THE EFFICIENCY COST OF CHILD TAX BENEFITS*

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INTRODUCTION

FAMILIES WITH CHILDREN RECEIVE PREFERENTIAL treatment in the U.S. federal income tax. The budgetary cost of these child tax benefits is about \$140 billion in 2006, or nearly \$1,900 per child. This is larger than the tax expenditure from the deductibility of mortgage interest for owner-occupied homes, larger than the tax expenditure from the deductibility of state and local taxes (including property taxes), and even larger than the tax expenditure from the exclusion of employer contributions to medical insurance premiums. As shown in Table 1, the real value of child tax benefits approximately doubled over the past decade and one-half due to the expansion of existing tax provisions and the creation of new provisions. The \$140 billion annual cost of child tax benefits is a direct measure of the value of tax revenue not received and payment made to families with children due to child tax benefit provisions.

However, the true cost of providing child tax benefits should also incorporate economic efficiency considerations. The efficiency implications of child tax benefits are derived using a representative agent model where the agent decides how much time to spend working and how many children to have. The assumption is that parents, to a large extent, determine the number of children in their family. Therefore, government subsidization of children may distort fertility choices.

The second section shows how the efficiency cost of child tax benefits depends on the cross-price substitution effect for leisure (time not spent doing market work) and children. The third section uses data from the National Longitudinal Survey of Youth (NLSY) to estimate this parameter. The estimation suggests that children and leisure time are complements. This implies that imposing a tax on children rather than a child subsidy would be efficient. This does not mean that a child tax would be optimal, only that child tax benefits reduce economic efficiency and that this cost should be weighed against any social welfare gains.

REPRESENTATIVE AGENT MODEL

Consider a representative agent that chooses how much time to spend working and the number of children to have. Because this is a representative agent, social welfare is represented by the agent's utility function

(1) $U(C, L, N)$,

where C is consumption, L is leisure time (nonmarket work time), and N is the number of children.

By assumption, raising children requires money but no time, or alternatively, time spent raising children is counted as leisure time. Leisure time is defined as $T - H$, where T is the time endowment and H is the hours of market work. Thus, all time other than time spent working for pay is considered leisure time. By this definition, time spent cooking, cleaning, caring for children, and any other home production activity is counted as leisure time.

The government has the ability to impose a linear income tax and can either subsidize or tax children, but must raise revenue R. There are no lump-sum taxes or subsidies and consumption is untaxed. This is equivalent to a model with a consumption tax and no income tax. The tax or subsidy of children is simply disproportionate taxation of children relative to consumption goods. By taking the price of consumption as the numeraire, we can write the budget constraint as

(2) $w(1 - \tau)T + Y = C + w(1 - \tau)L + P_N(1 + \theta)N$,

where w is the wage rate, τ is the income tax rate, Y is non-wage income, and $P_N(1+\theta)$ is the after-subsidy cost of raising a child. A negative value of θ is a child subsidy. By assumption, it takes expenditure level P_N to raise each child, and any child-related expenditure above this necessary level is considered consumption.

In this model it is possible to derive conditions under which it is optimal to subsidize, rather than tax, the presence of children in a family. Because

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Table 1
Estimated Budgetary Cost of Child Tax Benefits (billions)

	1992	*1996*	*1999*	*2004*	*2006*
Dependent Exemption	24.1	30.7	35.8	36.4	35.9
Earned Income Tax Credit	13.0	28.2	31.3	38.0	40.2
Child Tax Credit	-	-	19.9	31.2	56.2
Child Care Expenses	3.4	3.4	3.1	3.6	3.9
Head of Household Status	3.0	3.5	3.7	3.9	4.1
TOTAL	43.5	65.8	93.8	113.1	140.3
Number of Children (millions)	66.5	70.2	71.9	73.3	73.7
Expenditure per Child	$654	$937	$1,305	$1,543	$1,904
Real Expenditure per Child	$940	$1,204	$1,579	$1,647	$1,904

Sources: Office of Management and Budget, Tables 5-1 and 19-1, various years; U.S. Department of the Treasury, various years; U.S. Census Bureau, Table CH-1, 2007; and author's calculations.

there is a single representative agent and the government must raise revenue R, the optimal tax policy is simply the policy that is most efficient at raising the required revenue. As will be shown, the optimal tax treatment of children in this simple model primarily depends on the cross-price substitution effect between leisure and children.

The efficiency cost of a tax policy is measured by its excess burden, that is, the loss of utility greater than would have occurred had the tax revenue been collected as a lump sum (Auerbach, 1985). The excess burden of a tax policy is the loss in social welfare due to the distortion in relative prices only and not that which is due to the tax-induced loss of income. To calculate the exact excess burden, it is necessary to select an explicit utility function. Rather than do this, we will use the well-known approximation developed by Hotelling (1938), Hicks (1939), and Harberger (1964):

$$\textbf{(3)}\quad EB = -\frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n}(t_i t_j S_{ij})$$

where t_i is the tax rate on good i and S_{ij} is the substitution effect for good i given an increase in the price of good j. The optimal tax policy is the one that minimizes the Hotelling-Hicks-Harberger approximation of excess burden while still raising revenue R.

In this model, the excess burden is simply the sum of the three compensated deadweight loss triangles for consumption, leisure, and children. By assumption, the only distortions in the economy are those caused by the tax policy. All goods are produced under constant returns by competitive firms employing labor as the only input, so there are no profits. Consumption is untaxed, which enables us to drop the first of the three compensated deadweight loss triangles in the excess burden expression. The remaining compensated demands for leisure and children are both potentially affected by changes in either price:

$$\textbf{(4)}\quad EB = -\frac{1}{2}\Big[\tau w(S_{LL}(\tau w) - S_{LN}(\theta P_N)) + \theta N(S_{NN}(\theta P_N) - S_{NL}(\tau w))\Big].$$

The symmetry of the Slutsky matrix means that $S_{NL} = S_{LN}$. For analytical convenience, we will scale the units of leisure and children so that they are expressed in dollar terms. This normalization allows us to represent the optimal tax policy as the solution to this problem:

$$\textbf{(5)}\quad \min_{\tau,\theta}\left\{-\frac{1}{2}[\tau^2 S_{LL} + \theta^2 S_{NN} - 2\tau\theta S_{LN}]\right\}$$
$$\text{s.t.}\ \ \tau H + \theta N \geq R.$$

The first order conditions with respect to τ and θ can be solved to yield:

$$\textbf{(6)}\quad \tau = \frac{-\lambda(S_{NN}H + S_{LN}N)}{S_{NN}S_{LL} - (S_{LN})^2}$$

$$\textbf{(7)}\quad \theta = \frac{-\lambda(S_{LL}H + S_{LN}H)}{S_{NN}S_{LL} - (S_{LN})^2},$$

where λ is the multiplier on the government budget constraint. Evaluated at the optimum, this multiplier is positive because the excess burden of a tax policy is increasing in the revenue requirement, R. The denominators for both equations and are non-negative because this expression is the determinant of a second-order principal minor of the Slutsky matrix that is negative semidefinite.

Determining whether it is optimal to subsidize or tax the presence of children in a family is then reduced to signing the following expression:

(8) $S_{LL}N + S_{LN}H$

A child subsidy is optimal if and only if $S_{LL}N + S_{LN}H > 0$. Both N and H are constrained to be non-negative and S_{LL} is non-positive by definition, so it is the value of S_{LN} that is key in determining if a child subsidy is optimal. A necessary condition for the optimal tax policy to include child subsidies is that children and leisure time be substitutes.

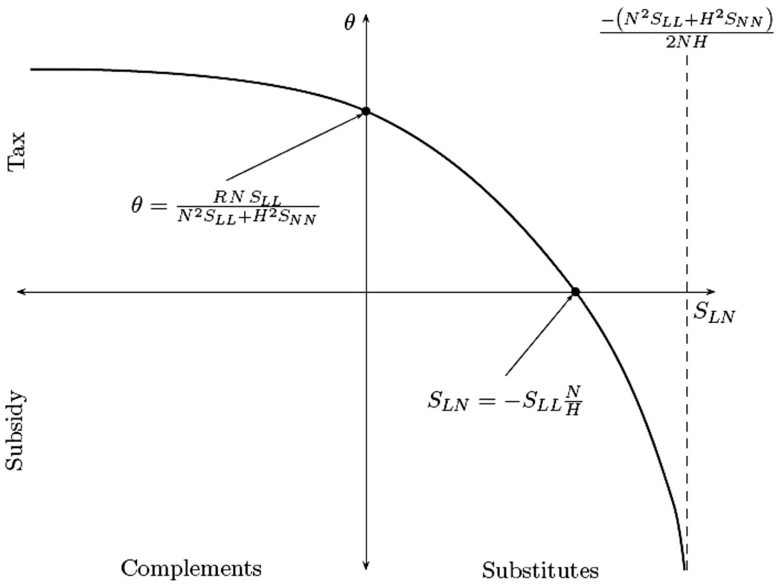
Result: *If leisure and children are complements ($S_{LN} < 0$), then it is* <u>*not*</u> *optimal to subsidize children.*

Recall that in this model, there are only two uses of time, leisure and market work. An equivalent way to express this result is that if labor supply and children are substitutes then it is not optimal to subsidize children. An intuitive explanation for this result comes from considering how the compensated demand for each good is affected by the tax policy. If leisure and children are complements ($S_{LN} < 0$), then an increase in τ increases the compensated demand for both leisure and children; whereas an increase in θ decreases the compensated demand for both leisure and children. The income tax distortions are reduced by imposing a tax on children.

If leisure and children are substitutes ($S_{LN} > 0$), an increase in τ increases the compensated demand for leisure but decreases the compensated demand for children. The income tax distortions are reduced by giving a child subsidy. Providing child tax benefits is costly in that the income tax rate must be increased in order to finance the benefits, so only when leisure and children are strong substitutes (as shown in Figure 1) is it optimal to provide child tax benefits. This strong substitute result was first derived in a three-good representative agent model by Corlett and Hague (1953/1954) and directs our attention to measuring the cross-price substitution effect. Figure 1 depicts how the optimal child tax treatment varies with the cross-price substitution effect for leisure and children.

Of course, the point of providing child tax benefits is not efficiency. Child tax benefits and other child subsidies are provided because they redistribute to families with children who presumably have

Figure 1: **Optimal Child Tax Treatment**



a higher marginal utility of income. I am not aware of any study that provides empirical evidence that the marginal utility of income for a family is increasing in the number of children, but I suspect that this may be the case. Child subsidies benefit society on net only if the welfare gain from redistribution outweighs the efficiency cost. If leisure and children are complements or weak substitutes, then there is an efficiency cost which should be weighed against the gain from redistribution.

While this simple model of labor supply and fertility choice abstracts from various characteristics of children, externalities associated with children, preexisting taxes and subsidies, and differences across families, this model provides a useful starting point to examine the efficiency cost of child tax benefits. In this model, the case for subsidizing children primarily depends on the cross-price substitution effect for leisure and children, a parameter that has received little attention in the empirical literature.

DATA AND ESTIMATION

I use cross-sectional variation in the National Longitudinal Survey of Youth (NLSY) to estimate the cross-price substitution effect for leisure and children. The data for this exercise is a sample of women from the 1979 NLSY. The NLSY contains detailed labor supply and fertility information for each respondent from 1979 to 2004. The sample is restricted to women who were 16 to 20 when first interviewed in 1979. This restriction enables labor supply and earnings histories to be constructed from age 19 until age 43. The number of children born to each woman by age 43 is also obtained. The women in the sample were interviewed annually from 1979 to 1994 and then biennially from 1996 to 2004. Women for which it is not possible to construct a complete labor supply or fertility history are dropped from the sample.

The decision to use a sample of women rather than a sample of married couples is motivated by the fact that approximately one-third of all births in the United States are to unmarried women. I use panel data, rather than a cross section, so that the analysis can be performed using each woman's fertility history. Using a cross section, we could only observe the number of children born and the woman's wage (if she is employed) at that point.

Three relationship categories are defined: married, partnership, single. Nearly all of the women in the sample are single at age 19 and about 88 percent are married for some period of time between age 19 and 43. Only 8 percent never report being married or in a partnership. Some women move between relationship categories several times. In this exercise, the relationship history is taken as exogenous as are the labor supply and earnings of husbands and partners.

The choice variables in the representative agent model are the average labor supply of the woman and the total number of children that she has. In the data, the average hours of market work is not the answer to a particular survey question asking how many hours per week she works when employed. Rather, it is created from a series of more than a thousand questions asking how many hours she worked week by week over the previous period. This measure of the average hours of work does not distinguish between a part-time worker who is employed continuously from age 19 to 43 and a full-time worker who is employed for only half that time period.

After removing observations that do not have complete birth, work, and earnings histories, the sample consists of 4,169 of the 6,283 women in the NLSY. All dollar amounts are inflation adjusted to year 2000 dollars using the CPI-U before averaging. An implied wage is calculated as the real average annual earnings divided by the average annual hours. The sample averages are reported in Table 2.

The *married*, *partner*, and *single* variables measure the fraction of time from age 19 until 43 that the individual is married, living with a partner, or single. The income of the husband or partner, as well as any nonwage income including welfare benefits, is combined into a single *nonwage income* variable. The *moved* variable indicates whether the individual's family moved to a different town while she was growing up. The summary statistics for variables indicating whether the individual lived with both biological parents until age 14 and whether either parent is an immigrant are also listed.

For those women with no reported hours of market work over the full-time period, no wage calculation can be made. This is unfortunate because an observed wage rate is essential in estimating the cross-price substitution effect for leisure and children. Therefore, the 110 women with no observed hours of market work are dropped from the sample.

It is apparent from Table 2 that the women for whom it is not possible to calculate an average wage rate are quite different from the remaining sample. This is particularly true with respect to their family background and fertility choices. No

Table 2
Sample Averages by Hours of Work (computed using sample weights)

	All	*Hours > 0*	*Hours = 0*
Observations	4,169	4,059	110
Sample Weight	1	0.985	0.015
Weekly Hours	26.43	26.83	0
Annual Earnings	18,084.51	18,362.11	0
Nonwage Income	27,867.33	28,001.11	19,152.40
Hourly Wage	12.45	12.45	-
Children	1.958	1.944	2.856
Married	0.566	0.569	0.366
Partner	0.071	0.070	0.123
Single	0.363	0.361	0.511
White	0.776	0.782	0.394
Hispanic	0.062	0.060	0.191
Black	0.144	0.140	0.382
Other Race	0.017	0.017	0.033
Rural	0.219	0.220	0.132
Moved	0.570	0.571	0.517
Mother Education	11.54	11.57	9.20
Both Parents (14)	0.616	0.618	0.439
Immigrant Parents	0.086	0.086	0.111

Source: National Longitudinal Study of Youth (1979).

effort is made to correct for the selected nature of the remaining sample as this would require the specification of a participation equation, a wage equation, and exclusion restrictions. Because nearly 99 percent of the sample has an observable wage, the sample selection correction would not likely yield much additional insight, but would certainly add to the complexity.

A common approach to estimating a substitution effect in a static model is to estimate a linear (in levels or logs) demand equation that includes a wage variable and a nonwage income variable. This is particularly common in the labor supply literature, where an econometrician estimates a labor supply function of this form:

(9) $$\text{Hours}_i = \alpha_0 + \alpha_1 \text{ wage}_i + \alpha_2 \text{ nonwage income}_i + \sum_{j=3}^{k} \alpha_j x_{ji} + \varepsilon_i,$$

where x_{ji} is one of the predetermined characteristics of the individual that is observed by the econometrician and ε_i represents those unobserved characteristics that affect labor supply. The labor supply function should depend not only on the wage, but also on the prices of all other goods. By assuming that the vector of other prices is not individual specific, these other prices can be dropped from the regression. Identification of the labor supply elasticity comes from exogenous cross-sectional variation in the wage.

This same approach can be used to estimate the cross-price substitution effect for leisure and children. I specify a linear child demand function that depends on the wage, nonwage income, and predetermined observed characteristics:

(10) $$\text{children}_i = \beta_0 + \beta_1 \text{ wage}_i + \beta_2 \text{ nonwage income}_i + \sum_{j=3}^{k} \beta_j x_{ji} + \varepsilon_i.$$

Ideally, the individual specific cost of raising children (own price) should also be included in this specification. The absence of this variable is cause for some concern because the demand of a good clearly depends on its own price. The high degree of uncertainty about the level of expenditure required to raise a child – and how this level changes with family size, family income, and other factors – severely complicates determining an individual specific cost of raising a child. Similar to the argument for the exclusion of other prices in a labor supply equation, one could argue that there is little individual specific variation in the direct cost of raising a child. However, differences in child tax benefits by income level, family economies of scale, and geographical differences in the cost of food, housing, and health care suggest that this may not be the case. The direction of the bias in the estimates from this heterogeneity in the cost of raising children is not clear.

There is a serious concern that the decision to have a child has a direct influence on the wage or that some unobserved factors that influence the decision to have a child are correlated with the wage. There are several observed characteristics like the month and year of birth and measures of the reading habits of the individual's parents that could serve as instruments for the wage. However, instrumental variables estimation gives a very similar estimate of the cross-price elasticity. The IV estimate of the cross-price elasticity is more negative than the OLS estimate, although not significantly different. Using a Hausman test of endogeneity, we fail to reject that the wage is exogenous. However, this may be due to weak instruments. Because the results are similar, I report only the OLS estimates here.

The estimated cross-price substitution effect (compensated) for leisure and children is given by $\hat{\beta}_1 - (\overline{\text{hours}})\hat{\beta}_2$ as indicated by the Slutsky decomposition:

(11) $$\frac{\partial \text{children}}{\partial \text{wage}} = \left(\frac{\partial \text{children}}{\partial \text{wage}}\right)^c + (\text{hours})\frac{\partial \text{children}}{\partial \text{nonwage income}}.$$

The estimation of equation is given in Table 3. The reported income and substitution effects

Table 3
Linear Child Demand Estimation

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
wage	-0.0308 (0.0031)**	-0.0232 (0.0032)**	-0.0160 (0.0031)**	-0.0157 (0.0031)**	-0.0229 (0.0032)**
nonwage income	0.0191 (0.0011)**	0.0206 (0.0011)**	0.0080 (0.0013)**	0.0078 (0.0013)**	0.0203 (0.0011)**
married			1.372 (0.080)**	1.372 (0.080)**	
partner			0.571 (0.153)**	0.593 (0.153)**	
constant	1.701 (0.072)**	1.996 (0.133)**	1.156 (0.084)**	1.208 (0.165)**	1.918 (0.162)**
race & region controls	yes	yes	yes	yes	yes
family controls	no	yes	yes	yes	yes
religion controls	no	no	no	yes	yes
observations	4059	4059	4059	4059	4059
R-squared	0.1005	0.1422	0.2020	0.2063	0.1473
Total Effect	-0.0308	-0.0232	-0.0160	-0.0157	-0.0229
Income Effect	0.0125	0.0135	0.0052	0.0051	0.0133
Substitution Effect	**-0.0433**	**-0.0367**	**-0.0212**	**-0.0208**	**-0.0362**

Standard errors in parentheses. Race controls include: black, Hispanic, and other non-white. Region controls include northeast, central, and south. Family controls include: number of siblings, youngest child indicator, oldest child indicator, biological parents (14), immigrant parents, mother's education level, rural, moved, and a library indicator. Religion controls include: a measure of frequency of attendance, and indicators for Catholic, Baptist, Methodist, Lutheran, Presbyterian, Pentecostal, Episcopalian, Jewish, Other Christian, and Non-Christian.
**Significant at the 1 percent level.
*Significant at the 5 percent level.

are calculated using the sample average earnings and nonwage income for the sample with positive hours of work.

Across specifications, the estimated substitution effect is negative. In the representative agent model, this implies that the optimal child tax treatment is a tax on children. A back of the envelope calculation puts the optimal child tax in the range of $100 to $800 per child.[1] However, this is not a policy recommendation. The representative agent model does not allow for any social gains from child tax benefits, and thus we are only measuring the efficiency cost and ignoring the benefits. The United States currently provides child tax benefits equal to about $1,900 per child. This estimate of the cross-price substitution effect can be used to calculate the excess burden of a $1,900 child subsidy. I calculate the excess burden to be in the range of $330 to $475 per child. This implies that the true cost of child tax benefits is about 20 percent larger than the reported budgetary cost of $140 billion.

CONCLUSION

The budgetary cost of child tax benefits in the United States is large and, if history is to be our guide, will likely continue to grow. In a representative agent model, the efficiency cost of child tax benefits depends on the cross-price substitution effect for children and leisure (non-market work time). I use NLSY data to estimate this cross-price substitution effect and find that the estimates are negative across specifications. This implies that there is an additional efficiency cost that should be added to the budgetary cost when calculating the true cost of providing child tax benefits.

Note

1 This calculation depends not only on the estimated substitution effect, but also on estimates of the female labor supply elasticity, the fertility elasticity, and the average cost of raising a child. The large range reported here is due primarily to uncertainty about what should be included in the cost of raising a child.

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