CHILDREN IN BRAZIL: HEALTH, EDUCATION AND WORK

Carine Milcent
CNRS-PSE (France) and IEMS-Université de Lausanne (Switzerland)

Jack Huguenin
CNRS-PSE (France) and IEMS-Université de Lausanne (Switzerland)

Danielle Carusi-Machado
CNRS-PSE (France) and IEMS-Université de Lausanne (Switzerland)

Resumo

No Brasil, apesar da participação no sistema educacional ser obrigatória para as crianças entre 7 e 14 anos de idade, algumas não estão matriculadas na escola. Uma das principais razões é a sua inserção no mercado de trabalho que pode, conseqüentemente, ter um impacto na sua saúde. Escolas públicas no Brasil usualmente oferecem merenda e mais, crianças que trabalham às vezes cumprem dupla jornada: trabalham e estudam. O estado de saúde da criança pode estar sendo afetado pela participação ou não na escola e no mercado de trabalho. Problemas na freqüência escolar e no progresso educacional podem estar relacionados ao trabalho infantil e ao estado de saúde da criança. Desta forma, não podemos investigar esses três aspectos da vida da criança sem considerar as suas várias inter-relações. Neste artigo, usamos a Pesquisa de Padrões de Vida de 1996/1997 (PPV/IBGE) para mostrar essas interações, Trabalho infantil e freqüência escolar têm uma forte correlação. A freqüência escolar tem um impacto negativo na probabilidade da criança participar do mercado de trabalho. A participação da criança no mercado de trabalho afeta negativamente a probabilidade da criança avaliar bem a sua saúde. A principal conclusão do artigo é que uma política de desenvolvimento do capital humano deve considerar ambos os aspectos: saúde e educação. Uma política focada apenas em educação, como incentivos em ir à escola, tem efeito positivo na redução do trabalho infantil, mas não parece suficiente para melhorar a saúde das crianças. Na elaboração de políticas, o governo deve focar na população em risco social, crianças de famílias pobres, morando em piores condições e obrigadas a se inserirem no mercado de trabalho.

Abstract

In Brazil, even though school participation is compulsory for children between 7 to 14 years old, some of them are not enrolled in the education system. One fo the main reasons is their participation to the work market that may have an impact on their health. Moreover, child's school attendance in public schools usually insures a meal to child but for children working, they have to accumulate two journeys: school and job. So, child's health could be explained by both, school attendance and work market participation. In addition, problems related to school attendance and school progress could be related to child work or his health. Therefore, we cannot explore determinants of one of these components school attendance, health and child work without studying their interactions. In this paper, we use the database Living Standards Measurement Study Survey 1996/1997 (Pesquisa de Padrões de Vida -- PPV) to look at this interactions. It appears that child's labor and school attendance have a very strong correlation. School attendance has a negative impact in child's probability to participate in labor market. For instance, child ´s labor market affects negatively child ´s probability to evaluate his health as good and excellent. We also note that school attendance does not have a significant impact in child ´s health evaluation. The main conclusion of our article is that the development of human capital should consider together health and education. A policy focusing only in education, as incentives to go to school, does not seem to be sufficient to improve child's health. Also, government should also consider the population at risk, as children from poor families, living in worse conditions and obliged to work.

JEL: I12 J13 J18 J24

1. Introduction

The aim of this paper is to investigate interactions between health, education and participation to the labor market during the childhood and propose political instruments to improve the wellbeing of child in Brazil, i.e. his health status and his education. Indeed, improving the education of the child without improving his health status will not give him all the chances to succeed his adult life.

In Brazil, a child who follows a standard education profile should enter in the education system with the correct age (7 years old) and if he does not repeat any grade or drops out, so he finishes the compulsory part of school with 14 years old exactly. After 14 years old, even though a child could not finish the first degree of education system, he is not obliged to stay at school. School participation is compulsory for children between 7 to 14 years old, but we can still verify that there are children who are not enrolled in education system.

This phenomenon is more common in the poorest classes, where child labor could be an important source of income for the household, corroborating one of the assumptions in the economic literature of child labor: the luxury axiom. As commented by *Basu and Tzannatos (2003)*, "the luxury axiom asserts that poverty is the main cause of child labor, and leisure is a luxury good. Households whose adults' incomes are very low cannot afford to keep children out of some productive activity." Parents decide to keep their kids in labor market, as a strategy to complement the household budget, affecting education and future earnings of their children, as well as their mental or physical health. If household income falls short of subsistence consumption level, children are sent to work in spite of going to school or having more leisure time. *Jacoby (1994)* argues that borrowing constraints are an important factor determining withdrawal from school.

At the end of the 90's, an education program called "Bolsa Escola"[1] was implemented in Brazil. "Bolsa Escola" is a poverty-targeted social assistance program, so it gives cash grants to poor families (household per capita income less than R$90,00, so US$29 per month) who have children aged less than 15 years old. For each 3 months, child's participation in school is evaluated and if in any of these months, it is less than 85% of the classes, the household is not eligible to the program anymore. Therefore, this policy intervention creates incentives for parents to send their children to school, increasing school attendance and reducing school absenteeism. This program supposes that household income (and so, child's income) is the principal determinant(s) of a child's school attendance.

As a matter of fact, parent's income is not the only element affecting child's school attendance. We believe that child's education is also influenced by household composition, standards of life and the social context where children live and child's health, child's participation in labor market and own characteristics. A policy that intends to increase children's education should consider all aspects of child life. Moreover, even though this program, "Bolsa Escola", focuses on school attendance, we may still have problems associated with child's education progress due to repetitions. These problems - school attendance and school progress - could be related to child work or his health. Children who are working do not have enough time to dedicate to school and children who are not in good health could have difficulties in following the education system. All these components could be considered in the policy decision, which would have as a target not only child's education but also his health and working conditions.

Some authors (*Glewwe and Jacoby (1995), Behrman and Lavy (1994)*) point out that an undernourished child has difficulties to learn and to go to school. Children's work is influenced directly by the economic situation of the household, and when a child is working, less time or no time is allocated for studying.[2] A child's schooling should be affected negatively because his incentive to participate at the education system and his progress in depends on his health situation and on the time devoted to study. Child work could also negatively affect his current or long run health situation. This child could also

[1] In 1995, local experiences, as "Bolsa Escola", had been implemented in some Brazilian districts (Distrito Federal, Campinas e Ribeirão Preto). In 1997, a policy law approved a minimum income action which emphasizes child's school attendance and from 1998 to 2000, the poorest Brazilian districts received federal help to implement this program. In 2001, "Bolsa Escola" program was extended to all districts who want to participate in the program.

[2] It is important to note that in some cases child's labor could be viewed as good to child life, for example if child occupation is not so damaging to him and if the family needs a lot additional resources to increase food expenses or school enrollment.

evaluate his health negatively, since he feels more tired than other children, who are not working. This child has probably a very busy journey: school, work and homework.

Moreover, there are a lot of interactions between investments in health and education, and labor market insertion, in particular for children. So, notably work decision, school attendance and health status interact with each other but are also affected by parent's income and socioeconomic household conditions. For instance, parent's income influences directly the amount of resources allocated to food and medical expenses, so it has also an impact on child health status. More generally, in developing countries, the amount of resources parents intend to invest in child's education or health is closely related to their social economic situation. There is a large body of literature showing the difficulty of poor families to keep children attending school or to give them conditions to be in a good health. In sum, parent's income influences the three aspects we are studying related to childhood, so when analyzing child's decision about education and work and his subjective health evaluation, we must consider household income, social context of the household and standard of life.

To provide a highlight to policy, we study the interrelations between these three variables – child's health and child work and child's education in Brazil. Indeed, a more efficient policy of monetary transfer do not have to consider only one of its potential effect - even if that is its main target - but also its other potential effects. Monetary effect could not only affect education but also child health and the probability of child labor. Moreover, in the long term, this monetary transfer could affect different aspects of children lives, especially human capital accumulation in terms of education and health.

In this paper, we use the Living Standards Measurement Study Survey 1996/1997 (Pesquisa de Padrões de Vida - PPV). It is a household survey made for two Brazilian regions (Northeast and Southeast), where we can find questions about health, household characteristics and education. From this survey, we can investigate school attendance[3] and children school progress in the primary cycle and gymnasium, and their interactions with health and child work. As this survey was made before the existence of the "Bolsa Escola" program, we can assess the income impact on school attendance and child's health before its implementation. In the descriptive analysis, child's health is evaluated not only by the self-reported health status, but also by Body Mass Index (BMI). The self-reported health status is considered as a good predictor of the mortality by numerous authors (*Idler and Benyamini, 1997; van Doorslaer and Gerdtham, 2003; Deaton, 2003)*

We estimate a system of three behavioral equations for children and teenagers (school attendance, health status and child work). We relieved the assumption of independence of the disturbance terms of each equation. Moreover, if causalities between these three components (school attendance, health status and child work) can go in the two ways, it can also be the result of a simultaneous decision process. Thus, to take into account both endogenous aspects and simultaneity, we estimated different specifications for all three equations using full information maximum likelihood using a simultaneous equation probit specification.

It appears that child's labor and school attendance have a very strong correlation. School attendance has a negative impact in child's probability to participate in labor market. For instance, child ´s labor market affects negatively child ´s probability to evaluate his health as good and excellent. We also note that school attendance does not have a significant impact in child ´s health evaluation. The main conclusion of our article is that the development of human capital should consider together health and education. A policy focusing only on education, as incentives to go to school, does not seem to be sufficient to improve child's health. Also, government should also consider the population at risk, as children from poor families, living in worse conditions and obliged to work.

2. Empirical Literature on these three aspects

School attendance and child labor have been usually analyzed together. Education and child labor literature in Brazil is usually separated from health studies. We are interested in interactions between the three topics (health, schooling and child's labor), a topic which has never been analyzed.

[3] We remark that our variable school attendance only captures if child is enrolled at school, we do not know anything about his school absenteeism.

Many aspects influence the quality of life and the well being of an individual. Concerning children, the future quality of life is influenced by activities and investments taken place during childhood. These investments, chiefly in health and education, will determinate productive capacity[4] and results in the labor market, as human capital theory predicts (see *Becker, 1964*). When a child is healthy and well nourished those aspects could produce short term positive aspects concerning motivation and learning skills and, long term cumulative positive aspects in adult life. If a child has a poor quality of diet or is undernourished, such facts may bring negative effects not only for present school attendance (*Glewwe and Jacoby, 1995)* but also for future productivity in the labor market.

Another aspect that impacts child's quality of life is time devoted to study and leisure. Even though particular types of children's labor could be in some cases beneficial for learning economic skills and for improving household well being. Child's income could be a key aspect for household survival[5] but it can have negative and irreversible effects in child's health and education.

These three aspects (education, health and work) reflect household decisions. In case of education and health, decisions are made taking into account preferences and cost and benefits that result from resource allocation inside household. Particularly in developing countries, many households face credit constraints. In this context, they must decide if their children will go to school or to the labor market in order to make more money to household survival.

On one hand, child labor can be detrimental to the acquisition of formal education, both quantitatively and qualitatively, and causing damage to health or other things that impact in adult human capital, leading to lower wages in labor market. On the other hand, there can be positive pecuniary benefits to young labor, as vocational training and learning by doing, general workplace experience, professional contacts, etc. Young laborer can acquire some working experience in his job. Child labor could also be a way to finance education or health services in a very poor household.

In this article, we intend to identify the main aspects explaining school attendance, child's labor and the health status. We believe that these three aspects strongly interact. Child labor and health have a deep effect in school attendance. A child who is working has less time to dedicate to school. Otherwise, child's health status can influence the decision if child go or not to school and to work.

As already said in introduction, child health literature in Brazil focus on estimations of health demand reduced form, and which factors affect more or less this demand (*Kassouf (1994), Kassouf and Senour (1996) and Alves and Belluzzo (2004))*. In developing countries, there is a large literature on the demand for schooling and the related issue of child labor. In Brazil, researchers focus mainly on one dimension of child's quality of life: why some children go to labor market instead of entering in school life. The main purpose of Brazilian literature is to understand the reasons why parents prefer to send their children to work rather than sending to school.[6]

Household decisions concerning education and labor are analyzed independently, without taking in account interrelations caused by unobservable factors. For example, a child who has higher than average manual abilities would face a higher probability to help mother in domestic work. This fact will affect simultaneously the decision in between work or investment in human capital. Therefore, there are a lot of interactions between health and education and between health and child labor, mainly in childhood.

Positive correlations between education and health could be explained by the causal effect of education on health or the inverse: a causal effect of health in education. As *Berger and Leigh (1989)* point out there is not a consensus in economics about mechanisms through which education contributes to an increase in health. This fact can be caused by a direct effect, since more educated people are more efficient in health production and in resources allocation to health, or by an indirect effect, related to genetic factors. These unobservable factors could influence health and education in the same direction. So, in this case, education is not a cause of better health. Better educated people are also in better conditions to maintain their good health. For teenagers and adults, literature shows that their own level of

[4] There are many articles showing the positive relation between health and income. *Thomas and Strauss* (1998) show that there is a strong and positive relation between height and wages in Brazil, using a consumption database (ENDEF).

[5] This fact happens mainly in very poor families. *Satz (2003)* and *Basu and Chau (2003)* argue that banning all child labor may drive families to poverty or children to even worse options in informal and/or illegal market.

[6] *Basu* (1999) has an extensive international survey about this issue; for Brazilian case, see *Kassouf* (2001).

education can impact in individual health by efficiency in production of health or by others unobservable variables, as temporal preferences. For instance, an individual who learns the damages caused by smoking would be less attractive to cigarettes.

Concerning children, as high is parental education level; more efficient will be health production and larger will be preferences for maintaining a good health state. *Kassouf (1994)* estimated health demand for Brazilian children new born and who are still in the kindergarten. Increases in mother's educational level produce a better resource allocation to health. *Alves and Belluzzo(2004)* found the same results. They investigated Brazilian children ageing zero to 12 years using the same database we are using. Both utilize indicators based in anthropometrics measures. *Thomas, Strauss and Henriques (1991)* show that parental education, mainly mother's education level, has a significant positive impact on child health especially concerning height. The impact of mother's education can be explained by access to information: reading newspapers, watching television and listening to radio. Availability and processing of information have a particular role in the transmission of health education affecting child's nutrition. Infrastructure in a community, as garbage services or proximity of a hospital, is also a determinant of child's health. They show that there are significant interactions between maternal education and the extent of this infrastructure.

On the other hand, health can impact in educational human capital accumulation, particularly in the case of children. A well nourished child with good health state has a higher probability of performing better at school. Calculating this effect is not trivial because health quality indicator could be polluted by unmeasured errors. *Behrman and Lavy (1994)* also argue that previous studies supporting the role of child health on child schooling have failed to incorporate into the analysis the endogenous nature of child health. Child health and schooling should be defined together by households and there could be unobserved factors affecting both in different directions. The impact of child health on child education can be biased if the researcher does not consider these interactions. These authors estimated an educational production function, based in cognitive achievement, where health and child's nutrition are the production factors. Depending on the hypotheses made about household behavior, different estimates are calculated.

Glewwe and Jacoby (1995) investigate school late entrance in low income countries. They show that when considering household and community characteristics, there is a great support of the evidence that late primary school enrollment is caused by nutritional deficiencies in childhood and not by supply constraints (for example: lack of schools) or liquidity constraints.

Estimates of health impact in educational success of children are sensible to behavioral hypotheses made and to the nature of the factors unobservable. The great majority of articles in this area of research focus on child nutrition and education, but usually they have not considered that health state and school decisions can be influenced by the same household decision process about time and resources allocation.

One exception is *Alderman et alli (1997)* who estimate health impact in school attendance of children from 5 to 7 years old in rural Paquistan, using a longitudinal database with 800 households. They use two variables to measure child health state: an indicator of height corrected by age and normalized with z-score method and the number of diarrheas in the last 3 weeks before survey application. They have longitudinal information, so they can calculate health effect in the moment children should decide to enter or not to enter school. Their evidence suggests that policies that intend to increase child's health have a great and positive impact in school attendance, mostly in girls. These effects would result in future rewards, since a better health and education contribute positively for earnings increases due higher labor productivity.

3. Descriptive analysis and data information

3.1. Data information

The LSMS Brazil Survey - 1996/1997 (Pesquisa de Padrões de Vida -- PPV) was published by Instituto Brasileiro de Geografia e Estatística (IBGE) together with the World Bank. In this survey, we have information about education, household characteristics and anthropometrics information for all the residents. So we have together information about life conditions and parent's income and others crucial

indicators to define school attendance, health, child work. The survey is composed of 19.409 persons living in 4.940 households, distributed in the Northeast and Southeast.

We select 3.087 children between 7 to 14 years old, 15,9% of the total sample. In the northeast region, 17% are children with 7 to 14 years old. In the southeast region, this proportion is 15%. We find almost similar results with the PNAD/1996: 19% in the Northeast and 16% in Southeast.

To analyze children's education aspects we constructed one indicator for school attendance and we focus on the compulsory part of education. The law obliges parents to send their children from 7 to 14 years old to school except if the 8 degrees of primary and gymnasium are done. If the child follows a standard education profile[7] he will finish primary and second education level with 14 years old. We believe that for all children and teenagers in our sample the minimum of education level is the level established as compulsory by law. Our dependent variable assumes value one if the kid is attending school and zero in the other side. Keeping in mind this aspect of education we are interest in, we obtain a sample of 3.087 kids with 7 to 14 years old, as can be seen in the table 1. In order to have a picture of children who are in the age of compulsory school, we present descriptive statistics from this sample.[8]

Table 1: Our Sample – children with 7-14 years old

		Regions		Areas		
		Northeast	**Southeast**	**Rural**	**Urban**	**All regions** (a)
SAMPLE	# obs.	1762	1325	928	2159	3087
	% work	6,9%	3,8%	12,1%	2,8%	5,6%
	% health1	48,2%	54,5%	39,9%	55,6%	50,9%
	% freq	91,3%	94,7%	85,2%	96,0%	92,8%

OBS: (a) All regions and rural and urban areas together.
(b) Rural and urban areas incorporate southeast and northeast regions.
(*) We drop out 20 children who do not have information about parent's economic activity

3.2. Descriptive statistics

3.2.1. Geographical differences

Our database has information about two very different regions: Southeast and Northeast. We can look rapidly to three specific indicators: household welfare (per capita income), household composition (average number of persons in the household and average age of children), and standards of living (existence and quality of water, lighting, sewer distribution, material used in walls, roof and in the floor, etc.).

In our sample, the household median income per capita is of 91 reais (US$28,90). A strong difference is observed depending on the region: 64,52 reais (US$20,41) in northeast and 142 reais (US$45,11) in southeast. More than 75% of children located in northeast region have a household with less than 154,95 reais (US$49,22).

These income differences are sufficiently explained by regional economic structure. In northeast region, 28,6% of children have a father or mother who are employed in an agricultural activity, while in southeast the percentage of children's parents in agricultural activity decreases to 19,6%. Wage in agricultural sector is usually lower than in others. In northeast region, rural areas, and consequently agricultural activity is predominating, thus household per capita income level is lower than in southeast region.

As a matter of fact household conditions are better in urban than rural areas. The proportion 46,6% of children in Northeast region is living in households where water to drink is filtered (71,9% in the southeast). Differences are also remarkably when we focus on sewer distribution. In the Southeast, 58% of children lives in houses with the sewer system whereas this proportion decreases to 26.6% in the Northeast.

[7] This means that the child does not repeat a grade or do not drop out school system.
[8] We do not use information about working hours to child's labor supply (this variable, particularly for children, has many missing values). We are only interested in the child's participation in the labor market.

If we look to rural and urban classification, we note that the proportion of children living in houses with filtered water in rural area is 39,2% and in the urban area, 65,3%. In terms of sewer distribution, the scenario is more dramatic since only 5,2% of children in rural areas are living in a house with a sewer distribution system. In urban regions, this proportion increases to 55%.

Table 2: Regional differences

	Northeast	Southeast	Urban	Rural	Total
Number of households in the sample	1.008	832	473	1.367	1.840
Total sample (Children 7 to 14 years old)	1.762	1.325	2.159	928	3.087
Family per capita income (mean) (em US$)	57,62	92,88	93,51	24,48	72,75
Standards of Life					
% children living in a house with filtered water	46,6	71,9	65,3	39,2	57,5
% children living in a house with sewer distribution system	26,6	58,0	55,0	5,2	40,0
% children living in a house with electric light	83,0	93,4	99,5	59,4	87,4
% children living in a house where primary material of the outside walls is finished wood	83,4	94,3	94,4	73,5	88,1
% children living in a house where primary flooring material is adequate	25,8	51,4	47,9	11,1	36,8
% children living in a house where primary roofing material is adequate	95,9	99,1	99,3	92,6	97,3
% children living in house where the street on which the residence is located is asphalt or paving stone	40,2	58,6	65,9	6,8	48,1
% children living in house where the garbage is collected	54,0	68,8	81,4	11,3	60,4
Media of the number of rooms in the household	3,9	3,6	3,7	4,0	3,8
% children living in house with excellent or good conditions	30,3	44,2	43,5	19,2	36,2
% children living in house located in regulated condominium of houses and apartments or separate building	93,2	95,3	92,7	97,4	94,1
Family Characteristics					
% children who mother or father have an agricultural occupation	28,6	19,6	4,6	71,4	24,7
% children who has an illiterate father	34,0	15,4	14,3	52,0	25,8
% children who has an illiterate mother	28,2	13,0	12,5	43,0	21,6
Family size	5,7	5,1	5,0	6,4	5,4
Average age of our sample	10,6	10,6	10,6	10,7	10,6

Fonte: PPV 1996/97.

Living conditions are better in urban and southeast regions not only because household income is higher but also because these areas benefit from a better infrastructure in terms of public services. Street on which residence is located shows a part of these public services. As expected, in rural areas, there are many children living in a street without asphalt or paving stone (more than 88%). For interviewer´s opinion only 19,2% of children in rural areas are living in a residence where condition or state of repair is excellent and good. This proportion is 43,5% for urban children.

A measure that affects standards of living and particularly the ambiance to study is the existence of electric light. In urban areas, infrastructure facilities are remarkable, since almost all children are living in houses with electric light (99,5%). In rural areas, this percentage declines to 59%. In terms of region, the differences are less strong. In northeast, 16% lives in house where the light is derived from generators or lanterns. Another indicator of household's condition is material used in house construction. The primary material of outside wall reflects house infrastructure. As we can see, 88,1% of children are living in a house where this material is adequate, as finished wood or masonry. This situation changes in rural and northeast. There are houses using brick without coating or facing, uncoated mud rough wood or other thing.

Differences are more remarkable when we look to the proportion of children living in a house where primary flooring material is considered adequate (finished wood, carpeting, ceramic tile, stale, flagstone). In rural regions, only 11.1% of children are living in houses of this type (in urban areas, it is 47,9%). In Northeast, this percentage is 25.8% and in Southeast it is 51,4%. There are a lot of children living in houses where primary flooring material is cement, rough wood, earth or other.

In terms of education, we note, as expected, that parent's education is low in rural areas and in the northeast region. In general, father's education is lower than mother's education, probably because they had to begin earlier in labor market. In rural area, 43% of the children have a mother who did not go to school or who did not finish at least one year of school education (52% for fathers). In urban, this proportion slows down to 12,5% for mothers and 14.3% for fathers. In northeast region, 34% of the children have a father who did not go to school or who did not finish at least one year of school education and 28,2% have a mother in the same situation.

Turning to household size, the number of persons and children in household could affect resources allocation decisions between household members, generating an impact in terms of education and health. In rural areas, the number of persons by household is of 6,4 and the number of children[9] is of 4,3 (in urban areas 5 and 3,2, respectively).

From this first preliminary statistics, we note some strong differences between regions. Rural areas are probably more affected by difficulties associated with poverty. In fact, characteristics of the place where children are living affect children's school attendance, as soon as health situation and propensity to enter in the labor market. Without a good urban infrastructure and social or cultural activities, children could not succeed to have a good education and health formation.

3.2.2. Health

We can construct several kinds of instruments to evaluate child health situation, particularly with our database that provides us anthropometrics measures[10] and questions about people's health situation. We decide to create as dependent variable a dummy using the subjective health evaluation.

We also use weight and height to construct body mass indicator (BMI).[11] From this variable, we define a dependent variable of health.[12] However, there is not a consensus about the threshold of child's body mass index. It depends on sex, age and country. So we also constructed anthropometrics calculations by z-score method as recommended by the World Health Organization, but we will use that only as a control variable in our estimations.[13]

One of the health variables in the survey relates to the existence of a chronic disease that requires constant monitoring. In urban regions, there are more kids who have chronic health problem (8,3%) than in rural locations (4,5%). Between regions (northeast and southeast), percentages are the same (7,2%). This indicator must be used carefully. It may mean that either more people have a chronic disease in urban areas, or more probably the medical care is more accessible, so people have information on their potential chronic disease. The low percent of kids with chronic disease in rural area would not mean kids are not seriously sick but they have not had the correct information on their health status. Indeed, we cannot screen if the health status depends on information acquired from medical visit. This latter depends of the household income level. The question relates only to the existence of a chronic disease according to the child health status acknowledge, which depends on his household income level. As we are interested in the simultaneous effect of child work in health evaluation, we believe that child work will not affect the existence of a chronic disease.[14]

The subjective health indicator is built using subjective health evaluation questions. The child answers how he would assess the status of his health: if excellent or very good, our variable assumes value 1, and otherwise, value 0. In the lowest income class, 40,7% of children evaluate health as being good or

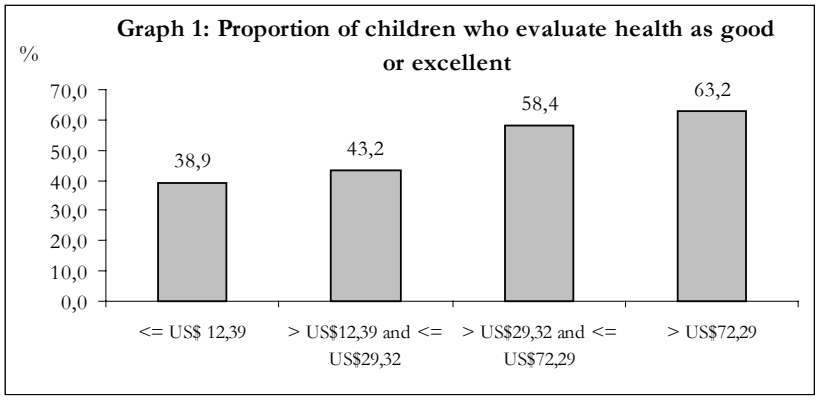
[9] Less than 21 years old.
[10] Weight and height are collected in the first or in the second visit to the house, according to a scale already defined.
[11] The body mass index (BMI) corresponding to weight divided by square of height.
[12] We constructed a linear indicator using the 95th and 5th of the U.S body mass index distribution (*Anjos, Veiga and Castro; 1998*) of each age and sex. These two thresholds delimit the normal range of BMI, so for children inside this range, the indicator assumes the value zero. For children outside this range (underweight or overweight) we compute the quadratic distance between the threshold and the real BMI. So as the child is more under or over weight, bigger is this indicator. The BMI distribution is concentrated in the spread of the distribution (variance) and not in the median value. The great majority of children (70%) lie in normal range.
[13] See Appendix 0 on variable definitions.
[14] We did not use it as dependent variable, but as covariate in health equation.

excellent. For the medium and higher income class, these proportions rise to 50,4% and 64,9%, respectively.

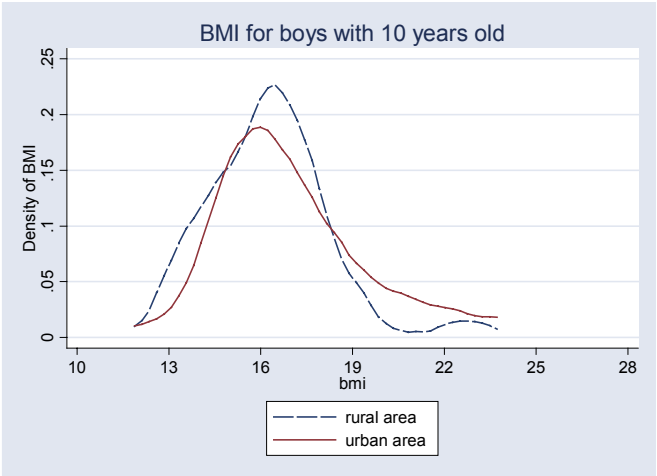
Usually, in rural regions, children suffer under nourish, do not have access to medical care and information about health prevention and diseases. Even though, there are children undernourished, they over-assess their health status and we could find a higher positive health subjective evaluation than they effectively are. The same happens by region, in the richest region (Southeast), the percent of kids in excellent or very good health is larger (54,5%) whereas this percent is 48,2% in the poorest one (Northeast).

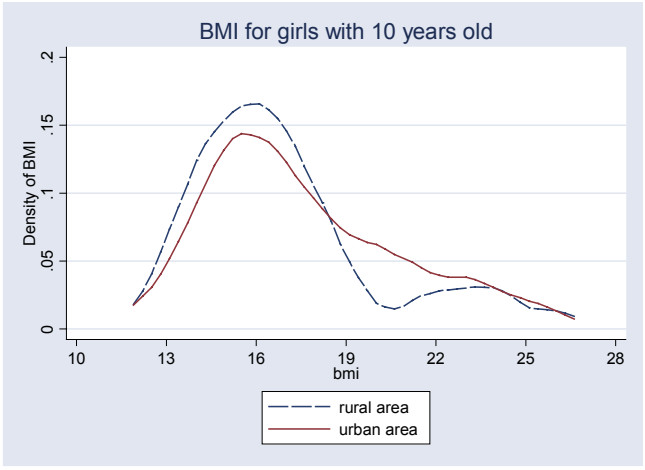
The graph 1 below shows the proportion of children who evaluate health as good or excellent by household income class.[15] In the richest income class, there are a large proportion of children evaluating their health as good or excellent (63,2%), otherwise, in the first income class, this proportion is 38,9%.

We also present interesting descriptive statistics showing differences between BMI. When the child becomes older BMI rises. As our sample includes all kids between 7 and 14 years old, and as the BMI varies considerably by age and by sex, graphs 2 and 3 display the BMI distribution for boys/girls with 10 years old for each region and rural/urban area.[16]



Graph 2: BMI by rural and urban areas

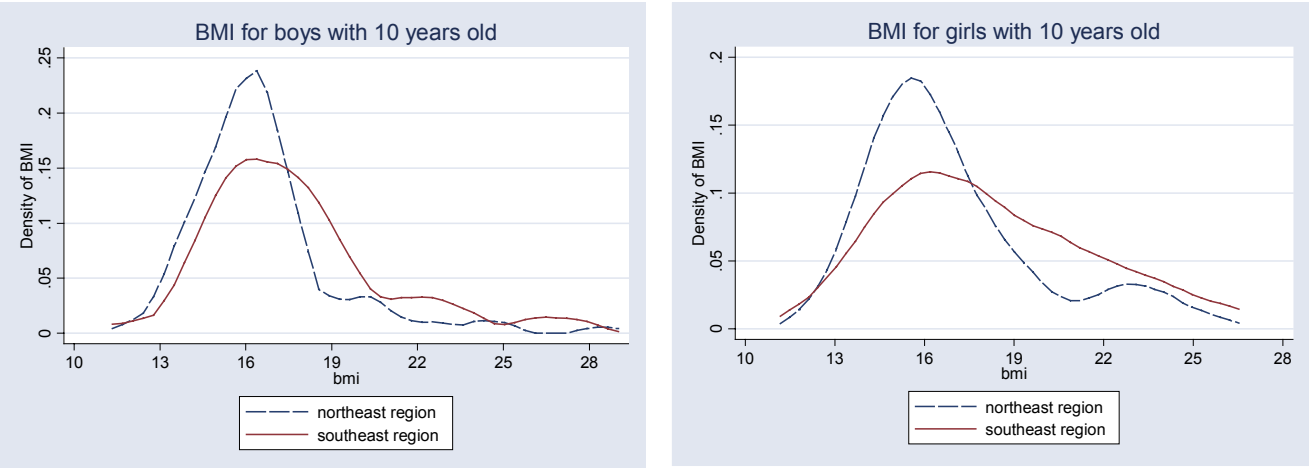




[15] We constructed 4 income classes: (1) poor families, per capita familiar income lower than R$38,44 (US$12,39), the 25th percentile (2) medium poor families, between R$38,44 (US$ 12,39) and R$ 90,99 (US$ 29,32), the 25th and 50th percentiles (3) medium families, between R$ 90,99 (US$ 29,32) and R$224,33 (US$72,29) and (4) rich families, bigger than R$224,33 (US$72,29).

[16] We consider two thresholds that delimits the normal range of BMI for boys and girls with 10 years old, as *Anjos, Castro and Veiga; 1998: (i)* the 95th (for boys, BMI=24,4 and for girls, BMI=24) of the U.S body mass index distribution; *(ii)* 5th (BMI=14,6 and 13,7, for boys and girls) of the U.S body mass index distribution. Outside this range, children are considered underweight or overweight.

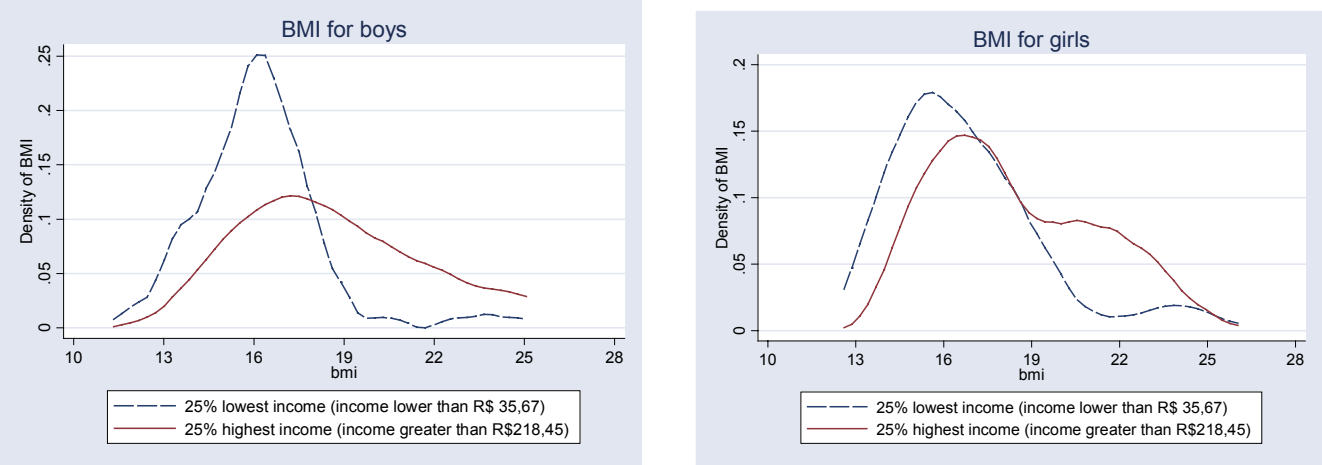
Graph 3: BMI by regions



For the poorest locations, rural and northeast region, there are more children in the medium level of BMI distribution. On the other side, for the richest locations, BMI distribution is smoother. So we can observe more ten-year's boys and girls with greater BMI in the richest locations than the poorest ones. This result is consistent not only with the existence of difficulties in medical access and health information in the poorest areas but also with a lower household per capita income, food expenses, contributing to a smaller body mass index. Child's overweighting in Brazil signs that the child is living in a household with better socio economic conditions. Differences between southeast and northeast are more acute than in rural and urban areas (see Graph 2).

Graph 4 displays that the differences in BMI distribution between richest and poorest are concentrated in variance. In richest household income class, there are more children with a high BMI and for the lowest; children are concentrated in the medium value. Girls from richest class have a bigger BMI than boys in the same income class.

Graph 4: BMI by household income class, boys and girls with 10 years old



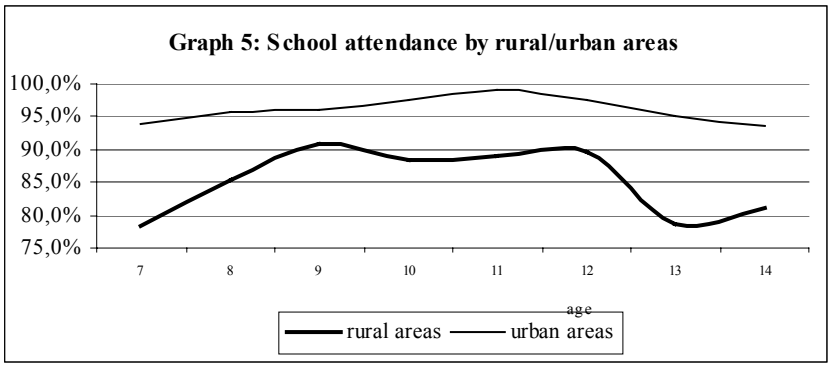
3.2.3. Education

Here we focus on school participation for kids between 7 to 14 years old. The great majority of our sample is attending school (92,8%) but this percentage varies between each region and household income class. In fact, human capital investments in children depend on incentives to enter in education system (returns to education and labor market attractiveness) and on the credit constraints households face (*Glewwe and Jacoby, 2004*). A poor household that could not borrow against future human capital could have difficulties in sending all kids to school; some of them go to labor market in order to contribute to household income. In this case, income should matter for current decisions about child's education

demand. *Barros and Mendonça (1991)* point out that children in Brazil, particularly in metropolitan areas, drop out school in order to benefit current opportunities in labor market..

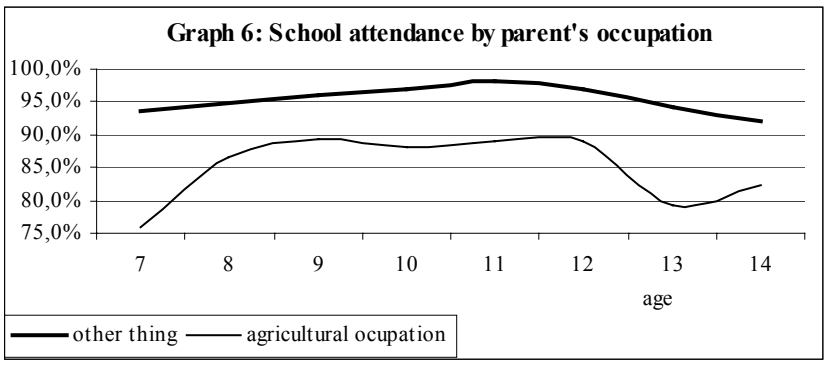
The proportion of 15,2% of children who lives in the 25% poorest families does not attend school. In the top of income distribution (the 25% richest families), this percentage slows down to 1,2%. Turning to differences between regions, 8,7% of children living in Northeast do not attend school, in Southeast, this percentage is 5,3%. Looking to rural/urban areas, we observe that in the first location, 15% do not go to school whereas in the second one, only 4% do not attend school.

For all ages, school attendance is lower in Northeast and rural areas and in the poorest households (see Graph 5). Differences are remarkable in extreme ages, particularly in rural areas. School entry is later for children living in rural areas - less than 80% children with 7 years old are attending school. In the urban area, this percentage increases to 94%. Also, we have that dropping out from school occurs earlier in rural area (12 to 13 years old).



In fact, social and economic differences between regions, particularly in terms of parent's education and economic occupation, as highlighted above, could help us to understand why children do not attend school or why their parents do not have the right incentives to insert them in education system.

Firstly, regional differences in labor market affect household income and also parental occupational choice. In Northeast, particularly in rural area, children have a high probability to enter later in school, since parents could have asked them to help in domicile or agricultural work. The proportion of 51% of children who are not attending school has a mother or father employed in an agricultural work, and on the other side, only 22% of children who are attending school have a mother or father employed in this kind of job. The difference in school attendance by rural versus urban area (Graph 5) is also almost similar to Graph 6, by parent agricultural occupation.



Parent's characteristics could also have a great impact in children's school attendance. The percentage of 53% of children not attending school has an illiterate mother and this proportion decreases to 19% when we restrict to children who are attending school. In fact, mother's education is considered one of the principal determinants of children's educational attainments (*Kassouf, 2001; Barros e Mendonça, 1991*), usually more crucial than father's education.

The time children stay at school and his educational performance will depend strongly on his age. The proportion of children attending school increases until 11 years old, and after, begins to drop out. For fourteen's years old kids, this proportion is of 89,9%. For school attendance, until 14 years old, the proportion of children going to school is relatively similar between boys and girls. The majority of school

entry occurs in the ages 9 and 10. After 14 years old, school attendance declines. Boys quit school earlier and girls normally have more years of education completed.

Another characteristic of school participation is if child is attending a private or public school. School infrastructure is different between regions. In rural areas private school is not so developed as in urban ones. A percentage of 97% of children in rural area are in public school, in the urban areas, 74%.

3.2.4. Child Work

Even though Brazil has a law protecting children and teenagers[17] -- work is only allowed for children 14 and older, with apprenticeship available at age 12 -- in 1999, 3 millions children with age between 5 to 14 years, so 9% of population in this age, were working (*Kassouf, 2001*). In child work literature, particularly in studies for developing countries, household decisions are important to define child's time allocation between school, work and leisure. Great part of this literature emphasizes determinants of child labor and what are the influences to parental decisions towards child labor, as we have already shown in sections 1 and 2. [18] ..

Turning to our database, we find that 21% of the kids in the poorest income class are working. This percentage for the richest income class decreases to 4,5%. We have also made this tabulation for each region and rural/urban areas. As the majority of children who are working are employed in agricultural activities (60% of working children have an agricultural occupation), it is not surprising that children's participation in the economic activity is larger in rural (12,1%) and in the northeast (7%) areas.

Economic activity influences child's participation in the labor market. Depending on parent's activity, children may help them in their work. In those regions where agricultural economic activity predominates, child's labor is usual, particular for younger boys.

3.2.5. Interaction between health, education and child work

There are lot of interactions between the three endogenous variables (work, education and health) and variables not considered as endogenous that affect each one separately, for example mother's education. So in constructing a policy, governments should integrate actions in these threes areas in order to have a great effect in child's life and welfare state.

As explained by the luxury axiom, child labor is mainly due to the poverty. The decision to push children in some productive activity is less likely to be the result of the level of health status even though it may cause some indirect effects on the child's participation in the labor market. On the contrary, it seems more likely that child labor affects health and also school participation decisions. The percentage of 52% of children not working evaluates their health as excellent or very good. This proportion diminishes to 45,6%, when they are working. So in terms of subjective health evaluation, child labor seems to have a negative impact in health, probably because children when working fell more tired. Hard work, demanding a great physical activity, should be incompatible with children's age and evolution. When child is working probability of suffering from illness could be significantly increased as an adult. A policy to decrease incentives to child labor could be good if it does not create difficulties for household survival.

Child labor has also a negative relation with children's school attendance. When a child begins to work, he could not be success in conciliating school or studying time with working time. In some cases, he would prefer to dropout school. Among the proportion of children working, the proportion of school attendance is of 79,6%. These children accumulate a double journey in school and in the work. On the other side, among the children not working, the percentage of school attendance is of 93,5%.

[17] Federal government create the Program on the Eradication of Child Labor to target specific cases where children's activities represent hazard to them, like charcoal mines, shoe manufacturing, sugar cane harvesting and sisal plantations. Families with children at risk to work receive some money if they keep their children at school. Coverage of this program is not so large and focus on hazard activities.

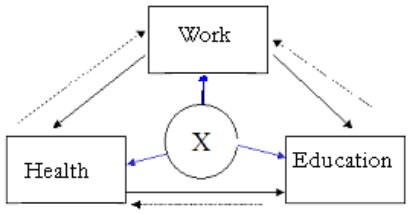
[18] *Menezes-Filho et al* (2002) analyzed time allocation decisions for children and adolescents in several Latin and Caribbean countries. Problems with school attendance can be linked to variables reflecting the household structure in the various countries, in particular parental education and the number of young children.

Even though literature remarks negative effects of labor in childhood, in some cases, child work could be essential for household survival. In a very poor household, prohibition of child labor could be accompanied by an increase in poverty and consequently worst live conditions for the children. *Satz (2003)* points out that bans on all child labor may drive families to choose even worse options for their children and that child labor is often a symptom of other problems (poverty, inadequate school system and so on).

Education can allow child to achieve some basic notions of hygiene than influencing his/her state of health in the long and short term. Concerning school attendance, child work and health problems may ban the child to go to school and study hard. The former, because less time is dedicated to school, and the latter, for physical reasons. Child health is widely perceived to affect strongly schooling (*Behrman and Lavy,1994*). When we look to school participation, for example, we note that 50,3% of children in public school do not assess their health as very good or excellent. This proportion decreases to 38% for children in private school. We also note that children who assess being in good health, 95% attend school, and 90% who evaluate being not in good health participate in school system. So, a good health evaluation is also important to school participation. Policies with positive impact in child's health should have positive effects in school participation. And also, a policy that creates incentives to go to school seems not to be sufficient to have a positive impact in health evaluation. So, adding a health action to a policy that creates incentives to school participation could be more efficient to increase children's welfare state in terms of health.

Interactions between these three variables are resumed figure 1. In the following, we consider all these relations. We explore the possible correlations between these variables and we show interrelations and potential channels that a policy could act to increase its impact.

Figure 1



4. Econometric Specification[19]

In this section, we explain our econometric strategy. Our model is composed of three behavioral equations for children and teenagers that should be attending school or that just finished the first degrees of the Brazilian education system.

- The first equation corresponds to the decision to work (Have you worked during the last 7 days? Yes or No), with the associated endogenous variable, denoted y_1^* , taking value 1 if working and 0 if not;

- The second equation corresponds to the health status, and is denoted y_2^* . The health status is measured by the subjective health evaluation (How would you assess the status of your health? Excellent, very good, good, average, poor, no opinion, don't know, neglected), taking value 1 if in very good or excellent health and 0 if not;

- The third equation corresponds to school attendance (Do you attend school? Yes or No), in the sense that children attend or not the compulsory part of education, with the associated endogenous variable, denoted y_3^*, taking value 1 if school is attended and 0 if not.

4.1. A simultaneous approach

Some studies about child's school attendance and child labor in Brazil uses for estimation a multinomial logit procedure (*Menezes-Filho et al, 2002 and Corseuil, Santos and Foguel, 2001*).

[19] For each equation, the independent variables and their definition are presented in the Appendix 0.

Normally, they use four alternatives: work and study, study, work, not study and not work. Multinomial logit model may not accommodate some features that might seem sensible, such as correlation of unobservable across alternative that have common elements. So in our case, we believe that some unobservable variables can affect simultaneously the alternatives. For example, in the case of "work and study" and "work and not study", children ability could affect them. In addition, using a multinomial logit model supposes that these two variables (child's work and school attendance) are the result of a common decision. Because, we want to relieve the model of this assumption and test for it, we use another approach. Moreover, we want to incorporate another dimension of child quality of life (health status).

To take into account both endogenous aspects and simultaneity, all three equations are estimated by full information maximum likelihood (FIML) using a simultaneous equation probit specification. The model can be re-written, for each observation *n*:

$$\begin{cases} y_{1n}^{*} = x_{1n}'\beta_1 + y_{2n}\alpha_{12} + y_{3n}\alpha_{13} + u_{1n} \\ y_{2n}^{*} = x_{2n}'\beta_2 + y_{1n}\alpha_{21} + y_{3n}\alpha_{23} + u_{2n} \\ y_{3n}^{*} = x_{3n}'\beta_3 + y_{1n}\alpha_{31} + y_{2n}\alpha_{32} + u_{3n} \end{cases}$$

Where the variables y_i^* are unobserved continuous endogenous variables to which the variables y_i are associated by the relationship $y_{in} = 1I\left(y_{in}^{*} > 0\right)$. For simplicity, the exogenous variables of each equation *i* are denoted by x_{in}, with the relationship $x_{in} = s_i . x_n$, where x_n is the vector of all exogenous variables and s_i is the selection matrix corresponding to equation *i*. The disturbance terms $u_n = \left(u_{1n}' . u_{2n}' . u_{3n}'\right)'$ are jointly normally distributed as $u_n \to N(0, \Sigma)$, and assumed to be independent across *n*, with the covariance between u_{in} and u_{jn} being σ_{ij}.

The conditions for identification require some normalization of the variances σ_i^2 of the perturbations u_{in} and some exclusion restrictions on the exogenous variables x_{in}.[20] Here, the variances σ_i^2 are set to 1. Given the explicit exclusion restrictions of the model, no further identification restriction is needed. Nevertheless, the conditions for logical consistency[21] are *not* satisfied. Depending on the dependent variable of the health status y_2^*, we have to do some more assumptions to estimate our model.

We chose FIML in contrast to Limited Information Maximum Likelihood (LIML) because FIML estimation may provide some improvement in the quality of the estimation, allowing to estimate simultaneously all relevant parameters including covariance parameters, and thus also some improvement in the subsequent interpretation of the results.[22] There are also been several attempts to estimate such multivariate probit model using FIML, but most assume some constraints on the covariance parameters to simplify the multiple integration problem.[23]. Some FIML estimation procedures, following the development of techniques based on simulation (*Gouriéroux and Montfort (1996)*) have recently been implemented to overcome the difficulty arising from the numerical evaluation of multiple integrals. These

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[20] We have some variables that affect only one y_i^*. For the choice of the instrumental variables, we followed the literature on economic development.

[21] The problem of the logical consistency in a simultaneous equation model has been previously treated in a general framework by *Gouriéroux, Laffont et Montfort (1980). Maddala (1983)* proposes an approach based on the probabilities of the possible outcomes in a bivariate probit setting. Here we extend to a general multivariate setting. The logical consistency of the model requires that, whatever the exogenous variables involved, the sum of all probabilities of the different possible values of the endogenous for each observations span no more and no less than 1.

[22] The respective virtues and disadvantage of both approaches are well known, and will not be discussed here (*Heckman (1978)* and *Amemiya (1978)* for early developments of the estimation of multivariate probit models).

[23] *Ashford and Sowden (1970), Sickles and Taubman (1986), Bock and Gibbons (1996).*

techniques have mainly been developed for the estimation of multinomial models, but their application to multivariate probit models is quite straightforward. We offer here an alternative method without resorting to simulations, by the approach of exact maximum likelihood developed by *Huguenin (2004)*. This method can be performed with all its virtues on systems of equations of relatively small dimension.

4.2. Subjective health evaluation

We consider as health status the subjective health evaluation which is a dummy variable. Therefore, the logical consistency condition imposes some high assumptions. We tried different forms of model respecting the logical consistency condition and we present the one given the highest log-likelihood, a fully recursive model in term of the endogenous variables.

Whatever the model[24] we tried, we always obtain that $E(u_{2n}u_{1n}) = 0 E(u_{2n}u_{3n}) = 0, \alpha_{31} = 0$ and $\alpha_{32} = 0$. So we decide to present results from the model below:

$$\begin{cases} y^*_{3n} = x'_{3n}\beta_3 + u_{3n} \\ y^*_{1n} = x'_{1n}\beta_1 + y_{3n}\alpha_{13} + u_{1n} \\ y^*_{2n} = x'_{2n}\beta_2 + y_{1n}\alpha_{21} + y_{3n}\alpha_{23} + u_{2n} \end{cases}$$

The estimation is performed by maximizing the log-likelihood function with respect to the parameters, and it allows further to estimate the marginal effects η_{ij} of the independent variable x_j on the dependent variables y_i, defined as $\eta_{ij} = \frac{\partial E(y_i)}{\partial x_j} = \frac{\partial \Pr(y_i = 1)}{\partial x_j}$, by the average of the estimated marginal effects for each observation.

And last, some cross effects ζ_{ij} of the dependent variables on each other can be estimated in the same way, with:

$$\zeta_{ij} = E\left(y_i \middle/ y_j = 1\right) - E\left(y_i \middle/ y_j = 0\right) = \Pr\left(y_i = 1 \middle/ y_j = 1\right) - \Pr\left(y_i = 1 \middle/ y_j = 0\right).$$

5. Results[25]

5.1. Some intuitive features

Boys have a bigger probability to work than girls. This result is consistent with our descriptive analysis that shows that the percentages of boys who work are greater for all ages when compared to the same percentage for girls.

In terms of race, we observe that children who are white have a bigger probability to declare be in a good health than black children whereas we have controlled by income.

The age variable is important to child work and school attendance probabilities. As soon as the child becomes older probability to work increases and to go to school decreases.

The chronic indicator has an expected negative sign in health equation. A child with a chronic problem diminishes his probability to evaluate his health as being very good or excellent by 44%. Probably, this indicator does not work only as a health indicator; it also shows that children who know having a chronic problem have more access to information i.e. access to health care services. These children might be in a better situation than other children who visit seldom a doctor.

In respect to household composition, total number of siblings is included directly in all three equations. A larger number of siblings impact negatively in both aspects of human capital: health

[24] We have estimated the model through triangular systems (fully recursive) and isolated endogenous effects (one parameter or two parameters). Results available upon request.

[25] See table 3 in Append. 1.

evaluation and school attendance. However, controlling for siblings composition (depending on gender and age) does not impact on health nor on child work, only in school attendance and positively. Comparing two children with the same number of siblings and everything else equal, the one with older brothers or sisters has a great probability to go to school.

We have constructed proxies of standards of life in order to reflect context where child is living. These proxies are probably not well captured by categorical variables describing income classes.[26] One major indicator of house conditions that may impact in child's school is the presence of electric light. The existence of electric light indicates, first that child is living in a house offering one of the minimum conditions to study, the light, and second, in a place with the supply of basic infrastructure. It appears that controlling by all other variables, the effect of this variable is not significant. In health equation, we included sewer and water condition indicators, also reflecting living conditions that could affect directly the health status of children; however coefficients are also not significant.

Living in a rural area increases the probability of child work by 4.7% and decreases the probability of school attendance by 2%. We observe no effect on the fact to reside in a rural area on the health declared whereas; in statistic descriptive high differences are observed. In this model, we control for participation on the labor market and for the residence environment. So, if statistical differences observed are due to them, it is consistent that no effect is obtained.

5.2. Education, work and health

With the methodology employed here, we can identify interactions between our three endogenous variables since we are considering simultaneity. First, we can identify direct effects, for example, the impact of child's insertion in labor market or in school in the self reported health state or the impact of school attendance in child's probability to work. Second, with this method, we take into account the indirect effects: school attendance has an impact in child work probability, and child work affects child's health evaluation, we control for the indirect effect of school attendance through work in health.

The significance levels of the covariances between errors equations show that work decision is simultaneously determined with school and health evaluation. Health evaluation and school attendance are not simultaneously determined. The link between child's labor market and school participation has already been a lot discussed in the literature. Our results are the same as the other studies. School attendance has a positive impact in his probability to be outside labor market (see table 3 in Append. 1).

School attendance has no significant indirect effect on health subjective evaluation and, no element goes in a sense of a direct effect on health evaluation. A policy that intends to increase health through school attendance does not seem to have a great impact on health evaluation. In public school, policy of free “merenda” does not seem to have a significant effect on health.[27]

The level of child health subjective evaluation is influenced by the participation of the child to the labor market. It seems reasonable to think that a painful work influences child health subjective evaluation. In fact, child work has a negative impact in child health. So, on the side of policy, government should pay attention in regulations about the type of jobs designated to children. It should be reasonable to have a regulation about jobs causing damages to child's health. Since child's income could be the only way to keep the household over the poverty gap, we also think that decision makers have to be very careful about the measures to implement.

In fact this result suggests that a health policy could not only restrict attention to variables affecting children's education but also to variables impacting directly in health evaluation and in child's decision to participate to the labor market. An educational policy is not sufficient to improve child's health; we know present different instruments and their effect on health.

[26] After trying both, a continuous indicator of household per capita income and 4 income classes, we decided to consider a non-linear effect of income.

[27] Probably the “merenda” is not composed by a good diet nutrients and probably, even thought an obligation, it is not a well established norm, particular in poor locations.

5.3. Ways for policy makers

The effect of parental education on child work is not significant when we control by income and the type of parents employment.

The effect of mother's education on school attendance is positive. When mother changes to a highest education level, this fact decreases by 2% the children's probability of school attendance. A mother more educated would be more conscious about factors affecting child human capital accumulation and consequently, future life opportunities to her children. A child with a mother who has an intermediate 1st cycle incomplete has a bigger probability to go to school compared to mothers with a low level of education. The same phenomenon happens when we focus in father's education. This result confirms the ones of *Kassouf (2001)* and *Barros and Mendonça (1991)*.

Mother's education is one of the principal determinants of child health. Only mother education (and not the education of the father) has significant and positive effect in a good or excellent self reported evaluation. Having a mother with the highest education level increases by 13% child's probability to evaluate his health as good or excellent compared to an illiterate mother. If she has only elementary school (1st to 4th series), the probability increase is smaller, 5,6%.

So, mother's education seems to play an important role on two of our three dependent variables - health and education. Since these variables are not independent from each other, the impact of mother's education has a direct and indirect effect on child's health (through its positive effect on school attendance).

Another mother's characteristic affecting children is her economic status. When she is in labor market, less of her time is dedicated to take care of kids but she is also in a better economic condition. The impact of mother's economic activity in child work is positive (an increase of 5% in child's probability to work), probably because she can demand kids to help her in her job, particularly if it is an agricultural or domicile work.

Even controlling for household income classes, we note that parent's type of occupation (employees in private sector with a formal registration or employees in public sector) affects child's probability to go to the labor market. A stable employment of parents has a significant negative impact on child work (around 2%). Participation in labor market contributes to mother's income accumulation, which impact in child's education. Moreover, mothers working outside may feel more secure to known their children at school during the working time. At least, mothers could be more conscious about the importance of investments in education. This main effect is reduced by the indirect effect of mother's economic activity through child work in child school attendance probability. Mother's economic activity has a positive impact in child's probability to work, and since child labor has a negative impact in school attendance, this contributes to a reduction in the probability of child to go to school. For mothers economically active, child's probability to participate in school increases 2,5%.

The marginal effect of a mother working without remuneration on the probability of evaluating health as good or excellent is negative and significant (1,3%). So, even though categorical variable indicating existence of a non remunerated mother does not have a direct effect on child's health, it has a negative indirect effect on children (trough child labor). Having a father with a good job in terms of stability increases the probability to self report health as good or excellent by 0,8%.

Regarding child's health only when child is in the third and fourth income class we have positive and significant impact on health evaluation. So, a monetary transfer policy will be efficient only if the household income goes up to the third income class. Worse, small subsidies could be used for other thing than allocate to better human capital of children. Therefore, it seems that this policy is not the best one to improve health. Looking to school attendance, the result is more ambiguous. The impact is also positive but concentrated in the fourth class (2.3%).

We also constructed an index (PCA) using a set of variables describing social and economic environmental where children is living. We used the statistical technique called principal component analysis that ensures that the index includes variables that are additive and assigns different weights to each variable (*see Appendix O)*. In fact, this index is reflecting permanent income, and is constructed by variables as house conditions. We obtain that our index of permanent income affects positively school attendance probability (14.5%). As we said, the index of permanent income affects positively school

attendance probability and negatively child's probability to work, reflecting a better environment to child development. We also find that good house conditions affect positively health evaluation (5%), showing the importance of cleaning up the environment in health (*Deaton, 2003*).

6. Conclusions

Several aspects influence child human capital. Without a good acknowledge of them, any policy could not be really efficient. We have demonstrated that child work has a negative influence in child's probability to evaluate very good or excellent his health. We have also showed that child school attendance has a negative effect in child's probability to work. So, a policy aiming to increase human capital should focus in some aspects of school attendance and also look after child health.

In terms of household per capita income, we do not show what is expected. A policy of monetary transfers does not seem appropriate to increase child's health. We propose some different keys that could be used by decision makers.

Mother's variables, especially education - if she has less than elementary 1st cycle complete - play a significant role in explaining children's health. Mother's education seems to have a positive effect in school attendance and health, and, moreover, more educated mothers are more conscious about negative effects of child work in their future life. Since child work has a negative effect in education, there is an indirect effect of mother's education in child education. The same thing is observed through child's health education. So, it could be a key for policy makers.

The child participation in labor market is also influenced by the kind of mother´s occupation. Self-employment and non-remunerated occupations create incentives to child labor, since mother could ask her children to help her. In order to reduce child work, and consequently, to have an impact in child education, another key could be to focus on families where the mother is self employed or non remunerated and who do not have a great education level.

Another important instrument to increase child's health and education seems to be a policy that focuses in large families. We should also create specific policies for boys, since they are more likely to be in the labor market, affecting negatively his education and health. Household infrastructure is also important to child's education and health since it could reflect good conditions for studying and living. Children in houses without good conditions are more vulnerable, so, it seems more effective to construct a health policy focusing in these families.

The main conclusion of our article is that the development of human capital should consider together health and education. A policy focusing only in education, as incentives to go to school, does not seem to be sufficient to improve child's health. Also, government should also consider the population at risk, as children from poor families, living in worse conditions and obliged to work.

Our subjective health evaluation indicator reflects more the current situation than a long-term health situation that could be delineated by the Body Mass Index (BMI). We believe that we can complement our results if we construct a health indicator based in body mass index to look to another aspect of health (medium term) and if we also consider children school delay, since we could capture some characteristics of school quality.

7. References

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Appendix 0

For each child, the independent variables are the following:

- *age*: between 7 and 14 years;
- *sex*: value 0 for girls and 1 for boys;
- *race*: indicator of the race as defined by being non white (value 1) or not;
- *north*: regional indicator (value 1 for Northeast, region Southeast is taken as reference);
- *rural*: rural indicator (value 1 for rural area), urban area is taken as reference;
- *irmtot:* number of brothers and sisters that the kid has (no limit of age);
- *nkunderf*: number of younger siblings girls with less than 21 years old;
- *nkoverf*: Number of older siblings girls with less than 21 years old;
- *nkunderb*: Number of younger siblings boys with less than 21 years old;
- *nkoverb:* Number of older siblings boys with less than 21 years old;
- *edm/edp*: dummies for the education level of the mother and father (value 0 without any education, value 1 with uncompleted elementary school or up to the 3rd series of the first degree, value 2 with completed elementary school or through the 4th series of the first degree, value 3 with uncompleted intermediate 1st cycle or 5th to 7th series of the first degree, value 4 with completed intermediate 1st cycle or completed 1st grau, value 5 who has at least completed intermediate 2nd cycle or uncompleted 2nd grau);
- *clincome:* four classes income: 1 (*rfpc*<=38,443 reais), 2 (*rfpc*>38,443 reais and *rfpc*<=90,992), 3 (*rfpc*>90,992 reais and *rfpc*<=224,3333) and 4 (*rfpc*>224,3333).
- *logrfpc*: the logarithm of family per capita income (*rfpc)*;
- *activm*: indicator of the mother's economic activity status (value 1 if active);
- *estabp, estabm (*for father and mother, respectively): value 1 if they have a formal job (employees in private sector with a formal registration, employers, employees in public sector (also militars);
- *unpaidm*: indicator of the mother's working status (value 1 if mother was an unpaid worker);
- *sewer*: value 1 if the house has a sewer system, and value 0 otherwise;
- *water:* value 1 if the house has filtered water, and value 0 otherwise;
- *food14*: log of total expenses in food divided by number of persons in the household;
- *cronic*: indicator of chronic disease (value 1 if child reports a chronic disease);
- *Fldwhohaz*: height for age z-score;
- *Fldbmiz*:Bmi z-score;
- *Condlocal*: the condition or state of repair of the residence? Value 1 if Excellent or good;
- *Local*: residence is located in a regulated condominium of houses and apartments, separate building (value 1), value 0 otherwise;
- ocparents: indicator of the parents agricultural occupation;
- *electric*: the type of light source in the residence, (value 1 if the house has electric light).
- *Prof*: number of persons occupied (prof) as teacher in basic education

We also constructed one index (*PCA*) using a set of variables describing social and economic environmental where children is living that is a proxy of the permanent income. We used the statistical technique called principal component. We select a relatively wide range of possible variables explaining family´s socio-economic situation by good household conditions. The correlation between family per capita income and pca1 is 0.31 (sign. at 5%).

Appendix 1

Table 3: Marginal effects
Three-Equations Simultaneous Maximum Likelihood Probit Estimation

Variables	WORK (1)	HEALTH (2)	FREQ (3)
AGE	0,107*	0,021	-0,054*
SEX	0,046*	-0,023	-0,009
RACE	-0,005	-0,083**	0,012
NORTH	0,008	0,020	0,003
RURAL	0,047*	-0,010	-0,020**
IRMTOT	-0,034	-0,247*	-0,204*
NKUNDERF	0,029	0,009	0,161*
NKOVERF	0,023	0,030	0,275*
NKUNDERB	0,057**	-0,003	0,181*
NKOVERB	0,069*	-0,008	0,192*
EDM1	0,014	0,015	-0,005
EDM2	0,006	0,056**	0,005
EDM3	0,023	0,128*	0,019*
EDP1	0,000	-0,057**	0,024*
EDP2	0,022	-0,019	0,007
EDP3	0,014	-0,061	0,019**
EDP4	0,015	-0,143*	-0,010
PCA1	-0,045*	0,115	0,145*
CLINCOM2	0,005	0,020	-0,005
CLINCOM3	0,003	0,095*	0,004
CLINCOM4	0,002	0,117*	0,023*
ACTIVM	0,049*	-0,010	0,025*
ESTABM	-0,013	0,003	0,000
UNPAIDM	0,048*	-0,013*	0,000
ESTABP	-0,028*	0,008*	0,000
WATER	0,000	-0,039	0,000
SEWER1	0,000	-0,012	0,000
FOOD14	0,007	0,195	0,000
CRONIC	0,000	-0,440*	0,000
FLDWHOHZ	0,002	0,064	0,000
FLDBMIZ	0,006**	0,169**	0,000
CONDLOCL	0,000	0,050**	0,000
LOCAL	0,000	0,068	0,000
ELECTRIC	0,000	-0,002	-0,012
PROF	0,000	-0,006	-0,037**
AGE10	0,000	0,004	0,027**
WORK		-0,420*	
FREQ	-0,267*	0,154	
Covar1&2	0,32*		
Covar1&3	0,84*		
Covar2&3	-0,14		
Log-Likelihood	-2322,92		
Observations	2229		

Note: * statiscally significant at 1%, ** statiscally significant at 10%