

Childcare and other Child Services

Consider first state-provided or subsidised services for children that do not vary with the parent's labour market time. These might include schooling, health care and childcare for non labour market time. In the simple model presented here, the provision of these non-cash services reduces parental expenditure on children (x_C) by the amount that the parents save on these services (which depends in part on whether the parents would have chosen these services in the absence of state provision). These additional resources effectively increase parental income, should be reflected in an increase in parental leisure and personal time and hence will act to reduce measured child costs.

However, the value of some childcare subsidies also depends upon the extent of parental labour market time. Even though this is not explicitly incorporated into the model, these effects are, in principle, captured. If parents of young children increase their hours of labour market time, they often⁷ adjust the inputs to child welfare $U_C(x_C, h_C)$ by decreasing h_C (spending less time caring for their children) and increasing x_C (purchasing childcare services). The introduction of a childcare subsidy reduces the price of childcare services, leading to a substitution towards x_C and away from h_C , which may in turn lead to an increase in h_M , market work. It also produces an income effect. It is this income effect that should, in principle, be captured by the patterns of adult leisure time.

4 Initial Estimates of the Full Cost of Children

4.1 Estimates of the Total-Income Elasticity of Labour Supply

A number of studies have surveyed the estimates of the total-income elasticity e arising from the labour supply literature. Pencavel (1986) surveys the US and UK non-experimental labour supply literature. Across the 15 studies that he summarises, the median estimate of e for men is -0.29 .⁸ However, the range of estimates is broad. Excluding the 2 most extreme values at either end, e ranges from -0.06 to -0.44 . He concludes that a 'best' estimate of e for men is -0.20 . Killingsworth and Heckman (1986) conduct a similar survey for women, finding a median total-income elasticity of -0.09 . The variation of estimates is similarly broad.⁹ Blundell and MaCurdy (2000) survey more recent studies. They find a median total-income elasticity of -0.07 for men and -0.17 for women. Again, however the range of estimates is broad.

In most of the studies in these surveys, the primary question of interest is the magnitude of the wage elasticity of labour supply. Identification of the income effect is usually achieved via strong assumptions about the exogeneity of capital or spouse income. A limited number of studies have more directly addressed income effects by seeking empirical examples where there is exogenous variation in incomes. A recent example is Imbens, Rubin and Sacerdote

⁷ Alternative strategies are to reduce h_A or h_L (adult home production or leisure). For example, parents might arrange non-overlapping work times to reduce the need to purchase formal childcare.

⁸ Calculated from his Table 1.19 and 1.20. This excludes the Wales and Woodland study (for the reasons mentioned by Pencavel) and also excludes those studies which estimate a negative compensated price elasticity for labour supply. The median result for experimental studies is somewhat lower -0.10 which is consistent with Metcalf's (1974) hypothesis of the impact of the non-permanent nature of the experimental change.

⁹ This is the median of the 82 estimates of the total-income elasticity presented in their Table 2.26.

(1999) who look at the changes in behaviour associated with lottery winnings. They estimate a total income elasticity of around -0.03 to -0.06 . They find little variation by sex and age.

It is clear that there is no simple consensus value of e arising from the research literature. The exogeneity of lottery winnings makes the results of Imbens et al particularly appealing. However, many of the labour supply surveys estimated a much stronger income response. As a compromise I take -0.1 as my preferred value for e . However, values of e ranging from -0.05 to -0.2 could be justified on the basis of some sub-sets of the research literature. This implies that the estimates of child costs could be between half and double those presented here! Finally, given the wide variation in results for both men and women, I do not attempt to distinguish the elasticity between men and women.

4.2 Estimates of the Full Cost of Children

The starting point for these estimates are the results in Craig and Bittman (2004). They describe how parental time-use patterns vary as the composition of the household changes. For the estimation method presented here, the key relationship is that between parental leisure/personal time and family composition. Table 2 presents Craig and Bittman's estimates of this relationship controlling for the age and education level of the parents.¹⁰ The estimates differ slightly from those in Craig and Bittman for the reasons described in the note to the table. Leisure and personal time is defined as all time other than time spent in market work or in home production (home production includes childcare).

The sample size for these calculations is not very large, and so some of the patterns observed are likely to be due to sampling error.¹¹ Nonetheless there are some interesting patterns. Starting with the 'both parents' panel, it can be seen that, when the youngest child is aged 0-2, the parents' leisure time is reduced by around 2 hours (per day) when they have one child and 3.6 hours when they have two. Having three children actually leads to an increase in parental leisure time. Craig and Bittman speculate that this might be due to the capacity for the older child to supervise the younger.

When the youngest child is aged 3-4 the time cost is around 3 hours for both one or two children, and again lower for the three child household. With older children (up to age 11, Craig and Bittman don't consider older children), the time cost is lower for the first child then increases more steadily with increasing numbers of children.

The second and third panels of the table show how this time cost accrues to the mother and father respectively. As Craig and Bittman show, most of the adjustment of the mother comes about via increases in home production (including childcare) time, whereas most of the father's adjustment arises through increases in labour market participation. For the youngest children, more of the time cost falls on mothers, while for the oldest age group the adjustment is more equally shared (though see below for the limitations of this time use measure).

¹⁰ Age and education serve as (an imperfect) proxy for the full income of the household. One possible improvement would be to take explicit account of the child-related income transfers received by families with children. Doing this would tend to increase the cost of children estimates shown here. Child-specific transfers mean that parents have a higher full income than an age and education matched group of non-parents. Removing this difference would reduce their full income and hence leisure hours.

¹¹ See Craig and Bittman (2004) for approximate standard error estimates (based on the assumption of independent diary-days).

The data in this table represents the term $-(h_L^* - h_L')$ as defined in equation (1). This can be combined with estimates of the net marginal wage rate (\$12.00 and \$10.30/hour for men and women respectively)¹² to obtain estimates of the cost of children as they accrue to mothers and fathers. Some initial estimates are shown in Table 3, for families with two children only.

Table 2 Change in Parental Leisure and Personal Time Associated with the Presence of Children, Australia 1997 (hours per day)

Number of Children	Age of Youngest Child		
	0-2	3-4	5-11
Both Parents			
0	0	0	0
1	-1.9	-3.0	-0.8
2	-3.6	-2.9	-1.9
3+	-2.5	-1.9	-2.2
Mother			
0	0	0	0
1	-1.4	-1.5	-0.5
2	-2.3	-1.7	-0.9
3+	-1.7	-1.5	-1.1
Father			
0	0	0	0
1	-0.3	-1.5	-0.5
2	-1.4	-1.0	-1.1
3+	-0.6	-0.5	-0.9

Notes: ABS 1997 Time Use Survey, Confidentialised Unit Record File. Estimates provided by Craig and Bittman, based on those in Craig and Bittman (2004) using an OLS regression of combined paid and unpaid work time controlling for education, age, day of the week and disability status. Parental leisure and personal time is all time other than paid or unpaid work. The regression is estimated over couple-headed households where the head is aged 25 to 54, and there are either no children, or children aged under 12 only. The corresponding estimates in Craig and Bittman (2004) also control for household income.

Apart from the large absolute value of child costs (discussed further below), the most interesting feature of this table is the relative values for men and women. For young children, mothers bear a higher cost, but this is reversed when the youngest child is aged 5-11. The latter result is due to the relatively equal hours change as shown in Table 2, together with the higher wages (and hence higher opportunity cost) of fathers.

¹² In 1997 the mean gross weekly wage for male and female employees paid for between 35 and 39 hours was \$691 and \$591 respectively (ABS *Weekly Earnings of Employees (Distribution), August 1997*, Cat No. 6310.0, Table 6. For both men and women, this is the modal hours category presented in this table). Assuming a mid-point of 37 hours implies gross wage rates of \$18.68 and \$15.97 per hour for men and women. For people earning this wage all year, the marginal income tax rate (including Medicare levy) was 35.5%. I therefore use net marginal wage rates of \$12.00 and \$10.30 per hour for men and women respectively.

Table 3 Full Cost of Two Children, Australia 1997, \$ Per Week

Age of Youngest Child	Change in Leisure/ Personal Time (hours/week)	Home Production Elasticity	
		Zero	Same as Market Labour
Mother			
0-2	-16.1	\$1,658	\$1,036
3-4	-11.9	\$1,226	\$766
5-11	-6.3	\$649	\$406
Father			
0-2	-9.8	\$1,176	\$735
3-4	-7	\$840	\$525
5-11	-7.7	\$924	\$578

Notes: Calculated using expression (1) using wage rates of \$10.30 and \$12.00/hour for mother and father respectively. The parameter α is calculated using mean market and non-market hours of 3.0 and 5.0 hours for both men and women (in couples without children).

There are two main reasons why we should be very cautious with respect to this conclusion. First, it does assume that the labour supply and non-market home production income ‘elasticities’ are the same for men and women. Even though the literature doesn’t provide evidence of different elasticities, this has not been subject to tests of any great power.

Second, the time use patterns shown in Table 2 are based upon primary time patterns only. Craig and Bittman (2004) show that much time which is recorded in the survey as a primary activity of leisure or personal care, is also coded as having a secondary activity of child supervision. Moreover, this is more likely to happen for mothers rather than fathers. A narrower definition of leisure which excluded this time would show a greater share of the cost of children as falling on mothers.

To understand the magnitude of these child costs it is useful to compare them with the money income level of the average household. One way of doing this is to use expression (2). The time-use survey reports mean hours of market work as 39 hours per week for fathers and 19 hours for mothers.¹³ Using the total of these hours (58) as h_M in expression (2) yields the estimates shown in Table 4.

¹³ This is mean hours of work per week as reported in the questionnaire part of the survey rather than the time diaries. It is for all families included in Table 1. Corresponding hours for couples without children would be somewhat higher.

Table 4 Household Full Cost of Children Relative to Mean Money Income, Australia 1997

Number of Children	Age of Youngest Child		
	0-2	3-4	5-11
Home Production Elasticity = 0			
1	2.2	3.6	1.0
2	4.3	3.5	2.3
3+	3.1	2.3	2.7
Home Production Elasticity = Market Labour Elasticity			
1	1.4	2.3	0.6
2	2.7	2.2	1.4
3+	1.9	1.4	1.7

Notes: Calculated using expression (2) using a mean weekly market hours of 58, $e=-0.1$, and $\theta=1$ or 1.6.

It is clear, first of all, that the estimates are very sensitive to our ignorance of the magnitude of the income response of home production. Recall also, that arguable values for the total income elasticity of labour supply could lead to results that were between half and double these estimates. Nonetheless, even with these caveats the results do serve to illustrate the large magnitude of the full cost of children to their parents.

By way of comparison we could note that the simple square root equivalence scale often used in income distribution analysis implies that a two-child family requires an income 1.4 times that of the couple without children. In other words, the additional cost of two children is 0.4 times the money income of the couple without children. The per-capita equivalence scale (usually considered the largest feasible scale) implies an additional cost ratio of 1.0. For a two-child household where one child is aged 0-2, Table 4 shows a corresponding ratio of either 2.7 or 4.3. Even if we were to double the income elasticity, this would still be well above the per-capita equivalence scale.

However, this result is not implausible. The idea that the per-capita scale is an upper bound arises from the assumption that children consume less than adults (and that there are no diseconomies of household scale). When time costs are included, there is every reason to believe that young children will have a greater impact upon the parents' living standard than would the presence of another adult in the household.

Finally, the table also shows how costs vary with the age of the youngest child. For the two-child household they decrease with age, but for larger and smaller households there are U and inverse-U shaped patterns. A decline with age is what we would expect with respect to the time spent caring for children. However, these results also include the impact of expenditures on children (via their impact on parental labour supply). Though these particular patterns might not be statistically significant, there is no theoretical reason that would require the total cost of children to fall with age.

4.3 Limitations

First, and most obvious, are the econometric limitations of the estimates presented here. Even though concepts such as the income elasticity of labour supply have been subject to much econometric research they still remain very imprecisely measured. Even less is known about the income elasticity of home production time. The model does also not explicitly incorporate any labour market rigidities. The estimates presented here should thus be considered as

indicating the type of information required to estimate the costs of children, and only as very broad estimates of likely magnitudes.

Assuming that we could indeed reliably estimate it, what are the theoretical limitations of the model and what do these suggest more generally about other attempts to measure the cost of children? I list some key issues here, starting with issues particular to the adult good model, but then moving on to consider issues that also have wider applicability.

Joint Consumption/production in the Household

This is a standard criticism of the adult good model. The adult good model, whether in expenditure or in time, does not take account of the economies of household scale in consumption and/or home production. For example, elements of household expenditure may include household public goods which are shared by all members. Similarly, the home production for the adult may be produced jointly with home production for the child (eg sweeping the house or cooking).

This joint consumption/production has both an income and a substitution effect. The income effect arises because it is now possible to produce more final consumption for the same amount of expenditure or time input. The substitution effect arises because these jointly produced goods are now relatively cheaper than in smaller households. The adult good model captures the income effects of joint consumption, but not the substitution effects.

The omission of public good substitution effects probably leads to an over-estimation of the cost of children. This is because joint consumption/production will make goods other than adult personal time relatively cheaper in the larger household. (This assumes no joint production of adult personal time – this possibility is addressed separately below). The substitution effect will mean a shift towards these jointly consumed goods in the larger household, and hence less consumption of the adult good. The adult good method, however, will interpret this substitution as representing an income effect and hence will over-estimate the drop in full adult income, and hence over-estimate the cost of children.¹⁴

Direct Price Effects on Adult Leisure Consumption

A similar effect can occur because of the direct effects of children on the price of adult leisure and personal time. Some aspects of adult leisure consumption become relatively more expensive when children are present, for example, eating out or going to the movies might require expenditure on additional childcare. The impact of this is the same as for the previous case of non-leisure goods becoming less expensive – parents will tend to substitute away from leisure activities and this will erroneously be interpreted as an income effect of children.

The magnitude of child cost overestimation associated with these two price responses will depend upon many factors; the extent of joint production or consumption, the share of adult

¹⁴ This result might not occur if the adult good is a strongly complimentary to the goods that have joint production or consumption. However, given the wide range of goods that are likely to experience jointness, this does not seem very likely. This relationship was first pointed out by Nelson (1992). See Bradbury (1997) for a diagrammatic representation.

leisure/personal time that is subject to relative price changes, the price elasticity of adult personal time, and the possibility for substitution within leisure time.¹⁵

Secondary Time Activities

The time use described here only refers to ‘primary activities’. As mentioned above, many parents (particularly mothers) record a leisure/personal activity as primary, but are also undertaking a secondary childcare activity at the same time. If we were to conduct the adult good examination of the basis of the narrower activity of leisure and personal time where there is no secondary childcare, then the estimated costs of children would be larger.

Joint Consumption of Adult Personal Time

However, a different view of how to treat joint activities could provide support for yet another reason why we might view the child cost estimates as too high. What if adult personal time is jointly produced/consumed along with time devoted to childcare? This is a fundamental issue for this and any other method used to estimate the time costs of children.

Adult leisure and personal time includes sleep, personal care and leisure activities. If we think of the good ‘leisure’ then it is conceivable that time spent on some aspects of childcare might be effectively producing leisure at the same time. Supervising children in play activities might both count as childcare service to the child, but also be an activity very close to leisure for the adult. If this is the case, then the adults are effectively consuming more leisure than time-use studies would reveal. In other words, they are not as badly off when they have children, and the method will over-estimate the cost of children.

Another way of thinking about this is to consider childcare (or part of childcare) and leisure as close substitutes in the household welfare function. Because childcare and adult leisure belong to different sub-branches of the separable welfare structure, such a particular pattern of substitution is assumed to not occur in the model used here.

Violation of Preference Stability Assumption

Despite all these limitations, the conclusion that the total cost of raising children is extremely large does not seem implausible. Can we derive any welfare and/or policy conclusions from these estimates?

The model used here assumes that adults maintain the same preferences for their own consumption whether they do or do not have children, and the real value of this consumption is used as the welfare index. This is thus a ‘situation comparison’ in the terminology of Pollak and Wales (1992). Is this a sensible comparison to make?

One way of considering this is to view this model as being part of a lifetime welfare model where the benefits of being a parent enter at the lifetime level, but the costs appear within each period’s sub-welfare function. If the sub-welfare functions enter the lifetime welfare function symmetrically, then the situation comparison is sensible. We can use methods like the adult good approach to talk about how child costs are spread across the lifecycle. However, there are reasons for thinking the actual function might be non-symmetrical.

¹⁵ For example, if an increased price for going to the movies simply leads to the adult increasing their time watching videos at home, then there will be no price effect on aggregate adult personal/leisure time.

Parents might be happy to have a relatively low standard of parental living when they are raising their children. In part, this acceptance might reflect the fact that this pattern is the norm. In this case we might argue that this norm reflects an inefficient situation and so should be rejected. However, other reasons are harder to reject. For example, parents' health and vitality generally diminishes as they age. The steady reduction in child time burden as children age might be seen as an appropriate complement to this.

Ultimately, these sorts of issues are not likely to be resolved easily. Nonetheless, we need to bear them in mind when interpreting the results of *any* child cost calculation.

5 Concluding Comments

When thinking about family and social expenditures on children, it is important to remember that the price, cost, consumption and value of children are related, but nonetheless distinct, concepts. This paper has explored some, but by no means all, facets of the relationships between these concepts.

The cost of children is not the same as children's consumption – even if we restrict attention to the domain of household commodity consumption. Section 2 considered the difference between these two concepts in the context of the allocation of private and household-public purchased commodities within the household. In this context, the cost of children is typically expressed in the literature in terms of the consumer equivalence scale. Under reasonable assumptions, it was shown that children's consumption is less than the 'equivalent income' of the household, but more than the 'cost of children' to the parents. The first relationship stems from the pattern of intra-household sharing of resources, and the likelihood that adults will be judged to need more than children. The second relationship arises from the existence of household public goods, which means that some of children's consumption does not require additional expenditure.

Expenditure costs, however, are only a small part of the cost of children. Parents reduce their leisure and personal hours considerably when they are raising their children. In the model presented here, this change in time-use arises from a combination of the time and the expenditure costs of children. The expenditure costs enter via the pressures they place on parental labour supply. Time use data thus has great potential to enable us to ascertain the full magnitude of the cost of children.

Some simple estimates based on the time use results of Craig and Bittman suggest that the full costs of raising children are very large indeed. Though difficult econometric problems (and theoretical simplifications) mean that these estimates should only be considered broad estimates of magnitude, some of the results may be of policy relevance.

For example, if we are prepared to assume that income elasticities are constant across groups (and so are the various potential biases discussed above), then the change in adult leisure across the lifecycle can be used to conclude whether the time costs of younger children are outweighed by expenditure costs of older children. Here, it is found that children aged 5 to 11 generally cost less than younger children – at least for families with one or two children. This has implications for policies that might seek to assist parents spread their childrearing costs across the lifecycle.

Finally, we should remember that all these estimates of the costs of children to parents are specific to the social and economic context in which the families are located. Cross-national

differences in state support for parents and children are likely to lead to different pattern of child costs, and different patterns of children's consumption.

Appendix A Valuing Children's Consumption of Commodities

The household is assumed to

$$\begin{aligned} &\text{maximise } W(u_A, u_C) \\ &\text{where } u_A = U_A(x_A, x_P) \\ &\text{and } u_C = U_C(x_C, x_P) \end{aligned} \tag{3}$$

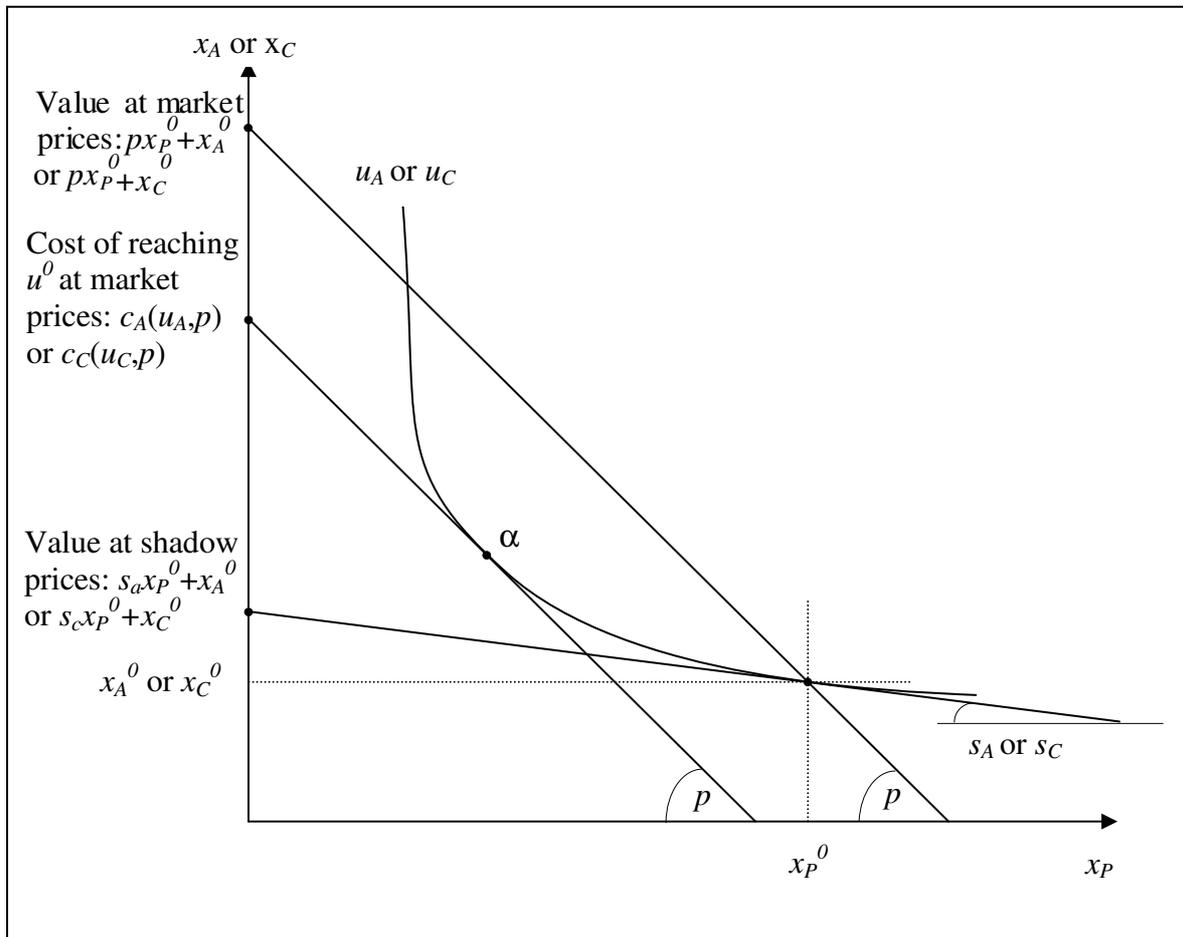
subject to a budget constraint $x_A + x_C + px_P \leq Y$ with x_A adult consumption of the private good, x_C child consumption and x_P consumption of a good that is public within the household. The relative price of the public good is p .

The different ways of valuing adult or child consumption are illustrated in Figure 2. An adult living alone and reaching utility level u_A will consume at point α . The absolute slope of the budget constraint passing through this point is p . However, because each unit x_P contributes to the consumption of more than one person, the optimal solution for the household is to consume a greater amount of the public good, x_P^0 . At this point, the marginal value of x_P is relatively low. The 'shadow price' that would have led to this consumption point is indicated by the budget constraint with slope s_A .

Lazear and Michael (1988) value individual consumption using this shadow price for the household good. With this approach, individual adult or child consumption is given by the intersection of the shadow price budget constraint with the vertical axis ($x_A + s_A x_P$ or $x_C + s_C x_P$). This, however, effectively ignores the economies of sharing in the household.

To address the concept of a situation comparison, however, we need to ask; how much would it cost to reach the welfare level u_A if the person faced market prices? When the household with children has an income of Y and faces a market price of p , the decision rule of (3) leads to an adult welfare level of u_A . When the adult lives alone, the cost of reaching this welfare level is $c_A(u_A, p)$, the cost function corresponding to $U_A(x_A, x_P)$. Figure 2 shows that this will be between the market and shadow price valuations of consumption.

Figure 2 Alternative Methods for Valuing the Consumption of Adults and Children



Note: This figure shows an indifference curve for one of the household members (ie corresponding to $U_A(x_A, x_P)$ or $U_C(x_C, x_P)$ in equation (3) where x_A or x_C as appropriate is measured on the vertical axis.

The *consumer equivalence scale* for the adult is then defined as the ratio between the household income and the income that the adult would require to produce the same welfare level if they lived alone. That is

$$\text{Equivalence Scale: } m = \frac{Y}{c_A(u_A, p)} \quad (4)$$

For the household containing children, *equivalent income* is income divided by the equivalence scale, which is equal to the adult consumption level within the household.

$$\text{Equivalent Income} = \text{Adult's Consumption: } Y / m = c_A(u_A, p) \quad (5)$$

The *cost of children* can be defined as the additional expenditure required so that the parents can maintain their consumption-based welfare level. This is the expression (4) in difference form

$$\text{Cost of Children: } Y - c_A(u_A, p) \quad (6)$$

These expressions are all from the point of view of the adult's consumption-based welfare. In valuing the consumption level of children in households, it is sensible to use the same approach as for adults. That is, we ask the question: How much would it cost to ensure that the children had the same level of commodity-based welfare if all the commodities they consumed had to be purchased on the market? Using comparable notation this is

$$\text{Children's Consumption: } c_C(u_C, p) \quad (7)$$

If we define the equivalence scale as in equation¹⁶ then knowledge of the equivalence scale can be used to place bounds on the value of children's consumption. It is reasonable to assume that the consumption of the adult will be generally higher than the consumption of the child (see text for caveats). From (5), this implies that child consumption will be less than Y/m .

A bound from the opposite direction can be obtained using the relationship between shadow prices and costs shown in Figure 2. Adult consumption valued at shadow prices is an underestimate of the cost of achieving welfare level u_A at market prices, $c_A(u_A, p)$. The same applies for children. Combining these results, and using the result from public goods theory that the sum of the shadow prices will equal the market price, gives

$$c_A(u_A, p) + c_C(u_C, p) \geq s_A x_P + x_A + s_C x_P + x_C = p x_P + x_A + x_C = Y$$

$$\text{re-arranging...} \quad (8)$$

$$c_C(u_C, p) \geq Y - c_A(u_A, p) = Y - Y/m$$

The bounds upper and lower bounds for children's consumption are thus

$$\left(1 - \frac{1}{m}\right)Y \leq \text{Children's consumption} \leq \left(\frac{1}{m}\right)Y \quad (9)$$

or

$$\text{Cost of children} \leq \text{Children's consumption} \leq \text{Equivalent income}$$

¹⁶

We might term equivalence scales defined as in equation (4) as 'consumption-based' equivalence scales as they describe the conditions necessary for consumption-based welfare to be constant in different family environments. An alternative approach is to see the equivalence scale as a political statement expressing a social valuation of the needs of different family types. In this case, the link between the equivalence scale and consumption levels is more tenuous.

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