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EXPENDITURE DECISIONS OF DIVORCED MOTHERS AND INCOME COMPOSITION

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Abstract

In this paper we analyze the relationship between the income sources of custodial divorced parents and their expenditure patterns. While recipients of child support transfers are not typically legally required to observe explicit expenditure guidelines, it is of interest to determine whether individuals receiving such transfers allocate their income differentially from those who do not. We use data from the Consumer Expenditure Survey to directly investigate the issue of whether or not divorced mothers receiving child support income spend larger amounts on "child goods" than those not receiving child support holding total household income constant. By comparing the estimated coefficients on child support income and other income in an of Engel curve specification we argue that we can classify child goods as being public or private and say something about the expenditure patterns of noncustodial fathers under a Nash-Cournot equilibrium model of parental expenditures on public child goods and some plausible assumptions regarding the manner in which child support transfer decisions are made by noncustodial fathers. Our empirical results indicate that income composition does affect the expenditure patterns of divorced mothers and that consumption externalities exist even among divorced parents. These results highlight the importance of examining changes in the expenditure patterns among *both* divorced parents when attempting to determine the implications of income transfers between the parents for the welfare of children.

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1. INTRODUCTION

In this paper we examine the effect of the composition of a divorced mother's income on her expenditure patterns through the use of simple models of the expenditure decisions made by divorced parents and by conducting an empirical analysis of the expenditures of divorced mothers on "child goods."[1] We will argue that determining whether composition effects exist is important in conducting an informed debate on the effect of child support transfers on the welfare of divorced parents and their children.

Standard utility-based models of individual choice would seem to allow no role for the composition of income in determining expenditure allocations across goods categories except in two situations. The first case essentially involves a misspecification of the objectives of the agent. Say that utility was assumed [incorrectly] not to be a function of leisure. Then the [misspecified] demand function for a particular good may well indicate that consumption decisions are responsive to the mix of earnings [which are partially determined by leisure consumption] and nonlabor income, holding constant total income. The size of the composition effect in such a case would depend on the degree of complementarity or substitutability between leisure and the good in question.

The second situation is one in which restrictions on the usage of various types of income result in non-perfect fungibility. A leading example of such a case involves the use of food stamps in the United States.[2] While food stamps are considered income, they generally only have value to the recipient when used to purchase food items in a grocery store.[3] Of course, such

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[1]Some descriptive analyses have been performed in which the expenditure patterns and income sources of intact and nonintact families are compared [see, *e.g.*, Weiss (1984) and Boyle (1989)]. In addition, a model of the labor supply decision of divorced mothers has been estimated by Graham and Beller (1989)]. The impact of child support payments on the labor supply of these mothers is the focus of their analysis.

[2]We are grateful to Alberto Martini for helpful discussions and specific references in this area of research.

[3]Of course, there does exist a large black market in which food stamps can be exchanged for cash. However, food stamps are typically sold for substantial discounts in these markets [with respect to their face value], thus making

restrictions on the use of income are only binding if the consumer would have spent *less* than the amount mandated to be spent on the good in question in the absence of the constraint. While some researchers have obtained estimates which imply that only a small proportion of households receiving food stamps are constrained to purchase more food than they would have given perfect substitutability of food stamps and cash [see, *e.g.*, Senauer and Young (1986)], Engel curve estimates of food expenditure out of food stamp "income" distinguished from other income sources reveal much larger marginal propensities to consume out of food stamps.[4] In the one experiment which has been conducted in which the treatment group of food stamp recipients was allowed to exchange their food stamps for cash, no difference in the marginal propensity to consume food out of food stamp income was found, though the control group [which still faced the imperfect substitutability constraint inherent in the current program] exhibited larger marginal propensities to consume out of food stamp receipts [Ohls *et al.* (1991)].

Consider the following OLS regression results, which are derived from specification [4] reported in Table 3 below. The population from which the sample is drawn is a random national sample of U.S. households headed by a divorced mother with at least one [own] child under age 18 living with her. The dependent variable, c_m, is the total annual amount spent by the household on an aggregate category of "child-specific" goods, which consists of all expenditures on apparel for children and infants in the household in this particular equation. After-tax income from all sources other than child support and alimony payments, y_m, and total child support and alimony payments, s, are included as regressors as well as a number of other characteristics describing the household, denoted by $\underset{\sim}{z}$. A summary of the estimated conditional expectation function together with heteroskedasticity-consistent standard errors [in brackets] is given by

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them imperfect substitutes for cash even when such options are available.

[4]These results would seem to be inconsistent, since income composition should have no effect on expenditures when food stamps and cash are perfect substitutes. For a review of the large literature on the effect of food stamps on food consumption, see Fraker (1990).

$$\hat{E}[c_m | y_m, s, \underset{\sim}{z}] = \underset{[609.462]}{-1562.415} + \underset{[.003]}{.006\, y_m} + \underset{[.011]}{.025\, s} + \underset{\sim}{z}\hat{\underset{\sim}{\delta}},$$

An asymptotically valid test in which the null posits equality of the coefficients on the two types of income and the alternative posits that the coefficient on child support income is strictly greater than that associated with other income rejects the null hypothesis at the .05 significance level.

It appears that the two cases for income composition effects in expenditures described above cannot readily be invoked to account for this result. Firstly, though *both* child support income and other income are functions of time spent in the labor market, it is not clear that we should expect children's apparel expenditures and labor supply decisions to be closely associated. Secondly, recipients are not generally required to spend child support income [or alimony] in a prescribed manner by legal institutions, as in the case of food stamps or housing vouchers provided by the government. Thus child support income is perfectly fungible.[5]

We will argue that the regression result cited above and the others presented below indicate that expenditures on the children by one divorced parent continue to have significant consumption externalities for the other parent even after the divorce. Given that children must be considered to be public goods from the perspective of divorced parents, regression results such as the one cited above should be cautiously interpreted. Moreover, this finding indicates that the welfare implications of transfers between divorced parents for themselves and their children can only be ascertained by examining the consumption patterns within both parents' households.[6]

Numerous studies exist on the effect of divorce on the income and expenditure patterns of divorced fathers and mothers, though most studies are

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[5] One could argue more subtly that there do exist constraints on the expenditures of mothers receiving child support income in that failure to provide an "adequate" quality of life for the child may result in the award being reduced or eliminated, and in extreme cases can cause the loss of child custody. The framework used throughout the paper is static, so such possibilities cannot be formally addressed here.

[6] Even if there are no consumption externalities among divorced parents, to evaluate the welfare of children requires information on the expenditure decisions of both parents.

descriptive in nature and ignore the possibility of consumption externalities between the two households. The sharp decline in the real income of households headed by divorced women compared with the pre-divorce income levels of the intact household [even after adjusting for changes in household composition] has been well-documented in many studies [*e.g.*, Bane and Ellwood (1986), Duncan and Hoffman (1985,1988), Weitzman (1985)]. The precipitous decline in the income of mothers after divorce has been partially attributed to low child support awards [*e.g.*, Williams (1987), Lazear and Michael (1988), Garfinkel and Oellerich (1990)] and to imperfect compliance with child support awards [see, *e.g.*, Del Boca (1986), Del Boca and Flinn (1990), Weiss and Willis (1989)]. Except for papers by Weiss and Willis (1985,1989,1991) and Del Boca and Flinn (1990,1991), the possibility that children remain public goods even after divorce and the implications of this for the determination of "optimal" child support awards and compliance decisions has not usually been considered.[7] Our empirical results suggest that the decision to ignore the public goods nature of children after divorce is questionable.

In Section 2 we set out a model of expenditure decisions of divorced parents in two situations; one in which expenditures on children after divorce convey no consumption externalities to the other parent [the private good case] and the other in which they do [the public good case]. In Section 3 we derive implications for Engel curves from the two models. In Section 4 we conduct tests for the "publicness" of expenditures on child-specific goods after divorce using data on the expenditures of divorced mothers from the Consumer Expenditure Survey. Section 5 contains a brief conclusion.

2. EXPENDITURES ON CHILD-SPECIFIC GOODS BY DIVORCED PARENTS

In attempting to determine whether the receipt of child support income affects the expenditure patterns of custodial parents, and if it does, the nature of the relationship, it is crucial to know if children are private or public goods for divorced parents. Within intact households, let us think of

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[7] There are pragmatic reasons for ignoring this possibility, most of which arise from the severe data limitations confronting researchers examining the expenditure patterns of divorced parents.

"household" expenditures as being the result of a bargaining game played by the parents, each of which has their own well-defined set of preferences and resources which they control.[8] Because parents within intact households share the same residence with the child, there are undoubtedly strong consumption externalities linking the welfare of the parents which operate through purchases of child-specific goods.[9] When the parents are essentially never simultaneously in the presence of the child, it seems natural to question whether such consumption externalities remain following divorce.[10]

Let each parent possess an utility function given by $u_i(x_i,\vartheta(c_i,c_{i'}))$, where x_i denotes the quantity of a private good x consumed by parent i and c_i denotes the level of expenditures on an aggregate child good c by parent i for $i,i' = m,f$. We will assume throughout that the utility functions u_m and u_f are continuously differentiable, satisfy the standard concavity conditions, and that the Inada conditions[11] hold; furthermore, we will assume that the goods x_i and $\vartheta_i \equiv \vartheta(c_i,c_{i'})$ are normal. Without loss of generality, we will normalize the prices of the two goods to unity.

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[8] If household behavior is modelled as arising from the maximization of a single household utility function subject to a household budget constraint, then the question of whether child-specific goods provide consumption externalities is not well-defined unless the relationship between "household" preferences and the preferences of individual household members is made explicit.

[9] Child-specific goods are of course only one example of the many types of consumption externalities which are likely to exist in intact families.

[10] Even if children remain "pure" public goods for divorced parents, the method by which public good expenditures are determined may be different in the two cases. It may be the case that within intact households public good expenditures are efficient, that is, the equilibrium allocation lies along the Pareto frontier, while among divorced parents noncooperative equilibrium outcomes prevail. See Del Boca and Flinn (1991) for a discussion of this issue in the context of a model of compliance with child support orders. In this paper, we will consider noncooperative equilibria of the Nash-Cournot type only.

[11] These are conditions on the limiting behavior of the first partial derivatives of the utility functions u_m and u_f. In particular, they require that $\lim_{a\to\infty} \partial u_i(a,b)/\partial x_i = \lim_{b\to\infty} \partial u_i(a,b)/\partial \vartheta_i = 0$ and $\lim_{a\to 0} \partial u_i(a,b)/\partial x_i = \lim_{b\to 0} u_i(a,b)/\partial \vartheta_i = \infty$ for i = m and f and for all positive a and b.

Our attention focuses on the sub-utility functions ϑ_m and ϑ_f. Employing the terminology of the public goods literature [see, *e.g.*, Cornes and Sadler (1986)], child goods will be classified as private goods, impure public goods, or pure public goods according to the following properties of the sub-utility function ϑ which in all cases assume $i \neq i'$ and $i,i' = m,f$.

Private: *If* $\partial\vartheta_i/\partial c_i > 0$ *and* $\partial\vartheta_i/\partial c_{i'} = 0$ *for all* $(c_i, c_{i'})$.

Impure Public: *If* $\partial\vartheta_i/\partial c_{i'} \neq 0$ *and* $\partial\vartheta_i/\partial c_{i'} \neq \partial\vartheta_i/\partial c_i$ *for some values of* $(c_i, c_{i'})$.

Pure Public: *If* $\partial\vartheta_i/\partial c_{i'} = \partial\vartheta_i/\partial c_i > 0$ *for all values of* $(c_i, c_{i'})$.

In the private good case, each parent's utility is independent of the expenditure patterns of the other. Such an extreme specification of the preferences of divorced parents can be rationalized given a household production technology [see Becker (1965)] in which child services are produced only by combining market goods with time spent in the physical presence of the child. In this case, any expenditures made on child goods when parent i is not in the physical presence of the child have no utility payoff to i. In any noncooperative equilibrium, each parent will only purchase child goods when he or she has physical custody, and his or her utility will be independent of the other parent's expenditures on the child.

The other extreme is the pure public good case. In this case, the sub-utility function takes the form $\vartheta(c_i, c_{i'}) = \vartheta(c_i + c_{i'})$; $i,i' = m,f$; and each parent's expenditure on the child good is a perfect substitute for the other's. While the empirical relevance of this case may be questioned *a priori*, many strong theoretical results are available concerning the effect of income transfers on the provision of pure public goods of which we will make extensive use.

The intermediate case is that of an impure public good; for this case not many strong theoretical predictions are available though it may well be the most useful way to model consumption externalities among divorced parents. To take one example, purchases of toys may be expected to contribute

to the general happiness of the child, a state both parents can enjoy. However, if two divorced parents were jointly *given* a collection of toys, we would not in general expect them to be indifferent as to the manner in which the toys were distributed them [assuming that the toys do not move with the child as he or she moves between parents]. Much of the pleasure of giving a child a toy comes from the *direct* observation of him or her enjoying it, an experience which is not possible if the toy is owned by the other parent. We would argue that it probably makes sense to think of most child goods as impure public goods, though by the nature of the theoretical results available to us we will be forced to test between the extreme interpretations of private and pure public goods. We will hereafter restrict our attention to these two cases.

Without loss of generality, we will define $\vartheta(c_i,c_{i'}) = c_i$ for the private good case and $\vartheta(c_i,c_{i'}) = c_i + c_{i'}$ for the pure public good case. We assume that the parents make their choice of child good expenditure taking the other parent's child good expenditure as fixed. A slight modification of the decision problem specification of Bergstrom *et al* (1986) leads us to write parent i's utility maximization problem as:

$$[1] \qquad \underset{x_i,\vartheta_i}{\text{maximize}}\ u_i(x_i,\vartheta_i)$$

$$\text{s.t.} \quad x_i + \vartheta_i = y_i + (\partial\vartheta_i/\partial c_{i'})c_{i'},$$

$$\vartheta_i \geq (\partial\vartheta_i/\partial c_{i'})c_{i'},$$

where y_i denotes parent i's (exogenously-determined) wealth. Note that in the public good case, $\partial\vartheta_i/\partial c_{i'} = 1$, while in the private good case this partial derivative is 0.

Ignoring the inequality restriction in the choice problem, we can define the demand function for the child good ϑ_i by $f_i(y_i+(\partial\vartheta_i/\partial c_{i'})c_{i'})$. Imposing the inequality restriction results in the demand function

$$[2] \qquad \vartheta_i = \max \{ f_i(y_i+(\partial\vartheta_i/\partial c_{i'})c_{i'}) , (\partial\vartheta_i/\partial c_{i'})c_{i'} \}.$$

When the child good is private, [2] reduces to

[3] $$c_i = \max \{ f_i(y_i) , 0 \},$$

but under the Inada conditions $f_i(\xi) > 0$ for all $\xi > 0$, so that $c_i = f_i(y_i)$ given that parent i's wealth is positive. The normality assumption implies that $f_i'(y_i) \in (0,1)$ for all positive y_i.

Now consider the case in which ϑ_i is a pure public good. The restricted demand function for parent i becomes

[4] $$c_i + c_{i'} = \max \{ f_i(y_i+c_{i'}) , c_{i'} \}$$

$$\Rightarrow \quad c_i = \max \{ f_i(y_i+c_{i'}) - c_{i'} , 0 \}.$$

In this case, the Inada conditions and normality assumptions imposed on u_i will not be sufficient to imply that c_i is positive for *all* values of $(y_i, c_{i'})$. The differences in [3] and [4] yield the first method of empirically distinguishing between pure public and private goods; we state without proof the following obvious result.

Proposition 1: Assuming that both goods are normal, the Inada conditions hold, and positive wealth for both parents, then $(c_m, c_f) \in (0,\infty)^2$ *when the child good is private and* $(c_m, c_f) \in \{[0,\infty)^2 - (0,0)\}$ *when the child good is public.*

When the child good is public, one [but not both] parents may optimally choose to make no expenditures on the good; in the private good case both parents must spend positive amounts on the good. A strong test of whether ϑ_i is private simply involves determining whether divorced parents report expenditures on the items we regard as comprising c_i for i = m and f. This "test" has the weakness of being very sensitive to the choice of goods comprising c_i. If one defines c_i very broadly, the likelihood of zero expenditures on it will go to zero for purely accounting reasons. If we define c_i very narrowly, we are likely to find corner solutions for a number of reasons not germane to our interests here.[12] Futhermore, this result would not be operative in any

[12]Since the survey used in the empirical work below records expenditures on a

cooperative solution to the parents' public good problem, which would require strictly positive public good expenditures by both parents. For these reasons, Proposition 1 is of quite limited empirical value.

The principal means we will use for distinguishing between the private and public goods interpretations of expenditures on children involves a comparison of "propensities to spend" out of own income, y_i, as opposed to income received by parent i which is transferred to i from parent i'. Since almost all transfers are made from divorced fathers to their ex-spouses, we will consider only transfers from the father to the mother. The transfer will be denoted by s, where $s \in [0,y_f]$.

The conditions we have placed on the preferences of the parents are sufficient to guarantee the existence of an unique Nash-Cournot equilibrium for any values of the initial income wealth distribution $(y_m,y_f) \in \mathbb{R}^2_+$ [see, *e.g.*, Bergstrom *et al.* (1986)]. Qualitatively, three types of equilibria can be distinguished in terms of the wealth distribution: (1) $(y_m,y_f) \in \mathcal{E}_1 \Leftrightarrow (c_m>0,c_f>0)$; (2) $(y_m,y_f) \in \mathcal{E}_2 \Leftrightarrow (c_m>0,c_f=0)$; and (3) $(y_m,y_f) \in \mathcal{E}_3 \Leftrightarrow (c_m=0,c_f>0)$. In the set of wealth distributions $\mathcal{E}_1$, both parents spend positive amounts of their own income on the child good. In sets $\mathcal{E}_2$ and $\mathcal{E}_3$, only one parent spends positive amounts on the child good.

Warr (1983) and Bergstrom *et al.* (1986) have built upon an insight contained in Becker (1974) to establish that any redistribution of income within the set of contributors to a public good which leaves the set of contributors unchanged after the redistribution in Nash-Cournot equilibrium leaves the total expenditure on the public good unchanged as well as the welfare levels of all the contributors. In the context of our problem, we have:

Proposition 2: Assume that the initial wealth distribution is such that $(y_m,y_f) \in \mathcal{E}_1$. *Consider a transfer of size s from the father to the mother*

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number of categories of goods over a fixed period of time, some households are likely to report zero purchases of infrequently purchased items over the sample period. Also, consumers may be more likely to under-report purchases of items which constitute a small portion of their budget through systematic recall error. On these and related issues, see Section 3.3 in the survey paper by Deaton (1986).

where $s \leq c_f^*(y_m, y_f)$, *the initial Nash-Cournot level of expenditure by the father on the child good. Then* $c_f^*(y_m+s, y_f-s) = c_f^*(y_m, y_f) - s$.

Proof: See Theorem 1 of Bergstrom *et al.* (1986).

An immediate implication of Proposition 2 is that the utility levels of the two parents will be unchanged after any redistribution given that the Nash-Cournot equilibria [pre- and post-transfer] belong to the set $\mathcal{E}_1$. Transfers of income from one parent to the other are accompanied by dollar-for-dollar reductions in public good expenditures by the parent making the transfer.

Consider the Nash-Cournot child-good expenditure level of the mother as a function of the income distribution, or $c_m^*(y_m, y_f)$. Under our assumptions on the utility functions of each agent, we have that $\partial c_m^*/\partial y_m \geq 0$ and $\partial c_m^*/\partial y_f \leq 0$. Then using Proposition 2 and this observation, for small changes in the transfer we have:

Proposition 3: $\partial c_m^*(y_m+s, y_f-s)/\partial s$ *is greater than* **[equal to]** $\partial c_m^*(y_m+s, y_f-s)/\partial y_m$ *if* $(y_m+s, y_f-s) \in$ **[**$\notin$**]** $\mathcal{E}_1$.

Proof: When $(y_m+s, y_f-s) \in \mathcal{E}_1$, then $\partial c_m^*/\partial y_m > 0$ and $\partial c_m^*/\partial y_f < 0$, so $\partial c_m^*/\partial s = \partial c_m^*/\partial y_m - \partial c_m^*/\partial y_f > \partial c_m^*/\partial y_m$. When $(y_m+s, y_f-s) \in \mathcal{E}_2$, then $\partial c_m^*/\partial y_f = 0$, and $\partial c_m^*/\partial s = \partial c_m^*/\partial y_m > 0$. When $(y_m+s, y_f-s) \in \mathcal{E}_3$, $\partial c_m^*/\partial s = \partial c_m^*/\partial y_m = 0$. □

Compare the result of Proposition 3 with the effect of a transfer on child good expenditures by the mother in the private good case. In this case, the transfer income is simply aggregated with other income, so that after the mother receives a transfer of s from the father her new income level is $\tilde{y}_m = y_m + s$, and her expenditures on the child good are given by $f_m(\tilde{y}_m)$. It is obvious that $\partial f_m/\partial s = \partial f_m/\partial y_m \in (0,1)$ [given our assumption of normality] in this case. Thus in the private good case, the effect of a small change in transfer income is identical to the effect of a small change in own income on the child good expenditures of the mother. The same is true if child goods are public when the father is not purchasing them. In the case in which child goods are public and both parents are purchasing them, a marginal

change in transfer income has a *greater* effect on child good expenditures of the mother than does a marginal change in her own income by Proposition 2. The case in which the mother spends no money on the child good is not empirically relevant, since virtually all mothers in our sample make a positive expenditure on the group of goods we have denoted child goods.

Before turning to the formulation of empirical tests for the nature of child goods of divorced parents, we explore a few generalizations of the framework given above and their implications for some of the tests reported below.

When children are public goods, we have already found a rationale for the propensity to consume child goods out of child support income to exceed the propensity to consume these goods out of own income, so let us consider the case in which child goods are private. The composition of income may affect the expenditure decisions of mothers because mothers feel a moral or legal obligation to spend child support income on child-specific goods. There are a number of ways to operationalize such a concept, though all are to some extent arbitrary, especially in the context of a utility-maximizing model of expenditure decisions. One could simply index the utility function of the mother [assumed to be the only potential child support recipient] by a term reflecting the composition of her income, say $\eta(s,y_m)$. Then the mother's utility function will be given by $u_m(x_m,c_m;\eta(s,y_m))$, and the resulting demand function for the child good can exhibit virtually any form of dependence on s in the absence of restrictions on the index η. This underscores the point that arguments involving moral obligation or other unrestricted forms of preference shifts are not useful from the point of view of testing. That said, it must be admitted that any results which indicate there do exist differences in propensities to consume child goods out of different income sources are consistent with a model of private goods and preference-shifting of this type.

Finally, consider the case in which child goods are public, and where cooperative solutions are implementable. Since efficient solutions to the public goods problem can lie anywhere along the Pareto frontier, and since the frontier [typically] contains a continuum of points, to say anything specific about the effect of income transfers on the level of provision of the public good and the welfare of the parents it is necessary to choose a particular sharing rule. For simplicity, consider a Nash Bargaining rule in which the

"disagreement point" for each party is their utility level evaluated at the noncooperative Nash-Cournot equilibrium level of expenditures on the public good. When the wealth distribution $(y_m+s, y_f-s) \in \mathcal{E}_1$, then the value of the disagreement point to each parent will be unchanged for small changes in s. Since the disagreement points are invariant to marginal changes in s for wealth distributions in this set and since the set of efficient outcomes remains invariant with respect to the income redistribution, the Nash Bargaining level of provision of the public good and the welfare levels of the parents will be invariant with respect to marginal changes in s for wealth distributions in the set $\mathcal{E}_1$. This implies that the individual receiving the transfer will spend it dollar-for-dollar on the child good, as in the Nash-Cournot situation, and implies that marginal changes in transfer income have a greater effect on child good expenditures than do marginal changes in own income.

For wealth distributions in the complement of the set $\mathcal{E}_1$, the disagreement utility levels will change with marginal changes in s and so will the Nash Bargaining solution to the problem. It seems difficult to characterize the effect of changes in wealth on expenditure patterns in this case without further restrictions on preferences. On a positive note, the test for privateness of child-specific goods which we develop below will have some power [locally] against alternative hypotheses which specify that the child-specific goods are public but expenditures are *not* determined in Nash-Cournot equilibrium. Our feeling is that expenditure coordination on public goods by divorced parents is better modelled as a noncooperative outcome than within a cooperative framework.

3. ECONOMETRIC FRAMEWORK

Our econometric strategy will be to adopt a nonstructured environment in which to conduct estimation and perform testing. The spirit of the analysis is very much exploratory, and we wish to come to some conclusions on the issue of the "publicness" of child goods for divorced parents with as few intrusions from arbitrary functional form specifications as possible. In this section we will explore estimation and testing issues from the perspective of the models discussed in Section 2 and will indicate how our tests should be interpreted

in the light of the data restrictions we face.

The data utilized in our empirical analysis report only the expenditures of the mother [who presumably has custody of some or all of the children from the marriage] over the period of one year, so we will focus our attention on the mother's demand function for child goods. Since the information is cross-sectional, we will assume that prices are fixed and will estimate Engel curves for the child-specific good. Consider the linear Engel curve

$$[5] \qquad c_m = \alpha_0 + \alpha_1 y_m + \alpha_2 s + \alpha_3 y_f + \underset{\sim}{z}\underset{\sim}{\delta} + \varepsilon \ ,$$

where $\underset{\sim}{z}$ is a row vector of observable preference shifters, $\underset{\sim}{\delta}$ is a conformable column vector of fixed parameters, and the random variable ε is a disturbance term which represents both approximation errors from the linearization of the [possibly] nonlinear true Engel curve and also unobservable preference heterogeneity in the population of divorced mothers. For simplicity, assume that expenditures on the child good are positive for all mothers so that we do not have to be concerned with censoring problems.[13]

If the expectation of ε conditional on the set of all observable variables on the right-hand side of [5] is zero in the population, asymptotically valid tests for the "publicness" of the child good and expenditure patterns of both parents reduce to tests on the parameter vector $\underset{\sim}{\alpha}$. To rule out certain seemingly pathological situations which would render our tests "powerless" in the statistical sense of the term, we make the following assumption:

Assumption: Let the post-transfer wealth distribution of divorced parents be given by the bivariate distribution $G(y_m+s, y_f-s)$. $\int_{\omega \in \mathcal{E}_1} dG(\omega) > 0$.

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[13] That is, assume that in the population the post-transfer wealth distribution of divorced parents is such that the probability of the set $\mathcal{E}_3$ is "small." The technical assumption which follows in the text rules out the zero probability possibility for the set $\mathcal{E}_1$. In the data utilized below, out of 161 cases, 8 spend nothing on the more broadly-defined child-specific good and 22 spend nothing on the more narrowly-defined child-specific good over the reporting period of one year. We report estimates of a Tobit model of child good expenditures in the Appendix, where censoring is specifically addressed. More details are presented in the following section.

The assumption implies that under random sampling from the population of divorced mothers, as sample size grows the probability of not having any sample members from non-intact families in which both parents make positive expenditures on the child-specific good in Nash-Cournot equilibrium goes to zero.

Consider the following restrictions on the parameters of [5] which are derived from arguments presented in Section 2.

$\mathcal{P}1$: ϑ_m *is a private good* $\Leftrightarrow \alpha_3 = 0$.

If ϑ_m is a private good, then expenditures by the mother are only a function of her total income, which is the sum of her own income and transfers received from the father in the form of child support. Conditional on child support, the father's income has no effect on her expenditure decisions. The father's income will have no effect on the expenditures of the mother even when the child good is public for wealth distributions in the set $\mathcal{E}_2$,[14] but by the technical assumption given above the population of divorced parents contains a mixture of the two types, and therefore α_3 should be strictly less than zero if child goods are public.

The statement $\mathcal{P}1$ gives us a clear and concise way to determine whether or not child goods are public; unfortunately, in the data utilized below *no* information regarding the father is available. The data does, however, contain information on mother's income by income source. We can use this information to test for the publicness of child goods.

$\mathcal{P}2$: ϑ_m *is a private good* $\Leftrightarrow \alpha_1 = \alpha_2$.

While over the set of income distributions in $\mathcal{E}_2$ this equality holds even in the public good case, over the set of income distributions in $\mathcal{E}_1$ we have $\alpha_2 > \alpha_1$. Then in the population, α_1 will only equal α_2 if the child good is

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[14] By Proposition 3, this statement also holds for divorced parents with post-transfer wealth belonging to $\mathcal{E}_3$, though we are no longer explicitly considering this set for simplicity and due to its limited empirical relevance.

private under our technical assumption.

Although the following observation is not useful in the empirical work below because of the absence of information on the father's own income and the nontrivial nature of defining the set $\mathcal{E}_1$, we provide it for completeness.

$\mathcal{P}3$: *Over the set* $\mathcal{E}_1$, ϑ_m *is a public good* $\Leftrightarrow \alpha_2 = \alpha_1 - \alpha_3$.

This fact follows immediately from Proposition 2.

Due to data limitations, all our tests for publicness of child goods utilize only the restriction in $\mathcal{P}2$. Before testing can be carried out, several statistical issues must first be discussed.

Since the data utilized does not contain any information on the father's income, the model estimated is of the form

$$[5'] \qquad c_m = \alpha_0 + \alpha_1 y_m + \alpha_2 s + \underset{\sim}{z}\underset{\sim}{\delta} + \varepsilon'$$

where $\varepsilon' = \varepsilon + \alpha_3 y_f$.

Note that even if the disturbance ε is mean independent of $(y_m, s, y_f, \underset{\sim}{z})$, it is not reasonable to assume *a priori* that ε' is mean independent of $(y_m, s, \underset{\sim}{z})$. We may doubt the validity of the mean independence assumption in this case due to assortative mating, the probable dependence of the size of the transfer on the father's income, or for a number of other reasons.

Aside from the problem of the father's income being included in the disturbance term ε', we must consider the possibility that it is not appropriate to consider the disturbance term ε to be mean independent of the vector $(y_m, s, y_f, \underset{\sim}{z})$. Interpreting the disturbance term ε as partially reflecting the tastes of the mother, the father's decision of how much to transfer may be a function of ε. For the father's transfer rule to be a function of ε, the following conditions must be met: (1) the father must perfectly or imperfectly observe the value ε and (2) the child good must be public. Condition 1 is simply the common sense observation that the transfer rule cannot be a function of ε unless some [possibly noisy] indicator of the true value is available. Condition 2 is more substantive, and is derived from the presumption that if the child good is private, the father's decision of how much to transfer to the mother should not be conditional *on her disposition of the*

transfer.[15] If child expenditures are public goods, his opportunity cost of providing an additional dollar to the mother by means of a transfer will in general be a function of his income, her income, and her preferences [which are partially represented by ε].[16]

The preceding arguments imply the ordinary least squares (OLS) estimator of [5'] is in general inconsistent because of the failure of the mean independence assumption. However, it is true that a consistent test of the hypothesis of the privateness of child goods among divorced parents can be constructed using OLS estimates.

Proposition 4: The OLS estimator of [5'] is consistent given $E[\varepsilon|y_m,\underset{\sim}{z}] = 0$ *if* ϑ_m *is a private good.*

Proof: By $\mathcal{P}1$, when ϑ_m is a private good $\alpha_3 = 0$, so that $\varepsilon' \equiv \varepsilon$. By $\mathcal{P}2$, when ϑ_m is private, $\alpha_1 = \alpha_2$, so that we can write [5'] as

$$[5''] \qquad c_m = \alpha_0 + \alpha_1(y_m+s) + \underset{\sim}{z}\underset{\sim}{\delta} + \varepsilon.$$

When the good is private, the opportunity cost of transferring income to the mother is independent of her characteristics y_m, $\underset{\sim}{z}$ and ε, so in particular

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[15] We may have to modify this statement in the presence of a third party [*e.g.*, legal institutions], the objective of which is a function of the mother's expenditure patterns and upon whose actions the father's opportunity costs of tranferring resources to the mother depend. For example, while the father may not care directly about the mother's disposition of the transfer, judges may impose harsher penalties for failures to comply with child support obligations when there is evidence that the mother spends a large proportion of her income on child-specific goods. The relevance of such concerns is an empirical question.

[16] The father's opportunity cost of marginally increasing his transfer when the wealth distribution is in the set $\mathcal{E}_1$ will be zero. With random preferences of mother [and assuming homogeneity of tastes among fathers], we should actually define the sets $\mathcal{E}_i(\varepsilon)$ for all possible values of ε. Then given perfect observability of ε by father, the opportunity cost to the father of an additional dollar in child support transfer will only be positive if $(y_m+s, y_f-s) \notin \mathcal{E}_1(\varepsilon)$. The reader interested in the issue of compliance with child support orders is referred to Del Boca and Flinn (1990,1991) and Weiss and Willis (1989).

$E[\varepsilon|y_m,\underset{\sim}{z},s] = E[\varepsilon|y_m,\underset{\sim}{z}]$. Thus if $E[\varepsilon|y_m,\underset{\sim}{z}] = 0$, the OLS estimator of [5'] is a consistent estimator of the vector $\underset{\sim}{\alpha}$ under the assumption that the child good is private. □

In the following section, we will use OLS estimates to test the privateness of child goods using Proposition 4. The test statistics presented were all computed under the assumption that the disturbances ε are independent but with virtually no restrictions on the conditional variances $V(\varepsilon|y_m,\underset{\sim}{z})$ [using the Eicker-White heteroskedasticity-consistent estimator of the OLS covariance matrix; see Eicker (1967) and White (1980)]. Note that the null hypothesis is $\mathcal{H}_0$: $\alpha_1 = \alpha_2$ while the alternative is $\mathcal{H}_A$: $\alpha_2 > \alpha_1$, so that the test is one-sided. Rejection of the null hypothesis of the privateness of child goods implies that the OLS estimator is [in general] inconsistent. In this case, consistent estimates of $\underset{\sim}{\alpha}$ can be obtained given the existence of valid instrumental variables for y_m and s.

4. EMPIRICAL ANALYSIS

The data we use to test for the publicness of a child-specific goods come from the Consumer Expenditure Survey.[17] Because we desired to minimize problems connected with having a large proportion of the sample reporting zero expenditures on the expenditure aggregates and short-term fluctuations in normal income and expenditure processes, we decided at an early stage to utilize yearly income and expenditure measures. To obtain these yearly aggregates, it was necessary to match households on the quarterly survey tapes; this process was undertaken for the 1986-1989 period. Many households could not be matched across all the five quarters for which they could potentially be present; in addition, many households were lost to the final sample used in the empirical work due to missing data problems. As was mentioned in Section 3, these data only pertain to the mother's household. No information is available as to the characteristics, income, or expenditure patterns of the divorced father.

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[17] The Consumer Expenditure Survey is described in detail in BLS Handbook of Methods Bulletin 2285 (Bureau of Labor Statistics 1988, Chapter 18).

To be included in our final sample, we had to have been able to match the household's records in all five consecutive quarters of the survey. For each quarter, the household must have been headed by a divorced female and must have contained at least one [own] child under the age of 18. We also required the household to have a yearly after-tax income of at least $4000 dollars and not to have obtained its total income from child support and alimony payments. Our final sample consists of 161 households.

Our measure of child support income, s, is actually child support income *plus* alimony income.[18] We believe, as do Lazear and Michael (1988), that there is not a strong argument for attempting to disentangle the two. Under the null hypothesis that all income is "symmetric" in the Engel curve of the divorced mother, it clearly makes no sense to separate the two. Under the public goods model, *any* transfer by the father should have the same effect on the expenditure pattern decisions of the mother, so efficient estimators would be defined with respect to the sum of the two categories. The "own income" measure of the mother, y_m, is equal to after-tax yearly income minus child support and alimony receipts over the year-long period.

Two separate child-good aggregates are used in the empirical analysis. In constructing expenditures on the aggregates, only household expenditures on items for the use of household members were included [*i.e.*, expenditures on gifts for individuals not living in the household are not included in expenditures on the child-specific goods]. The more narrowly-defined measure includes only household expenditures on clothing for infants and boys and girls. This grouping consists of approximately 30 detailed expenditure categories for all types of clothing and footwear for children. While some of these items of apparel may be used by adults, the amount of "spillover" can be expected to be small.

The broader definition of child goods which we use includes all the apparel items described above plus expenditures on infant's furniture and

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[18] While the codebook for use with the CES tapes indicates that the alimony and child support information is collected separately, not one member of our sample reported separate amounts. This implies that either no one in our sample received alimony [an unlikely event], or that *de facto* the income sources are grouped by respondents, interviewers, or in the data processing stage.

equipment, toys, sporting goods, and recreational lessons. Clearly there is much more scope for the [direct] use of some of these items by adults [especially sporting goods and recreational lessons], though we assumed a large proportion of goods even in these categories would be purchased primarily for children. The mean of expenditures on the more broadly-defined measure of child goods is about 44% greater than the mean expenditure on children's apparel.

Table 1 presents descriptive statistics for the sample and includes the means and standard deviations of the income sources, expenditure categories, and the characteristics of the household which are incorporated in various ways in the regression specifications reported in Tables 2-6 and the Appendix. The total annual average income of the mother is [excluding the child support transfer] $16,527. If we exclude the cases in which no transfer is received, the average annual child support payment is $2,985; including the zero receipt cases lowers the mean to $1873. For the 101 women receiving child support, this source of income represents 19% of their total after-tax income on average; over all sample members, the average percentage of after-tax income from child support is 12%. The households spend a small but not trivial proportion of their income on the two aggregates we have defined as child-specific. The proportion of nonwhites in the sample, .22, is probably low with respect to the proportion of nonwhites in the population of households headed by divorced mothers because of the sample selection criteria we have used. The sample is relatively uniformly distributed across the United States.[19] The households contain more girls in the age range 2-15 than they do boys; this may be due to a higher probability of divorced fathers obtaining physical custody of their [older] sons than of daughters.[20]

Tables 2 and 3 report the results of OLS regressions and the tests for equality of the coefficients on mother's income and child support income using a variety of alternative sets of regressors representing characteristics of

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[19]The excluded indicator variable for area of residence is non-urban [in all regions].

[20]"Split" custody arrangements, in which each parent gains physical custody of at least one of the children, may have implications for expenditure patterns quite different from those associated with sole custody [of all children] by either parent. Due to data limitations, we are not able to pursue this issue.

TABLE 1

DESCRIPTIVE STATISTICS

(Sample Size = 161)

			Positive-valued Observations		
	Mean	St. Dev.	#	Mean	St. Dev.
Mother's Age	37.85	6.10			
Non-White Indicator	.22				
High School Diploma	.44				
Some College	.20				
College Grad or More	.20				
Northeast Urban	.23				
Midwest Urban	.29				
South Urban	.25				
West Urban	.16				
# Boys 2-15	.63	.77	76	1.33	.57
# Girls 2-15	.71	.68	95	1.20	.43
# Others in HH	1.38	.54			
y_m	16527.46	13000.19			
s	1872.68	2490.48	101	2985.17	2563.17
Child Aggregate	643.06	585.76	153	676.66	581.62
Child Clothes	446.73	411.17	139	517.43	398.95

the household. To make the testing exercise as transparent as possible, we have reparameterized [5'] by including the variables (y_m+s) and s in the regressions instead of y_m and s. By [5'] the coefficient associated with (y_m+s) is α_1 while the coefficient associated with s is $(\alpha_2-\alpha_1)$. Under the null, the coefficient associated with s should be 0, while under the alternative it is strictly positive. All specifications estimated condition on household composition: the number of boys between 2 and 15, inclusive; the number of girls between 2 and 15, inclusive, and the number of other members of the household not belonging to these two groups.[21] The regressions reported in Table 2 have the broadly-defined measure of child-specific goods as the dependent variable while those in Table 3 use apparel expenditures. The specifications reported in column 1 of both tables include no other regressors; column 2 specifications include (4) region indicator variables; column 3 specifications also include (3) schooling attainment indicators; and column 4 specifications also include the mother's age [linear and quadratic terms] and a non-white indicator.

Looking at the results reported in Table 2, we see that the estimates of the coefficients of interest, α_1 and $(\alpha_2-\alpha_1)$, are quite stable across the four specifications. Expenditures increase with the number of children in the household in an apparently reasonable way. These OLS estimates indicate that while about 1.2 cents of every dollar of the mother's "own" income is spent on the child-specific good, about 5.5 cents of every dollar of child support income is spent on the good. We now turn to the issue of deciding whether or not these differences are statistically significant enough to find in favor of the publicness of child goods.

The standard errors reported in brackets [referred to as Eicker-White] are consistent even when the error distributions are not identical in the population though they are still required to be independent. When the disturbances are not identically distributed and are not necessarily normal, the OLS estimate of $(\alpha_2-\alpha_1)$ divided by the Eicker-White estimate of its standard error has an asymptotic standard normal distribution under the null

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[21] Very few sample households reported any infants [*i.e.*, children less than two years of age], so that the residual category principally includes older children and adults.

TABLE 2

LINEAR ENGEL CURVE ESTIMATES AND TESTS FOR PUBLICNESS OF CHILD-GOOD AGGREGATE

[Heteroskedasticity-Consistent Standard Errors in Brackets]

Coefficient	*1*	*2*	*3*	*4*
Constant	36.117 [226.957]	-232.622 [232.802]	-312.160 [225.660]	-1681.118 [861.470]
(y + s)	0.012 [0.006]	0.013 [0.006]	0.012 [0.006]	0.011 [0.005]
s	0.043 [0.018]	0.042 [0.019]	0.038 [0.018]	0.031 [0.018]
# Boys 2-15	148.388 [61.530]	150.033 [62.248]	151.302 [63.139]	164.628 [66.313]
# Girls 2-15	325.645 [86.524]	313.866 [86.484]	328.441 [88.028]	366.821 [95.997]
# Others in HH	-22.457 [114.781]	-46.445 [116.177]	-31.634 [115.566]	-38.541 [119.594]
Region Dummies	*no*	*yes*	*yes*	*yes*
Schooling Dummies	*no*	*no*	*yes*	*yes*
Other Mother's Characteristics	*no*	*no*	*no*	*yes*
TEST STATISTICS:	2.318 (0.010)	2.247 (0.012)	2.109 (0.017)	1.689 (0.045)

hypothesis.

The test statistic for each regression specification is reported at the bottom of Table 2, along with the probability of obtaining that value of the test statistic under the null hypothesis [in parentheses]. As we can readily see, the differences in the coefficients are statistically significant at conventional significance levels in all cases, even in column 4 where a total of 16 parameters are being estimated using 161 observations. These results suggest that the broadly-defined category of child goods cannot be considered to be private.

Table 3 reports the results of performing exactly the same exercise using children's apparel as the dependent variable. The same general pattern of results is seen in Table 3 as was observed in Table 2. In particular, the estimates of the $\underset{\sim}{\alpha}$ vector are stable across the columns. While only about .6 cents of every dollar of own income is spent on children's apparel, about 2 cents are spent on this item out of child support receipts. From inspection of the test statistics reported at the bottom of the table, we can see that the probability levels of the test statistics under the null of privateness are less than .05 in all cases. Thus even using this narrowly-defined measure of child-specific goods, we reject the hypothesis that child-goods are private for divorced parents.

It is natural to question how sensitive our inferences are to functional form assumptions. While the assumption of linearity in income simplifies the testing exercise considerably, we have found similiar results when an Engel curve which is a quadratric in income was estimated. Given the properties of a quadratic approximation to a general nonlinear Engel curve, we can not expect the marginal propensity to purchase child-specific goods to be greater than the corresponding marginal propensity to consume child-specific goods out of other income everywhere in the sample space. Thus we first test solely for the marginal propensities to be *different* at some points in the sample space, and given the finding that they are, we compute how many of the sample observations exhibit a higher propensity to consume child-specific goods from child support income than from other income using the point estimates.

When a distinction is made between sources of income in expenditure decisions and the Engel curve is a quadratic [approximately] in the income

TABLE 3

LINEAR ENGEL CURVE ESTIMATES AND TEST FOR PUBLICNESS OF CHILDREN'S CLOTHING

[Heteroskedasticity-Consistent Standard Errors in Brackets]

Coefficient	*1*	*2*	*3*	*4*
Constant	75.910 [181.291]	-141.422 [187.496]	-222.173 [178.414]	-1562.415 [609.461]
(y + s)	0.005 [0.003]	0.007 [0.003]	0.007 [0.003]	0.006 [0.002]
s	0.021 [0.011]	0.022 [0.011]	0.021 [0.011]	0.018 [0.011]
# Boys 2-15	106.606 [47.478]	111.261 [47.876]	114.479 [48.553]	121.429 [52.571]
# Girls 2-15	269.762 [47.478]	281.026 [66.468]	279.698 [67.990]	305.393 [72.268]
# Others in HH	-27.767 [90.694]	-16.527 [104.641]	-11.918 [87.635]	-21.184 [89.555]
Region Dummies	*no*	*yes*	*yes*	*yes*
Schooling Dummies	*no*	*no*	*yes*	*yes*
Other Mother's Characteristics	*no*	*no*	*no*	*yes*
TEST STATISTICS:	1.883 (0.029)	1.974 (0.024)	1.916 (0.027)	1.655 (0.048)

sources, we have [from [5′]]

$$[6] \qquad c_m = \lambda_0 + \lambda_1 y_m + \lambda_2 s + \lambda_3 y_m^2 + \lambda_4 s^2 + \lambda_5 y_m s + \underset{\sim}{z}\underset{\sim}{\delta} + \varepsilon.$$

If no distinction is made between the income sources in making expenditure decisions, then three nonredunant restrictions emerge: (1) $\lambda_2 = \lambda_1$; (2) $\lambda_4 = \lambda_3$; and (3) $2\lambda_3 = \lambda_5$. These restrictions are imposed via the matrix R with the null hypothesis represented by $R\underset{\sim}{\chi} = \underset{\sim}{0}$, where $\underset{\sim}{\chi} = (\lambda_0 \ldots \lambda_5 \ \delta')'$. Assuming that the disturbances are independently distributed, the test statistic $(R\hat{\underset{\sim}{\chi}})'(R\hat{\Sigma}_{EW}^{-1}R')^{-1}(R\hat{\underset{\sim}{\chi}})$ is asymptotically distributed as a $\chi^2_{(3)}$ under the null hypothesis, where $\hat{\underset{\sim}{\chi}}$ denotes the OLS estimates of $\underset{\sim}{\chi}$ and $\hat{\Sigma}_{EW}$ denotes the Eicker-White estimate of the covariance matrix of the OLS estimates.

In Table 4 we present estimates of the linear-quadratic Engel curve models where the dependent variable is the amount spent on the broadly-defined child-specific goods aggregate. The test statistics for the null hypothesis of no distinction between the income sources in expenditure decisions appears at the bottom of the columns. We can see that the null is decisively rejected for all four specifications, as was true in the linear case. Looking at the estimates of the $\underset{\sim}{\lambda}$ vector, we see that there appears to be no significant interaction between the two income sources [locally], and that expenditures are a concave function of each income source. This pattern is consistent across all four specifications.

We can compute consistent estimates of the marginal propensities to consume child-specific goods out of the two income sources using the OLS point estimates. While the local quadratic approximation implies negative values of at least one of the marginal propensities for some sample observations, we find that 87.6% of all our sample observations had positive marginal propensities to consume the good from *both* sources of income *and* exhibited a higher propensity to consume out of child support income than from other income using estimates from column 1 of Table 4. This percentage was similiar across the other columns in the table [87.6%, 87%, and 87% in columns 2 through 4, respectively].

Table 5 contains Engel curve estimates for the case in which the dependent variable is children's clothing expenditures. Using this dependent variable, we also decisively reject the null hypothesis that the marginal

TABLE 4

LINEAR-QUADRATIC ENGEL CURVE ESTIMATES AND TESTS FOR PUBLICNESS OF CHILD-GOOD AGGREGATE

[Heteroskedasticity-Consistent Standard Errors in Brackets]

Coefficient	*1*	*2*	*3*	*4*
Constant	-295.033 [222.814]	-372.153 [242.730]	-386.503 [224.030]	-1203.137 [816.522]
y	0.035 [0.007]	0.033 [0.006]	0.032 [0.006]	0.030 [0.007]
s	0.192 [0.060]	0.199 [0.056]	0.198 [0.052]	0.189 [0.049]
y^2	-2.115E-07 [.609E-07]	-2.011E-07 [.602E-07]	-1.953E-07 [.602E-07]	-1.876E-07 [.612E-07]
s^2	-1.231E-05 [.466E-05]	-1.341E-05 [.417E-05]	-1.359E-05 [.395E-05]	-1.348E-05 [.375E-05]
*y*s*	-2.630E-06 [2.030E-06]	-2.268E-06 [1.788E-06]	-2.448E-06 [1.714E-06]	-2.330E-06 [1.674E-06]
# Boys 2-15	156.080 [57.460]	150.975 [58.132]	150.975 [58.364]	167.295 [60.657]
# Girls 2-15	343.070 [90.699]	320.211 [90.849]	334.730 [90.838]	369.100 [95.438]
# Others in HH	-27.703 [120.344]	-53.918 [121.382]	-44.091 [118.676]	-47.963 [121.330]
Region Dummies	*no*	*yes*	*yes*	*yes*
Schooling Dummies	*no*	*no*	*yes*	*yes*
Other Mother's Characteristics	*no*	*no*	*no*	*yes*
TEST STATISTICS:	9.502 (0.023)	12.730 (0.005)	13.394 (0.004)	13.985 (0.003)

TABLE 5

LINEAR-QUADRATIC ENGEL CURVE ESTIMATES AND TESTS FOR PUBLICNESS OF CHILDREN'S CLOTHING

[Heteroskedasticity-Consistent Standard Errors in Brackets]

Coefficient	*1*	*2*	*3*	*4*
Constant	-157.421 [181.410]	-253.502 [188.227]	-281.932 [172.689]	-1263.365 [563.375]
y	0.021 [0.004]	0.021 [0.004]	0.020 [0.004]	0.018 [0.004]
s	0.128 [0.036]	0.128 [0.031]	0.128 [0.031]	0.127 [0.030]
y^2	-1.294E-07 [.309E-07]	-1.271E-07 [.286E-07]	-1.232E-07 [.288E-07]	-1.111E-07 [.297E-07]
s^2	-8.661E-06 [3.333E-06]	-8.682E-06 [2.771E-06]	-8.696E-06 [2.804E-06]	-9.088E-06 [2.703E-06]
*y*s*	-2.235E-06 [1.022E-06]	-2.014E-06 [.821E-06]	-1.934E-06 [.845E-06]	-1.832E-06 [.836E-06]
# Boys 2-15	113.505 [45.086]	114.291 [45.453]	115.808 [45.660]	124.438 [49.354]
# Girls 2-15	283.039 [69.758]	288.085 [67.925]	285.778 [68.787]	308.043 [71.087]
# Others in HH	-29.719 [94.615]	-19.305 [91.243]	-18.789 [90.163]	-26.894 [91.203]
Region Dummies	*no*	*yes*	*yes*	*yes*
Schooling Dummies	*no*	*no*	*yes*	*yes*
Other Mother's Characteristics	*no*	*no*	*no*	*yes*
TEST STATISTICS:	9.739 (0.021)	12.874 (0.005)	12.699 (0.005)	13.825 (0.003)

propensities to spend are the same from the two income sources. We find evidence for an interaction effect between the two income sources in this case, but otherwise the pattern of results is much the same in Tables 4 and 5. The percentage of all sample cases for which both estimated marginal propensities to consume children's clothing are positive and for which the marginal propensity to consume this good out of child support income is greater than the marginal propensity to consume out of other income is 85.7%, 87.0%, 87.0%, and 86.3% across the four columns of Table 5.

We have also performed tests of the null hypothesis using a Tobit model which explicitly allows for the possibility of corner solutions [*i.e.*, zero expenditures on the child-specific good by the mother]; the results of these tests are reported in the Appendix. Since such a relatively small proportion of the sample observations make no expenditures on the child-specific good [.05 when the broad definition is used and .14 when children's clothing is used], the Tobit specification yields results very similiar to those found in Tables 3 and 4. In summary, all the evidence we have examined points to the existence of an income composition effect in the expenditure decisions of divorced mothers which is consistent with expenditures on child-specific goods conveying consumption externalities even after divorce.

Rejection of the null hypothesis of privateness generally implies that the OLS estimator will produce inconsistent estimates. As mentioned in Section 3, we can define a consistent instrumental variables (IV) estimator for $\underset{\sim}{\alpha}$ given the availability of instruments. Since we have such limited information on the mother's household and no information on the father's, finding such instruments is not an easy task. To get some notion of the sensitivity of the OLS estimates of $\underset{\sim}{\alpha}$ to the possible endogeneity of the income variables, we have estimated some IV regressions for the case of linear Engel curves only. Most of the instruments we use could easily be argued not to be valid, therefore not much faith should be put in the consistency of the estimates reported in Table 6.

We estimated regressions alternatively using the broad and narrow definition of child-specific goods as the dependent variable. For each dependent variable, we estimated [5'] first instrumenting both mother's own income and child support income and then instrumenting only child support income. Using the broad child-good aggregate, the results in column 1

TABLE 6

LINEAR ENGEL CURVES ESTIMATES
USING INSTRUMENTAL VARIABLES

[Heteroskedasticity-Consistent Standard Errors in Brackets]

	DEPENDENT VARIABLE			
	CHILD-GOOD AGGREGATE		*CHILDREN'S CLOTHING*	
Coefficient	*1*	*2*	*3*	*4*
Constant	-259.632 [299.522]	-77.877 [220.812]	57.872 [207.438]	57.518 [170.572]
y_m	0.019 [0.013]	0.012 [0.006]	0.004 [0.007]	0.006 [0.003]
s	0.095 [0.049]	0.125 [0.048]	0.037 [0.034]	0.039 [0.029]
# Boys 2-15	150.627 [61.356]	139.962 [62.425]	98.879 [49.787]	105.090 [48.070]
# Girls 2-15	344.029 [95.571]	319.659 [94.059]	262.987 [72.089]	268.617 [69.210]
# Others in HH	41.041 [113.75]	-16.054 [121.665]	-4.297 [89.602]	-25.840 [90.861]
Instrumented Variable(s)†	y_m, *s*	*s*	y_m, *s*	*s*
Elasticity w.r.t. $(s/(y_m+s))$‡	0.218 [0.166]	0.331 [0.143]	0.139 [0.157]	0.139 [0.129]

Notes:

† *The instruments were as follows:*
For y_m: *# Household Members - 1; Region; Schooling; Mother's age and age squared.*
For s: # Boys 2-15; # Girls 2-15; # Others in HH; Region; Schooling; Mother's age; Nonwhite.

‡ *For the definition of this elasticity see the text.*

represent increases in the size of the α_1 estimate of 58% and of 73% in the α_2 estimate over those obtained by OLS estimation. In column 2, where only child support income is instrumented, the increase in the estimate of α_2 is even more striking [127% greater than the OLS estimate]. In the case of children's clothing, the pattern of the results is essentially the same. Instrumental variable estimates of α_1 are very similiar to OLS estimates of the same parameter, but estimates of α_2 increase quite markedly in the IV regressions.

To conclude this section, we compute estimates of the elasticity of expenditures on the child aggregates with respect to a change in the proportion of the mother's total income represented by child support. If the child aggregate is a private good, this elasticity should be zero. The computed values of the elasticities using the IV estimates of α_1 and α_2 from each column are presented at the bottom of Table 6 [evaluated at the sample means of the variables] along with their asymptotic standard errors. A one percent increase in the proportion of the mother's income from child support increases expenditures on the child-specific good from between .14 to .33 percent in this illustrative calculation, though the elasticities are not precisely estimated.

5. CONCLUSION

We have provided evidence that the coefficients associated with child support [and alimony] income and other income differ in Engel curves for expenditures on child-specific goods in households headed by divorced mothers. While many possible explanations for such an empirical result exist, we believe that it provides strong *prima facie* evidence that significant consumption externalities remain for parents after divorce.

Whether or not consumption externalities exist after divorce, the modelling framework set out in Section 2 makes clear the fact that the welfare of divorced parents and their children [where the children's welfare is implicitly assumed to be a function of the expenditures by both parents on child-specific goods] can only be assessed by examining the expenditure patterns of both parents within a given model of inter-household behavior. For example, the fact that the share of expenditures on child-specific goods by divorced mothers is increasing in the share of their income which comes from child support may indicate that total expenditures on the child-specific good are increasing, decreasing, or independent of the level of child support transfers depending on whether or not their exist consumption externalities and the inter-household income distribution. Unfortunately, the development of models of interdependent household behavior which fully incorporate consumption externalities is made difficult due to the lack of appropriate data to use in estimation and testing.

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APPENDIX

In this appendix we report the results of estimating a Tobit model of expenditures on the child-specific good. In this case, we define a latent variable

$$[A.1] \qquad c_m^* = \underset{\sim}{x}\underset{\sim}{\xi} + \varepsilon,$$

where $\underset{\sim}{x}$ is a row vector of exogenous variables [including both the terms in income and the other household characteristics $\underset{\sim}{z}$] and $\underset{\sim}{\xi}$ is a conformable column vector of parameters. The random variable ε is i.i.d. normal in the population with mean zero and variance σ_ε^2. The mapping between the latent variable defined in [A.1] and the observed expenditure level is

$$[A.2] \qquad c_m = \begin{cases} c_m^* & \Leftrightarrow \quad c_m^* > 0 \\ 0 & \Leftrightarrow \quad c_m^* \leq 0 \end{cases}.$$

The parameters $\underset{\sim}{\xi}$ and σ_ε are estimated using a maximum likelihood estimator. Tests of the null hypothesis were derived by estimating the model under both the null [which implies restrictions on the quadratic function of the two income sources appearing in the "latent" Engel curve specification in [6]] and the alternative hypothesis [in which no restrictions on the quadratic function of the income sources are imposed in [6]]. A likelihood ratio test statistic is then formed which is distributed as a $\chi^2_{(3)}$ under the null hypothesis.

We only estimated specifications which included the quadratic function of the income sources and household composition variables [as in column 1 of Tables 2-5]. The results are reported in Table A.1. It is apparent that much of the nonlinearity in the income terms found in the regression specifications reported in Tables 4 and 5 arises from the zero expenditure cases in the data; in the Tobit specification, only for income from child support does there appear to be evidence for a statistically significant nonlinearity in the latent variable specification of the Engel curve. Given the quadratic specification of the latent Engel curve function, we do find evidence to reject the null hypothesis of the behavioral insignificance of the income source when using children's clothing and especially when using

TABLE A.1

TOBIT ESTIMATES OF LINEAR-QUADRATIC ENGEL CURVES AND TESTS FOR PUBLICNESS OF CHILD GOODS

[Asymptotic Standard Errors in Brackets]

	Child Aggregate		*Children's Clothing*	
Coefficient	*(R)*	*(UR)*	*(R)*	*(UR)*
Constant	-269.039 [229.063]	-336.375 [254.327]	-128.929 [158.397]	-197.769 [177.316]
y		0.036 [0.011]		0.022 [0.011]
s		0.195 [0.059]		0.133 [0.045]
$(y+s)$	.038 [.012]		.022 [.009]	
y^2		-2.208E-07 [1.637E-07]		-1.264E-07 [2.151E-07]
s^2		-1.246E-05 [.578E-05]		-9.391E-06 [3.742E-06]
$y*s$		-2.644E-06 [1.921E-06]		-2.252E-06 [1.605E-06]
$(y+s)^2$	-2.776E-06 [1.945E-06]		-1.694E-06 [1.474E-06]	
# Boys 2-15	183.650 [55.694]	173.537 [60.287]	153.302 [41.931]	153.353 [43.960]
# Girls 2-15	381.524 [70.715]	370.942 [67.593]	336.859 [46.676]	335.772 [45.542]
# Others in HH	-38.815 [70.670]	-55.043 [69.312]	-88.303 [50.035]	-89.633 [48.897]
σ	508.876 [22.483]	493.610 [22.785]	387.546 [20.385]	376.764 [19.594]
Likelihood Ratio Test Statistic		10.624 (.014)		7.666 (.053)

the broadly-defined child-specific aggregate.

For a given sample observation i, for a small change in the amount of income received from one of the sources, we calculate the marginal change in expenditures according to

$$[A.3] \qquad MPC_i(\nu) = \partial c_i^*/\partial \nu \; \mathbb{I}(c_i^* > 0) + 0 \cdot \mathbb{I}(c_i^* \leq 0), \quad \nu = y_m, s \; ;$$

where $\mathbb{I}(\cdot)$ denotes the indicator function. We found that 87.6% of the total sample exhibited positive marginal propensities to spend on the child-specific aggregate out of both income sources and had a greater marginal propensity to spend out of child support income than out of other income. The corresponding figure was 85.7% when expenditure on children's clothing was the dependent variable.