The Determinants of Child Labor in the Northeast and Southeast Regions of Brazil with Special Emphasis on Education*

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1 Introduction

Accordingly to a recent report from the Director-General of the International Labour Organization, see, ILO (2006), there are good news about the global problem of child labor: child labor is declining, and, the more harmful and hazardous the type of job, the faster the decline. However, citing the same source, the child labor is still a pervasive and pressing problem. Looking at Table (1) is easy to see that child labor reaches an average of 15.8 of the world's children.
The Report asserts that the decline was massive in Latin America, so as to *"... putting it on a par with some developed and transition economies"*.. However, an activity rate of more than 5% is not be comfortable about.

The issue of child labor is important once one starts thinking about its effects on child psychological, and educational achievements, as well as how that kind of activity could impact on child's future health. In fact, child labor has also deleterious consequences for the whole economy, as it reinforces

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Table 1: Global Trends in Child Labor

Region	Child Pop. (million)		Econ. Active Children (million)		Act. Rate	
	2000	**2004**	**2000**	**2004**	**2000**	**2004**
Asia and the Pacific	655.1	650.0	127.3	122.3	19.4	18.8
Latin America and the Caribbean	108.1	111.0	17.4	5.7	16.1	5.1
Sub-Saharan Africa	166.8	186.8	48.0	49.3	28.8	26.4
Other Regions	269.3	258.8	18.3	13.4	6.8	5.2
World	1,199.3	1,206.6	211.0	190.7	17.6	15.8

Source:

a sort of "poverty trap" among generations. By forcing their children to work, parents necessarily preclude their siblings from the benefits of good education, at least. These children will grow up as bad educated adults, which in turn will decrease dramatically their chances of getting a good source of income. They will became, than, poor parents, reinforcing the vicious circle of poverty.

In Brazil, the situation has improved after two decades of intensive application of national and local programs to reduce child labor, such as PETI, *Programa Nacional de Erradicação do Trabalho Infantil* (National Program for Eradication of Child Labor), and *Programa Bolsa-Escola*, (Program of Scholarships). Despite these efforts, there are many issues surrounding the determinants of child labor in Brazil. For instance, those programs apparently started without the due scientific scrutiny, also, very few was and is know regarding particularities how household structure and returns to education affect the amount of child labor. For all of this, the **Konrad Adenauer Foundation**, a German foundation that has a long and important presence in Brazil, decided to finance a project to understand the determinants of child labor and its reality.

For such an important and challenge task, the present project had to develop a strategy in order to deal with the complexities that surrounds the subject. By far the most challenging step is to deal with the huge amount of writings about the subject. To be frankly, one has to start reading the

writings of Karl Marx, to be sure not to miss any important piece of information. However, there should be necessarily a balance between scope and depth. So the next paragraphs describe the structure of this final report.

Section (2) builds a necessary survey of the theoretical literature regarding child labor. As outlined above, the literature is so vast that one can easily get lost on his way. The Section starts by describing the different approaches to model household decisions. Both unitary, non-unitary and strategic models are surveyed, given the necessary background to understand the modern literature. Following this first step, a necessary point of departure is the paper of Basu and Van (1998). Both because of its originality and conciseness this paper is a must. Next, the whole literature concerning the influence of credit markets imperfection on child labor is touched by means of the seminal approach contained in Baland and Robinson (2000). Finally, a modern and more comprehensive model of child labor is surveyed by means of the analysis of the model contained in Cigno and Rosati (2005). All the complexities appears now, and a big challenge rises in front of us. Fertility, credit constraints, returns to education, nutrition, and so on, all are different dimensions of the problem of child labor.

The important question of how returns to education affects child labor is the subject of Section (3). There one learns that education could be a cause as well as a consequence of child labor, so any attempt to include this variable in econometrics specifications must deal with simultaneity problems. Also, it is shown that not only child's education is a determinant of child labor decisions but also parents education do affect that decision, specially mother's education. At last, but not least, there are a lot of challenges if one decides to use returns to education in child labor models. Mainly because of that, few studies try to use that strategy, and when they do so it better have a good data set. Luckily, we have at our disposal a very detailed and under used data set, the PPV which is the subject of Section (4).

Section (4) describes the available data set, its strength and weakness. Because it is a household survey with a sound collection and sampling methodology, it looks strange to us why is it that this data set hasnot been used before for child labor research. Anyway, the PPV has the strengths of a representative household data set combined with very unique information regarding, especially, education and subject welfare assessments[1]. Present

[1]In fact, there are so many details that we were not able to explore all of the data strengths. This, of course, awaits further investigations.

at this Section is a preliminary empirical investigation. By mean of a set of Tables and Graphs, an initial picture of the determinants and complexities about child labor was drawn. Also, in line with econometric *praxis*, some behavioral aspects surrounding the phenomenon under analysis could be singled out.

As to empirical part, Section (5) deals with all econometric aspects of the project. It starts by claiming the adequateness of the multinomial logit model. Both because of its simplicity and easy of estimation, the logit model has been the choice of almost all those who estimate models of child labor. However, this section makes a point by stressing some implicitly assumption present on logit models, for instance the famous IIA hypothesis, and some difficulties on how to interpret results. At this very Section, parameters are estimated by maximum likelihood, and the corresponding marginal effects are calculated. A focused discussion about the results is also performed. Finally, Section (6).

2 A Survey of the Theoretical Literature on Child Labor

The aim of this section is to provide a survey about the main theoretical writings on child labor produced by economists. As simple as this appears, one can soon realize that this is a huge, and indeed very complicated task. First, the literature, as we will see, can be traced back into the past as deep as to meet some "classical" economists such as Karl Marx, Alfred Marshall and Arthur Pigou. Second, the contemporary literature experienced a enormous boost in the last two decades. According to Edmonds (2007), an Econlit search for the keyword *child labor* revealed more than 200 peer reviewed articles. Third, there are still so many different potential explanations for this very complex phenomenon that, with no surprise, there is a plethora of different models coexisting. Hence, any attempt towards successfully realization of a survey as proposed must take a very selective view.

The plan is to very briefly touch on the ideas of Karl Marx, Alfred Marshall and Arthur Pigou regarding child labor. This completes the present introduction and is based on Basu (1999). The survey continues on the next section by giving a sketch of the types of household models that served as inspiration for more recent models of child labor. More specifically, the unitary

and non-unitary approaches are developed succinctly, preparing the necessary background for progressing towards more recent approaches. After that the focus moves in the direction of papers that are key to understand the modern debate. The first one, an already classic, paper is Basu and Van (1998). The greatest importance of this paper is the fact that it presents a very complicated subject, i.e., a model that explicitly treats child labor, in a very elegant and concise way. Next, following an important branch of modern development economics studies, the credit constraint channel and its impact on child labor is brought into attention by the analysis of Baland and Robinson (2000). Finally, the more elaborate and complete approach of Cigno and Rosati (2005), specially as it is concerned to dynamics and fertility decisions, is studied in detail.

2.1 Household Modeling

The literature, both theoretical and empirical, on household economics, or family economics, can be traced back to seminal paper of Samuelson (1956), where he developed his "model of consensus", giving a first theoretical explanation for the unitary model of the household. The field has developed enormously, so one has to be very careful to avoid missing the point and getting lost on the way out. Next paragraph shows, then, the sketch of a basic model of a "single household". After that main broad approaches to "multi-person households", i.e., unitary, strategic and collective models are outlined[2].

Traditionally the economic approach to the economics of household has been to treat the entire family as a unique decision structure. This is so even if, arguably the most frequent situation, the household is comprised of more than one person. From that perspective the whole consumer theory could be applied and the orthodox individualism could be seamless maintained. Consequently, the decisions of the household could be described by means of the maximization of a (household) utility function with respect to a budget constraint. It is a textbook result that from that perspective one can come up with a set of testable restrictions based on the classical theory of the consumer. For instance, to name just two:

- household demands, as a function of the vector of commodities price and income, must be homogeneous of degree one;

[2]The paper of Donni (2007) is closely followed.

- symmetry and negative-definiteness of the Slutsky matrix.

However, since the pioneering work of Gary Becker on family economics, the way that economists approach the behavior of households has changed dramatically. In order to be more pedagogical, it is important to discuss the developments by way of two broad perspectives:

1. even though one still assume that the household is treated as a unique decision maker, its scope is enlarged, so as to view it as both a consumption and production unit. In the latter case, the household combines time of the agent with market goods in order to produce outputs. Also, non-market activities, such as fertility and children education, can under appropriate assumptions be can be the result of rational decisions;

2. devise theoretical perspective that justifies the fact that the household can be treated as a single decision maker even though this perspectives is hardly acceptable, unless in one person households.

The first perspective is due mainly to the seminal contributions of Gary Stanley Becker (Becker (1965), Becker (1974) and Becker (1991)), a University of Chicago economist, who one the nobel prize. Among his many interesting insights, two are very important and will be discussed now: the household, besides being a consuming unit, is also a producing unit, and, the "goods" produced by the household encompass also such things as children, health, education and so on. Below, it is developed the basic model of household behavior with domestic production.

The household is assumed to have the following utility function

$$u = U(c^1, c^2, \cdots, c^N) \tag{1}$$

where $c^1, c^2, \cdots, c^N$ denotes the set of N possible different goods that can be consumed by the household. Next is assumed that, using that N possible different goods as inputs together with the available time of the household as an additional input, there are N household production functions, one for each good:

$$c^j = f_j(t_j, q_j^1, q_j^2, \cdots, q_j^N) \tag{2}$$

with t_j representing the amount of time devoted to the production of commodity j and q_j^k for $j = 1, 2, \cdots, N$ and $k = 1, 2, \cdots, N$ meaning the

amount of commodity k used as input in the production of good j. To link the quantities used as inputs to the quantities produced and leisure (here understood is time not worked), the next constraints are set:

$$wL + \sum_{k=1}^{N} p^k q^k \geq y \tag{3}$$

$$L \geq \sum_{j=1}^{N} t_j \tag{4}$$

$$q^k \geq \sum_{j=1}^{N} q_j^k \tag{5}$$

where w is the wage, L the leisure time, p^k the market price of good k, produced by the household, y is the household income, and, q^k the amount produced of commodity k, where $k = 1, 2, \cdots, N$. The household problem turns to be the maximization of its objective function subject to these restrictions, i.e., the time and the input restrictions, that is,

$$\max_{t_1, t_2, \cdots, t_N, q_1^1, q_1^2, \cdots, q_N^N} U(c^1, c^2, \cdots, c^N) \tag{6}$$

subject to the constraints (3), (4) and (5). The solution of this problem is not trivial. However, there is a huge decrease in computation if the problem is treated in a two-step approach. First, minimizes the resulting cost function and the maximizes the utility function.

As simple as it appears this model has great generality. Its main contributions relies on the fact that the household is seen as a productive unit and the key insight that shadow prices play a fundamental role in the decision process of the household. For instances, as outlined by Donni (2007) *"... the negative relationship between fertility and wage rates can be explained by the fact that the increase in wage rate also raises the shadow price of children.[actually, the price of raising children]"*.

Despite its simplicity, the single decision maker model just outlined above is at odds with methodological individualism. Hence, to move on towards more credible models it is necessary to develop multi-person households model. Next, a simple model of a household comprised of a "husband" and a "wife" is developed. This is done with two objectives in mind: to present

a simple framework to show that with strong assumptions the unitary model still applies in the context of a multi-person household; and, to start thinking about real multi-unit household modeling approaches.

The household has two people, a "husband" and a "wife" whose subscripts will be $j = 1, 2$, respectively. The vector of household purchased goods is a vector $\mathbf{q} \in \mathbb{R}^K$. An important distinction is made on the possible uses of the purchased goods. There are three possible uses:

- husband's individual consumption, $\mathbf{x_1} \in \mathbb{R}^K$
- wife's individual consumption, $\mathbf{x_2} \in \mathbb{R}^K$
- joint consumption, $\mathbf{X} \in \mathbb{R}^K$

such that

$$\mathbf{x_1} + \mathbf{x_2} + \mathbf{X} \leq \mathbf{q} \tag{7}$$

The household budget constraint, given a vector of commodities prices $\mathbf{p} \in \mathbb{R}^K$, is

$$\mathbf{p}'\mathbf{q} \leq y \tag{8}$$

where y, as before, is the total exogenous household income. Now, we need to specify the form of preferences. There are at least three possibilities:

- each member of the household is completely selfish, in the sense that he or she only cares about his own and joint consumption of goods. This means that $u_i = u_i(\mathbf{x_i}, \mathbf{X})$
- each member of the household cares about each other. This means that $u_i = u_i(\mathbf{x_1}, \mathbf{x_2}, \mathbf{X})$
- each member of the household is altruistic, as it appears in Becker (1991). This means that $u_i = u_i(\phi_1(\mathbf{x_1}, \mathbf{X}), \phi_2(\mathbf{x_2}, \mathbf{X}))$

Clearly, the results that could emerge are dependent on which specification for the preferences is chosen. Besides that the problems of how the joint consumption is purchased (how much) and the bargaining process involved are left untouched. We will return to this point, but now it is important to understand some attempts to reconcile the complex bargaining process

involved in multi-person households with the use of a single decision maker model. The first attempt is the **Dictatorial Model**. According to that even though there are many people in a household, it is assumed the existence of a head who has complete power of all resources purchased and distributed in the household, as well as he or she controls all income sources. Although convenient, the dictatorial model is very unlikely to be a good characterization of how real households behave. Unless we are dealing with ancient type of societies or, although in this century, very underdeveloped type of societies, this assumption is wide open to severe criticism.

A second attempt is called the **Consensus Model** and is related to the contribution of Samuelson (1956). Different from the dictatorial model, where there is a unique utility function by way of the emergence of a (benevolent) dictator, in the consensus model this uniqueness arise from a sort of familiar consensus. I the words of Samuelson (1956) the choice of that welfare function considers *"... the deservingness or ethical worths of ... each of the members ... "*. The existence of such a welfare function means that the new maximization problem would be

$$\max_{\mathbf{x_1},\mathbf{x_2},\mathbf{X}} W(u_1(\mathbf{x_1},\mathbf{x_2},\mathbf{X}),u_1(\mathbf{x_1},\mathbf{x_2},\mathbf{X})) \tag{9}$$

subject to the constraints (7) and (8). This approach, however, faces some challenges. One special weakness of the consensus model has to do with the well known negative results regarding the aggregation of individual preferences of heterogeneous agents, i.e., the famous Arrow's Impossibility theorem.

The final attempt is due to Becker (1974) and is well known as the **Rotten Kid Theorem**. Gary Becker established that under certain assumptions, specially on the household members' preferences, the household members will act as if there is only one decision maker. According to Becker (1974) if it is assumed that the husband and the wife have, respectively, the utilities below:

$$u_1 = u_1(\phi_1(\mathbf{x_1},\mathbf{X}),\phi_2(\mathbf{x_2},\mathbf{X})) \tag{10}$$

$$u_2 = u_2(\mathbf{x_2},\mathbf{X}) \tag{11}$$

These preferences together with the assumption that each household member has non-negative personal income and take decisions independently to each other form the necessary set up to prove the famous theorem. In his proper words the Rotten Kid Theorem can be summarized by saying that *"Each beneficiary, no matter how selfish, maximizes the family income of his benefactor and thereby internalizes all effects of his actions on other beneficiaries. "*. The intuition is that not only the egoistic agent will agree to maximize the utility of the altruistic agent and internalize al of her action, but also the altruistic agent will behave optimally in the sense that he will refrain from taking actions that rises his own utility under her wife expenses (i.e., if it decreases even more her utility). As intuitive as it appears, Bergstrom (1997) showed that the Rotten Kid Theorem could fail. His famous "night-light" counter-example and his formal alternative reformulation of Becker's Rotten Kid Theorem has diminished the domain of applicability of this result. The Rotten Kid Theorem still is an important benchmark, though.

The unitary model has an important limitation: it does not consider the complex strategic and bargaining process involved in a household comprised of many agents. In order to consider these complications, "non-unitary approaches" or "multi-person household models" represent the alternative in terms of models. Although there are a multitude of different models, they can be divided between two sets: the **strategic approach** and the **collective approach**. In a nutshell, the strategic approach explicitly consider the strategic interactions between the members of the household. The methodological tools are supplied by game theory and the equilibrium concept is, of course, Nash equilibrium. The collective approach takes a very different point of departure. It does not discuss the nature of the decision process that occurs inside the household. However, it manages to address the main perceived weakness of the strategic approach, i. e., the fact that equilibrium outcomes are generally not Pareto efficient. Both approaches are detailed below[3].

In the **strategic approach** each member of the household[4] has an income

[3]Clearly the huge literature about the strategic and collective approach deserves a separate section, or even a whole paper. Notwithstanding that, for pragmatic reasons we need to be very selective. The readers should consult the references cited along the text if they want to deepen their knowledge on the subject.

[4]The assumption of the existence of only two members, the "husband" and the "wife", is kept for ease of exposition.

share out of the household total income[5]. Define ρ_i as the share of total income accruing to household member $i = 1, 2$, i. e., $y = \rho_1 + \rho_2$ and $\mathbf{X_i}$ the consumption of the public good of household member i. The budget constraint becomes

$$\mathbf{p}'(\mathbf{x_i} + \mathbf{X_i}) = \rho_i \tag{12}$$

Now, in the tradition of game theory, household member will maximize the utility function in order to get his/her reaction function. This becomes

$$\max_{\mathbf{x_i}, \mathbf{X_i}} u_i(\mathbf{x_1}, \mathbf{x_2}, \mathbf{X_1} + \mathbf{X_2}) \tag{13}$$

subject to the constraint (12). The reactions functions are

$$\mathbf{x_i} = \mathbf{x_i^*}(\mathbf{p}, \mathbf{x_i}, \mathbf{X_i}, \rho_i) \tag{14}$$

$$\mathbf{X_i} = \mathbf{X_i^*}(\mathbf{p}, \mathbf{x_i}, \mathbf{X_i}, \rho_i) \tag{15}$$

The next step is to find the household Nash equilibrium. Under certain regularity conditions, it is proved to exist at least one Nash equilibrium. If one allows to assume stronger assumptions, uniqueness of equilibrium can be obtained.

The strategic approach allows investigator to understand much better such phenomena as divorce, socially prescribed gender roles in the household, child bequests, out of wedlock children and so on. Is is a very well structured approach to household behavior that aims to substitute the unitary approach. It has, also, a set of testable restriction that could be used empirically do perform research and policy evaluation. However, it has a major drawback. By analogy to a voluntarily contributed public good, the strategic equilibrium is usually not efficient. The welfare of both members of the household could be augmented by increasing the consumption of the public good at the expenses of a decrease of the consumption of private goods. From this perspective, the approach advocated by Andre Chiappori stands as the seminal contribution to the collective approach to household economics. As it will be shown, Chiappori (1992) starts by requiring that the

[5]Note that the question of how these shares are divided is not explained by the model. To make things easier, we abstract from this problem and assume, for instance, that there is an exogenous and predetermined rule that maps exogenous variables into income shares.

equilibrium in the household must be efficient, and then, proceed to develop its results.

The basic model to understand the **collective approach** starts by assuming that whatever the process governing the decisions inside a household might be it must be efficient. As cited before, this is a complete departure from the strategic approach as there is no guarantee of Pareto efficiency. o make sure the outcome of the household decision process is efficient, Chiappori (1992)assumes that following welfare function is maximized

$$\max_{\mathbf{x_1},\mathbf{x_2},\mathbf{X}} \mu \cdot u_1(\mathbf{x_1},\mathbf{x_2},\mathbf{X}) + (1-\mu) \cdot u_2(\mathbf{x_1},\mathbf{x_2},\mathbf{X}) \tag{16}$$

subject to the constraints (7) and (8). The scalar μ is a weight that represents the "power" that each household member has along the the efficiency frontier of all possible welfare allocations. Following the main agenda, the objective of that model is to characterize the properties of the demand function of the household. From Chiappori (1992) and Browning and Chiappori (1998) a set of testable restrictions on individuals demand are outlined. The main restrictions are:

- [**SR1**]The Slutsky matrix is equal to the sum of a symmetric, semi-definite matrix and a rank-one matrix
- [**Linearity**] The Slutsky matrix is equal to the sum of a symmetric, semi-definite matrix and a linear combination of the derivatives of household demands with respect to distribution factors
- [**Proportionality**] The responses to different distribution factors are co-linear

A final remark is worth mentioning. The collective model allows the examination of collective labor supply models. These models treat explicitly the decision process that a household must go through in order to decide who will work and for how many hours. This is accomplished by explicitly treating the commodity "time" as a valuable resource[6]. The importance of the collective labor supply model can not be overestimates as it forms the basis to build models that deal with child labor. As a matter of fact, next section described a key paper on child labor based on a simple version of a collective labor supply model, i.e., Basu and Van (1998) contribution.

[6]Indeed, this is a key contribution to the household economics agenda since the seminal paper of Becker (1965).

2.2 Basu and Van (1998)

Although the problem of child labor was widespread all over the world and it was recognized as one of the worst problem for children future development, there is no attempt to synthesize all these problem into a simple, yet interesting, model of child labor. The paper Basu and Van (1998) appears as a important seminal contribution to the understanding of child labor. According to Cigno and Rosati (2005) state that *"Basus analysis of child labor has the merit of presenting what is a very complex problem in a relatively simple and compact way."*. The next paragraphs present a sketch of Basu and Van (1998) paper so as to serve as a theoretical benchmark for the estimation of the model stage.

To start understanding Basu and Van (1998) paper is important to visualize the reality that the author were immersed at the writing of their paper. It was the late 1990's, so at the outset we know there was a huge stock of information about the phenomenon of child labor. Indeed, a very detailed and precise stock of both quantitative and qualitative information regarding child labor. For instance, organizations such as UNICEF (United Nations' Children Fund), and more specifically ILO (International Labor Organizatioin), as well as considerable set of scientific papers[7] had made very clear the astonishing statistics related to child labor. As a matter of fact the authors cited a statistics, published by ILO, that says that there are 79 million child workers around the world in 1990. A second important point was the fact that society and governments as a whole have taken official steps towards fighting back child labor.

A concrete, and important, example of that was the famous Harkin's bill (Child Labor Deterrence Act of 1997), in the United States. In summary, this bill aims at imposing a ban on imported goods from countries that have used child labor as an input. Also, there were many examples of non-governmental organizations that aimed, by means of organized movements or boycotts, stop the imports of products labeled as "child labor intensive". Hence, the atmosphere was completely favorable to solve the child labor problem via a strong and massive movement of banning the child labor by force of a decreet. Actually, one of the main contributions of was to show that apparently well-intentioned legislation, such as the Harkin's bill, almost always have unintentionally bad side effects.

[7]The interested reader could check these references on the original paper of Basu and Van (1998).

Finally, the existing idea about the causes of child labor, according to Basu and Van (1998), were to some extent biased. The dominant idea was that *"child labor is very often equated with child abuse. The phenomenon is taken to be a product of avaricious entrepreneurs seeking cheap labor and selfish parents ..."*. In fact, Basu and Van (1998) do not deny the existence of the "avaricious entrepreneurs", but they strongly reject the portraying of the average parent, who send their child to work, as a selfish person. Actually, a key contribution of the paper was the fact that child labor is a rational response of a household head to a set of economic and institutional incentives and, as it, could be analyzed by means of economic tools. In their own words, Basu and Van (1998) state that *"... while not denying that child abuse does occur in all societies, we take the position that when we have children working as a mass phenomenon as in many less-developed countries, it is much more likely that this reflects ... the problem of stark poverty where the parents are compelled to send the children to work for reasons of survival."*. Hence, after realizing the prevailing reality regarding child labor issues in the late 1990's we can proceed to detail the formalism contained in Basu and Van (1998). It happens that a first look at their two axioms, i.e., **The Luxury Axiom** and **The Substitution Axiom Axiom**, is a necessary step to understand their model and results.

These axioms are defined below[8]:

Luxury Axiom 1 *A family will send the children to the labor market only if the family's income from non-child-labor sources drops very low.*

Substitution Axiom 2 *From a firms's point of view, adult labor and child labor are substitutes. More specifically, child labor can be substituted by adult labor.*

Basu and Van (1998) starts by defining the supply side of the economy. The following initial assumptions are worth mentioning:

1. There are N identical households, which one comprised of a adult and a child;

2. The preferences of the household are summarized by a preference relation defined on the space of consumption and child labor, i.e., $\{(c, e)|c \geq 0, e \in \{0, 1\}\}$;

[8]They are just an exact reproduction of what appears in Basu and Van (1998), page 416.

3. Adults supply labor inelastically;

4. Adult and child consumption are assumed to be the same.

Given that initial set of assumptions, the luxury axiom can be represented by the following relationships:

$$\begin{aligned} (c,0) &\succ (c+\delta,1) \quad \text{if } c \geq s \\ (c+\delta,1) &\succ (c,0) \quad \text{if } c < s \end{aligned} \tag{17}$$

where $\delta > 0$, $s > 0$ is the exogenously given subsistence level and $\succ$ is the usual strict preference relation. The constraint faced by the household is, given the assumption that parent and child have the same level of consumption:

$$2c \leq ew_C + w_A \tag{18}$$

where w_C and w_A are the child wage and adult wage, respectively. Than, the household problem[9] is to maximize the preference relation "$\succ$" subject to the constraint (18). The outcome of this maximization are the following supply functions

$$S^A = N \tag{19}$$

$$\begin{aligned} S^C = \quad & 0 \quad \text{if } w_A \geq 2s \\ & N \quad \text{if } w_A < 2s \end{aligned} \tag{20}$$

where S^A and S^C are adult supply and child supply functions, respectively. The natural next step is to characterize the demand for labor side of the economy. Basu and Van (1998) make the following assumptions regarding the technology of production:

1. There are n firms, each producing a homogenous consumption good;

2. Adults and children are substitute in production subject to an adult-equivalent scaling factor $\gamma \in (0,1)$;

[9]It is implicitly assumed that the child has no sovereign over his own labor supply. The adults choose if for him. In fact, most approaches to child labor use a similar setup.

3. Firms are wage taker in input markets;

4. The firm's production function[10] is given by $x_i = f(A_i + \gamma C_i)$, where it is assumed that $f' > 0$ and $f'' < 0$.

The firm's problem is as follows:

$$\max_{\{A_i, C_i\}} f(A_i + \gamma C_i) - A_i w_A - C_i w_C \tag{21}$$

The solution to the maximization problem described in (21), i.e., the aggregate demand for adult labor (D^A) and aggregate demand for child labor (D^C) is given by the following relations:

$$\begin{aligned} D^A &= 0 \text{ and } f'\Big(\frac{\gamma D^C}{n}\Big) = \frac{w_C}{\gamma} \text{ if } w_A > \frac{w_C}{\gamma} \\ D^C &= 0 \text{ and } f'\Big(\frac{D^A}{n}\Big) = w_A \text{ if } w_A < \frac{w_A}{\gamma} \\ f'\Big(\frac{D^A + \gamma D^C}{n}\Big) &= w_A = \frac{w_C}{\gamma} \text{ if } w_A = \frac{w_A}{\gamma} \end{aligned} \tag{22}$$

From that perspective, Basu and Van (1998) define a *labor market equilibrium* as a pair (w_A^*, w_C^*), such that

$$D^A(w_A^*, w_C^*) = N$$

$$D^C(w_A^*, w_C^*) = S^C(w_A^*) \tag{23}$$

A key point clearly made by the authors is the fact that an economy could exhibited multiple equilibria or one type of equilibrium. The multiplicity of equilibria could be summarized into only two types:

- A **good equilibrium** where only adults work, wages are high and there is no child labor;

[10] A_i and C_i represents the amount of adult labor and child labor employed by firm i, respectively.

- A **bad equilibrium** both adults and children work, adult wages are very low and children wages are even less.

One very interesting result of these types of equilibria is the fact that a so advocated ban on child labor could, in fact, be inefficient. The reasoning goes as the following. Suppose an economy has only one type of equilibrium, let us say the bad equilibrium. This could characterize very well an underdeveloped country or Britain during industrial revolution. Suppose a ban on child labor is proposed. It is not straightforward to see how the likely effects would be without a theoretical set up. However, Basu and Van (1998) show neatly that a ban could actually hurt the society. In fact, it could hurt the very ones that the ban was supposed to improve, the parents who send their children to work. To see that note that a ban on child labor will decrease[11] the supply of child labor, this will increase adult labor. But, as long as that increasing in adult labor does not compensate the decreasing on household's total income due to the fact that the child can not work, the intervention will hurt the poor. Hence, there are no grounds to back up a ban, unless the objectives *"stem from other hidden agenda such as protectionism or misguided concern for labor. Any argument for a ban has to be much more sophisticated."*.

Although Basu and Van (1998) developed a simple set[12], they are able to characterize in a very elegant way the complexities surrounding the world-wide phenomenon of child labor. The point that child labor is a "rational" reaction to economic incentives and the deep analysis of multiple equilibria and policies to combat child labor are the main contributions from Basu and Van (1998). The absence of dynamics, the lack of an explicit treatment for alternatives use of time (besides work) and the omission of credit channels are the main drawbacks of Basu and Van (1998). The next section, by way of understanding Baland and Robinson (2000), will fix some of these problems, especially the role played by (imperfect) credit markets[13] and dynamics.

[11] Actually, if the ban is perfectly implemented it will make $S^C(w_C) = 0$.

[12] These authors generalized their model, in that same paper, so as to include fertility issues as well as the possibilities of continuous child labor supply. Their policy conclusions and general results remain the unaltered, however.

[13] The important role of credit markets on a host of development issues has become a prevalent topic in the literature. An interesting reference for the interested reader is the book Bardhan and Udry (1999).

2.3 Baland and Robinson (2000)

The paper of Baland and Robinson (2000) incorporates important developments from the literature of overlapping generations model and imperfect credit markets into a coherent model of household decision about child labor issues. Parents, in a dynamic setup, will fail to internalize the efficient trade-off between child labor and (loss of) earning ability. This is a consequence of impossibility of leaving bequests for their children and/or imperfections in the credit markets that prevent parents from borrowing. We proceed to the model itself now.

The model consists of two periods, $t = 1, 2$. This a first important departure from static models, including Basu and Van (1998). There are L_p parents alive in the beginning of period 1. The number of children that each parent has is n, deterministically. Both parents and children live for two periods. The other agents in the economy run units of production (firms) that use labor to produce a *numeraire* good. These agents, and their firms, live for both periods as well. The timing of decisions is as follows:

1. [**FIRST PERIOD, t=1**] Parents decide how to allocate their children's unit time endowment between child labor and human capital accumulation. Parents supply and work inelastically. Parents can save.

2. [**SECOND PERIOD, t=2**] Parents supply and work inelastically, again. They also can leave bequests to their children. Now, children became adults and cycle of the household goes again.

There are a couple of interesting issues worth commenting. First, Baland and Robinson (2000) explicitly raise the issue of the trade-off between child labor and education. As long as they incorporate the decision by the parent regarding the level of time the child should devote to work, and, as it will be shown soon, this has future implications for child's earning ability, the trade-off stands as a key driving force in their model. Second, dynamics is finally modeled. Different from many antecessors, here included Basu and Van (1998), Baland and Robinson (2000) use a overlapping generation setup. Finally, mainly as a consequence of the dynamic setup, the sophistication brought by the fact that capital markets issues is another key development of Baland and Robinson (2000). In consonance with modern approaches to development issues, bequest-constrained economies and capital market imperfections play a prominent role in their paper. It is important now to describe some key assumptions and definitions:

1. Parents have, at each period, an endowment of A_i efficient units of labor, for $i = 1, 2$;

2. The amount of child labor chosen by parents is given by $l_c \in [0, 1]$;

3. If parents have chosen for a given child a value of l_c of child labor in period $t = 1$, this child in period $t = 2$, now an adult, has an additional amount of endowment of labor of $h(1 - l_c)$. Where the function h is twice continuously differentiable, strictly increasing, and strictly concave with $h(0) = 1$;

4. The markets for young and old parental, child, and adult labor are all competitive with respective wage rates of w_{p1}, w_{p2}, w_{c1}, and, w_{c2};

5. c_p^1, c_p^2 and c_c represent parental consumption at $t = 1$, parental consumption at $t = 2$, and, child consumption, respectively.

For easy of exposition, the authors set $w_{p1} = w_{p2} = w_{c1} = w_{c2} = n = 1$. Along the lines of Becker (1991), the parental utility functions is given by

$$W_p\big(c_p^1, c_p^2, W_c(c_c)\big) \equiv U(c_p^1) + U(c_p^2) + \delta W_c(c_c) \tag{24}$$

where U and W_c are both twice continuously differentiable, strictly increasing, and strictly concave. The exogenous parameter $\delta \in (0, 1)$ measures the degree of altruism that parents have in relation to their children. Besides having to choose l_c, parents can decide to give their children transfer, at $t = 2$, or save. These two choice variables are denoted by $b \geq 0$ and $s \geq 0$. Note that the non-negative constraint on savings reflects a key assumption of the model: agents are credit constrained, so parents can not borrow. This specific kind of capital market imperfection will play an important role in the paper's results.

Hence, parents face the following three budget constraints,

$$c_p^1 = A + l_c - s \tag{25}$$

$$c_p^2 = A - b + s \tag{26}$$

$$c_c = h(1 - l_c) + b \tag{27}$$

Then, the problem faced by the parent in the household is to maximize

$$\max_{b,l_c,s} U(c_p^1) + U(c_p^2) + \delta W_c(c_c) \tag{28}$$

subject to the constraints (25), (26) and (27). The first order conditions with respect to b, l_c and s are, respectively

$$\begin{aligned} U'(c_p^2) &= \delta W_c'(c_c) \text{ and } b > 0 \\ &\text{or} \\ U'(c_p^2) &> \delta W_c'(c_c) \text{ and } b = 0 \end{aligned} \tag{29}$$

$$U'(c_p^1) = \delta W_c^{'}(c_c) h'(1 - l_c) \tag{30}$$

$$\begin{aligned} U'(c_p^1) &= U'(c_p^2) \text{ and } s > 0 \\ &\text{or} \\ U'(c_p^1) &> U'(c_p^2) \text{ and } s = 0 \end{aligned} \tag{31}$$

To start understanding the key results from Baland and Robinson (2000) it is necessary to understand the conditions under which the efficient level of child labor emerges. It is a textbook result that the amount of child labor is efficient if equates the marginal return of education to the its opportunity cost in terms of lower child labor. In our case this means that l_c^* is the efficient amount of child labor if:

$$h'(1 - l_c^*) = 1 \tag{32}$$

Therefore, following the same reasoning, child labor will be inefficiently high when $h'(1 - l_c^*) > 1$ with $l_c^* > 0$. Baland and Robinson (2000) proceed to developed their main findings by means of a set of propositions. To understand the relevance of their results, we apply the following strategy: first, write down the original proposition[14], and then, discuss the relevant issues.

[14]Of course, given the scope of this book all proofs are omitted here. However, we insist that the interested reader try to follow the derivations presented in the original paper. In fact, and that is one of the beauties of Baland and Robinson (2000)' paper, the proofs demand only differential calculus as the mathematical tool.

Proposition 3 *[Baland and Robinson (2000), pp. 669] If bequests and savings are interior, then the laissez-faire level of child labor is efficient.*

Proposition (3) establishes a benchmark of efficiency from which is possible to analyze departures from that point. A first point worth discussing is the fact that the term "efficient" is used to characterize the level of child labor chosen by the household head. This perspective is perfectly aligned with Basu and Van (1998)'s view that the best perspective to start up the analysis of child labor is to accept the fact that economic incentives are a major driving force of that phenomenon. Also, this a powerful reminder that a naive, romantic claim that at any cost child labor should be banned is not efficient once you employ a more accurate economic analysis. A second issues is the fact that, by no means a great surprise, the existence of bequests and the well functioning of the credit market by way of savings are conductive for the achievement of efficient allocation of resources, in our case child labor. Next, the impossibility of leaving bequests turns out to cause an inefficient allocation of child labor.

Proposition 4 *[Baland and Robinson (2000), pp. 669] If bequests are at a corner, then* $h'(1 - l_c^*) > 1$ *and the laissez-faire level of child labor,* l_c^**, is inefficiently high.*

In the case that $b = 0$, i.e., the parent can not left bequests, there is an intrinsic inefficiency. Now, parents fail to internalize the effects of child labor, even though they are not credit constrained. To understand better this channel of reasoning, it is interesting to note first how is possible to have bequests equal to zero. 3 show that a small income from labor and a lack of enough altruism are the two driving forces that lead parents to have a zero level of bequest. Following their own words *"From the first order conditions one can easily see that bequests are more likely to be at a corner [*$b = 0$*] the lower A and* δ *are."*, and they are emphatic in asserting that *"... the extent of child labor and its inefficiency can be interpreted as due to either poverty or lack of altruism."*. So, poverty and lack of altruism are the culprits.

Suppose that the parent is poor, he would probably choose not to leave bequest to his children because there is no enough money to spend with his own consumption in both periods and his children's consumption as well. Also, given that he is poor he will likely make use of the income generated by his children's labor. So, the parent would rather not use that much his

children labor if it was possible to be compensated in the second period. But, the only way of this happening is to believe that their children could enter in a kind of contract that trades off less child labor in the first period for a transfer of income from their children in the first or second period. This transfer will not happen in the first period simply because children has no income and it will neither happen in the second period because these promises are obviously not credible. The second possibility, i.e., a lack of altruism works as a preference shift. Its obvious implications are that, by being less altruistic, the parent does not care that much about their children's welfare, so a consequence is to not let bequests. The following proposition demonstrate that key role played by credit markets on the efficient use of child labor.

Proposition 5 *[Baland and Robinson (2000), pp. 670] If savings are at a corner, then the laissez-faire level of child labor, l_c^*, is inefficiently high.*

The point now is that, even if the parent internalize the cost of child labor by leaving a non-negative bequest, the constraint on borrowing and the implicitly search for consumption smoothing let the household with a unique source for transferring more income into period 1: child labor. This is a very elaborated setup to see the implications of credit constraints and offers a nice opportunity, by inspecting samples that come from credit programs campaigns, to test the theory. Baland and Robinson (2000) also build a model that incorporates two-sided altruism and obtain analogous results: the existence of perfect capital markets is a necessary condition to obtain an efficient level of child labor, and, it is necessary both perfect capital markets and positive transfers to achieve an efficient level of child labor. The authors also touch upon the topic of endogenous fertility and assert that the effect of child labor is in general ambiguous, unless the change in child labor is exogenously motivated, such as, for instance, in a ban. In that case, the effect of a reduction in child labor is to decrease fertility. Next paragraphs will describe the main general equilibrium and policy implications of the paper.

Proposition 6 *[Baland and Robinson (2000), pp. 675] With a linear technology of production, a marginal ban on child labor is a Pareto improvement when bequests or savings are at a corner.*

This result stands as an important contribution by virtue of the following:

1. it offers an indisputable corollary in terms of policy to reduce child labor, i.e., reduce the hours children are allowed to work;

2. it is of general applicability, since it can be applied to remedy situations where child labor is being used above its efficient level either when this overuse is caused by lack of bequests or by imperfections in credit markets or both;

3. it gives a "positive answer" to Basu and Van (1998) concerns regarding the likely welfare impacts of a ban on child labor[15].

As neat as proposition (6) appears, it restricts its results to a very special kind of technology of production, the linear case. The authors go on and generalize the technology of production as to make it non-linear, although separable in parental and child labor. They obtain a similar positive result regarding the Pareto-efficiency of interventions such as marginal bans on child labor[16]. Others types of policy interventions that look like the marginal ban, such as a firm decides unilaterally not to employ children, or, a country decide not to import goods produced using child labor as input, can has its effects analyzed by the same point of view. Although the authors are cautions about extending their results to more complex scenarios without the aid of a more detailed model, they justify the use of the following type of interventions/policies in real economies:

- a massive program of human capital creation, by means of governmental subsidies;

- programs that trades off consumption (both parental and children) for child education, such as **PROGRESA** in Mexico or **BOLSA ESCOLA** in Brazil;

- A tax on child labor.

[15]One should be careful at this point. The term "positive answer" must be understood in context where there are two different models being compared.

[16]In fact, this result should be contextualized. According to Basu and Van (1998), their proposition holds only when there is a specific coincidence of values for the elasticities of consumption and wages for parents. See the original proposition on Basu and Van (1998), page 677.

By virtue of clarifying the role played by credit market imperfections, Baland and Robinson (2000) paper stands as an important contribution to the determinants of child labor. Nevertheless, there are still important features of reality not attended in their paper. Among important omissions, it would be important to have appearing in a model of child labor:

1. the quality-quantity trade off of children and its obvious implications for fertility decisions and for child mortality;
2. a better description of the human capital process, as to allow the discussion of quantity and quality of schooling;
3. gender issues;
4. heterogeneity, as to make possible to asses the effect of income inequality on child labor
5. international international trade.

From the list above, the next paper to be analyzed, i.e., Cigno and Rosati (2005), considers the first three. The remaining two items, heterogeneity and international trade, are discussed only tangentially along the other sections.

2.4 Cigno and Rosati (2005)

The models so far summarized, Basu and Van (1998) e Baland and Robinson (2000), albeit represent important contributions to the literature on child labor, they still leave untouched on just tangentially touched some important aspects of the subject. From this perspective, Cigno and Rosati (2005) come up with a modern, and in a certain sense, unified approach to the issue of child labor. Cigno and Rosati (2005) start by pointing out some shortcomings of past models of child labor, and, then elaborate over their proper model. As it will be clear below, they are able to address the shortcomings of Basu and Van (1998) and subsume the key insights of Baland and Robinson (2000) in a more general model.

Accordingly to Cigno and Rosati (2005), the following are the main criticisms with respect to past attempts to model child labor:

1. some important model's implications are very sensitive to initial assumptions;

2. fertility behavior is crudely modeled. At best, a very simple model of fertility behavior is used, often exogenously;

3. the dynamical aspects of the problem are addressed in a very basic way. There is a two-period set up, which aggregates too much important sub-periods;

4. absence of a more realistic dynamic trade-off between present consumption and education. Usually, past models left completely unspecified the alternatives to time spent working for children;

5. the implicit household model used is not realistic. Neither the unitary nor the collective models are well suited to described the intra-household decision and allocation processes that occur in developing economies[17].

The sensitivity of the model is seen very clearly in Basu and Van (1998) model. Specially regarding technological postulates, Cigno and Rosati (2005) are incisive in asserting that *"... a small change in the technological postulates ... throws doubt on one of the model's more optimistic implications. The same applies, with greater force, to the representation of parental preferences."*. From Basu and Van (1998), one can see that the technological assumptions are key to obtain the existence and characterization results. However, the criticism is more apparent when in turn into the issue of parental preferences. In fact, the behavior of parents are a kind of weird! They will do anything possible to let their off-springs out of the labor force, but as long as the family reach the subsistence level (from top to bottom) they will not hesitate not only to put children to work but also to extract "up to the last drop" of their children's available time.

As to fertility behavior, Cigno and Rosati (2005) asseverate that Basu and Van (1998) treat fertility behavior as parents have perfect control of it. The contradiction, according to Cigno and Rosati (2005) is seen by analyzing the following question: *"It it is true that that keeping children from working is highest in people's mind, why is that people have children when the circumstances are such that they will have to work?"*. In order to circumvent that problem, as we will see, Cigno and Rosati (2005) make fertility and

[17]Indeed, the "Family Constitution" model is one of the distinctive contributions of both authors, for instance, Cigno (1993) and Rosati (1996).

endogenous variable. Besides that, fertility is random, which is a much more realistic assumption.

The model appearing in Basu and Van (1998) are static one. The only justification of such a choice, given the inherently dynamical aspects surrounding the phenomenon of child labor, is pragmatism. Issues like fertility, bequests, credit markets, human capital investment must be framed in a dynamical setting. Even though Baland and Robinson (2000) use an two-period overlapping-generation model, it does it inevitably because they will address issues, such as savings and credit constraints, that demands necessarily a dynamical set up. In fact, one of the key contributions of Cigno and Rosati (2005) is to model much more realistically the dynamic aspects of household decisions. As it will became clear, a two-period overlapping model is not enough (because it has only two decision nodes) to address all complexities involved in the inter-temporal household decision process.

One of the interesting insights gained after two decades of intensive research on child labor is the fact that any candidate for a "good model" of child labor must address the puzzle of "idle" children. In fact, both Basu and Van (1998) and Baland and Robinson (2000), and actually almost all predecessors, assume that education time is the complement of working time. But the issue much more complex. In fact, Biggeri and *et alli* (2003) show that a large proportion of children who neither work nor study does not do anything[18]. Given that, the main contribution of Cigno and Rosati (2005) is to address partially these concerns by showing that is possible to obtain corner solutions, as well as interior ones, for children time allocation problem between work and school. Although these authors do not address alternatives to working besides schooling, they have the merit of point out a avenue worth exploring if one decides to incorporate other alternatives to work, such as "idleness".

In subsection (2.1), we have discussed the main approaches to household modeling. In summary, there are two broad categories: the unitary approach and the non-unitary. In the unitary model, *a la* Becker, it is assumed that all decisions inside the household are taken by a "benevolent" head. If there are more than two people, we abstract by assuming that they arrive at some deal such that still a head of the household will make decisions. Differently from that perspective, non-unitary models explicitly consider the fact that a

[18]Indeed, this proportion persist after eliminating those children who perform household chores, who are sick and who are not able to find a job.

coordination problem arises when the household has more than one decision maker. The **collective model** of Andre Chiappori is one of the key approaches belonging to the set of non-unitary models. The collective model, by construction, assume that the outcome of the household decision process is Pareto optimal. However, this optimality is consistent with different process of household decisions, which is, in an sense, a weakness of that approach. The main contribution of Cigno and Rosati (2005) is to develop an alternative model of household decision process: the "Family Constitution".

Although a detailed discussion of the "Family Constitution" approach is beyond our scope, we touch upon relevant points of that model. In fact, the "Family Constitution" approach is a response to criticisms regarding the adequacy of the collective approach in reflecting the real household decision process about child labor issues in developing and underdeveloped countries. Cigno and Rosati (2005) say that *The collective model is appropriate for portraying the behavior of adults who can credibly threaten to break the family sodality if they not get at least as much as they would under an alternative arrangement.* and make a strong point against its use by concluding that *[the collective approach] is less useful in a developing country context, where the marriage relationship is typically subject to much more constraints than just the law of the country.*. Hence, Cigno and Rosati (2005) find inspiration in a paper of Neher (1971) and develop the idea of a "Family Constitution". The "Family Constitution" is an agreement about an inter-temporal allocation mechanism between three different generations leaving under the same household: grandparents, parents and children. In a seminal paper Cigno (1993) works out the concept of a "Family Constitution" and proves that it is self-enforcing in the sense that it is a inter-temporal Nash equilibrium of the game played by each of the three players (grandparents, parents and children). As it will be shown, a model of child labor that assumes a "Family Constitution" could delivery very different conclusions when compared to other assumed behavior[19].

Before getting into details of the model developed in Cigno and Rosati (2005), henceforth **CR model**, it is important to understand that a useful model of child labor which assumes a realistic household model, must consider two important issues:

1. the sequential nature of decisions inside the household;

[19] We urge the interested reader to read the original seminal papers and Cigno and Rosati (2005) to gain a deeper understanding of the "Family Constitution" approach.

2. fertility are only partially controlled, i.e., it is a random variable.

Cigno and Rosati (2005) start by defining the sequence of decisions taken inside the household. Figure (1) shows all stages of the process, and Table (2) describes all variables. The stages, decisions and outcomes are:

- STAGE 0

    1. Along with a_0, would-be parents choose the level of birth control, c_0. This last variable conditions the likelihood that a child is born;

- STAGE 1

    1. This stage comes if and when a child is born. Now, parents decide their own level of consumption a_1, as well as their child consumption (food, attention, medical care, and so on), c_1. This last variable conditions the probability that the child survives up to next stage;

- STAGE 2

    1. This stage comes if and when a child survives and reaches school age. Now, parents decide **whether to send their children to school or work**. Also, parents decide their own consumption, a_2, as well as each child's consumption, c_2, time allocated to school, e, inputs used for child education, k, saving, s, and net transfers, m. Beyond that, children will enter stage 3, as adults, with a stock of human capital of h, and the cycle starts again for a new cohoort of adults;

- STAGE 3

    1. This completes the life time of those adults described since stage 0. Now, as old people, they choose their level of consumption, a_2, and net transfers, m;

Parent's preference a represented by a *Becker-style* utility function represented by

$$U = \sum_i u_i(a_i) + \beta U^*(c_2, y)n \tag{33}$$

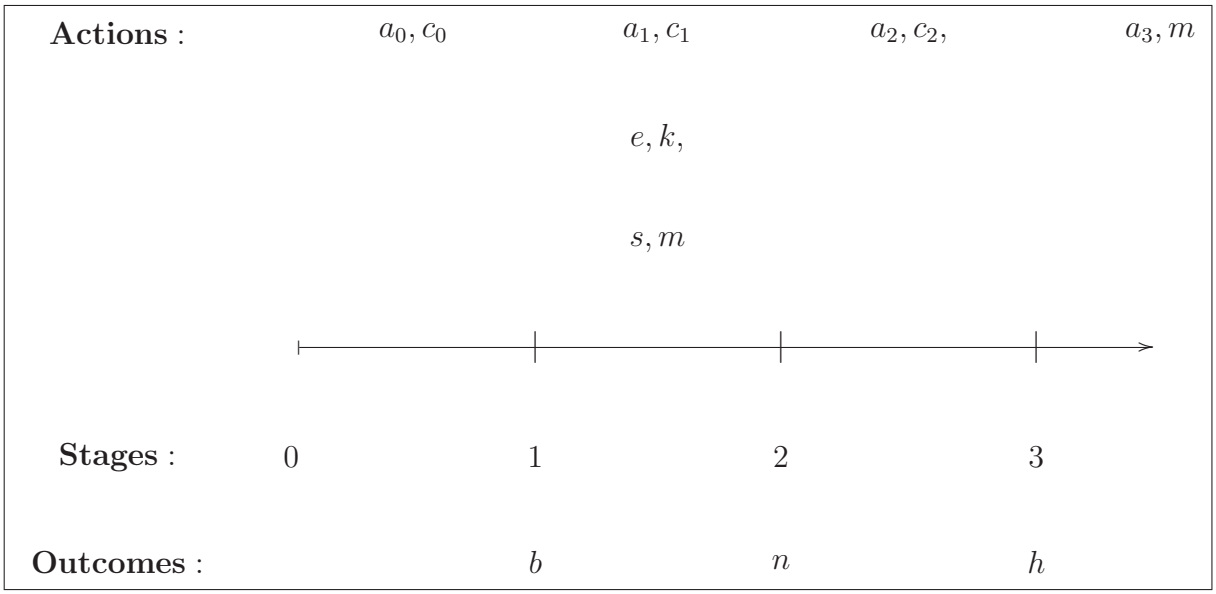

Figure 1: Decision Stages

Table 2: Description of Variables

Variable	Description
a_i	Parental consumption at stage $i = 0, 1, 2, 3$
c_0	level of birth control
c_j	child's consumption at stage $j = 1, 2, 3$
e	time that a school-age child spends studying
k	inputs (other than own time) used for child's education
s	parental saving per child
m	net transfers to each grown-up child
b	number of births
n	number of school-age children
h	human capital of each grown-up child

Source:

$\beta \in (0, 1]$ denotes parent's altruism towards their children, y is the child's stage 3 income, and n the number of children who live to be adults. $U^*(.,.)$ deserve further elaboration. The term tries to represent the optimal allocation of resources to children. Cigno and Rosati (2005) assert that *[$U^*(\Omega)$ is] the maximized value of a child's lifetime utility, where Ω includes the endowments with which this person entered adult life, as well as his consumption before becoming an adult, and $U^*(\Omega)$ is a concave indirect utility function. The elements of Ω may be anything from money and capital goods to human capital, and even health status.* So, from the formal point of view $U^*(.,.)$ summarized all optimal decisions taken by parents regarding their children.

One of the important contributions of the **CR model** is to explicitly model the human capital accumulation of the children. Accordingly to traditional approaches, they assume that there exists a human capital function that relate innate ability and investment in human capital to the stock of human capital that a child bring to adult life. The function can be written by

$$h = h_0 + g(e, k) \tag{34}$$

where h_0 represents natural (innate) talent, e child's time spent in school, and k is other educational inputs, such as books, tuition, transportation costs. The function $g(e, k)$ is assumed to have constant returns to scale, linear-homogeneous, and $g(0, k) \equiv g(e, 0) \equiv 0$. After normalizing the time endowment of each child, the cost o providing at least h units of human capital is

$$Q(h, w_c, p_k) \equiv \min_{e,k}(ew_c + kp_k) \tag{35}$$

$$\text{s.t. } h_0 + h_0 + g(e, k) \geq h \text{ and } 0 \leq e \leq 1$$

This function is defined for

$$h \geq h_0 \tag{36}$$

where w_c and p_k are the opportunity cost of child labor and the price of ither educational inputs, respectively. As a cost function, $Q(h, w_c, p_k)$ is increasing in output, and increasing and concave in input prices. Now, we move on to define parental decisions. From the inspection of equation (33) and figure (1)

it should be clear the route taken by Cigno and Rosati (2005) is to break down the problem into simpler pieces. So, the authors focus on the decisions taken in stage 2. At stage 2, after parents have decided the values of (a_0, a_1, c_1), and n is realized, they need to decide over the values of (a_2, c_2, e, k, m, s), see figure (1). In fact, given the cost function (see, equation (35)), parents choose (a_2, c_2, h, m, s).

The self-enforcing family constitution is responsible for three constraints[20] to parent's problem. The first constraint is a consequence of the fact that the family constitution prescribes that parents must give to each of their children, at stage 2, more than z,

$$c_2 + Q(h, w_c, p_k) \geq z \tag{37}$$

For the same reason parents, at stage 3, must give back to their adult children some of the x they are supposed to receive (and actually end up receiving). This is described by the following,

$$x + m \geq 0 \tag{38}$$

Finally, defining the interest rate by r, parental old age consumption is determined by,

$$a_3 = sr - mn \tag{39}$$

There are two final constraints. The first one has to do with parents stage 2 budget constraint. For this, denote W_2 the sum of the amount, net of x, due to the grandparents under the family constitution, and of any other fixed charges such as rents or taxes,

$$a_2 + [c_2 + Q(h, w_c, p_k)]n + s = W_2 + w_c n \tag{40}$$

The second constraint represents asset and credit market imperfections,

$$s_0 \leq s \leq s_1 \tag{41}$$

where the lower bound, s_0, could represent lack of assets to sell or to offer as collateral, and, the upper bound s_1, could represent the usual difficulties in accessing credit markets in developing countries.

[20]These constraints are not necessarily bidding. It could happen that some of them could be bidding at the same time.

Table 3: Description of Equilibrium

Equilibrium	Description	Implications
Saving or dissaving	$\frac{u_2^{'}(a_2)}{u_3^{'}(sr-mn)} = \frac{U_{c_2}^*(c_2,hw+m)}{U_y^*(c_2,hw+m)} = r$	r^L and $m < 0$
		r^L and $m > 0$
		r^H and $m < 0$
		r^H and $m > 0$
No saving or dissaving	$\frac{u_2^{'}(a_2)}{u_3^{'}(-mn)} = \frac{U_{c_2}^*(c_2,hw+m)}{U_y^*(c_2,hw+m)}$	it can generate
		either high or low
		child labor supply
	$\frac{U_{c_2}^*(c_2,hw+m)}{U_y^*(c_2,hw+m)} = \frac{w}{Q_h}$, or $h = h_0$	
Binding constitution	$\frac{U_{c_2}^*(c_2,hw+m)}{U_y^*(c_2,hw+m)} = \frac{u_2^{'}(a_2)-\lambda}{u_3^{'}(sr-mn)}$	outcomes are
		inneficient

Source:

Hence, at stage 2, given the number of surviving children n, parents solve the following problem,

$$\begin{aligned} \max_{(a_2,c_2,h,m,s)} U_2 &= u_2(a_2) + u_3(sr - mn) \\ &+ \beta U^*(c_2, hw + m)n, \text{ with } \beta \in (0, 1] \end{aligned} \tag{42}$$

subject to constraints (36), (37) - (41), and the following "subsistence" restrictions,

$$a_2 \geq a_s, a_3 \geq a_s, c_2 \geq c_s, \text{ and } y - x \geq a_s \tag{43}$$

The core of the **CR model** was just described. From this point, Cigno and Rosati (2005) elaborate in many directions, exploring the outcomes that result from equilibria that result from bidding and non-bidding restrictions. Since the spirit of our presentation is not to give details of all these results, we have decided to summarize the many accomplishments of the **CR model** in the Table (3).

Table (3) illustrates the richness of the **CR model**. It extends the analysis in many directions, as well as it encompasses some past results, for

instances, the fact shown by the **CR model** that lack of access to credit markets results in a high supply of child labor was first established by Baland and Robinson (2000).

There are two final contributions from Cigno and Rosati (2005) worth commenting about[21]: the effect of access cost and the effect of extreme poverty on child labor. As to the effect of access costs on child labor, Cigno and Rosati (2005) offer a interesting explanation for the existence of a large proportion of children reporting doing nothing (idle) in surveys. By facing high access cost to either schooling or working, it is a rational choice not to do anything. Whether this is a good explanation or not, one needs to wait for empirical tests. Anyway, it is a coherent attempt to explain a "puzzle" from the literature on child labor[22]. Regarding the effects of extreme poverty on child labor, those authors explain that income has a stronger effect the closer the family stand in relation to some poverty line metric. This result, of course, has important policy prescriptions. Next section describes a key aspect that is intrinsically related to child labor: education.

3 Child Labor and Education

For a good understanding about the relationship between child labor issues and education is important, firstly, to have a closer look at what one means by the term education. From the perspective of child labor studies such as Cigno, Rosati, and Tzannatos (2002) and Edmonds (2007), the term education can have, depending in the context, the following meanings:

1. It could mean educational outcomes, such as grades, learning achievements, highest academic degree and so on. This is one of the key researched topics in the literature, and is concerned with analyzing and measuring the effect that early child working has on educational outcomes;

[21]It is important to mention a deliberate omission of our survey. The fertility issue, although receiving a whole chapter of Cigno and Rosati (2005), are not elaborated in the survey. This is so only for pragmatic reasons. Even though fertility issues are at the center of the modern debate related to child labor, we are sure that this will bring us to far from our initial purposes.

[22]For a first modern attempt to address the issue of idle children, see Biggeri and *et alli* (2003).

2. It could mean the returns of education, i.e., how much a person could improve his well-being by acquiring additional schooling. In this context, the literature is looking for a causal relation from returns to education towards child labor. As it will be shown below, the term itself, "returns to education", is broad enough to encompass many dimensions, so as to be capable of changing giving the change from one of its possible dimension;

3. Finally, it could mean parents' educational background and how this influences (their) choices of children's working time.

Whatever the context under review, the subject is surrounded by empirical and theoretical difficulties. For instance, returns to education is a concept, sometimes, hard to define and, especially, to calculate. Also, the determination of the share of children's time that goes to working and the share that goes to schooling are jointly determined, which by itself complicates a lot isolating the effects. By the same token, educational outcomes are frequently hard to define and/or achieve reasonable consensus: how one should measure a successful educational achievement of a child at school? Should one use an average grading system or average time for grade completion? Hence, given the complexities of the subject, we start by describing contributions that try to find a effect of child labor on educational outcomes.

3.1 The Effect of Child Labor on Educational Outcomes

Accordingly to Edmonds (2007) *"the extent to which work affects schooling performance , and attainment is perhaps the second most researched question in the child labor literature."*. In fact, the modern literature on the consequences of child labor to educational issues is large, as can be seen in Orazem and Gunnarson (2004). To start understanding how to interpret the problem, it is a interesting strategy to build up a conceptual framework. Hence, we will closely follow the approach appearing in Orazem and Gunnarson (2004).

Orazem and Gunnarson (2004) utilize a variant of the classic model appearing in Ben-Porath (1967). The proposed model has the following characteristics:

1. The path from childhood up to the end of adulthood is aggregate into three periods of time;

2. The first stage is defined as the length of time a child spends all of his/her time at school, i.e., $A = 1$. The second stage is, indeed, where parents decide whether their children will spent any time working. So, at this stage, $A \in (0, 1)$. The third, and final stage, the child specializes in working, meaning that $A = 0$, and consequently, $L = 1$.

3. Parents decide the allocation of their siblings between labor and school attendance;

4. The returns to education are assumed to be positive and decreasing with years of schooling;

5. The wage a worker child will receive at time t is given by: $W(H_t)$, where H_t is the total human capital accumulated at t;

6. Finally, assume an exogenous interest rate r.

Armed with those assumptions, a straightforward "cut-off" rule can be represented by the following equilibrium condition[23]

$$-AW(H_0) + \frac{W(H_1) - W(H_0)}{1 + r} \geq 0 \tag{44}$$

The interpretation of this condition is well known: the child should attend school if the present value of an additional unit of time studying is greater than the cost of acquiring this additional unit of time. As it, this is a traditional outcome of human capital accumulation models. Interesting, because the returns to education is assumed to be diminishing with schooling years, the traditional life-cycle of time allocation is obtained, i.e., initially people only study ($A = 1$), then, do both schooling and working simultaneously ($A \in (0, 1)$ and $A + L = 1$), and finally, people only work ($A = 0$ and $L = 1$).

As simple as it appears, the result above is just one side of the problem. Remember that the proposed agenda is to investigate the impact of child labor on educational outcomes. Hence, it is necessary to incorporate an educational production function into the framework. Orazem and Gunnarson (2004) conjecture the existence of a production function of the following form

$$H_{ij} = H(C_{ij}, Z_j, H_{ij}^0) \tag{45}$$

[23] See, Ben-Porath (1967)

where i and j index the child and the household, respectively. Cognitive attainment as measured by test scores is represented by H_{ij}, Z_j is a vector of variables thought to impact on the production of human capital (parent's attributes, communities characteristics, and so on) and H_{ij}^0 is past schooling and/or unobserved ability. The educational production function "closes" the model. Hence, the channel through which child labor affects educational outcomes is seen by putting together equations (44) and (45). The advantage of formally defining a model like that is making the interpretation of the workings of the problem much easier. Two key insights emerge from the analysis:

- Decisions regarding child labor and education are jointly determined. This makes difficult to estimate equation (45). So any attempt to measure the impact of child labor on educational attainment must deal with endogeneity problems on the estimation of the production function;
- The majority of studies, e.g., Ravallion and Wodon (2000), is interested in measuring the impact of child labor on school attendance. However, the model explained by Orazem and Gunnarson (2004) can be generalized such as to interpret H_{ij} as time in school, school achievement and others.

In order to have a glimpse on the available empirical results, we comment briefly in a couple of papers. As outlined before, Ravallion and Wodon (2000) find a increases in child labor are not associated with changes in school enrolment in Bangladesh. This lead those authors to conclude that the effect of child labor, if it exists, on school enrolment is probably small. However, Orazem and Gunnarson (2004) draw attention to the fact that this apparent lack of association between child labor and school enrolment could be masking an undesirable phenomenon: children could be adjusting the changes in time devoted in child labor at the intensive margin, i.e., they remain enrolled but do not attend school as regularly. That was exactly the results found in Boozer and Suri (2001) who conclude that in Ghana an one hour increase in child labor reduces school attendance by 0.38 hours. As to school achievement, there is evidence that child lowers years of attained schooling, see for instance Psacharopoulos (1997), even though, the study is open to methodological criticism by not controlling for endogeneity of child labor. Studies that attempt to correct the endogeneity are Rosati and Rossi (2001) and Gunnarsson (2003). These two studies find again the deleterious

effects of child labor on school achievement, but this time, possibly due to the correction of endogeneity, they are smaller.

Although the study of the effects of child labor on educational outcomes is a very important issue, it would bring us too far from our initial objective. In fact, we believe that if one is interested in studying that issue it is necessary to focus only on that. Since we are looking for estimating a "traditional" child labor model that explains what are the determinants of parents choice regarding their children allocation of time, it is more reasonable that the causal link should be inverted. This means, one should try to discuss how returns to education, broadly defined, affect child labor. This is the subject of the next subsection.

3.2 How Returns to Education Affect Children's Time Allocation?

There is a large body of literature that explicitly show the link between return to education and child labor. Indeed, both models discussed before, i.e., Baland and Robinson (2000) and Cigno and Rosati (2005), make use of the return of education. The present section discusses two interrelated issues: what variables can change the returns of education, and by which mechanism returns to education influence child labor. But before that, an important the effect of parents educational background and child labor is briefly discussed.

The last decades witnessed the accumulation of ample evidence that parental educational background has an important effect on decisions concerning the allocation of time to work for their siblings. For instance, Cigno, Rosati, and Tzannatos (2002) asseverate that *"In general, children of better educated parents are more likely to attend school and less likely to work part or full time than the children of less educated parents."*. Indeed, an interesting issue is the fact that many studies find that even though there is a significant effect of mother's level of education, father's effect is frequently found to have no effects on child labor. Examples from these effects can be found in Rosati and Tzannatos (2000), for Vietnam, and, Cigno, Rosati, and Tzannatos (2000) for rural India. Cigno, Rosati, and Tzannatos (2002) offer four possible explanations for this asymmetry:

1. education might confer greater power inside the household. This means that by acquiring more education the mother will have a greater influence over the bargaining process. Note, however, that this line of rea-

soning does not explicitly assume in any way how this extra bargaining power will be used;

2. extra education will likely improve the chances that mothers find outside employment. The probable consequences are that children's time are redirected towards household chores. Although this it would be better if children trade off their time working in favor of schooling time, it is an improvement to trade off outside work with household work;

3. another possibility is that mother's education could simply be an input in children's production of human capital. This is a reasonable assumption, as in almost all any societies mothers have a fundamental role during the process of learning and development of children;

4. better education might improve the understanding of parents regarding the likely gains from augmenting the level of schooling of their children.

Regardless of what is the explanation for asymmetries between fathers and mothers, it is a reality that the role mothers' education play in child labor issues has been recognized by policy makers. An interesting example is the fact that programs aiming to reduce child labor by means of conditional cash transfers, for instance PROGRESA in Mexico and BOLSA ESCOLA in Brazil, elect the mother as the recipient of the money. This clearly recognizes the fact that mothers "care" more about their children. The rest of this subsection will discuss, sequentially, the following issues:

1. the mechanism through which returns to education influence child labor decisions;

2. the variables affecting returns to education;

3. the difficulties in measuring returns to education.

The traditional approach related to time allocation and human capital investments is grounded in the seminal contributions of Gary Becker, for instances, Becker (1965) and Becker (1991). As outlined in the models of Baland and Robinson (2000) and Cigno and Rosati (2005), by solving a optimization problem, parents must decide how much time their children must devote to each of the competing tasks. For easy of explanation, let us assume that children's available time should be allocated between to non-overlapping

and exhaustive tasks: work and school. Now, according to the tenets of the neoclassical approach, the parent must take the following decision: how much time should a choose to make my child work, t_w^*. Clearly, by choosing t_w^*, the parent, by way of the available time constraint, is also choosing the amount of time his/her child will spend in school, say t_s^*.

Now, for each additional fraction of time the parent is willing to devote to/diminish from child laborΔt_w^*, or, equivalently, to remove from/devote to child schooling, he/she will have a marginal loss/gain. The marginal gain, can be understood as the improvement[24] on the parent's well being arising from the fact that his/her child will have a higher amount of schooling. Obviously, these gains in welfare are consequence of higher wages for his/child and/or of altruistic considerations. Anyway, one can put all marginal gains in terms of increased parental utility under the same tag, and call it return to education, or, as it will be clear next, a better name would be "gross return to education". Now, associated with the gains originated by greater time devoted to schooling, there will be associated costs. Candidates for those costs are many, we postponed their discussion, however. Hence, an increase in time devoting to schooling will require additional costs. The returns of education net these additional costs would be better called "net returns to education".

The line of reasoning is then that parents will increase schooling time (of their children), if, and only if, the "gross return to education" is greater than the marginal cost associated with that, or, in other words, if the "net return to education" is positive. This movement will keep on going until the "net return to education" is equated to zero. The mechanism through which returns to education influence child labor decisions is than by the impact that these decision have on parents well-being.

The concept of returns to education, either gross or net, is decidedly large. Table (4) lists a set of variables. The column of "Costs" is dos not need further commenting. All these items have a clear impact on parental costs associated with increasing time devoted to schooling. A final remark is the fact that even though the effect of (marginal) cost is important for determining the "net return to education", these literature is still few studies addressing this issue, accordingly to Cigno, Rosati, and Tzannatos (2002).

[24]From this point on, we are doing our thought experiment by assuming that $\Delta t_w^* < 0$, i.e., the parent is increasing the time of child's schooling. The effect of $\Delta t_w^* > 0$ is completely analogous.

From the column of gross returns, a first remark should go to the impact of school quality on returns to education. Its working is not difficult to apprehend: better schools, *ceteris paribus*, will increase the chances a child will receive a higher future wage w_f^{child}. It is a difficult and, likely because of that, tangentially touched topic of research.

Table 4: Variables Influencing Returns to Education

Gross Return	Costs
interest rate r	school fees
child's present wage w_0^{child}	educational materials
child's future wage w_f^{child}	school availability
altruism	distance from school
risk of child mortality	
school quality	

Source:

Interest rate is import because it turns possible to asses the present value of the stream of gains arising from more schooling. However, it is also difficult to measure as well as its effect are likely to operate in the very long run. The risk of child mortality is important for the determination of returns to education as it measures the probability that the stream of values from one child will actually be realized in the present. Before we proceed to the discussion about the difficulties of measuring returns to education, it is important to briefly touch an important issue: what factors could break down the link between returns to education and schooling.

There are two know factors: lack of parental altruism and credit constraints. A lack of parental altruism has the effect of nullifying the impacts of returns from education. The argument is simple, since parents are not altruistic, they will refrain from increasing child's time devoted to schooling because the gains from that will be appropriated much more by the child than by the parent himself. The credit constrain channel is due to the seminal paper of Baland and Robinson (2000), see Subsection (2.3). The credit constraints faced by, generally poor, households make impossible inter-temporal trade arrangements between parents and children. This means, among other things, that bequests could be zero. This fact, accordingly to Baland and Robinson (2000), results in inefficiently high child labor. As pointed out in Edmonds (2007), *"[with zero] bequests, children can not compensate parents*

for the forgone consumption that comes from decreasing child labor.". Next, we move to discuss the difficulties that surround the estimation of the returns to education. To make as simple as possible without missing the point, we focus only in two variables that determine the "gross return to education": child's present wage w_0^{child} and child's future wage w_f^{child}.

One first problem is that if one wants to evaluate what will be the likely future wage of a child, w_f^{child}, it is necessary to consider issues like: what is the likely job the child will get, chances of finishing all schooling levels, unemployment duration, labor market, and so on. But even if we narrow down the up to consider only child's present wage w_0^{child} as the opportunity cost of schooling, there remains important obstacles. First, child labor is more prevalent in areas where formal wage is rare. This creates econometric difficulties, because of the heavy selection bias. Second, returns to education variation are difficult to separate from variations in confounding factors affecting local income. Third, there will be other opportunity cost other than the present wage, for instance, the lack of socialization and leisure time. However, the econometric literature has been prodigious in coming up with clever strategies to overcome those obstacles. Main approaches[25] are described in Edmonds (2007), and are just listed below:

1. use aggregated returns to education;
2. trying to examine whether there are changes in the returns to education and schooling for a common factor;
3. use other indicators' movements to infer movements in returns to education. For instance, changes in adult employment by educational status;
4. use changes on non-local labor markets that could be attractive for children (parents). For example, the effect of urban labor market on rural child labor.

This and the preceding section concludes the necessary theoretical explanation for the understanding the modern debate about child labor, with especial emphasis on education. Next section deals with the chosen methodology as well as describes the data set used and perform important preliminarily empirical analysis.

[25]Note that all approaches have a common objective, i.e., to find direct or indirect exogenous sources of variation in returns to education that could be reasonable operationalized.

4 The Data Set Used - Survey of Standards of Living

The "Pesquisa sobre Padres de Vida" (PPV), Survey of Standards of Living, was a major effort taken by the Brazilian government jointly with the World Bank in order to gather a comprehensive data set base to both quantify the determinants of the well being of the population, and, to identify those determinants and assess the impact of public policies and programs. The PPV was a pilot project and it was conducted during the period of 1996-1997. As a specific aim, the PPV wanted to put together a set of information concerning household components' well-being that used to be found only if one look for different data bases. According to one of the few available documents about the PPV, see IBGE (2004), the survey had the following characteristics:

- a host of socio-economic topics studied in an integrated approach, available in a single household sample;
- the field work lasted from march 1996 up to march 1997, so seasonal effects could be captured;
- a rigid control over all process related to the application of questionnaires, as well as regarding data input and analysis;
- incorporation of data processing as a integrating part of the survey.

A total of 4,800 questionnaires were collected by means of a sample plan that consisted of two stages of selection and stratification[26] of the population. As PPV was a pilot survey, the government decided to restrict its realization to the following geographical areas:

1. metropolitan region of Fortaleza;
2. metropolitan region of Recife;
3. metropolitan region of Salvador;

[26]The primary sampling unit was the geographic sector area as defined by the 1991 Demographic Census, and the secondary sampling unit is the household. For details about the sampling structure, see, Albieri and Bianchini (1997).

4. the rest of the urban area of the Northeast region;
5. the rest of the rural area of the Northeast region;
6. metropolitan region of Belo Horizonte;
7. metropolitan region of Rio de Janeiro;
8. metropolitan region of São Paulo;
9. the rest of the urban area of the Southeast region;
10. the rest of the rural area of the Southeast region;

The questionnaire was planned to offer a set of information whose objectives were:

- measure well-being distribution and the level of poverty;
- describe the pattern of access to public services such as water, sanitation, health, education, and others;
- understand how households react to governmental policies and programs;
- allow a deeper analysis concerning the relationships among different issues like health and employment, pattern of expenditures and nutritional levels, and so on.

Before we turn into details of the data set, it is worth stressing two important aspects of the PPV: first, the data set has labor market information from people with ages as early as 5 years. Clearly, this is a key feature as we are interested in studying child labor. Second, there is enough detailed of time allocation of children's activities as to permit us to depart from past analysis that assumes only the dichotomy work *versus* school. A final remark is important, even though there is a huge lively debate over the right definition of child labor, we just follow "traditional" approaches and define child labor as it appears, for example, in Cigno and Rosati (2002) and Cigno and Rosati (2005). This means we made a "cut" in a ours sample and considered all children from 6 (inclusive) up to 16 (inclusive) who who responded that had a

work in the last seven days as child labor. Now, we are able to start analyzing and comparing[27] our data set.

Table (5) shows the distribution of children, by sex, among four mutually exclusive activities: work only, neither work nor study, study only, and, work and study.

Table 5: Work/study status of children by sex (%)

	Male	Female	All
Work only	4.50	2.10	3.30
Neither Work Nor Study	7.10	9.20	8.10
Study only	74.50	82.00	78.20
Work and Study	14.00	6.60	10.40

Source:

A first striking result is the fact that, even by the end of the 20^{th} century, 13.70% of children are laborers (work only, and work and study). For rural India this number goes to 14.52%, incredibly close are those two numbers. Also, boys work and study twice as much as girls.

Table (6) shows the distribution of activities by age group. If we start reading the Table by going down in the "Work only" column it is evident a pattern of increasing percentage of people engaged in work. In fact, the greatest marginal increase happens from 12 to 13 years. This pattern also occurs in the "Work and study" column. However, the column "Neither work nor study" brings us an alarming picture. Its "U" shaped representation, i.e., starting with 20.80%, achieving a minimum at 11 years with 20.80%, and, finally going up to 11.80% are very bad news.
Indeed, this feature of the data set deserves much more concern as one might conjectures what are those kids doing. These are probably wandering around the big cities of Brazil begging, committing small crimes and preparing themselves to be criminal adults.

But, for as ironic that it could be, Brazil is much better than rural India because for all age groups, the percentage of people doing nothing in India is almost twice the same percentage for Brazil (see, Cigno and Rosati (2005), pp. 85). Figure (2) draws the values of Table (6). Tables (7) and (8) show

[27]To keep the comparisons meaningfully, we restricted ourselves to Cigno and Rosati (2002) and Cigno and Rosati (2005).

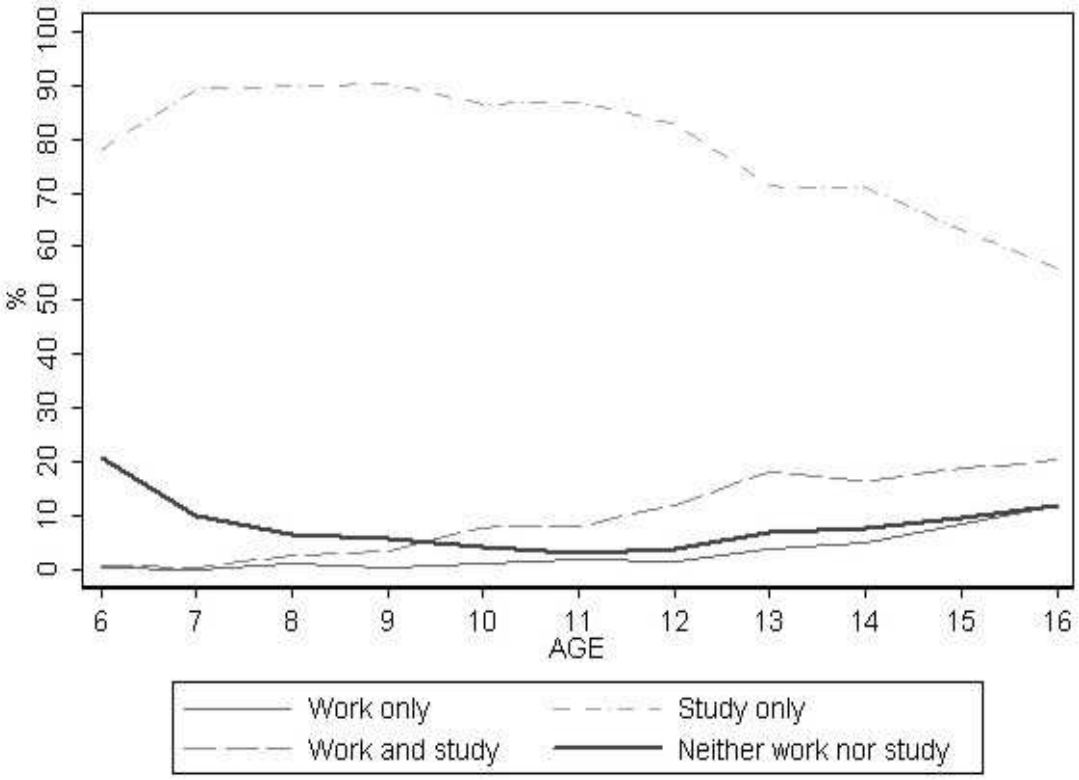

Figure 2: Work/study status of children by age (all)

Table 6: Work/study status of children by age (all) (%)

	Status			
Age	Work only	Work and study	Neither work nor study	Study only
6	0.30	0.80	20.80	78.10
7	0.00	0.50	10.20	89.30
8	1.00	2.70	6.50	89.80
9	0.30	3.60	5.90	90.30
10	1.20	7.90	4.40	86.50
11	2.10	8.10	2.90	86.90
12	1.40	12.10	3.70	82.80
13	3.70	18.20	6.80	71.20
14	4.90	16.40	7.70	71.00
15	8.30	18.90	9.80	63.10
16	11.80	20.30	11.80	56.00

Source:

the distribution of activities by age group for boys and girls, respectively. The patterns are roughly the same, with in the column "Neither work nor study" presenting, again, the same "U" shaped form.
Figures (3) and (4) draw the respective numerical values for boys and girls, respectively.

Tables (9) and (10) show the distribution of activities by age group, for urban and rural geographical region. A first interesting piece of evidence is the absence of any children only working in urban areas until the age of 13. However, in urban areas, the evidence is different. With the exception of age 7, probably due to sampling errors, all ages have a positive percentage of only working. In fact, as early as 10 years, 4.10 percentage of this age group only works! This important piece of evidence should call attention to the fact that the problem of child labor is not a homogeneous one. In fact, it appears that child labor has different causes depending on the geographical localization of the analysis. Of course, from a strict methodological point of view, one must realize that, by not separating the sample, a big mistake might occur: use a model to try to describe a different phenomenon.

The fact that income is a key determinant of child labor is recurrent topic in the literature. In fact, as outlined before, income has a direct effect, as

Table 7: Work/study status of children by age (boys) (%)

	Status			
Age	Work only	Work and study	Neither work nor study	Study only
6	0.50	1.10	22.10	76.30
7	0.00	0.50	10.30	89.20
8	1.40	3.70	6.00	88.90
9	0.50	5.10	4.60	89.80
10	2.20	11.10	5.80	80.90
11	3.00	10.70	2.10	84.10
12	1.70	15.20	3.00	80.10
13	5.20	24.30	4.80	65.70
14	4.80	22.70	6.10	66.40
15	11.80	25.30	7.80	55.10
16	16.90	28.90	8.50	45.80

Source:

Table 8: Work/study status of children by age (girls) (%)

	Status			
Age	Work only	Work and study	Neither work nor study	Study only
6	0.00	0.50	19.60	79.90
7	0.00	0.60	10.10	89.40
8	0.50	1.50	7.10	90.80
9	0.00	2.10	7.20	90.70
10	0.00	4.40	2.90	92.70
11	1.10	4.80	3.70	90.40
12	1.00	8.60	4.50	85.90
13	2.20	12.00	8.90	76.90
14	5.00	10.40	9.20	75.40
15	4.40	11.90	11.90	71.70
16	7.20	12.60	14.90	65.30

Source:

Table 9: Work/study status of children by age (urban) (%)

	Status			
Age	Work only	Work and study	Neither work nor study	Study only
6	0.00	0.00	12.90	87.10
7	0.00	0.00	6.20	93.80
8	0.00	1.00	4.40	94.60
9	0.00	1.50	5.10	93.40
10	0.00	4.50	2.90	92.60
11	0.00	1.50	1.10	97.50
12	0.00	6.80	2.90	90.20
13	1.50	10.70	4.90	82.90
14	2.10	10.00	6.90	81.00
15	1.70	15.60	8.90	73.80
16	9.00	18.40	11.00	61.60

Source:

Table 10: Work/study status of children by age (rural) (%)

	Status			
Age	Work only	Work and study	Neither work nor study	Study only
6	0.80	2.40	37.60	59.20
7	0.00	2.00	21.20	76.80
8	3.40	6.70	11.80	78.20
9	0.90	8.60	7.80	82.80
10	4.10	16.40	8.20	71.30
11	6.20	20.70	6.20	66.90
12	4.90	25.40	5.70	63.90
13	9.40	37.50	11.70	41.40
14	11.60	31.90	9.40	47.10
15	26.60	28.20	12.10	33.10
16	19.50	25.70	14.20	40.70

Source:

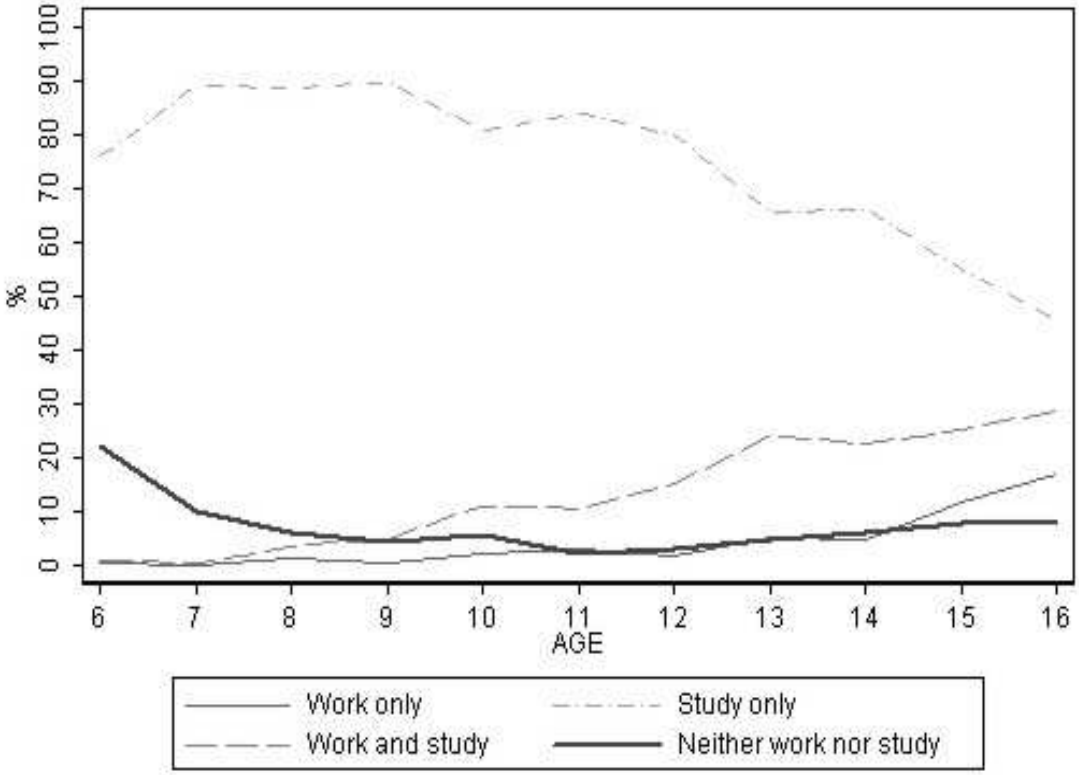

Figure 3: Work/study status of children by age (boys)

well as a indirect effect. The direct effect is the fact that lower income, especially if the household is getting closer to the subsistence level, will make parents to diminish any altruistic feelings and supply more from their children available time. The indirect effect, due to the seminal paper of Baland and Robinson (2000), is due to credit constraints. Since credit constraints are highly prevalent among the poor or very poor, income has a indirect effect on child labor, as well.

Two patterns are worth commenting in Tables (11). First, clearly income is highly correlated with child labor, i.e., the lower the income quintile the greater the percentage of children who work only. The same pattern occurs with the category "Neither work nor study". Also, there is a strong correlation between the "study only" and income quintile: the higher the income

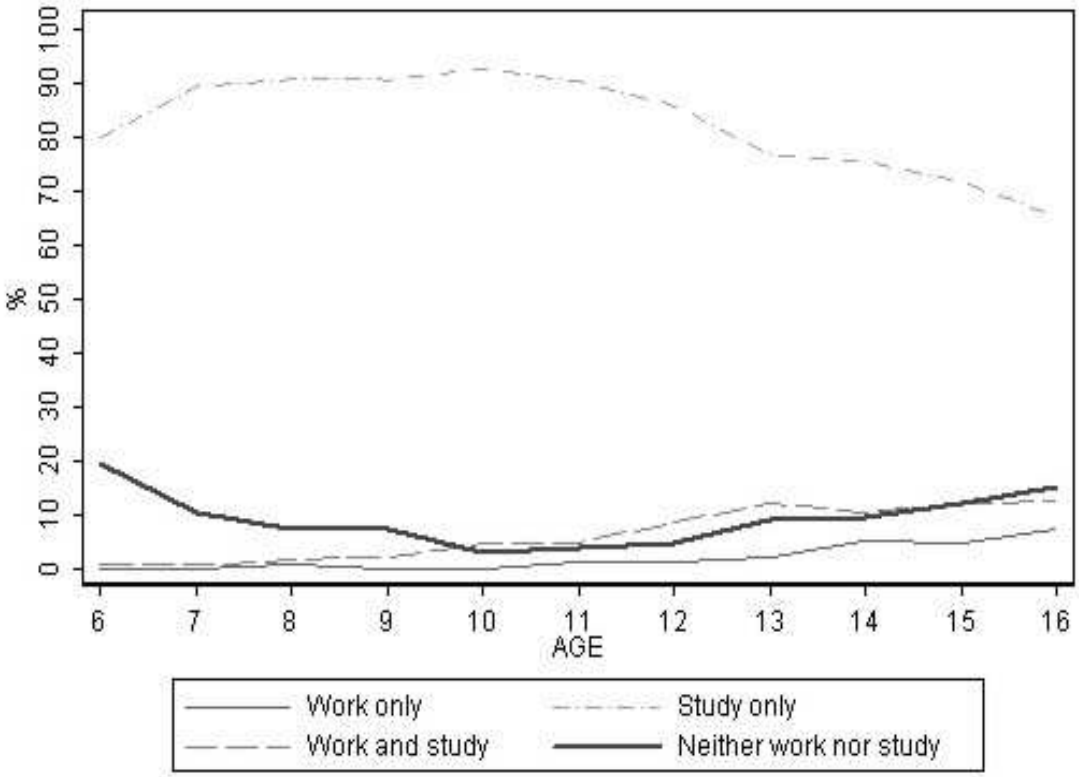

Figure 4: Work/study status of children by age (girls)

Table 11: Work/study status of children by household income (%)

	Income quintile				
Status	1	2	3	4	5
Work only	5.70	3.10	2.30	1.60	1.10
Study only	64.30	76.60	82.50	87.70	93.30
work and study	15.30	11.60	8.70	7.60	4.60
Neither work nor study	14.70	8.70	6.50	3.10	1.00

Source:

quintile the greater the percentage of children who only study.

Accordingly to Cigno and Rosati (2005), an important element for the analysis of child labor is nutrition. This is so because nutritional status of a child is both a determinant, as well a cause of child labor. Since, those type of jobs available for children are generally effort intensive, it is an obvious consequence that, *ceteris paribus*, better nourished children will devote more of their time to labor activities. Looking from another point, there is a huge literature showing the deleterious effects of child labor on children health. For instance, Graitcer and Lerer (1998) point out to morbidity, injury, and hazard risks associated with child labor, and, Forastieri (2002) child labor, may demanding increased nutritional needs, can exacerbate malnutrition. However, it is important to note that child labor could have good nutritional results.

Indeed, Edmonds (2007) asseverates that *To the extent that child labor brings additional resources to the child, this may improve health and nutrition (especially in the destitute populations where child labor is more prevalent)..* So, as to speak child labor could in fact have a net positive effect on child nutritional status. The absence of either a positive or negative affect was found in the article of Francavilla (2003). Anyway, we find important to report the distribution of BMI (Body Mass Index) by age group, for different type of activities. Table (12) shows these numbers.

Comparing both columns, "Work only" and "Study only", one can see that up to the age of 12 it appears that children who do not work have a better nutritional status, as shown by a greater BMI. After that there is no difference between these two categories. Figure (5) shows graphically these patterns.

For boys only, the pattern is roughly the same, as it appears in Table (13). In Table (14), which shows the percentages for girls, the cutting point is the age of 13, however, the pattern is analogous. Figures (6) and (7) show the contents of the Tables for boys and girls, respectively.

Table 12: Body mass by age and work/study status (all)

	Status			
Age	Work only	Study only	Work and study	Neither work nor study
6	17.73	16.11	14.64	15.28
7	NA	16.21	14.88	16.40
8	16.13	16.29	15.54	15.88
9	14.87	16.88	16.48	16.02
10	15.95	17.35	16.81	15.81
11	16.24	17.80	16.45	17.69
12	16.14	18.24	18.06	18.71
13	19.39	19.39	18.42	18.54
14	19.86	19.44	19.29	21.50
15	20.32	20.24	20.47	20.17
16	21.30	20.70	20.81	21.03

Source:

Table 13: Body mass by age and work/study status (boys)

	Status			
Age	Work only	Study only	Work and study	Neither work nor study
6	17.73	16.17	14.48	15.66
7	NA	16.15	14.22	16.94
8	15.67	16.47	15.37	16.16
9	14.87	16.78	16.34	16.44
10	15.95	17.22	16.67	15.05
11	15.86	17.70	16.45	17.94
12	15.39	17.87	17.78	17.48
13	18.79	18.50	17.95	19.40
14	19.13	18.92	19.01	20.27
15	20.18	19.70	20.13	19.82
16	20.70	20.85	20.42	20.04

Source:

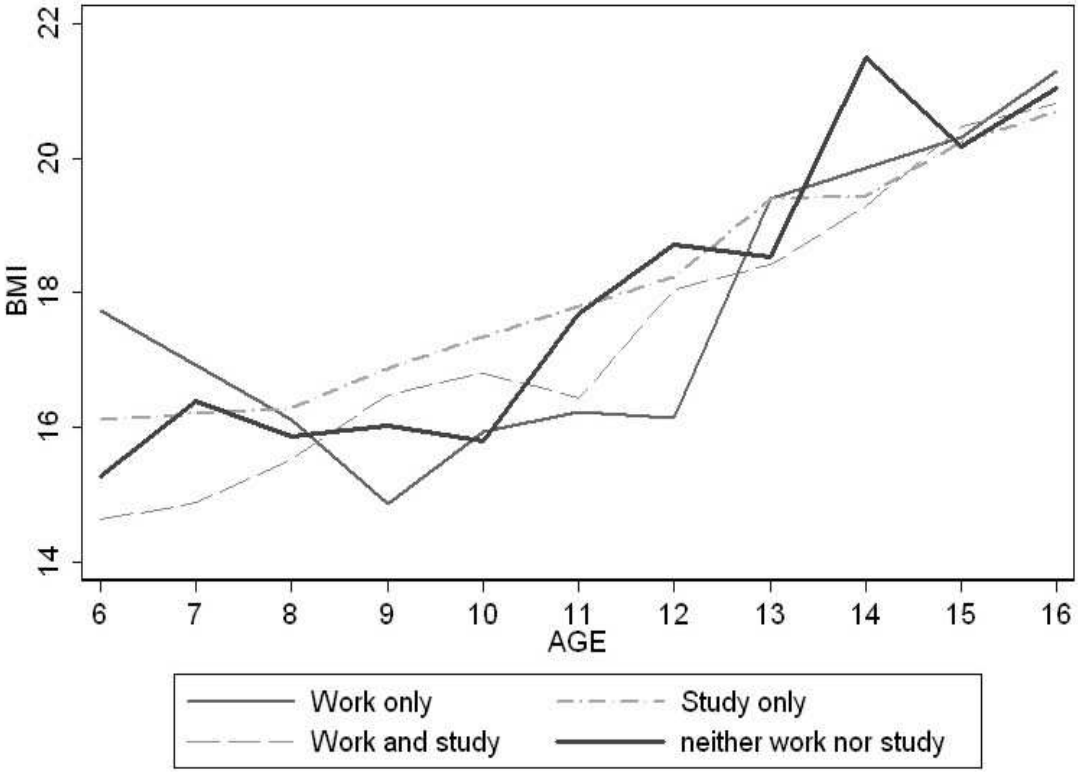

Figure 5: Body mass by age and work/study status (all)

Table 14: Body mass by age and work/study status (girls)

	Status			
Age	Work only	Study only	Work and study	Neither work nor study
6	NA	16.05	14.95	14.89
7	NA	16.27	15.54	15.75
8	17.50	16.11	16.01	15.62
9	NA	16.99	16.82	15.85
10	NA	17.47	17.18	17.07
11	17.57	17.90	16.47	17.54
12	17.63	18.63	18.64	19.66
13	21.07	20.16	19.44	18.19
14	20.52	19.87	19.79	22.27
15	20.71	20.68	21.27	20.42
16	22.86	20.62	21.58	21.55

Source:

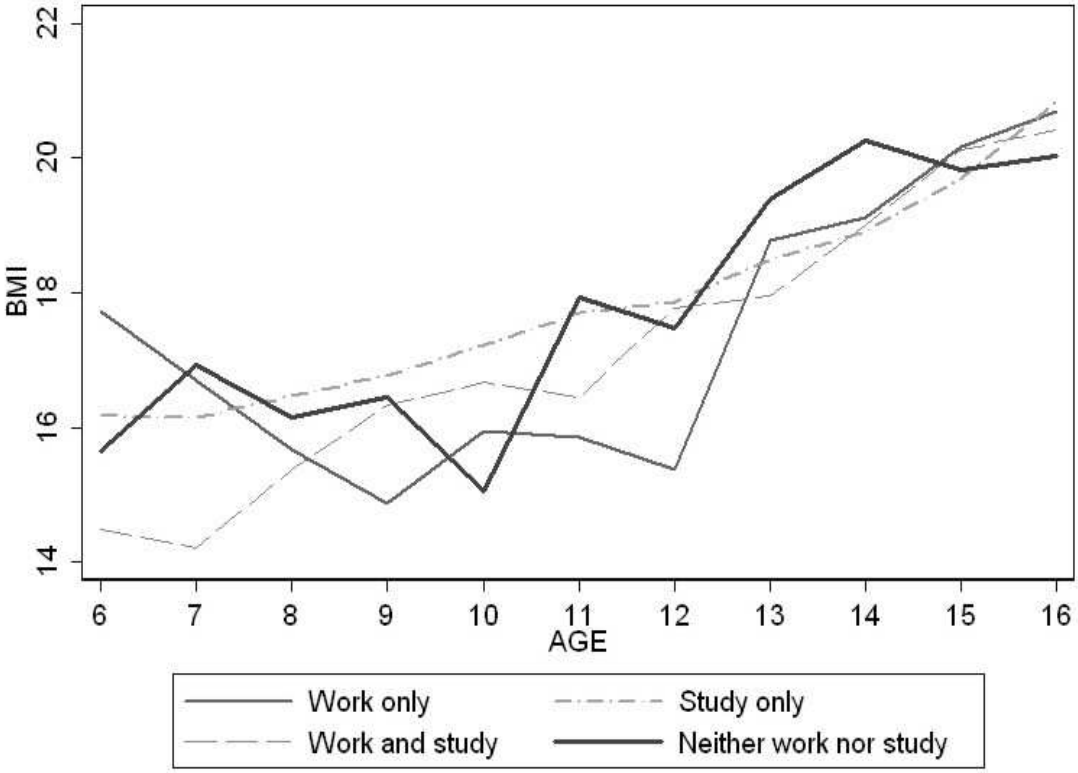

Figure 6: Body mass by age and work/study status (boys)

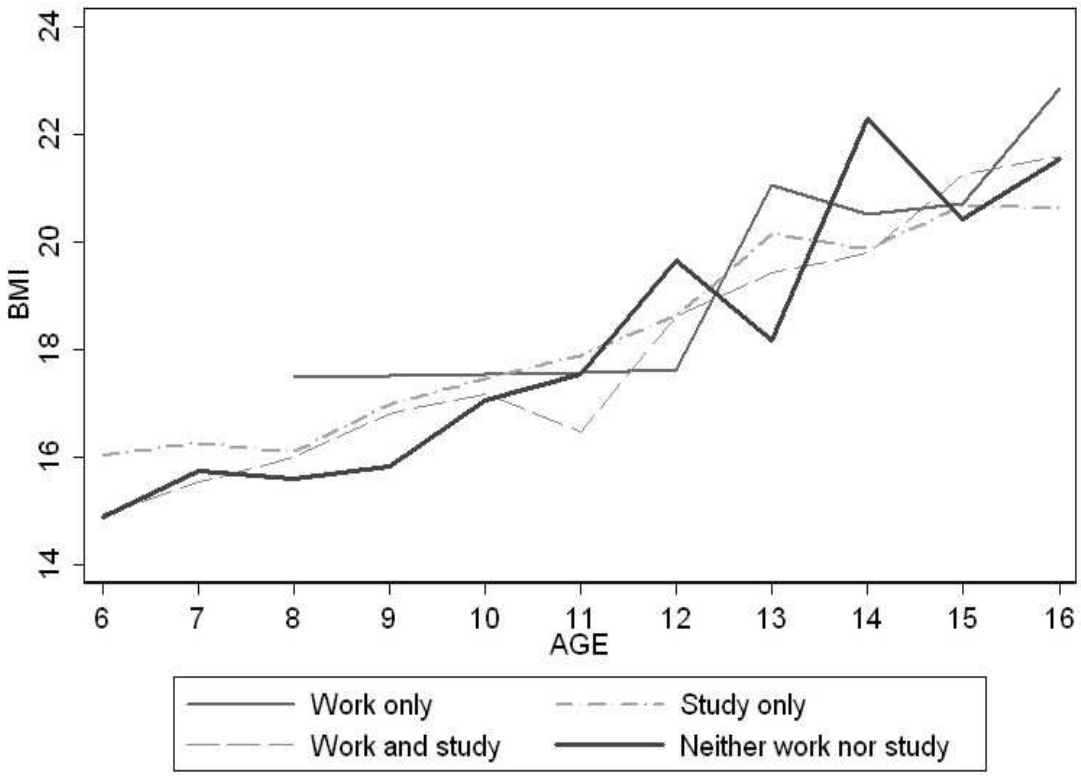

Figure 7: Body mass by age and work/study status (girls)

Summing up, the PPV appears to offer a very rich and interesting data set to explore the determinants of child labor. Especially regarding the issue of education, the PPV has a reasonably detailed set of information. This type of information goes beyond the tradition of reporting some proxy for educational attainment. The data brings detailed event-history type of information about the educational prospects of all individuals from the sample. More specifically, the preliminarily analysis shows some patterns for the likely determinants of child labor.

The next section is concerned with developing and estimating an econometric model of child labor. By an econometric model of child labor, we mean a model that could be able to capture the essential determinants of children time among different alternatives. Of course, this type of endeavor

presents some challenges. Among the more important, we can list:

1. Build an econometric model that represent a compromise the with structural representations of the underlying model of child labor and the "estimability" of the model;

2. justify the use of independent variables by way of using a theoretical mark based on the three models discussed before, i.e., Basu and Van (1998), Baland and Robinson (2000), and, Cigno and Rosati (2005);

3. the resulting estimates should alow the researcher to draw some sound policy conclusions.

As it will be shown below, we are able to reasonably accomplish these three objectives, by using a multinomial logit model and apply it to a subset of the PPV data set.

5 The Econometric Model

Econometrics models trying to assess the impact of different variables on the time children allocate to different tasks has been estimated for a couple of years. Modern examples are Deb and Rosati (2004), Ray (2000), Cigno and Rosati (2002), and, Cigno and Rosati (2005). The literature applying these models to Brazil are much less representative, however. Good examples are Kassouf, Mckee, and Mossialos (2001), and, Krueger, Soares, and Berthelon (2006). With few variations, these authors apply a set up that treats the choice of different tasks as an outcome from a set of finite alternatives, and employ multiple choice models, almost always multinomial logit.

The model proposed here extend past approaches that used Brazilian data sets by incorporating the following:

- Past studies used the PNAD, a Brazilian household micro data set to get their results. Although PNAD is a frequently used data set on empirical applications, due especially to its coverage, detailed questionnaire and rigorous methodology of collection, it has some limitations *vis à vis* the PPV. As outlined before, PPV has much more detailed questions regarding educational outcomes, as well as it has questions about subjective measures of well-being that will proved to be useful later on;

- Following Biggeri and *et alli* (2003) and Deb and Rosati (2004), we take seriously the point that asserts that there are more alternatives than just **only work** and **school only**. This means that we consider other alternatives such as "idle children";
- The fact that we are using a data set collected in 1996-1997, put us in an interesting position to evaluate the situation regarding child labor in Brazil just before the National Congress had passed and sanctioned the Bolsa Escola program[28]. See, Denes (2003).

The next two subsections deal with the multinomial model and the estimation process, respectively. First, a concise discussion of the multinomial logit model and how it is going to model the issues surrounding child labor is developed. After that, estimations are performed and analysis performed on the model's outcomes.

5.1 The Multinomial Logit Model

Our empirical model, although not belonging to the "structural" approach, considers a underlying conceptual framework that was described by the models of Basu and Van (1998), Baland and Robinson (2000), and, Cigno and Rosati (2005). Parents are assumed to control their children time endowment and choose among four different, and exhaustive alternatives, say, **work only**, **school only**, **work and school** and, **idleness**.

The theoretical models described provides support for the existence of a latent parent utility index. As it became conventional in the literature of discrete choice, see, for instance Wooldridge (2002), this latent random variable is called **indirect utility function**. Hence, we assume that a parent from a specific household will choose for child i, the occupation j, where $j = 0, 1, 2, 3$ if he/she will, respectively, choose the alternative **work and school**, **idleness**, **school only**, and, **work**. This parent indirect utility function is:

$$y_{ij}^{*} = X'\beta + \epsilon_{ij} \tag{46}$$

where y_{ij}^{*} is the indirect utility function, X is a vector of independent variables though to influence the parent's choice, β is a vector of correspondent

[28]Bolsa Escola was a major program whose objectives were, among others, to decrease child labor.

parameters, and, ϵ_{ij} is a unobserved random error whose distribution is assumed to be Weibull. Now, the maximizing behavior of parents yeld the following result. A given parent whose vector of independent covariates is X will choose alternative $k = 0, 1, 2, 3$ for his/her child if, and only if, this alternative gives him/her the highest value for indirect utility. This means that:

$$Prob(y_i = k|X) = Prob(y_{ik}^* \geq y_{i0}^*, y_{ik}^* \geq y_{i1}^*, \cdots, y_{ik}^* \geq y_{i3}^*) \tag{47}$$

where $Prob(y_i = k|X)$ represents the probability that the $i'esimo$ parent choose that his/her child perform task k. Clearly, from Equation (47), the value of $Prob(y_i = k|X)$ requires the calculation of multiple integrals. However, a straightforward result from the literature on discrete choice asserts that if ϵ_{ij} are Weibull, the formula for multinomial logit probabilities became:

$$Prob(y_i = k|X) = \frac{\exp(X'\beta + \epsilon_{ik})}{\sum_{j=0}^{3} \exp(X'\beta + \epsilon_{ij})} \tag{48}$$

where $k = 0, 1, 2$. Assuming that observations are independent among households and and children inside a household, maximum likelihood can be directly applied to the sample. Note, however, that as simple as it appears, the multinomial logit model has two important caveats worth mentioning. First, there is the famous implicit assumption of Irrelevance of Independent Alternatives (IIA). This can be better understood by noting that if we pick any two alternatives, say, $j = 0$ and $j = 2$, the relative probabilities for these two alternatives is:

$$\frac{Prob(y_i = 0|X)}{Prob(y_i = 2|X)} = \exp[(X_0 - X_2)'\beta] \tag{49}$$

This means that the relative odds between alternatives 0 and 2 only depends on their independent variables and (common) parameters. Put in a different way: this implies that adding or removing a different alternative, or, changing the attributes of this third alternative will not change the odds between alternatives 0 and 2. This, as is well know, can be implausible(see, Wooldridge (2002)).

A second issue regarding the multinomial logit model is the fact that the marginal effects of estimated parameters are complicated to calculate. One can not infer from estimated parameters the values of the marginal effects, i.e., $\frac{\partial Prob(y_i|X)}{\partial x_i}$, where x_i is a specific continuous covariate included in the

random vector X. However, most econometric and statistical packages have routines to calculate that. Next subsection describes the variables chosen for estimation and perform estimations based on the multinomial logit model.

5.2 Estimation

We start by describing the variables that appears in Table (16). This Table describes all variables used, as well as some descriptives statistics in order to have a general picture of the available empirical content. The variable *sex* tries to capture any difference between parent's behavior towards their children sexes. There has been empirical support for the fact that parents tend to invest more in males(see, Cigno and Rosati (2005). Age effects are captured by both *age* and *age*2 (age squared), with the later trying to represent any non-linear effect of age. An important variable, say *education*, measures the completed years of education of the child. Clearly, this is an important control as one expects to decrease the probability of sending a child to work the higher *education* is, *ceteris paribus*.

Both the number and age structure of the household's children are represented by variables $n6-16$ and $n0-5$, respectively, the number of children aged between six and sixteen years, and, the number of children aged between zero and five years. The justification for the use of such type of variables dates back to the seminal paper on child's investment by parents: Becker (1965). Also, these variables are rooted on fertility issues that appear in, for instances, Basu and Van (1998) and Cigno and Rosati (2005). The "quality" of children is proxied by the variable BMI, Body Mass Index. The BMI is a widely used index to measure nutritional status of human population. Specifically in Economics, the BMI has been used not only to measure nutritional status, but also as a good predictor of children survival to subsequent stages of life, see, for instance, Klasen (1996).

Dummies for region and geographical area are used. Given the available data set, there are observations coming from only two distinct regions[29]: Northeast and Southeast. Brazilian'a regional disparities could be very well represented by those two contrasting regions. The Southeast regions is the richest, and most developed region of Brazil. As a matter of fact, the state of São Paulo, the richest and more industrialized in the whole country, is

[29]Unfortunately, the PPV does not make available the identification of less aggregate information that could be used.

located in the Southeast region. Differently, the Northeast region has been historically a very poor and unequal place. These regional differences are captured by the dummy *region*.

The geographical area can be inferred from the dummy *urban*. That child labor could have different determinants if the analysis is performed in urban areas or rural areas is a point already known to researchers. So, it is very important to condition on that variable. In fact, it appears that the very type of job that children perform in rural areas are different than the type of tasks performed by urban children. For instance, while a rural child laborer is more likely to perform agricultural tasks, that is probably less deleterious than to his/her health, a urban child worker is probably doing a harder job. Also, idleness in urban areas raises much more concerns than its reciprocal in rural areas.

As discussed in Subsection (3.2), parents educational background is likely to influence child labor. These influences are not symmetrical, as past studies[30] shows that mothers will probably have a stronger effect that fathers do. Two variables, *educf* and *educm* represents, respectively, father's educational achievement and mother's educational achievement. The size of the household is represented by *size* and includes all household members, i.e., parents, children, grandparents and servants. Income *per capita* is used as a measure of available resources to spend in consumption. Of course, one might wonder why measures of wealth were not applied. There are a couple of variables in PPV that could e used as proxies for wealth. However, the number of missing values are huge. Variable *income* is used to represent income *per capita*. The last variable, *eval*. measures the expectation that parents have over their level of education. Since this kind of variables, as far as we know, has not appeared in the literature of child labor, it deserves a little elaboration.

As a nice innovation, the PPV, in Section 15 - *Avaliação das Condições de Vida* (Evaluation of Life Conditions), makes some subjective welfare measurement questions. These kind of questions ask the household member to answer his/her subjective assessment of welfare in different situations. Sometimes it could ask, for instance,

> *In your opinion, the total income of your family allows that all of you live your lives?: with difficulty, more and less difficulty, or, easily*

[30] See those citations at Subsection (3.2).

Table 15: Description of Variables

Variable	Description
sex	child's sex (male = 1)
race	child's race (white = 1)
age	child's age in years
age2	squared child's age in years
education	child's education in years
n6-16	number of children ($6 \leq age \leq 16$) in the household
n0-5	number of children ($age \leq 5$) in the household
BMI	BMI ($\frac{weight}{height^2}$)
northeast	regional dummy (NE = 1)
urban	geographical dummy (urban = 1)
educf	father's education (elem. = 1, middle = 2, high = 3, superior = 4)
educm	mother's education (elem. = 1, middle = 2, high = 3, superior = 4)
size	number of people in the household
income	household income per capita
eval.	subjective welfare question (very good = 1, good = 2, regular = 3, bad = 4, very bad = 5)

Source:

Other type of question asks the respondent to grade, in a subjective scale, how he/she evaluates some dimensions of household welfare or expenditures. For example,

> *How do you evaluate the life conditions of household members regarding to Education/Schooling Level?: very good, good, regular, bad, and, very bad*

The latter was the exact question that we have taken n order to use as the last independent variable. The hope is that that variable, represented by *eval.*, could be an exogenous source of variation of how intense the household head values the level of schooling of the household members. It is a first innovative attempt to depart from traditional measures of returns to education that are so hard to figure out. The use of subjective questions to aid the estimation

of econometrics models is a novel development, see, for instances, Pradhan and Ravallion (2000), and, van Praag, Frijters, and i Carbonell (2000). Now, we proceed to the estimation, but before it is important to take a look at Table (16).

Table 16: Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max	Obs
sex	0.51	0.50	0	1	4664
race	0.41	0.49	0	1	4664
age	11.18	3.14	6	16	4664
age2	134.89	69.81	36	256	4664
education	3.75	2.53	1	12	4664
n6-16	2.52	1.35	1	8	4664
n0-5	0.51	0.82	0	5	4664
BMI	18.09	3.47	9.13	43.04	4340
northeast	0.58	0.49	0	1	4664
urban	0.71	0.45	0	1	4664
educf	1.65	0.95	1	4	4452
educm	1.65	0.93	1	4	4595
size	5.75	2.24	2	16	4664
income	285.38	585.36	0	13361.81	4346
eval.	2.73	0.87	1	5	4649

Source:

Table (16) presents all independent variables together with mean, standard deviation, minimum and maximum values, as well as the number of valid observations. The next step is to estimate the model. The model used is described in Equation (48), and was estimated using the *mlogit* routine from $STATA^{TM}$, version 9.1 from StataCorp. The estimated coefficients together with their standard errors are show in Table (17).

However, the information on Table (17) is not completely informative. The important information in a model is the marginal impact, i.e, the marginal change in the dependent variable given the correspondent marginal change in a specific independent variable. As it is well know, see, Wooldridge (2002), the marginal effect usually has not only a different value but also, sometimes, it switch the sign. Luckily, $STATA^{TM}$ has a algorithm (*mfx*) to compute the marginal effects, together with standard errors, for all independent variables

Table 17: Estimated Coefficients

Var.	1	Coef.	Sd. Dev.	2	Coef.	Sd. Dev.	3	Coef.	Sd. Dev.
sex		1.2640	.2417		1.2024	.1321		-.1051	.1392
age		-.1783	.4086		.7154	.2259		-1.8278	.1688
age2		.0359	.0167		-.0142	.0092		.0924	.0078
education		-.3429	.0698		.0242	.0392		-.4274	.0532
n6-16		.0346	.1081		.2107	.0666		-.0807	.0795
n0-5		.2317	.1466		.0744	.0956		.1890	.0913
BMI		.0580	.0378		.0449	.0207		.0556	.0229
northeast		-.1958	.2463		.4822	.1335		-.4835	.1499
urban		-2.3753	.2803		-1.3753	.1331		-.3941	.1495
educf		-1.2114	.4934		-.3764	.1150		-.1966	.1456
educm		-.4979	.4134		-.3153	.1182		-.5140	.1738
size		.0755	.0719		-.01657	.0457		.0233	.0507
income		.0006	.0002		-.0001	.0002		-.0023	.0007
eval.		.5555	.1361		.1093	.0786		.6365	.0840
cons		-6.6885	2.6731		-9.3998	1.4418		5.7765	.9997

and to each possible value of the dependent variable. Tables (18), (19), (20), and, (21) represent the marginal effects for **only work**, **work and school**, **idleness**, and, **school only**, respectively. The symbol $(*)$ means statistic significance at the 5% level.

Table 18: Estimated Marginal Effects - (Only Work)

Variable	$\frac{\partial y}{\partial x}$	Std. Dev.
sex	.0035	.0014 (*)
age	-.0004	.0012
age2	.0001	.0001
education	-.0009	.0004 (*)
n6-16	.00007	.00031
n0-5	.0006	.0004
BMI	.0001	.0001
northeast	-.0005	.0007
urban	-.0122	.0047 (*)
educf	-.00339	.0012 (*)
educm	-.0013	.0011
size	.0002	.0002
income	2.02e-06	.00000 (*)
eval.	.0015	.0006 (*)

Table 19: Estimated Marginal Effects - (Work and Study)

Variable	$\frac{\partial y}{\partial x}$	Std. Dev.
sex	.0568	.0071 (*)
age	.0352	.0094 (*)
age2	-.0007	.0004 (*)
education	.0017	.0017
n6-16	.0097	.0030 (*)
n0-5	.0031	.0043
BMI	.0019	.0009 (*)
northeast	.0223	.0059 (*)
urban	-.0821	.0113 (*)
educf	-.0168	.0052 (*)
educm	-.0137	.0053 (*)
size	-.0008	.0020
income	-6.19e-06	.0000
eval.	.0041	.0036

Table 20: Estimated Marginal Effects - (Neither Work nor Study)

Variable	$\frac{\partial y}{\partial x}$	Std. Dev.
sex	-.0044	.0036
age	-.0491	.0073 (*)
age2	.0024	.0003 (*)
education	-.0112	.0019 (*)
n6-16	-.0024	.0020
n0-5	.0048	.0025 (*)
BMI	.0014	.0006 (*)
northeast	-.01387	.0043 (*)
urban	-.0079	.0046 (*)
educf	-.0046	.0038
educm	-.0131	.0045 (*)
size	.0006	.0013
income	-.0001	.0000 (*)
eval.	.0166	.0030 (*)

Table 21: Estimated Marginal Effects - (Study Only)

Variable	$\frac{\partial y}{\partial x}$	Std. Dev.
sex	-.0559	.0083 (*)
age	.0143	.0120
age2	-.0017	.0005 (*)
education	.0105	.0027 (*)
n6-16	-.0074	.0039 (*)
n0-5	-.0086	.0053 (*)
BMI	-.0035	.0012 (*)
northeast	-.0078	.0076
urban	.1023	.0130 (*)
educf	.0248	.0066 (*)
educm	.0281	.0071 (*)
size	-.0000	.0026
income	.0000	.0000 (*)
eval.	-.0222	.0049 (*)

Before we start commenting on the estimated coefficients, it is important to describe more carefully the interpretation of the results. To do so, note that:

1. All marginal effects are calculated having the choice **Study only** as the referential state. This means that any draw conclusions must consider that;

2. Although we could analyze each of the three tables, i.e., Tables (18), (19), and, (20), pragmatism direct us to concentrate on Table (18) and (19);

3. Note that when a marginal effect means that a specific change in an independent variable **increases** the probability of a child belonging to a specific state, we do not know from which state this child is likely to depart from.

After these initial remarks, let us proceed to the analysis. The first interesting point is the fact that for those variables that have a significant parameter, the absolute values for **Work and Study** are greater than those

values for **Only Work**. This is the case for *sex*, *urban*, *educf*, *income* and *eval*.. A likely explanation is that the state **Only Work** is a quite awful one. Even in poor households, the availability of information about the risks associated with child labor, refrain parents to condemn their children to such a terrible situation. However, the state **Work and Study** is much more sensible to changes in independent variables, sometimes more than ten times the correspondent effect.

For **Only Work**, being a men increases the probability of becoming a child worker, however a higher achieved degree of schooling decreases this chance. Living in a urban locality decreases the chances that a child only works. Interesting, father's education, and not mother's education, decreases the chance of child labor. Income per capita has a positive value on child labor, i.e., the higher the income the higher the probability of child labor. This apparent contradictory result could be reflecting credit constraints. The positive sign of *eval*. makes sense. Note that the higher the value of this variable, the lower the household head appreciates the level of education of the household's members.

As to **Work and Study** is important to first note the great impact of the variable *urban* in the probability of belonging to that category. The key interpretation problem is that for a given effect, say increase the probability, on **Work and Study**, one may wonder whether the improvement happens because more people who used to work only started to study also, or whether people who only study started to work altogether.

The effects of parents educational background are both positive and significant. Interesting, the impact of father is greater than that for mothers. Now, *age* and *age*2 are positive and negative, respectively. This means that the older the child the less likely to do both working and schooling. However, this pattern is not monotonic, it reaches a maximum than decrease after that, since $age2 = -0.0007$. Also, BMI is now positive and significant, showing probably that parents will allow better nurtured children to do some working besides going to school.

The variables *income* and *eval* have the expected values, i.e., negative and positive, respectively, as well as both are statistically significant. Finally, it is worth mentioning that the number of siblings aged between six and sixteen has a positive effect. Probably, the greater the number of children the higher the probability a parent will send their children to work as a supplemental income device. Next Section concludes by commenting on some issues that could be discussed taking the estimates in consideration.

6 Conclusions

After the long analysis, both theoretical and empirical, of the issue of child labor, one wonders at what kind of conclusions we have reached. This is a formidable task. As it hopefully became evident, child labor is a very complex subject, and as it need to be approached from different perspectives: economic, sociological, political and so on. Even if equipped with a sound methodology, the task of drawing specific conclusions does not belon to the realms of Social Sciences. However, we are sure that important lessons can be taken from this long way:

1. Child labor is a very complex phenomenon. Just after one decides to start studying the subject, it is necessary to deal with issues concerning the very definition of child labor;

2. The theoretical models abound. Sometimes, many of these models deliver contradictory or very unrealistic outcomes. However, it is an inevitably feature of good scientifically work, i.e., to figure out a sound model;

3. The empirical methodology is still grounded on the estimation of multinomial choice models. It appears that it is necessary to depart from multinomial logit, in other to avoid the, very restrictive, IIA assumption;

4. There are key differences among the determinants of child labor in Brazil;

5. The fact that geographical localization has a strong effect in child labor demands that both analysis and policies be heterogeneous;

6. The strong effect of parental education should call attention to policy makers to the fact that in order to decrease child labor, a program of educational improvement of parental education could be a nice strategy;

7. The effect of income per capita, although weak, signals that policies to improve income and easy credit constraints are both viable options to governments that want to fight against child labor;

8. The government should follow closely the undesirable effects of its interventions.

An interesting finding of this report is the key role of parents evaluation of the importance of education on child labor. In fact there is growing evidence that in order to evaluate the impact of interventions, governments must be aware that parental perceptions as to the value of some key variables that are policy-targets can be very heterogeneous. The orthodox approach to policy evaluations is to not consider heterogeneity in parental perception. But if different parents have different perceptions as to the value of education, clearly they will respond differently.

The innovative approach taken here is to use the subject welfare question regarding the perceptions of parents as to the satisfaction regarding household level of education as a proxy for their perceptions. It appears that this could be a fruitful strategy to further explore, since the variable *eval*. has a strong and significant effect.

As a closing comment, it is important to stress the fact that many directions for future research are now open. First, we believe that the expectations of parents should be incorporated in a more developed way. Second, the dynamics of educational achievement must be modeled together with labor markets dynamics. This is a topic of great interest. Third, multinomial probit or mixed logit models should be applied to model child labor, as these models dispense with the IIA assumption. Fourth, fertility behavior should be included in a more detailed way.

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