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Abstract: Recent years have seen the emergence of a theoretical literature exploring the economics of child labor. Though prior models nominally contain households with multiple children, all children are identical in their returns to labor-market and education activities. In the real world, of course, households composed of identical twins are the exception rather than the rule, and inherent heterogeneity may imply different returns to labor market and human-capital accumulation for different children. Indeed, there exists a prior empirical literature that identifies significant specialization across children within households vis-à-vis labor market and education activities. This paper explores such specialization both theoretically and empirically. We construct a model that allows child heterogeneity, diploma effects, and altruism from parent to children and child to parent. Our theoretical model identifies potential distortions (inefficiencies) in the time allocation across children of labor market obligations and education opportunities in poor households - even when the parents care equally about all children and their future consumption. We then employ a previously unanalyzed data set from Guyana to test the implications of our model.

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I. Introduction

Recent years have seen the emergence of a theoretical literature exploring the economics of child labor. Two important recent works in this area are Basu and Van (1998) and Baland and Robinson (2000). Though these and other prior models contain households with multiple children, they treat all children as homogeneous with regard to labor market earning potential and human capital accumulation. Consequently, all children are identical in their labor market time allocation and adult human capital stock. In the real world, of course, households composed of identical twins are the exception rather than the rule, and inherent heterogeneity may imply different returns to labor market and human-capital accumulation for different children. In turn, these differential returns may provide incentive for the unequal treatment of heterogeneous children. Indeed, we will subsequently review an extensive empirical literature that finds strong evidence of intra-household specialization among children across labor market and education. We will also present new evidence from a previously unanalyzed Guyanese data set of significant intra-household specialization among children.

Contrary to the common reflexive response, it is not *prima facie* evident that egalitarian treatment of heterogeneous children in the labor market and education system is desirable in all circumstances - even for the child who would appear shortchanged in education opportunities and unduly burdened in the labor market. Though most would agree that in an ideal world all children should receive the benefits of full-time education, and that no child should participate by necessity in an adult labor market, virtually all would agree that our world falls short of ideal. In a world such as ours, asymmetric

treatment (specialization) of heterogeneous children may even be beneficial for the (seemingly) disfavored child in the presence of intra-household and inter-generational transfers. The rationale is simple - comparative advantage.

Beyond incentives associated with comparative advantage, there are institutional features of both the labor market and education systems that may further contribute to the unequal treatment of children - and some of these may arise even in the absence of heterogeneity. Specifically, there are potential increasing returns to both labor market and human capital accumulation activities for individual children that may be lost when all children are treated identically. For example, two children with four years of education may earn less than one with eight years due to diploma (sheepskin) effects. Similarly, there may be labor market opportunities for a child willing to work eight hours a day that are unavailable to those who work four. Finally, there may be intra and extra-household gender bias that affect child returns to labor versus non-labor activity. These possibilities likely generate difficult decisions regarding child time allocation in multiple child households. Such decisions have not been considered in prior models.

In this paper we will develop a simple model to facilitate exploration of incentives for child specialization across labor market and human capital accumulation activities. We then assess the efficiency properties of children's time allocation and demonstrate that, in the absence of utility balancing second-period transfers, the division of labor-burden and education-opportunity across heterogeneous children is inefficient. The model allows child heterogeneity, diploma effects, and altruism from parent to children and child to parent. In this environment, optimal time allocation generally entails the unequal treatment of children - even when the parents care equally about all children and value

their future consumption. The remainder of the paper is organized as follows: Section II provides a brief child-labor literature review and surveys empirical evidence of the intra-household child specialization in labor-market/education time allocation. Section III presents the model, explores the efficiency properties of various outcomes, and considers policy implications. Section IV provides an exploration of child specialization in Guyana. Section V summarizes, concludes, and outlines further directions for research.

II. Literature Review

The child labor literature has experienced tremendous growth in recent years. Loci of attention include child labor in a historical perspective, works that employ primarily institutional and policy analysis, econometric analyses, and primarily theoretical pieces. Indeed, this literature has become so voluminous that a careful survey of these various literature strands would far exceed the size constraint of this paper. Fortunately, a recent *JEL* survey (Basu, 1999) draws together many of the disparate threads of the literature. Consequently, the discussion below will be limited to recent theoretical and empirical works of special importance or relevance to our interests - and even so we regretfully omit some important works in each category. Readers interested in a detailed literature review are referred to the above mentioned survey article.

Theoretical work on child labor accelerated rapidly following Basu and Van's (1998) seminal work on multiple equilibria in labor markets with and without child labor. The source of multiple equilibria in this model is simple and compelling. Namely, the augmented labor supply that obtains when children as well as adults are labor suppliers so depresses the equilibrium wage that child labor is necessary to maintain household

consumption at the subsistence level. Were all child labor eliminated the reduced labor supply might result in a wage sufficiently high that parents are not compelled to have their children work for wages. This result has important policy implications with regard to partial versus complete bans on child labor. Namely, partial bans on child labor may adversely impact precisely those they are intended to help.

A second recent important theoretical work is that of Baland and Robinson (2000). In contrast to Basu and Van (1998), Baland and Robinson focus on the efficiency properties of child labor supply and include consideration of the trade-off between child labor and human capital accumulation. In a two-period model that allows second period transfers between parent and child, they identify conditions under which the child labor supply is inefficient. Specifically, child labor supply is inefficiently high when bequests are at a corner and capital markets are imperfect. The intuition is that, due to capital market imperfections, parents have no mechanism for shifting consumption forward in time other than child labor. Borrowing against their children's future earning potential is precluded by its unenforceability.

Though these two recent theoretical pieces both constitute important contributions to different aspects of the child labor problem, neither addresses the possibility of intra-household specialization of heterogeneous children between the labor-market and human capital accumulation. While both models nominally allow multiple child households, and in equilibrium only some fraction of the child population may be employed, all children are homogeneous. As noted above, there is strong empirical evidence of intra-household specialization, and we believe the parental allocation decision *of their children* across

labor market and human capital accumulation activities is both important and potentially agonizing.

Though we are aware of no prior theoretical treatment of intra-household child specialization between labor and education, there has been extensive empirical investigation of intra-household specialization across the full range of activities - including child labor and education. One of the important early works in this area is Chernichovsky's (1985), whose empirical analysis school enrollment and attendance in rural Botswana suggests that: "...some children may be assigned to school and kept there on a comparatively regular basis, while others may be assigned to household and farm tasks." In section IV we will replicate Chenichovsky's analysis with new data from Guyana, and find similar results.

Cartwright and Patrinos (1999), in an investigation of child labor in urban Boliva also find support of Chernichovsky's child specialization hypothesis and findings. As they state: "The presence of siblings in the household reduces the likelihood and the extent of child labor by allowing for a greater division of labor. The greater the number of siblings, the more likely it is that the child attends school only, or combines work and school." We think this result is particularly important since it provides evidence that the specialization found by Chernichovsky in a strictly rural environment, is also found in a purely urban setting.

In an empirical analysis of schooling and child labor in Peru, Patrinos and Psacharopoulos (1995) find the number of siblings, and their activities to be an important influence on child labor - though they emphasize the need for more research on these complex interactions. Though there are number of ambiguities in their findings, they

provide additional evidence of specialization within the household vis-à-vis labor and school activity. Burki and Fasih (1998) explore the determinants of children's non-leisure time allocation in Punjab, Pakistan. They find strong intra-household sibling effects in child time allocation decisions. Specifically, they find that the probability of a child being able to specialize fully in education (no market labor) is strongly influenced by the number of other children in the 10 to 14 year age cohort. In addition to these treatments of intra-household child specialization, further discussion and numerous other references to specialization in child labor-education activities can be found in Grooart and Patrinos (1999, eds.)

Other recent important empirical works that explore child time allocation between work and school, but that we consider more tangential to our focus than the papers cited above, include Akabayashi and Psacharopoulos (1999) and Ravallion and Wodon (2000). Akabayashi and Psacharopoulos (1999) investigate the trade-off between child labor and human capital formation using time-log data from Tanzanian. They find a trade-off between study and hours worked, and that social conditions have a greater effect on hours worked than study hours. Hours worked are found negatively correlated with reading and mathematical skills.

Ravallion and Wodon (2000) exploit a targeted school stipend in Bangladesh to test the extent to which child labor displaces schooling. Though they find that displacement occurs, they find a much stronger positive effect on attendance (than a negative effect on labor supply). However, the displacement effect of child labor on human capital accumulation (as distinct from schooling hours per se) may be greater than these results suggest, since labor may first displace complementary (to schooling) human

capital activities such as homework, before school attendance directly. We believe both Akabayashi and Psacharopoulos (1999) and Ravallion and Wodon (2000) suggest simple measures of substitution of hours-in-school hours versus work hours may mask other deleterious effects of child labor on human capital accumulation. It is for this reason that we adopt a definition of “education” much broader than the narrow “hour-in-school” in the theoretical model which follows.

A final literature of relevance to this paper concerns diploma (“sheepskin”) effects. Diploma effects are discontinuities in the returns to education associated with degree completion. There is strong empirical evidence of these discontinuities in the highly developed at both the high school and college level (see for example Park 1999; Belman and Heywood 1997; Jaeger and Page 1996; Heywood 1994; Weiss 1988). Empirical evidence of education return discontinuities in the developing world are less voluminous and conclusive, but most analyzes identify similar effects. For example, Griffin and Cox-Edwards (1993), Patrinos (1995), and Shabbir (1991) all find significant non-linearities (or threshold effects) in returns to education in developing world settings. We believe such discontinuities may have important effects on the intra-household specialization decisions with regard to children’s time.

III. Model

Our model takes the basic structure of the Baland-Robinson model as a starting point and adds two new features: intra-household child heterogeneity and a diploma effect. As in Baland-Robinson there are two periods in the model and parents are treated

as a single decision-making and consumption unit. In the first period, the parents of our representative family supply L units of labor inelastically, receive a wage we normalize to 1 , make a labor supply decision for each of their two children, and choose a “saving” level (s).¹ Unlike Baland-Robinson, we do not impose a non-negativity constraint on saving - which allows borrowing against second period labor earnings ($s < 0$). We will demonstrate that capital market imperfection, which drives the Baland-Robinson result, is immaterial to our principal findings. Each child (i) is endowed with one unit of time during this first period to be allocated between labor (l_i) and human capital accumulation ($1 - l_i$). In the narrative and model which follow we will often use the term “education” and the phrase “human capital accumulation” interchangeably. This convention is adopted solely in the interest of brevity and notational convenience. Our intended interpretation of “education” is broad - it should be interpreted as referring to all non-labor time associated with human capital accumulation. One example of this distinction between our use of “education” and the narrow interpretation of “time in school” might be homework hours. In our usage, this time is as much “education” as time in the classroom. The implication of this interpretation is that child labor may substitute for human capital accumulation without affecting attendance per se - for example, a child who works after school and therefore has reduced study time. With this interpretation in mind, we adopt the notation $e_i = (1 - l_i)$, where e denotes time devoted to education.

As our primary focus is the differential treatment of children motivated by heterogeneity, each child possesses a unique talent parameters, a_i . Though we use the

¹ Wages throughout should be interpreted as the equilibrium price per efficiency unit of human capital. We do not explicitly model firms’ problem, but with a linear technology and the resulting zero profit condition their inclusion would be straightforward.

term “talent” throughout, the key implication of this heterogeneity is that it is associated with differential labor market returns and human capital accumulation in the first period. Therefore, despite our nomenclature, this parameter might be associated with various environmental factors, forms of discrimination (e.g., gender), or even age, as opposed to inherent “talent.”

Talent (a_i) potentially affects both the child’s first period wage ($w(a_i)$) and the effectiveness of time devoted to human capital accumulation, $e_i = (1 - l_i)$. Specifically, we assume a more talented child acquires a larger second period human capital stock (h) for a given time investment, than a less talented child. These relationships are captured in the following properties of the wage and human capital accumulation functions:

$$\begin{aligned}
 (1) \quad (i). \quad & w(a_i), \quad w'(a_i) \geq 0 \quad i = 1, 2 \\
 (ii). \quad & h_e^i(e_i, a_i) \equiv \frac{\partial h}{\partial e_i} > 0, \quad h_a^i(e_i, a_i) \equiv \frac{\partial h}{\partial a_i} > 0; \quad i = 1, 2 \\
 (iii). \quad & h_{ee}^i(e_i, a_i) \equiv \frac{\partial^2 h}{\partial e_i^2} < 0, \quad i = 1, 2..
 \end{aligned}$$

We will later modify the properties of the human capital accumulation function by introducing a discontinuity at degree completion points - the diploma effect.

Since the talent parameter is exogenous, parents’ choices in the first period are how to allocate their children’s time between labor and human capital accumulation and how much to save. During the first period the entire family is treated as single consumption unit and their total consumption is:

$$(2) \quad C = L + l_1 w(a_1) + l_2 w(a_2) - s.$$

In the second period there are three distinct consumption units, as the parents and each child form distinct households. Allowing for bequests and transfers, the consumption of the three representative second period households are:

$$(3) \quad \begin{aligned} (i). \quad & c_p = L - b_1 - b_2 + \tau_1 + \tau_2 + s \\ (ii). \quad & c_i = h(\ell_i, a_i) + b_i - \tau_i, \quad i = 1, 2 \end{aligned}$$

where b_i and τ_i are, respectively, bequests from parent to their i^{th} offspring and transfers from the i^{th} offspring to parents. As we interpret these as *net transfers*, it will always be the case that $b_i > 0 \Rightarrow \tau_i = 0$ and $\tau_i > 0 \Rightarrow b_i = 0$.

Of course, positive bequests or transfers require some incentive in an optimizing model. It is simplest, and sufficient for our purposes, to simply assume two-way altruism (parent-to-child and child-to-parent). Alternatively, we can appeal to bio-economic natural selection models in which bequests from parent to child are selection dominant strategies (see, for example, Rogers (1998)).

Consistent with these transfer motivations, and abstracting from discounting, the parent's and offspring's utility functions are, respectively:

$$(4) \quad \begin{aligned} (i). \quad & W = U(C) + u_p(c_p) + \delta_1 U_1(c_1) + \delta_2 U_2(c_2) \\ (ii). \quad & U_1 = u_1(c_1) + \gamma_1 W \\ (iii). \quad & U_2 = u_2(c_2) + \gamma_2 W, \end{aligned}$$

where the δ 's and γ 's are the (possibly asymmetric) altruism discount parameter from parent to offspring and offspring to parent.² Equations (4) constitute a 3x3 system with the following reduced form system:

$$(5) \quad (i). \quad W = \left(\frac{1}{1 - \sum_{i=1}^2 \gamma_i \delta_i} \right) \left(U(C) + u_p(c_p) + \sum_{i=1}^2 \delta_i u_i(c_i) \right)$$

$$(ii). \quad U_i = \left(\frac{1}{1 - \sum_{i=1}^2 \gamma_i \delta_i} \right) \left((1 - \gamma_i \delta_i) u_i + \gamma_i (U(C) + u_p(c_p)) + \gamma_i \delta_j u_j \right), \quad i, j = 1, 2.$$

Much of the analysis that follows will focus on the “efficiency” properties of parental choice of education/labor for their heterogeneous children. Our notion of efficiency is Pareto, allowing for appropriate transfers. Before delving into this analysis a precautionary comment about the limitation (or appropriateness) of efficiency analysis in the realm of child labor is in order. Specifically, we wish to state emphatically, that insofar as practical policy is concerned, it is our view that “efficiency” should be but one (perhaps minor) consideration in determining the treatment of heterogeneous children. Having said this, efficiency is a clear criterion for assessing the effect of various market imperfections on the parents’ (constrained) choices of education-labor tradeoff across children.

Before we begin analysis of optimizing behavior in this setting it is useful to consider the unconstrained efficiency properties of alternative allocations of heterogeneous children across labor market and human capital accumulation activities.

² A necessary condition for stability is $\sum \gamma_i \delta_i < 1$.

The general efficiency condition becomes obvious if one first considers the case where child “talent” affects human capital accumulation but not wages (as we might expect for the menial tasks typical of child labor). In this case, efficient child-time-allocation (e_i) clearly requires equating marginal returns to education across children: $h_e^1(e_1, a_1) = h_e^2(e_2, a_2)$. Then by analogy, when talent also affects child wages ($w'(a_1) > 0$) the efficiency condition becomes: $h_e^1(e_1, a_1) / w(a_1) = h_e^2(e_2, a_2) / w(a_2)$. That is, we now must equate the “price-adjusted” returns to education. This price adjustment reflects the fact that the opportunity cost of education may vary across children, and this must be incorporated in the efficiency condition.

How do the less and more talented children’s labor supply (education) compare under the efficient outcome? Suppose child “1” is the more talented child at human capital accumulation, so $a_1 > a_2$. By our assumptions on h (equation 1), equating the marginal returns to education ($h_e^1 = h_e^2$) requires (not surprisingly) that the more talented child receive more education, since for identical labor supply the rate of return to education for the more talented child will exceed that of the less talented. That is, efficiency requires that if $a_1 > a_2 \rightarrow l_1 < l_2$. So, the less talented child is consigned to additional time in the labor market.

We now examine the explicit optimization problems, beginning with the parent. As motivated previously, the reduced form parent objective function is:

$$(6) \quad \max_{e_i, s, b_i} W = \left(\frac{1}{1 - \sum_{i=1}^2 \gamma_i \delta_i} \right) \left(U(C) + u_p(c_p) + \sum_{i=1}^2 \delta_i u_i(c_i) \right)$$

subject to 2 and 3. The resulting first order conditions with respect to e_1 , e_2 , s , b_1 , and b_2 are respectively:

$$\begin{aligned}
 (7) \quad (i). \quad & -U' w(a_1) + \delta_1 u_1' h_{e1} \leq 0 \\
 (ii). \quad & -U' w(a_2) + \delta_2 u_2' h_{e2} \leq 0 \\
 (iii). \quad & -U' + u_p' \leq 0 \\
 (iv). \quad & -u_p' + \delta_1 u_1' \leq 0 \\
 (v) \quad & -u_p' + \delta_2 u_2' \leq 0.
 \end{aligned}$$

We first consider an interior solution to (7) with symmetric altruism. Manipulation of (i) - (v) yields the efficiency condition: $h_e^1(e_1, a_1) / w(a_1) = h_e^2(e_2, a_2) / w(a_2)$. Also note that the marginal utilities of children are equated ($u_1' = u_2'$).

Much of the remainder of the paper will focus on the case where bequests are at a corner. We believe that there are a number of good reasons to focus on this (seemingly) special case. The first is a “luxury axiom” applied to bequests/transfers. That is, there is likely a minimum consumption level below which no agent will undertake voluntary transfers. Indeed, such an assumption would be consistent with the observed mass point at zero transfers. Without such a threshold, we would observe a continuum of arbitrarily small transfers. Formally, a bequest-transfer luxury axiom specifies a second-period consumption level (\underline{c}) below which no agent will transfer positive amounts ($b_i = 0$ if $c_p < \underline{c}$ and $t_i = 0$ if $c_i < \underline{c}$).

Beyond the luxury axiom motivation (which is a convenient analytical device) there are ample reasons to doubt that parental forecasts of utility balancing bequests are

an important factor in determining child labor/education during primary school for very poor households. Principal among these must be uncertainty about the future incomes of all consumption units (parents and offspring). While we do not model this uncertainty, its existence can only weaken the influence of future utility balancing bequest forecasts on current decisions about child time allocation. As these bequests are, in fact, far distant from the child labor decisions that are our concern, we expect the influence of utility balancing bequest motivations in current child labor decisions to be of second order significance. Having said this, the interior bequest analysis above constitutes an important point of reference for all which follows.

We now explicitly analyze (6) when a corner solution in bequests obtains. Naturally, given our interest, we continue to consider interior solutions to the parent's choice of child labor (the l 's). We also maintain the interior solutions in saving/borrowing (s) as its presence or absence does not affect the distortion that arises in the treatment of heterogeneous children. Let \underline{e}^c , s^c denote the solutions to this problem when bequests are at a corner. Then from (7) (i) and (ii) we have:

$$(8) \quad u_1' h_e^1 / w(a_1) = u_2' h_e^2 / w(a_2).$$

It is clear then, that in this case the efficiency condition, $h_e^1 / w(a_1) = h_e^2 / w(a_2)$, is in general, not satisfied. The fundamental intuition for this failure is that if these households are too poor to expect future bequests to serve as a utility balancing device for their offspring, they must adopt a second best mechanism. The only means available for this balancing is through the (inefficient) first period adjustment of their children's human capital stock. The consequence is that instead of efficiently equating marginal returns to

education, parents' choice of labor/education equates the *marginal utility returns* to education.

A number of important questions now emerge that are quite amenable to empirical analysis. First, one can ask how the more and less talented children's education levels depart from the efficient level. The answer to this question is easier to discern if we again first consider the case where talent affects human capital accumulation, but not child wages. Then (8) becomes, $u_1' h_e^1 = u_2' h_e^2$. At the efficient allocation ($h_e^1 = h_e^2$) child 1 (the more talented) has a larger human capital stock and therefore higher second period income (h) and consumption. Therefore, at the efficient education level, $u_1' h_e^1 < u_2' h_e^2$. This inequality is brought into equality (8) by decreasing the education level of the more talented child and increasing the education of the less talented. To see this, simply note that both the return to education and second period marginal utility are inversely related to the first period education. Consequently, the inefficient constrained solution generates a more egalitarian distribution of human capital than the efficient outcome.

Can the "compression" in education between more and less talented children identified above ever lead to an absolute reversal of specialization? That is, a situation where the more talented child receives less absolute education than the less talented. The answer, perhaps surprisingly, is yes. To see that such a solution is in fact a possibility (is consistent with equation 8), first note that while $e_1 < e_2 \Rightarrow h_e^1 > h_e^2$ this does not imply $h_2 > h_1$. If the more talented child's absolute advantage in human capital accumulation is sufficiently great, it is quite possible to have $e_1 < e_2$ and $h_1 > h_2$ which implies that $u_1' < u_2'$. We can gain more insight into the conditions under which this reversal is likely to

arise by first considering the case where children are identical. Then in the absence of a diploma effect (discussed subsequently) $e_1 = e_2$, $c_1 = c_2$, $u_1 = u_2$, and efficiency obtains. Now using the implicit function theorem on (8) we can derive the following expression for the local (instantaneous) direct effect of an incremental change in talent on labor supply:

$$(9) \quad \frac{\partial \ell_1^*}{\partial a_1} = \frac{u_1'' h_a^1 h_e^1 + u_1' h_{ae}^1}{u_1'' h_{e_1}^2 + u_1' h_{ee}^1}.$$

The sign of the denominator is clearly negative. So the sign of this partial turns on the numerator, whose first term is unambiguously negative. We have heretofore made no assumption regarding the sign of the h -function cross-partial that governs the sign of the second numerator term. However, it seems most natural to assume that this cross-partial is positive. Then, in principle, an increase in talent can have a positive or negative effect on labor supply in this local analysis. Assuming the cross-partial is, in fact, positive, the direction of the effect can be linked to concavity of the utility function. To see this, rewrite the condition for a negative numerator in terms of absolute risk aversion:

$$(10) \quad -u''/u' > h_{ae}/h_a h_e.$$

With concave utility, inequality (10) will likely be satisfied for the poor household since risk aversion becomes arbitrarily large as consumption approaches zero. Though we have few precedents for the cross-partial properties of the human capital accumulation function there is little reason to expect such an explosive property.

When inequality (10) is satisfied, the distortion in the treatment of heterogeneous children (vis-à-vis the social efficient level) is towards *under-education* of the talented child, both relatively and absolutely. One might call this a reverse (or perverse?) specialization. Once again, it is useful to contrast this result with the efficient solution that obtains when bequests are positive. Specifically, it is immediate from $h_e^1 = h_e^2$ that more talent is associated with less labor (more education) under the efficient outcome. Clearly, a significant positive relationship between talent and wages would attenuate this effect, and it is possible for the comparative advantage in education to shift to the less talented child.

We have demonstrated that it is *possible* for more talent to actually increase the labor supply of its possessor. This analysis raises the interesting question of whether more talent could ever actually reduce the lifetime utility of a child. Such a contingency would raise complex moral hazard issues, since it might be possible for a talented child to conceal their true talent level in such circumstances. However, we can demonstrate that this perverse outcome (more talent lowering lifetime utility) cannot occur in our model. To see this, insert the constrained (no bequest) education solutions (which we denote $e^c(\underline{a})$) back into the reduced form objective functions (5) to generate value functions: $W^c(\underline{e}^c(\underline{a}), s^c(\underline{a}), \underline{a})$, $U_i^c(\underline{e}^c(\underline{a}), s^c(\underline{a}), \underline{a})$. Employing the envelope theorem on the model with full generality ($w'(a) \geq 0$) all indirect effects of talent through optimized values on the value functions can be ignored when deriving partials (of the value functions) with respect to talent. The welfare effect of an increase in talent for the possessing child and household are therefore simply:

$$U_{a_i}^i = u_i' h_a^i > 0$$

(11)

$$W_{a_i} = U' w'(a_i) + \delta_i u_i' h_a^i > 0.$$

Welfare of all family members is therefore non-decreasing in the talent of another family member. This is attributable to the mutual altruism that permeates the system - directly and indirectly.

Diploma Effects

One aspect of the child labor issue that we believe has been regrettably neglected is the impact of diploma affects on the specialization of children to labor market and education activities. As noted in the introduction, diploma effects are well-documented discontinuities in returns to education associated with degree completion. Figure 1 below provides a graphical representation of the human capital accumulation function (h) with diploma effects at e^{d1} and e^{d2} for primary and secondary school.

[Figure 1 -- attached]

Discontinuities, such as are illustrated in Figure 1, complicate the analysis of labor/education choice by parents - though the additional distortion they introduce is not difficult to anticipate. To analyze this distortion, first consider interior solutions to the optimization problem (6), which we denote \underline{e}^* , s^* , \underline{b}^* . Suppose the marginal conditions for an interior solution to the child education problem are satisfied at levels: $e^{i*} < e^d$ for $i = 1, 2$. Then substituting the solution values \underline{e}^* , s^* , \underline{b}^* into (6) again yields the value function $W^*(\underline{e}^*(\underline{a}), s^*(\underline{a}), \underline{b}^*(\underline{a}), \underline{a})$. As an alternative to this strategy the parents can also consider the utility yielded by having one child specialize sufficiently in education

that they reach the diploma threshold. This is equivalent to adding the constraint $e^l \geq e^d$ (we again let child l be the more talented). Now denote the solution to the problem subject to this constraint as: $\underline{e}^\wedge, s^\wedge, \underline{b}^\wedge$. Then a necessary (but not sufficient) condition for diploma acquisition to be the optimal household strategy is $h_1^\wedge + h_2^\wedge > h_1^* + h_2^*$ -- that is, if second period total income with specialization (and diploma) exceeds income without specialization. The sufficient condition is: $W^\wedge(\underline{e}^\wedge(\underline{a}), s^\wedge(\underline{a}), \underline{b}^\wedge(\underline{a}), \underline{a}) > W^*(\underline{e}^*(\underline{a}), s^*(\underline{a}), \underline{b}^*(\underline{a}), \underline{a})$.

We now consider the intra-household distributional consequences of the diploma effect, and the increased specialization it elicits when the sufficient condition holds. The first case to consider is that where the household is wealthy enough to have positive bequests in the second period. In this case (7) (ii) - (v), which are not directly affected by the discontinuity in h , are satisfied with equality. As in the prior analysis, parents are able to use bequests to fully balance the second period consumption of their heterogeneous offspring, and themselves. Since the diploma will only be obtained if total second period income is augmented, marginal utility of all consumption units is lower: $u_1^{\wedge'} < u_1^{*'}$. Then from (7) (iii) - (v) it is therefore also the case that $U^{\wedge'} < U^{*'}$, which indicates that first period income is also higher when the diploma is pursued. Since $l_1^\wedge < l_1^*$, this can only be accomplished if the child specializing in labor market activity *more than compensates* for the lost labor income of the child specializing in school. Thus, $e_2^\wedge < e_2^*$, and the diploma effect absolutely reduces the education received by the specialized child laborer.

We now turn to the second case - the corner solution in bequests and transfers. Again, this case may arise when households believe they will be too poor to provide voluntary transfers, or if uncertainty about future income attenuates incentives to allow

forecasts of second period utility balancing bequests to govern the household's choice of education-labor allocations in the first period. This case becomes easier to analyze if we assume: $h_e^1(e_1 > e^d) < h_e^2(e_2 < e^d)$. That is, if the returns to an increment of education *beyond* the diploma threshold is less than the marginal return to education for the child who has not yet achieved a diploma. This assumption would be consistent with the many empirical studies that find rates of return to primary education exceed those to higher levels and requires that the slope of the h^1 function beyond e^d for the diploma recipient is less than the slope of h^2 for $e < e^d$. So the child not yet attaining the primary diploma would receive any additional education. Again, we solve for the education level of the child specializing in labor market activity by treating the diploma level of education for the other child as a constraint: $e^i = e^d$. As the solution, if the diploma strategy is chosen, will be at the discontinuity for child 1, the standard marginal conditions governing their education (7)(i) will not be satisfied. The remaining optimization problem for the parents (after choosing $e^i = e^d$) is again the level of education for child 2 - the child not achieving the diploma. This choice is still governed by (7)(ii), as it is continuous. Though satisfaction of 7(ii) permits a balancing of marginal utility returns to education between first and second period for parent and child 2, child 1 remains outside this system.

The potential solution identified above (where one child receives a diploma and the second does not) could result in dramatic inequality between second period offspring. Could such an outcome be an optimizing solution for a parent who values both children equally? In the presence of the diploma discontinuity, the answer is yes. When parents do not have sufficient resources to balance second period utility through bequests, the sole remaining optimizing instrument is the labor/education allocation. In the solution

described above, the choice is reduced to having one or both children consigned to an adulthood (as well as a childhood) of poverty. Though the marginal utility of the specialized laborer exceeds that of the specialized student at the diploma discontinuity, the additive form of offspring utility in the parental welfare function means that for a sufficiently large diploma effect, the “rational” choice of the parents is the lesser of two evils - that is, an escape vehicle for one, but not both children.

Offspring to Parent Transfers

We now briefly consider the case where offspring provide net second period transfers to parents. We have chosen to de-emphasize this case previously since, given the structure of our model, the second period must be interpreted as the entire intersection of the post-primary life of offspring and parent. Though even in the poorest countries there are often life-cycle intervals when parents are net transfer recipients (from offspring), we think it rare that parents are net recipients during the full interval of their offspring’s post-primary life.

In modeling offspring-to-parent transfers, our inclusion of offspring heterogeneity necessitates a more sophisticated treatment of second period sibling interaction than is found in Baland-Robinson. In particular, we model a transfer game between heterogeneous siblings who may have been provided differential opportunities for human accumulation in the first period. In the interest of time consistency, this case must be solved recursively, from the terminal period. When the parent is the net second period donor, time consistency problems do not arise.

The second period optimization problem of each offspring is then:

$$(12) \quad \max_{t_i} U_i = k \left((1 - \gamma_i \delta_i) u_i + \gamma_i (U(C) + u_p(c_p)) + \gamma_i \delta_j u_j \right),$$

subject to (2) and (3), where $k = 1 / \left(1 - \sum_{i=1}^2 \gamma_i \delta_i \right)$. Assuming altruistic symmetry ($\gamma_1 = \gamma_2$, $\delta_1 = \delta_2$) for notational convenience, optimization by each offspring yields first order conditions:

$$(13) \quad - (1 - \gamma \delta) u'_i + \gamma u'_p = 0 \quad i = 1, 2.$$

These first order conditions can be interpreted as reaction functions in a transfer game between offspring in the sense that each equation defines an implicit function of the form $\tau_i(\tau_j, e_i)$. Note that from this second period perspective, the e_i 's are exogenous as parents chose them in the first period.

A Nash equilibrium in the transfer game simultaneously solves the equations (13) and yields solutions of the form $\tau_i(e_i, e_j)$. These equilibrium transfer functions are then internalized by the parent in their first period optimization problem. The parent therefore considers the effect on subsequent offspring-to-parent transfers of their choice of child education/labor. Clearly, a child who receives more education will have a higher second period income from which to finance transfers to parents. The parental first period choice of child labor then becomes the solution to:

$$(14) \quad \max_{e_i, s} W = k \left(U(C) + u_p(c_p) + \sum_{i=1}^2 \delta_i u_i(c_i) \right)$$

again subject to (2) and (3) but with the equilibrium transfer functions, $\tau_i(e_i, e_j)$, replacing the parametric τ_i 's of the prior formulation. Setting the w 's equal to one, the first order conditions with respect to e_1 , e_2 , and s are:

$$(15) \quad (i). \quad -U' + u_p' \left(\frac{\partial \tau_1}{\partial e_1} + \frac{\partial \tau_2}{\partial e_1} \right) - \delta \left(u_1' \left(h_e^1 - \frac{\partial \tau_1}{\partial e_1} \right) + u_2' \frac{\partial \tau_2}{\partial e_1} \right) = 0$$

$$(ii). \quad -U' + u_p' \left(\frac{\partial \tau_2}{\partial e_2} + \frac{\partial \tau_1}{\partial e_2} \right) - \delta \left(u_2' \left(h_e^2 - \frac{\partial \tau_2}{\partial e_2} \right) + u_1' \frac{\partial \tau_1}{\partial e_2} \right) = 0$$

$$(iii). \quad -U' + u_p' \leq 0.$$

Combining (15)(i) and (ii) and noting that equations (13) indicate that in equilibrium $u_1' = u_2'$ we obtain:

$$(16) \quad (u_p' - \delta u_1') \left(\frac{\partial \tau_1}{\partial e_1} + \frac{\partial \tau_2}{\partial e_1} - \frac{\partial \tau_2}{\partial e_2} - \frac{\partial \tau_1}{\partial e_2} \right) = \delta u_1' (h_e^1 - h_e^2).$$

We can now apply the implicit function theorem to (13) to derive the following expressions for the partials of the transfer function with respect to education:

$$(17) \quad (i). \quad \frac{\partial \tau_i}{\partial e_i} = \frac{(1 - \gamma \delta) u_i'' h_e^i}{\gamma u_p'' + (1 - \gamma \delta) u_i'' h_e^i} > 0 \quad i = 1, 2$$

$$(ii). \quad \frac{\partial \tau_i}{\partial e_j} = \frac{(1 - \gamma \delta) u_j'' h_e^j}{\gamma u_p''} > 0 \quad i, j = 1, 2.$$

Utilizing these expressions in (16) yields:

$$(18) \quad (u_p' - \delta u_1') (h_e^1 - h_e^2) (1 - \gamma \delta) u_1'' \left(\frac{1}{(\gamma u_p'' + (1 - \gamma \delta) u_1'')} + \frac{1}{\gamma u_p''} \right) = \delta u_1' (h_e^1 - h_e^2),$$

which can only be satisfied when $h_e^1 = h_e^2$. Therefore, when parents anticipate second period transfers from offspring *and* internalize the relationship between their labor/education choices and future transfers, they are able to balance utility through transfers and exploit first period comparative advantage through specialization.

Child Labor Bans and Mandatory Education

We now consider the efficiency implications child labor bans. Note that in our model, as in Baland-Robinson, a child labor ban is functionally equivalent to mandatory education time. We again consider the case where b and τ are at corners and talent has no impact on children's first period wages. As previously developed, without a ban (7i-iii) yield optimal solutions e_1^* and e_2^* . Now suppose a partial ban on child labor is imposed so that $e_i \geq \underline{e}$, $i = 1, 2$. If the ban is binding for both children ($e_i^* < \underline{e}$), education time will be set to \underline{e} . Given our assumption of heterogeneity, $h_e^1 > h_e^2$, and the constrained labor allocation is not efficient.

We now turn to the more interesting case where the ban is binding for one child: $e_i^* < \underline{e} < e_j^*$. If there is reverse specialization ($e_1^* < \underline{e} < e_2^*$) in the absence of the ban, its imposition will cause $e_1 = \underline{e}$ and from (7i-ii), we have $U_b' > \delta u_{1b}' h_e^1$, $U_b' = \delta u_{2b}' h_e^{2b}$. Since the ban reduces first period family consumption we also know that: $U_b' > U' \rightarrow u_{2b}' h_e^{2b} > u_2' h_e^2 \rightarrow e_2^b < e_2^*$. Therefore, $e_1^* < e_1^b = \underline{e} < e_2^b < e_2^*$, and the partial ban decreases the reverse specialization distortion. However, it cannot correct the efficiency problem ($h_e^{1b} > h_e^{2b}$).

Now consider the case without reverse specialization: $e_2^* < \underline{e} < e_1^*$. After the ban the solutions are $e_2 = \underline{e}$ and $e_1 = e_1^b$, and the following will hold: $U_b' > \delta u_{2b}' h_{\underline{e}}^2$, $U_b' = \delta u_{1b}' h_e^{1b} \rightarrow u_{1b}' h_e^{1b} > u_{2b}' h_{\underline{e}}^2$. In turn this implies: $e_2^b = \underline{e} < e_1^b \rightarrow c_2 < c_1 \rightarrow u_{1b}' < u_{2b}'$. Therefore it must be true that $h_e^{1b} > h_{\underline{e}}^{2b}$ and the education allocation under the partial ban is again not efficient.

IV. Empirical Analysis of Diploma Effects and Child Specialization in Guyana

In this section we present new evidence from Guyana of diploma effects and intra-household child specialization in education and labor-market activities. This section should be viewed as preliminary in nature, and at this stage our focus is on replicating the estimation procedures of Patrinos and Psacharopoulos (1997) and Chernichovsky (1985), and comparing results with those in Guyana. We begin with an overview of Guyana, the Guyanese data, and some casual evidence of diploma effects.

About the size of Wisconsin, Guyana is more integrated economically and culturally with the southern Caribbean than South America. Per capita GDP in 1993 (the survey year) was approximately US\$400. Guyana's education and judicial system (both of which affect child labor) reflect its British colonial past. We employ two data sets to examine child-labor in Guyana: the Household Income and Expenditure Survey (HIES) administered by the Guyana Bureau of Statistics and the World Bank's Living Standard Measurement Study (LSMS).

The HIES was conducted in 1992-93 and included four sub-rounds to a national sample of 7,392 households. The Guyana LSMS surveys were originally developed by the World Bank and designed to gather data regarding poverty and social welfare. Because

the LSMS survey was to take place at about the same time as the HIES, it was decided to link the two surveys. The HIES questionnaire substituted for the normal LSMS modules on income, expenditures, labor activities, household businesses, housing, durable goods, and savings. The LSMS questionnaire was modified to focus only on health, education, migration, fertility, and anthropometrics. With regard to child labor, we utilize HIES for all labor market information and the LSMS education module for schooling. This module contains information for each household member over the age of three years, including the level completed, type of school, years repeated, and ages first attended and last attended.

As in many developing countries, the incidence of child labor in Guyana is high relative to high-income countries. According to the participation question in HIES 10.10% of the children aged 9 to 15 years are participating in the external (to the household) labor market. The participation rate for children, decomposed by age is shown in Table 1 below.

Table 1 Distribution of child labor by the age

AGE (1)	TOTAL NUMBER OF CHILDREN (2)	CHILDREN IN THE LABOR MARKET (3)	PERCENT OF CHILDREN IN LABOR MARKET (4)	PERCENT OF TOTAL CHILD LABOR (%) (5)
9	178	11	6.18	8.46
10	159	6	3.77	4.62
11	185	13	7.03	10.00
12	207	20	9.66	15.38
13	204	20	9.80	15.38
14	188	25	13.30	19.23
15	166	35	21.08	26.92
TOTAL	1287	130	10.10	100.00

Table 1 reveals increasing participation rates with age – with one interesting exception. The break with trend at age ten coincides with (or immediately proceeds) completion of primary school for most Guyanese youth. This pattern would appear consistent with a primary education diploma effect since at (or near) a diploma discontinuity the opportunity cost of labor increases significantly.

A second piece of evidence of a diploma effect in Guyana is discontinuity in the distribution of the highest educational level attained. In this case we eliminate the age and self-employment affects by including only salaried workers over 18, virtually all of who have completed their lifetime education. If the market return to years of education were continuous, we would expect to observe a continuous choice of the highest educational level attained. As illustrated in Table 2, the distribution of education highest education level for this population is highly clustered. Grades 6, 9, 10, 11 and 14, which are associated with completion dates of primary and the various secondary programs, are much more popular than other terminal grades. Again, we believe this suggests a discontinuity in returns to the education in Guyana.

Table 2 Distribution of highest standard attained (AGE \geq 18)

HIGHEST STANDARD ATTAINED	FREQUENCY	PERCENT (%)
2	6	0.49
3	17	1.39
4	45	3.68
5	57	4.66
6	174	14.24
7	85	6.96
8	96	7.86
9	123	10.07
10	190	15.55

11	255	20.87
12	2	0.16
13	8	0.65
14	152	12.44
15	12	0.98
TOTAL	1222	100.00

We now turn from diploma effects to evidence of intra-household specialization in education and labor market activities. As a precursor, we first present the distribution of child labor participation by gender in Table 3 below. This data does not appear to indicate dramatically different role assignment by gender across labor market and education.

Table 3 Distribution of child labor by gender

SEX	TOTAL (9≤AGE≤15)	CHILDREN IN LABOR MARKET	PERCENTAGE OF TOTAL (%)	PERCENT (%)
BOYS	668	73	10.93	56.15
GIRLS	619	57	9.21	43.85
TOTAL	1287	130	10.10	100

While Table 3 would seem to contradict patterns of dramatic *gender* specialization found in other countries, there is evidence of more general intra-household child specialization across labor-education activities. Of the 47 households with multiple children and *some* child labor, half (24) show complete specialization -- some children working and others not in the labor force at all. The remaining 23 multiple child households with some child labor have all children working. Of course, even in households where all children work, some may work more than others -- that is, be relative labor market specialists. On the flip side, even in a household where all children

are enrolled as full-time students, some children may allocate relatively more time for human capital accumulation during out-of-class hours. It is these indirect affects among children engaged in dual working-schooling activity that Patrinos and Psacharopoulos seek to capture by exploring age-grade distortions and child labor. We believe there are potentially serious selection bias problems with their methodologies, but data limitations constrain many first-best remedies.

Following Patrinos and Psacharopoulos (1997) we construct a schooling-for-age (SAGE) index to measure the age-grade distortion. Specifically, letting “*grade*” be the current grade (in years), “*age*” current age, and “*afa*” the age first attended, β_e below is a measure of “overage” for those currently enrolled.

$$(19) \quad \beta_e = \frac{\textit{grade}}{\textit{age} - \textit{afa}}.$$

We next map β_e into a zero-one variable as follows:

$$(20) \quad \textit{overage} = \left\{ \begin{array}{ll} 1 & \textit{if } \beta_e < 1 \\ 0 & \textit{if } \beta_e = 1 \end{array} \right\},$$

where a $\beta_o < 1$ indicates the child is behind schedule due to either grade repetition or temporary withdrawal. For those currently out of school the corresponding age-grade distortion measures are:

$$(21) \quad \beta_o = \frac{\textit{hg}}{\textit{ala} - \textit{afa}}.$$

$$(22) \quad \text{overage} = \begin{cases} 1 & \text{if } \beta_o < 1 \\ 0 & \text{if } \beta_o = 1 \end{cases},$$

Where “*hg*” is the highest grade attended and “*ala*” is the age last attended school.

The assumption in the prior literature is that, all else equal, more labor effort will increase the likelihood of a child falling behind schedule in school due to repetition (grade failure) or temporarily withdraw from school. It is also presumed that the distribution of age-grade distortion within a household may shed a light on intra-household specialization. Unobserved heterogeneity aside, age-grade distortion is potentially a better measure of child labor’s full impact on human capital accumulation than enrollment since it can pick up the indirect labor burden affects, such as reduced homework time. Table 4 below presents age-grade distortion in our Guyana data.

Table 4 Frequency of age-grade distortion

	CURRENTLY ENROLLED		NOT ENROLLED	
	OVERAGE	NOT OVERAGE	OVERAGE	NOT OVERAGE
FREQUENCY	657	755	884	218
PERCENTAGE (%)	46.53	53.47	80.22	19.78

We now use the Guyana data to duplicate the Logit procedure used by Patrinos and Psacharopoulos (1997) in their study on child labor of Peru. Table 5 below provides regression results. In the first estimation above, we pool all siblings. The second estimation groups siblings into three age subsets: siblings of 6 years or below, between 7 and 18, and those over 18. With this decomposition all sibling groups have significant affect on the overage distortion at the 90% confidence level, at least. As in Patrinos and

Psacharopoulos, the presence of siblings under 6 is significant and positively correlated with overage distortion. Though one would suspect that this might be attributable to child-care obligations, the gender dummy is (surprisingly) insignificant.

Table 5 Determinants of age-grade distortion for children (LOGIT)

VARIABLES	Estimate 1		Estimate 2	
	COEFFICIENT	MARGINAL EFFECT	COEFFICIENT	MAGINAL EFFECT
CONSTANT	-1.9534*** (-7.947)	-.4566***	-2.2845*** (-8.018)	-.5319***
SEX+	-.0292 (.331)	.0068	.0148 (.167)	.0034
AGE	.2012*** (12.256)	.0470***	.2269*** (11.496)	.0528***
AGE SQUARE	-.0028*** (-7.366)	-.0007***	-.0033*** (7.856)	-.0008***
HHEDU	-.0082 (-.550)	-.0019	-.0095 (.628)	-.0022
NIBS (0-6)	--	--	.1041* (1.862)	.0242*
NIBS (7-18)	--	--	-.1624*** (3.970)	-.0378***
NIBS (19+)	--	--	-.0921* (1.750)	(- .0214*
NIBS OUT OF SCHOOL (6+)	--	--	.1150*** (3.875)	.0268***
NIBS	-.0065 (-.264)	-.0015	--	--
PER CAPITAL INCOME	-.00001** (-2.447)	-.000003**	-.00001** (-2.177)	-.000003**
EAST INDIAN+	.4606*** (3.591)	.1077***	.4815*** (3.670)	.1121***
BLACK+	.6062*** (4.669)	.1417***	.5954*** (4.443)	.1386***
CHI-SQUARED	347.9821		374.3848	
N	2527		2527	

Numbers in parentheses are t-values.

*- 10% Significance level, **- 5% Significance level, *** - 1% Significance level.

+ - Dummy variable, excluded variables, in order, are girl, non-East-Indian and non-black.

Contrary to Patrinos -Psacharopoulos, coefficients of the older sibling cohorts are negative. Though we are hesitant to tie this result strongly to intra-household specialization (as there are contradictory stories that may be told) it would appear that more siblings facilitate the education of some, if not all, children.

Qualified support for the intra household specialization can also be found in the impact of the number of siblings on the educational level of the household members. As noted previously, Chernichovsky (1985) found that in Botswana the number of children between 7 to 14 years old had a positive impact on the education level of the children enrolled at school. Following Chernichovsky we divide children into groups according to their schooling status to explore the effects of more siblings on enrollment in Guyana. Table 6 below provides OLS regression results. As in Chernichovsky, the number of working age child siblings has a positive significant impact on the educational status of enrolled children while the number of children out of school has a negative impact. Chernichovsky takes this result as evidence of intra household specialization, and we too believe this is one reasonable interpretation.

Table 6 Determinants of educational level (OLS)

INDEPENDENT VARIABLES	DEPENDENT VARIABLES: EDUCATIONAL LEVEL (YEARS)		
	CHILDREN ENROLLED	CHILDREN ENROLLED	CHILDREN OUT OF SCHOOL (5≤AGE≤16)
CONSTANT	12.6973 (.927)	14.8512 (1.078)	-809.9114*** (4.713)
SEX (BOY)+	-5.8551 (.978)	-5.6494 (-.923)	-3.9597 (-.253)
AGE	.8663 (.808)	.3873 (.353)	103.3552*** (3.686)
AGE SQARE	-.1796*** (9.377)	-.1953*** (9.999)	-3.2549*** (-2.889)
EDUCATION OF HOUSEHOLD HEAD	-.0143 (-1.102)	.0016 (.124)	-.0303 (-.843)
BADY PRESENT+	-3.4457 (-.509)	-3.5230 (.511)	166.6016*** (2.967)
NUNMBER OF PERSON OVER 60	9.0816*** (2.836)	12.5633*** (3.812)	4.3611 (.805)
NUMBER OF CHILDREN 9—16	7.8433*** (2.673)	--	-2.4998 (-.367)
NUMBER OF CHILDREN 9--18	--	9.7345*** (3.854)	--
LAND OWNED (Acres)	-2.0143*** (4.309)	-2.1455*** (4.455)	-9.0835*** (10.153)
PER CAPITAL INCOME	.0002 (.876)	.0002 (.984)	-.0005 (-.478)
EINDIAN+	-8.2113 (-.944)	-9.6322 (-1.082)	23.0438 (1.021)
BLACK+	-8.2669 (-.953)	-8.1677 (-.927)	34.1347 (1.383)
NUMBER OF OBS	1,419	1,460	214
ADJUSTED R-SQUARE	.2191	.2637	.4818

t-values in parentheses.+ excluded dummy variables, in order, are girl, no baby, non-East-Indian and non-black. * -- 90% significance level, **-.95% significance level.

V. Summary and Conclusion

Our objective in this paper has been to draw attention to a heretofore little explored dimension of the child labor issue – the role of heterogeneity and diploma effects in generating incentives for intra-household child specialization across education and labor market activities. We demonstrate that the time allocation of children across activities is not Pareto efficient in the absence of fully anticipated, utility balancing, future transfers or bequests. Moreover, we argue that there are numerous reasons to expect that child labor decisions in poor LDC households *are not* dictated by the expectation of future transfers. Rather, they are more likely driven by contemporaneous consumption requirements. Consequently, there is reason to suspect that intra-household child time allocation across education and market-labor in poor LDC households is not, in fact, efficient.

It is critical to note that the inefficiency illuminated by our model is entirely independent of the inefficiency in the Baland-Robinson model – the model most closely related to ours. The underlying source of inefficiency in their model is imperfect capital markets, and more specifically, the inability to shift consumption forward in time. Our model admits perfect capital markets, not because they exist in poor LDC environments, but to demonstrate their irrelevance to our results. The ultimate source of inefficiency in our model is the tension faced by altruistic parents between fully exploiting the comparative advantage of their children and their desire to balance their offspring's future utility. In the absence of a mechanism to assure future utility balancing transfers, the contemporaneous parental allocation of child-time across education and labor is the sole utility balancing instrument. The solution to parental optimization problem in this

environment is a compromise that sacrifices potential gains from comparative advantage for the altruistic imperative to balance their offspring's future utility.

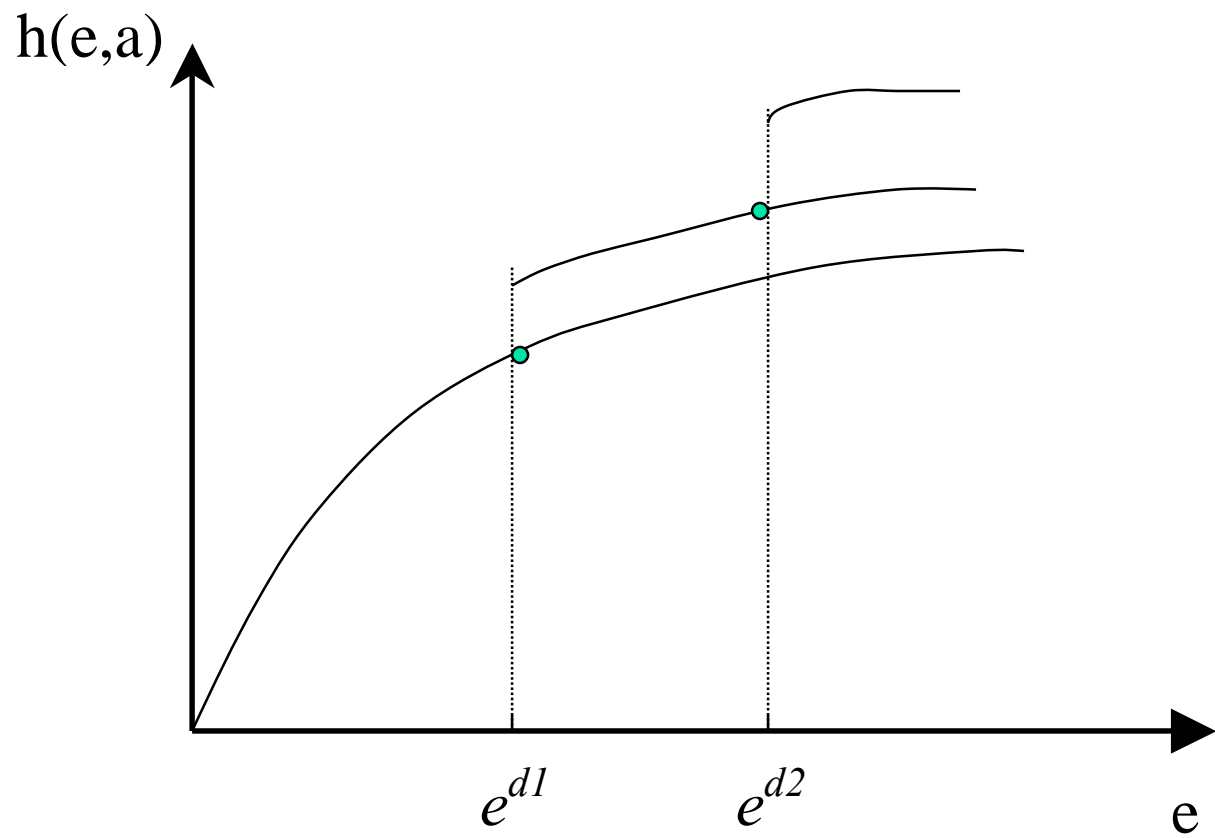
The manifestation of the inefficiency we identify is too much labor supply (too little education) for the child relatively talented in human capital accumulation. When the talent differential between children is large, we show that the distortion in time allocation across children can result in a “reverse specialization.” That is, a situation where the relative time allocation of children across labor and education reverses the pattern consistent with utilization of comparative advantage. In this case, the child more talented at human capital accumulation actually devotes more time to the labor market and less to education than the less talented child. We also argue that diploma (sheepskin) effects can have important impact on intra-household time allocation decisions, and can dramatically increase child specialization and subsequent income inequality. We also demonstrate that child labor bans – the policy focus of much of the prior literature – can only increase the inefficiency associated with child heterogeneity.

The final section of this paper is a preliminary empirical investigation of child labor in Guyana. Utilizing a previously unanalyzed data set, we replicate the procedures of two prior empirical explorations of intra-household child specialization across labor-market and education activities. The results in Guyana are generally consistent with prior findings, but more work needs to be done to satisfactorily separate age effects from the unobserved heterogeneity that is the focus of theoretical model.

Beyond the empirical work, a number of issues call for additional attention. From a modeling perspective, an OLG structure is preferable to the Baland-Robinson framework. Having said this, it seems unlikely that the range of issues addressed with the

current framework could be broached in an OLG setting and we believe that the inefficiencies identified would convey to an OLG model. In the policy dimension, it would be of interest to explore remedial government actions to correct the allocative inefficiency. One such possibility is a first period government education subsidy financed by a second period progressive (utility balancing) tax on the offspring. Finally, the very notions of heterogeneity and altruism, upon which the model rests, are themselves controversial. In the context of intra-familial resource allocation, the interaction of offspring heterogeneity and parental altruism may have natural selection motivations that lie at the boundaries of economic and biological analysis.

Figure 1 – Diploma Effect



References

Akabayashi, Hideo ; Psacharopoulos, George. "The Trade-off between Child Labour and Human Capital Formation: A Tanzanian Case Study," *Journal of Development Studies* v35, n5 (June 1999): 120-40.

Baland, Jean-Marie; Robinson, James A. "Is Child Labor Inefficient?" *Journal of Political Economy* v108, n4 (August 2000): 663-79.

Basu, Kaushik. "Child Labor: Cause, Consequence, and Cure, with Remarks on International Labor Standards," *Journal of Economic Literature* v37, n3 (September 1999): 1083-1119.

Basu, Kaushik and Van, Pham Hoang "The Economics of Child Labor," *American Economic Review* v88, n3 (June 1998): 412-27.

Belman, Dale and John Heywood. "Sheepskin Effects by Cohort: Implications of Job Matching in a Signaling Model," *Oxford Economic Papers* v49, n4 (October 1997): 623-37.

Burki, Abid and Tazeen Fasih, "Households' Non-leisure Time Allocation for Children and Determinants of Child Labour in Punjab, Pakistan," *Pakistan Development Review* v37, n4 (Winter 1998): 899-912.

Cartwright, Kimberly and Harry A. Patrinos (1999), "Child Labor in Urban Boliva," in *The Policy Analysis of Child Labor: A Comparative Study* (Grootaert and Patrinos eds.) New York: St. Martin's Press.

Chernichovsky, Dov, "Socioeconomic and demographic aspects of school enrollment," *Economic Development and Cultural Change* v33, n2 (January 1985): 319-32

Griffin, P. and A. Cox-Edwards (1993), "Rates of Return to Education in Brazil: do labour market conditions matter?" *Economics of Education Review*, 12, 245-55.

Grootaert, Christiaan and Harry A. Patrinos (1999). *The Policy Analysis of Child Labor: A Comparative Study* New York: St. Martin's Press.

Heywood, John S. "How Widespread Are Sheepskin Returns to Education in the U.S.?" *Economics of Education Review* v13, n3 (September 1994): 227-34

Jaeger, David A. ; Page, Marianne E. "Degrees Matter: New Evidence on Sheepskin Effects in the Returns to Education," *Review of Economics and Statistics* v78, n4 (November 1996): 733-40.

Park, Jin Heum, "Estimation of Sheepskin Effects Using the Old and the New Measures of Educational Attainment in the Current Population Survey," *Economics Letters* v62, n2 (February 1999): 237-40

Patrinos, Harry Anthony."Non-linearities in the Returns to Education: Sheepskin Effects or Threshold Levels of Human Capital?," *Applied Economics Letters* v3, n3 (March 1996): 171-73.

Patrinos, Harry A. and George Psacharopoulos, "Family Size, Schooling and Child Labor in Peru--An Empirical Analysis," *Journal of Population Economics* v10, n4 (October 1997): 387-405

Ravallion, Martin and Quentin Wodon. "Does Child Labour Displace Schooling? Evidence on Behavioural Responses to an Enrollment Subsidy," *The Economic Journal* v110, (March 2000): C158-C175.

Rogers, Alan R. "Evolution of Time Preference by Natural Selection," *American Economic Review* 84(3), (June 1994): 461-81.

Shabbir, Tayyeb, "Sheepskin Effects in the Returns to Education in a Developing Country," *Pakistan Development Review* v30, n1 (Spring 1991): 1-19

Tyler, John H.; Murnane, Richard J.; Willett, John B. , Estimating the Labor Market Signaling Value of the GED: *Quarterly Journal of Economics* v115, n2 (May 2000): 431-68

Weiss, Andrew. 1988. "High School Graduation, Performance, and Wages," *Journal of Political Economy*, Vol.96(4). pp. 785-820.