The impact of child labor and school quality on academic achievement in Brazil

Márcio Eduardo G. Bezerra
Escola Superior de Agricultura "Luiz de Queiroz" Universidade de Sao Paulo.

Ana Lúcia Kassouf
Escola Superior de Agricultura "Luiz de Queiroz" Universidade de Sao Paulo.

Mary Arends-Kuenning
Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign

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1. Introduction

In recent years, Brazil has experienced an impressive decline in child labor. According to the national household survey, the Pesquisa Nacional de Amostra por Domicilios (PNAD), in 1992, about 15 percent of Brazilian children aged 5 to 15 worked, compared to 8 percent in 2005 (IBGE 2005). With respect to educational indicators such as illiteracy rates and years of schooling, Brazil still lags behind other Latin American countries. However, during the 1990s, school attendance increased, principally in primary school and for students aged 7 to 14. In 1992, 87 percent of the children aged 7 to 14 attended school. By 2005, this percentage reached 97 percent (IPEA 2005).

This fall in child labor, along with the increase in school attendance, could be associated with changes in the socioeconomic conditions of children and adolescents. During the 1990s, the federal government instituted major policy changes. The first was the implementation of Law no. 9.394/96, the Lei de Diretrizes e Bases da Educação Nacional (LDB), which set minimum levels of spending per child in school, decentralized school decision-making authority, and set minimum teacher training levels (Castro 2000). The second was the creation of a special fund to increase school funding, especially for poor regions of the country, the Fundo de Manutenção e Desenvolvimento do Ensino Fundamental e de Valorização do Magistério (FUNDEF) (Castro 2000). The third was a change in labor legislation that increased the minimum work age to 16 years. Brazilian policymakers at the municipal, state, and federal levels also instituted social programs that paid poor families cash stipends conditional on their children’s school attendance and other behaviors. These social programs developed in the 1990s included the Programa de Erradicação do Trabalho Infantil (PETI) (Program to eradicate child labor) and Bolsa-
Escola (School scholarship program), which was incorporated in 2001 into a national comprehensive welfare program, the Bolsa-Familia program.¹

Despite the progress made since the 1990s in school attendance and child labor, a high percentage of students work while they attend school. According to the 2003 PNAD data, of Brazilian children aged 7 to 15, 88.1 percent only study, 1.0 percent work and do not study, 8.4 percent combine work with study, and 2.6 percent neither work nor study.² Of children aged 10 to 15, 90.2 percent of those who worked also attended school, compared to 96.6 percent of non-working children in that age group. Working adolescents aged 16 and 17 have a school attendance rate of 70.3 percent compared to an attendance rate of 83.0 percent for adolescents aged 16 and 17 who do not work. These statistics show that there are a significant number of children and adolescents who continue to divide their time between working and studying. An important research question regarding child labor in Brazil is whether working has a negative impact on the learning and school achievement of these students.

This study contributes to the literature by analyzing the direct impact of child labor on the academic progress of students as measured by standardized achievement tests. Authors such as Gunnarsson et al. (2004), Psacharopoulos (1997), Heady (2003), Akabayashi e Psacharopoulos (1999), Stinebrickner and Stinebrickner (2003), among others, studied the effect of early child labor on student achievement test scores. However, this study differs from previous studies because we investigate how the number

¹ Bolsa-Familia is a transfer program intended for poor families who have a monthly per capita income of up to R$ 100.00. This program was instituted in 2003 and unifies all the federal social welfare programs, including Bolsa Escola, Bolsa Alimentação, Cartão Alimentação e Auxílio Gás.
² In the 2003 PNAD, the rural populations of the states of Rondônia, Acre, Amazonas, Roraima Pará and Amapá in the Northern region of Brazil are not included.
of hours worked by young people might harm student learning. In addition, we find that the type of work that children do matters. Specifically, student performance is affected differently by work conducted inside the household than by work in the labor market.

The relationships between child labor and schooling involve interlinking factors. Therefore, the direction of causation can go either way. Child labor affects schooling, but poor performance in school might also impact child labor. Poor school quality and the indifference of families and students to school might cause students to enter earlier into the labor market. Factors that affect both child labor and school achievement occur at the levels of individuals, families, schools, and communities and include school availability, school infrastructure, parents’ education, family income, individuals’ natural abilities for school, community labor market conditions, and low levels of parental participation in their children’s education and in their communities (Barros and Mendonca 1996, Psacharopoulos 1997, Cavalieri 2000, Gunnarsson et al., 2004).

According to Soares (2002), the determinants of students’ academic progress can be classified into three groups of variables: those related to students’ individual and family characteristics, those related to the socioeconomic context of the school, and those related to the processes and pedagogical practices of schools.

As the relationship between work and school involves decisions about the child’s time allocation, the possibility exists that the low quality of schools, aligned with the disinterest in school of children and their parents, explains weak academic performance and induces poor families to prefer work to school. The low levels of educational achievement can result in two problems: the existence of a strong conflict between work and school and the perception that the benefits to schooling are low. An additional
contribution of this study is the attempt to control for school characteristics and for the students’ motivation to study by including proxy variables in the regression analyses.

2. Data

The Ministry of Education (MEC) through INEP makes available educational statistics to measure the quality of the Brazilian primary school system. The Sistema Nacional de Avaliação da Educação Básica (SAEB) (National system of basic education evaluation) was started in 1990 and since 1995 has administered a national standardized test every two years.

The data set used in this study is from SAEB, (INEP, 2003), which makes available microdata that include standardized test scores in Portuguese and Mathematics for students in the 4th and 8th grades of ensino fundamental (primary school) and the third year of ensino médio (secondary school) in public and private schools. The SAEB data set includes data about students’ study habits, students’ sociocultural characteristics, the characteristics and teaching practices of teachers and school administrators, managerial mechanisms, and school infrastructure.

In 2003, approximately 300,000 students, 17,000 teachers, and 6,000 administrators in 6,270 schools participated in the SAEB, covering all 26 states plus the Federal District. The SAEB does not cover all the students in the country. For example, the eighth grade and high school samples exclude rural areas. The survey is conducted with a sample that represents the universe of students enrolled in the three grades (INEP/SAEB 2005).

Together with the tests, information is collected about the social, economic, and cultural contexts of the students, such as personal, family, and school characteristics. The
teachers and administrators also respond to questionnaires and report about professional
training, pedagogical practices, socioeconomic and cultural classifications, leadership
styles and types of managerial mechanisms. Information about the available school
infrastructure is also collected.

The SAEB is collected from a representative sample of the population of students
who are enrolled in the three grades of interest in the schools chosen to participate in the
School Census. This sample is stratified by the following criteria: grade, state of
residence, whether the school is public or private, location of school (state capital city,
large cities defined as greater than 200,000 habitants, small cities), and size of school.

To conform to this stratification, the schools are sorted and within them a
minimum of one classroom of students and a maximum of two classrooms of students in
the same grade are given the achievement tests. In a given school, students in more than
one grade might be included in the sample. In each class chosen for the sample, half of
the students take the Mathematics exam and half take the Portuguese exam. In this study,
we include the data for eighth grade and the third year of high school, because few fourth
graders work. Rural schools are not included in the sample for these higher grade levels.

The administered exams are standardized and are in the form of multiple choice
questions. The object is to describe the abilities and capacity for learning of the students,
in the subjects of Portuguese (with a focus on reading comprehension) and Mathematics.
The SAEB uses the Theory of Item Response, a mathematical model that permits the
comparison of student progress at different levels of knowledge and also Proficiency

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3 The School Census is a national and annual undertaking, covering basic education at different levels
(preschool, primary, and secondary schooling) and types (regular, special, and youth and adult education).
It provides a data base with educational information about all the school establishments involved in basic
education, both public and private.
Scales to interpret and describe student progress. The students’ test scores are presented as percentage scales for Portuguese and for Mathematics. The scales describe at each level the competencies and abilities of the students.\textsuperscript{4} Based on the scales, SAEB classifies students into five levels of performance in Portuguese and in Mathematics—very critical, critical, intermediate, adequate, and advanced.

The levels of the performance scales are cumulative, meaning that the students who are placed at a given level are competent at the skills required at the previous levels of the scale. Each evaluated subject and grade has a unique scale based on these levels that reflect the stages in which students construct learning competencies and develop their abilities.

3. The econometric model

To analyze the effect of child labor on student school achievement test scores, we use two estimation methods—ordinary least squares and two-stage least squares. In addition to analyzing whether the student works or not, the analyses also consider the number of hours worked and the work conditions, specifically whether the student only works, studies and works only at home, studies and works only outside the home, or studies and works in both locations. The hours of work and work conditions have important impacts on students’ achievement because they determine how much time students can spend on school activities.

To obtain an estimate of the impact of child labor on school performance, control variables are included such as the individual characteristics of the student and of the family environment, characteristics of the school and the supply of educational services,

\textsuperscript{4} More detailed descriptions about the learning competencies and abilities can be found in the research paper SAEB in INEP (2002).
geographic characteristics of the schools, and, uniquely, controls for the student’s motivation to study.

The dependent variables are the Portuguese and Mathematics test scores, which are continuous variables, for each grade that is evaluated. The test score can vary, theoretically, from 0 to 500 points. However, according to INEP, it is not empirically possible to obtain the scores at the limit of the interval (values of 0 and 500 points), so no student is assigned a 0 score for skill and knowledge and similarly, no student has perfect knowledge and skill in a discipline.

The model to measure the effect of early labor on the students’ school performance is as follows:

$$D_i = \alpha + \beta L_i + \delta X_i + \rho M_i + \theta E_s + \lambda G_s + \epsilon_i, \quad i = 1, \ldots, n, \quad s = 1, \ldots, S$$

Where $D$ is the dependent variable that represents the school achievement test score of each student $i$ in Mathematics or Portuguese in the 8th grades of primary school and the third year of secondary school. The exogenous variables are represented by $L_i$, which refers to the information about child labor for each student $i$, $X_i$, which are the individual and family characteristics of students, $M_i$, which are the variables that proxy for students’ motivation to study, $E$, which represents the schools’ infrastructure and educational resources for each school, $s$, and $G$, which are the geographic aspects of each school $s$. In addition, there is an error term $\epsilon$, which represents the unobservable characteristics that affect learning achievement and that are not captured by the specified variables. The parameters that are estimated include $\alpha, \delta, \beta, \rho, \theta, e, \lambda$. 
The primary purpose of this work is to identify the effect of child labor on school achievement, represented by the estimated parameter $\beta$. We expect that

$$\frac{\partial D}{\partial L} < 0,$$

Or, the more that the child works, the lower is school achievement.

Authors like Heady (2003) and Gunnarsson et al. (2004) note the possibility that an endogeneity problem exists between child labor and school achievement. It is difficult to determine the true impact of work on school performance because factors that encourage children to work are the same factors that discourage school attendance.

For example, the hours that children work are hours that are not available for children to spend in school or studying. Another point is that children who are doing well in school might be more motivated to study and might know how to use their time efficiently than children who do poorly. These characteristics are also related to child labor so that differences in achievement might be erroneously related to child labor instead of underlying individual characteristics. Also, doing poorly in school might cause students to leave school and start working early. Finally, schools with little infrastructure and low teaching quality discourage students from only studying and increase the probability that students work.

To correct for the endogeneity problem, we estimate regressions using instrumental variables techniques where we consider variables indicating whether the student works or not and the number of hours worked per day as endogenous.

To estimate the probability of the child working and the number of hours the child worked, the following instrumental variables are used: the size of the city population.
where the student studies, specifically whether the city is a metropolitan area, a large city, or a small city, and the literacy rate and the average years of schooling of the population of the child’s state of residence that is over age 25. For these to be good instrumental variables, they must affect the labor market, but not affect school performance directly.

Therefore, the school performance equation is as follows:

\[ D_i = \alpha + \beta L^a_i + \delta X_i + \rho M_i + \theta E_s + \lambda G_s + \epsilon_i, \]  

(11)

Where \( L^a_i \) is an endogenous variable, which is replaced by the predicted probability that a child will work in the case of the variable indicating whether the child works or not and is replaced by the predicted number of hours worked obtained by the first stage of the estimation in the case of the hours worked variable.

The endogenous, right-hand side variable in the school achievement equation can be represented by the following equation:

\[ L^a_i = \alpha + \delta U_i + \theta P_i + \beta Z + \nu_i, \]  

(12)

Where \( L^a_i \) indicates the endogenous variables, \( U_i \) represents the type of city where the student studies and \( P_i \) represents the state-level characteristics of the student’s state of residence (average family income, percentage of the population older than 25 that is literate, and the average number of years of school of those older than 25) and \( Z_i \) represents the exogenous variables of the original model.

We assume that

\[ E(\nu_i) = 0, \quad Cov(U_i, \nu_i) = 0, \quad Cov(P_i, \nu_i) = 0, \quad Cov(Z_i, \nu_i) = 0 \]  

(13)
For the case in which $L_i$ is the endogenous variable hours of work, the two-stage least squares procedure is performed in a multiple regression model because both the endogenous variable and the dependent variable are continuous. In the case of the variable that indicates whether the child works or not, we have a continuous variable (school achievement) and a dichotomous variable (work or not). In this case, we use the probit model to estimate the probability that the student participates and then put the resulting estimates in the equation for school achievement, which is estimated by least squares. This estimation technique is based on Maddala (1983).

In this paper, we are also aware of the potential endogeneity of the variables that capture the type of work (domestic work, work outside the household or both). These variables are also binary. We do not estimate the predicted values of these variables with two-stage least squares. It is difficult to estimate the parameters of these variables because the dependent variable is continuous (school performance) but more than one endogenous variable on the right-hand side of the equation is dichotomous.

4. Descriptive results for the relationship between school performance and child labor

Table 1 presents descriptive statistics for adolescents in the 8th grade of primary school and in the third year of secondary school, by subject and by work situation. Note that in both the Mathematics and the Portuguese samples, children enrolled in the higher grade are more likely to be working outside the household or combining work outside the household with domestic work than those enrolled in the lower grade. As children get older, the opportunity cost of staying out of the labor market increases.
Table 2 presents descriptive information about students’ achievement by subject, by grade, and by work situation. A striking feature of the table is the low level of achievement that is demonstrated by students regardless of work situation.

A higher proportion of students who were not working achieved a superior score on the exams compared to students who worked. Table 2 shows that of the students in the two grades who were tested in Mathematics who did not work, more than 54 percent tested at the levels of intermediate, adequate, and advanced, despite the high number of students who tested below intermediate at the levels of critical and very critical.

In the group of students who worked, academic performance was much worse. More than 60 percent of the students in the two grades who worked, regardless of work situation, scored at the levels of critical and very critical. The result suggests that working and studying simultaneously can hinder the acquisition and development of knowledge. The worst achievement test scores are found for those students who work both inside the household and outside in the job market. The students who work only in the household or only outside the household have similar levels of academic achievement. In Mathematics for those in eighth grade and those in the third year of high school, those who work only in the household have slightly worse achievement test scores than those who work only in the market. Table 3 also shows the same analyses for the Portuguese exams and the results are very similar to those for Mathematics.

Among the students who were working, those who worked both in the household and in the market showed worse test performance in all the evaluated grades than the other work situations. Those students who worked only outside the household did worse than students who worked only within the household. An explanation for these
differences according to work situation could be that individuals who work in both situations or only outside the household worked more hours or worked more intensely during each hour worked than those who worked only at home, within a familiar environment. Results where the statistics presented in Table 3 are broken down by gender show that the difference is not due to gender differences; both males and females have lower test scores when they work only outside the household than when they work only inside the household. The one exception is for girls in the third year of high school Portuguese, who show slightly worse results when they work only at home than when they work only outside the household.

5. Results and Discussion

In this section, we present regression results to estimate the effect of child labor on children’s school achievement. The regressions include weights based on sample expansion factors.

For each grade and both subjects, three regressions are presented. Child labor is indicated in three different ways—in the first regression as a dichotomous variable indicating whether the child works or not, in the second regression as the number of hours worked, and in the third regression as dummy variables indicating whether the child works inside the household or in the market. All regressions include controls for individual and family characteristics, school characteristics, and student motivation. The student motivation variables attempt to capture the preferences of students for studying in order to minimize omitted variable problems. Inclusion of these variables also help to eliminate the endogeneity problem brought about by the correlation between student preferences, child labor, and school achievement.
We estimate two-stage least squares regressions, treating the right-hand-side variables indicating the number of hours worked and whether the child works or not as endogenous. The instrumental variables that are used in the first stage that predict child labor but do not directly influence school achievement are measured at the level of the city where the child lives and include the size of the city, the average monthly family income, the percentage of the population aged 25 years or older that is literate, and the average years of education of the population aged 25 years or older. A Hausman test was performed to compare the ordinary-least-squares estimates with the two-stage least squares estimates for the regression including hours of work as the measure of child labor.\(^5\) The choice of instrumental variables was guided by a study by O’Donnell et al. (2003) of the effects of child labor on children’s health in Vietnam. The study used variables that reflected opportunities in the local labor market as instruments for child labor.

**Descriptive analysis of the variables**

In Table 4, for each variable included in the model estimation, the means and standard deviations are presented, weighted by the sample expansion factor of the 2003 SAEB. The statistics are given for each grade and each subject evaluated.

The average student achievement score was less than adequate when compared to the standards set by SAEB. In the eighth grade, the average achievement test score of Mathematics students was 248 points, considered the intermediate level according to the

\(^5\) The logic of the Hausman test is as follows: under the null hypothesis, both the least squares and the instrumental variables estimates of \(\beta\) are consistent. Under the alternative hypothesis, only the instrumental variable estimate is consistent. The test, which has a Chi-square distribution, therefore involves an analysis of the difference between the parameters estimated by least squares and the parameters estimated by two-stage least squares (Greene 1997).
achievement scales devised by SAEB. By the 3rd year of high school, the average achievement test score of students is considered to be at the critical level, given the average of 279 points.

Almost 39 percent of the students in eighth grade and almost 27 percent of the students in the third year of high school respond that they did not work more than one hour per day and are therefore classified as non workers (only study). The rest of the students work and are classified as working only in the household, working outside the household, or as working in both locations. The majority of students who work do so only in the household (35 percent of eighth graders and 28 percent of those students in the third year of high school), followed by those who work only outside the household (14 percent and 24 percent, respectively) and those who work in both locations (12 percent and 21 percent, respectively).

Students in the higher grade level who report that they are working devote more of their time to work than students in the lower grade level who work. Eighth grade students who report working more than one hour per day work an average of 3.6 hours per day and students in third year of high school who report working work an average of 5.1 hours per day. Therefore, if the work week is five days, eighth grade students who work devote 18 hours per week on average to working and high school students in the third year who work devote 25.5 hours per week on average to working. In Kassouf (2002), the results showed that the older the child was, the higher the probability that the child was working and the less likely the child was studying.

The majority of students in both grades are females, with males accounting for 49 percent of the students in eighth grade and 45 percent of the students in the third year of
high school who were tested in Mathematics. Considering grade-for-age, students on average are one year older than the correct age for the grade in which they are enrolled. (In Brazil, children start school at age 7). In eighth grade, students have an average age of about 15 years and in the third year of high school, the average age is approximately 18 years. Menezes-Filho (2003) found a negative effect of age on school achievement when he analyzed the causes of the decline in achievement scores that occurred between the SAEB exams administered in 1995 and 2001.

Of the total number of students in both grades who knew their parents’ schooling level, over 50 percent had mothers and fathers who had not completed primary school (up to eighth grade). Kassouf (2002) found that mothers’ schooling had a larger impact on a children’s school attendance than fathers’ schooling. She concluded that the mother’s schooling is a proxy for the family’s preferences for education and the family’s ability to prepare children for formal schooling, whereas the father’s schooling is closely related to family income and the decision to send a child to work. Ray and Lancaster (2004) find strong evidence of positive effects of adult schooling on children’s learning in the countries studied.

The average monthly family income for eighth grade students was R$ 1,313 and for students in the third year of high school, it was R$ 1,418. This monthly income was estimated by the point system developed by ABEP. Because the SAEB data do not include direct measures of income, the presence of goods such as televisions and computers is used to impute income. Comparing those estimates with the values of income reported in the 2003 PNAD data, we observe that the imputed values of income
using SAEB are above the average monthly income of students in these grade levels in PNAD.⁶

Students enrolled in the higher grade level live in families with higher family incomes. Higher family income is associated with higher demand for education in Vietnam (Glewwe and Jacoby 2004), with higher school attendance in Pakistan and Nicaragua (Rosati and Rossi 2003), and with higher achievement test scores in Brazil (Albernaz et al. 2002). As children get older, those from poor families are more likely to drop out of schooling, while children from rich families remain. We expect that income has a positive and significant effect on students’ test scores.

A variable that often is found to be important in studies of child labor and education is the number of people residing in the household. Household size was found to have a negative and significant effect on the probability of being enrolled in the correct grade-for-age in Peru (Patrinos and Psacharopoulos 1997) and to have a highly significant and negative effect on the probability that a child attended school in Brazil (Emerson and Portela 2002). Both studies concluded that older daughters’ schooling was especially negatively impacted by the presence of younger siblings because of expectations that the older daughters would help with childrearing.

Adolescents in the higher grade level live in households of smaller size on average than children in the lower grade level. Children in eighth grade live in households with an average of 4.07 residents, compared to children in the third year of high school, who live in households with an average of 3.87 residents. Again, this is

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⁶ The value of monthly family income for all households (excluding the income of lodgers, domestic servants and their relatives, and children less than ten years old).
likely due to the fact that poorer children from larger households are more likely to drop out of school than richer children from smaller households.

The SAEB data include information about students’ motivation to study. Student motivation is an important determinant of student achievement, but is not considered in most studies of the effect of child labor on school performance. Heady (2003) and Gunnarsson et al. (2004) both called attention to the importance of finding variables to control for students’ motivation in studies of students’ school achievement as a way to better control for the endogeneity that arises from omitted variables.

As students advance in grade level, they report lower levels of motivation to study. Of the students in the eighth grade, 63 percent report that they enjoy studying Mathematics, compared to 56 percent of the students in the third year of high school. Of those students who do homework, only 48 percent of students in eighth grade report that they always do their Mathematics homework, compared to only 35 percent of students in the third year of high school.

An important issue for school performance is the relationship between students’ motivation and school delays. In eighth grade, about 42 percent of students are behind in school and in the third year of high school, 46 percent of students are behind in school. This variable reflects whether the student actually failed at least one grade or not. It should be considered in combination with the age variable, which reflects whether the student started late or not (after age 7) and how many times the student failed a grade.

About 88 percent of eighth grade students and 84 percent of students in the third year of high school who took the Mathematics exam attend public schools. The great
majority of classroom spaces for Brazilian children are found in the public schooling sector.

In a study that examines the relationship between school performance and child labor, it is necessary to control for school infrastructure. The supply of educational resources (libraries, computers, videocassette players, laboratories, etc.) influence school performance because they help students to learn. At the same time, school infrastructure can influence child labor because if school conditions are poor and discourage studying, children and adolescents become interested in other activities (Barros et al. 2001, Pontili 2004, Rios-Neto et al. 2002).

The descriptive statistics for students who took the Portuguese exam, also presented in Table 4, were similar to those described for students who took the Mathematics exam. Therefore, they are not discussed here.

**Equations for Mathematics and Portuguese achievement: Least-squares estimates**

Table 5 presents the regression results where the outcome variable is school achievement test scores. Columns (1), (4), (7), and (10) measure child labor with a dummy variable indicating whether the child works or not. Columns (2), (5), (8), and (11) measure child labor with the number of hours that a child works. Columns (3), (6), (9), and (12) include variables that indicate whether the student only studies, studies and works only at home, studies and works only outside the home and studies and works both at home and outside the home.

The results presented in columns (1), (4), (7), and (10) show that when students work, they obtain lower achievement test scores and that the effect is statistically
significant at the 1 percent level. In eighth grade, students who work obtain scores that are 8.5 points lower in Mathematics and 7 points lower in Portuguese compared to students who do not work. By the third year of high school, the disadvantage experienced by students who work has widened, with students who work scoring 11.5 points lower in Mathematics and 13 points lower in Portuguese compared to students who do not work.

As students increase the hours that they work, their achievement test scores decrease (columns (2), (5), (8), and (11)). An additional hour of working lowers the Mathematics exam score of students by 1.7 points in the eighth grade and by 1.6 points in the third year of high school. In Portuguese, each hour worked lowers students’ test scores by 1.6 points in eighth grade and by 1.8 points in the third year of high school. Although the marginal effect of an additional hour is approximately equal for students in the lower and the higher grade, high school students work longer hours (Table 4), so the total negative effect of working on achievement test scores is greater for high school students than for eighth grade students.

The final set of results presented in columns (3), (6), (9), and (12) show that the location where children work have differential impacts on children’s achievement test scores. In all cases, students who do not work have higher exam scores than students who work do, regardless of location. In addition, in all cases, the worst outcomes occur when students work both outside and inside the home. Students who only work outside the home tend to experience worse outcomes than those who only work inside the home, with the exception of students in eighth grade taking the Mathematics exam. For these students, working outside the household lowered the Mathematics exam score by 4.2
points, compared to a decrease of 8.4 points for students who only worked at home. Those eighth-grade students who worked both at home and outside the home experienced a decrease of 15.8 points on the Mathematics exam, representing about 6 percent of the average score of 246 points (Table 4). All of the work location variables were statistically significant at the 1 percent level, where the omitted category is not working. [Note: in future work, we will test for statistically significant differences across the types of work.] The worst outcomes were found for high school students taking the Portuguese exam, with those who worked only at home experiencing a decrease of 10 points relative to those who did not work. Those who worked only outside the home experienced a decrease of 13 points, and those who worked in both locations experienced a decrease of 20 points. Compared to the average of 267 points achieved on the high school Portuguese exam, students who worked in both locations scored about 7 percent lower on the exam.

The results for Table 5 also include estimates of the impact of individual, family, school characteristics on school achievement test scores. The individual and family characteristics include sex, age, race, mother’s schooling, father’s schooling, family income, and household size. Students’ academic motivation is measured by variables indicating whether the student likes to study Portuguese and Mathematics, whether the student does homework regularly, and whether the student is behind the appropriate grade-for-age. School characteristics include whether the school is public or private, school infrastructure, and average schooling levels and wages of teachers. The regressions also include controls for whether the school is located in an urban or rural area. The results for these individual, family, and school variables are not affected by
whether child labor is measured with a dummy variable, the number of hours worked, or dummy variables indicating the location of work.

Looking at individual and family characteristics, female students tend to do better in Portuguese than male students, and male students tend to do better in Mathematics than female students. Older students enrolled in a grade have lower test scores than younger students enrolled in the same grade. These students either started school late, or failed at least one grade. White students (omitted category) have higher test scores than students who are “yellow” (Asian), “pardo” (mixed race), or black.\(^7\) Parents’ schooling, especially mothers’ schooling, has a positive effect on students’ school achievement. Children from families with higher family income have higher test scores than children from poorer families. Family size has a modest, negative, and statistically significant effect on test scores, with each additional family member lowering test scores by between 1.6 and 1.9 points.

The estimated effects of the variables that measure student motivation are among the largest and most statistically significant effects of the included independent variables. Students who report that they like to study Mathematics and Portuguese and who always do the homework that their teachers assign have higher test scores than students who are not similarly motivated. At the same time, students who report that they have been held back in school at least one year obtain lower test scores than students who have not experienced any delays in their progress through school and the effect is highly statistically significant. Being delayed in school is an indicator of low motivation to study or of problems attending school.

\(^7\) These racial terms are the official terms of the Brazilian government.
Omitting the variables that control for students’ motivation could result in an overestimate of the negative impact of child labor on school achievement. We ran the regressions omitting the motivation variables and found that in some cases, the magnitudes of the negative coefficients on child labor increased and in other cases, the estimated effects of child labor did not change (results not shown, but available from the authors upon request).

It is important to recognize that when a student does not perform well in school and obtains poor grades, that student is likely to become disinterested in school and to become interested in other occupations. In other words, although we include some controls for motivation, endogeneity might still be present between child labor variables and motivation variables omitted from this study.

The estimated coefficients for the region variables indicate that students’ performance is better in the most developed regions of Brazil such as the Southeast and South, in contrast to the less developed region of the Northeast, which is the omitted category.

**Impact of school characteristics on student achievement**

The results for school quality presented in Table 5 indicate that students in the third year of high school obtain higher test scores if the school that they attend has a computer. This result holds for both Portuguese and Mathematics, with students who attend schools with computers improving their test scores by about 3.8 points in Portuguese and about 3.1 points in Mathematics. These impacts are modest given the mean achievement test scores in the sample. The mean of the Mathematics test score variable is 246 points for eighth grade and 279 points for the third year of secondary
school. For Portuguese, the mean test score for eighth grade is 233 points and for the third year of secondary school, 267 points. For children in eighth grade, there is no significant effect on test scores of attending a school with computers. Therefore, computers appear to be more effective for learning in later grades than in earlier grades. The result suggests an interesting hypothesis that perhaps computers are only beneficial once students have mastered the basics of reading and writing.

Students who attend schools with laboratories have statistically significantly higher test scores than students who attend schools without laboratories. This result is consistent across the two grade levels and the two academic subjects. However, the effect is modest and ranges from 2.2 points for eighth grade students’ Mathematics scores to 4.4 points for eighth grade students’ Portuguese scores.

The effects of attending schools with libraries are mixed, with libraries having a surprising negative and significant impact on students’ Portuguese scores in the third year of high school, and a modest positive and significant impact on students’ Mathematics scores in the eighth grade.

Eighth-grade students who attend schools with televisions/VCRs do significantly worse in Portuguese and Mathematics than students who attend schools lacking in televisions/VCRs. For third-year high school students, there was no significant impact of attending a school with a television on test scores. This result is interesting in the light of Brazilian educational policy. As part of a national program called FUNDEF, Brazil distributed funds to schools in the poor regions of the country. Teachers came up with projects for the funds, and the projects often included buying televisions (Carnoy et al. 2004). Teachers may have been motivated to request televisions because the equipment
made their jobs easier, rather than enhancing student learning. Having a television might be a signal of a poorly performing school that has been chosen for a government program.

The regressions include variables that control for teachers’ characteristics. The impact of the average level of teachers’ schooling on children’s achievement test scores is mixed, except for students in the third year of high school, whose test scores in Mathematics increase with the educational level of their teachers. In all the regressions, students’ achievement test scores are positively related to the teachers’ wage. Impacts are greater at the high school level than at the eighth grade level. We must be cautious when interpreting the school quality results because the results might reflect unobservable characteristics of the community, such as the motivation of parents to invest in their children’s schooling, rather than the effects of specific school investments.

**Time spent working and school performance**

In Table 6, we analyze whether there are nonlinearities in the effect of the number of hours spent working on school performance. The number of hours that students work is transformed into dummy variables representing the following ranges: 0 hours, 1 to 2 hours per day, 3 to 4 hours per day, 5 to 6 hours per day, 7 to 8 hours per day, and more than 8 hours per day. These dummy variables are included in the regressions for both Mathematics and Portuguese test scores, controlling for the same variables included in Table 5.

Table 6 includes only results for the hours worked variables. As the number of hours increase, the negative impact on students’ achievement test scores increases. This result is consistent across grades and across academic subjects. The results indicate that
8th grade students in Mathematics are able to combine working up to two hours per day with schooling without harming their performance in school. When students start working 3 hours or more per day, school achievement is harmed. As the number of hours worked increases to 8 or more hours per day, the negative impacts of work on schooling increase up to the point that eighth-grade students who work 8 or more hours per day score about 14 points lower on the Mathematics exam.

High school students show a decrease in their Mathematics achievement test scores even if they work only 1 to 2 hours a day. Those who work one to two hours a day score 4 points lower on the achievement test than those who do not work, and those who work 8 hours or more per day experience a decrease in achievement test scores of about 20 points.

In Portuguese, eighth grade students who work up to 2 hours per day experienced a decrease of 1.8 points in their test scores, which is quite low. The students who worked more than 8 hours per day lost about 18 points on the exam. At the high school level, those students who worked up to two hours a day decreased their test scores by 7 points. Those who work more than 8 hours scored almost 24 points lower on the exam than those who did not work. The effect of the most intense level of working is to decrease students’ achievement test scores by about 10 percent.

As expected, students who work 7 or more hours per day show the greatest disadvantage in their school achievement. High school students experience greater effects of working on school achievement than the eighth grade students as shown by the coefficients on the regressions presented in Table 6. In addition to these marginal effects, a higher percentage of high school students work long hours compared to eighth-grade
students. Also, high school students who work are likely to be older than the appropriate grade for age. An important conclusion to be drawn from Table 6 is that working up to 2 hours per day, or up to 14 hours per week, has minimal effects or statistically insignificant effects on school achievement. For eighth graders, for example, working up to 2 hours per day reduces the Portuguese score by 1 percent. For high school students in Portuguese, who show the greatest magnitude of effects of working a minimal number of hours, working up to two hours per day only decreases test scores by about 2 percent.

**Results from two-stage least squares regressions**

In Table 7, the equations for student achievement test scores are estimated using two-stage techniques, treating child labor as an endogenous variable. In columns (1), (3), (5), and (7), the estimated probability that the child works is included in the second stage regressions. The predicted probability is estimated based on a first-stage probit equation. In columns (2), (4), (6), and (8) the predicted hours worked is included in the second stage regressions, where the first stage equation is OLS. Two-stage techniques are used to control for the fact that it is not clear whether child labor causes poor school performance or whether poor school performance causes child labor.

First, we estimate the probability that a student works or not and the hours worked by students. The instrumental variables come from the characteristics of the population in the state where the student attends school, such as the average number of years of schooling of adults, the literacy rate of adults, and the average monthly income of families. Other instrumental variables include whether the student lives in a

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8 First-stage regression results are available from the authors by request.

9 This information is available by state (unidade da federação) and were taken from the 2003 PNAD data set.
metropolitan region, a large city, or a small city. After obtaining the first-stage regression results, we use the estimated coefficients to calculate a predicted probability that the student works and a predicted number of hours that the student works. These predicted variables are then included in the second-stage regressions where the dependent variable is achievement test scores in Portuguese and Mathematics.

Comparing the coefficients on the variables “child works or not” and the hours of work in the two-stage least squares results presented in Table 7 with the OLS results presented in Table 5, controlling for endogeneity changes the results substantively.

The results that control for endogeneity show larger negative impacts of working on children’s academic performance. For eighth grade students, the results in Table 7 indicate that working results in a decrease in test scores of 32 points in Portuguese and of 28 points in Mathematics compared to a decrease in test scores of 7 points in Portuguese and 8.5 points estimated using OLS (Table 5, columns 1 and 7). For students in the third year of high school, the two-stage least squares results (Table 7) indicate a decrease of about 23 points in Mathematics and Portuguese, compared to a decrease of 13 points in Portuguese and 11.5 points in Mathematics obtained with the OLS results (Table 5, columns 4 and 10).

In almost all the grades, the negative effect of hours worked increases and continues to be statistically significant in the two-stage least squares results (Table 7). The exception is column (4), the equation for eighth grade students’ Mathematics test scores, in which the predicted hours worked variable was not statistically significant even at the 10 percent level. In the third year of high school, an increase in the number of hours worked leads to a decrease in student achievement test scores, with each hour
worked leading a decrease in Portuguese test scores of 11 points and Mathematics test scores of 12 points, compared to the OLS results of 1.7 points and 1.6 points, respectively, presented in Table 5, columns (5) and (11). The Hausman test results indicate that the OLS results are not statistically significantly different from the two-stage results, except for the case presented in column (4), high-school Portuguese. Therefore, the OLS results are the preferred estimates, except for high-school Portuguese.

Conclusions

This study examines whether child labor affects the school achievement of students. We use data from the 2003 National Basic Education Evaluation System (Sistema Nacional de Avaliação da Educação Básica – SAEB), which includes achievement test scores in Portuguese and Mathematics for public and private students in the eighth grade and in the third year of high school throughout Brazil.

Using the detailed information available in the SAEB, we were able to investigate how school achievement differs with each additional hour of work and also how changes in the work conditions encountered by students affect students’ school achievement. To measure the impact of child labor on student achievement, in both grades available and both subjects, we estimated three regressions. The first included as an explanatory variable a binary variable controlling for whether the student worked or not, the second included the number of hours worked, and the third included variables to capture the effects of working outside the house, inside the home, or in both locations.

The estimated parameters were, in general, statistically significant and revealed a negative effect of child labor on school achievement. Students who work inside the home only experienced a negative impact on their achievement test scores, but the
negative impact was greater for students who only worked outside the house and especially for those who worked both inside and outside the house. Students who work both outside and inside the home have a heavy work load, possibly tire themselves physically, and have less time and energy to devote to their studies than students who do not work or who only work in one location.

Each additional hour that a student works lowers school achievement. Not surprisingly, those students who are most harmed in their school performance are those students who work 7 hours or more per day. However, even those students who are working long hours at the most experience a 10 percent decrease in their achievement test scores relative to students who do not work. In addition to being more likely to work and to work long hours, the high school students experience more negative effects of each additional work hour on their school performance than the eighth grade students do. However, an important result is that working up to 2 hours per day (14 hours per week) has a minimal or no impact on school achievement. This result informs a debate among researchers and policy makers about how to define child labor. Basu and Tzannatos (2003) criticize the use of certain classifications of child labor, defined by the number of hours, which might overestimate the incidence of child labor. For example, in the PNAD in Brazil, children are defined as working if they report working only one hour a week. However, devoting such a minimal amount of time to working is unlikely to harm children’s school progress.

In this study, we considered two issues that have been noted in the literature. The first was the use of variables that characterize students’ motivation to study, which have rarely been included in previous research, and the other issue was the endogeneity of the
child labor variable. When the student motivation variables are included in the regressions, the estimates on the child labor variables decrease in magnitude, indicating that omitting variables that control for student motivation might result in overestimates of the harm due to child labor.

To control for the endogeneity problem, we used two-stage least squares to estimate the predicted probability that a student would work and the predicted hours worked. The variables used as instrumental variables in the first stage were the size of the city where the student attended school, the average family income, the literacy rate of adults older than age 25 in the state, and the average years of education of the population aged older than 25 in the state. After controlling for the endogeneity of child labor, the estimated results are larger in magnitude than the estimated results using OLS.

This study emphasizes the negative impacts of children’s work activities on their achievement in school. These negative impacts compromise the development of human capital for individuals who work. An important policy implication of this work is that policies to expand access to school for working children are not sufficient; policies must also include teaching methods and alternative ways of learning directed to this group of students.

The work calls attention to the harm that domestic work can cause for children’s school achievement. Domestic work, which is often not counted in social statistics, should be included in policies designed to combat child labor. As mentioned before, child labor, whether it occurs inside or outside the home, causes a decrease in school achievement and the negative effects are stronger for higher academic levels. This is the result of a viewpoint that older children and adolescents are responsible for taking care of
younger siblings, especially in poor families where parents work outside the home and where mothers are household heads. Other children and adolescents help their parents in their small business and end up spending time in domestic work.

Another issue arises around the difficulty in enacting policies to eliminate child labor for families that require the earnings of children and adolescents so that children can dedicate their time solely to studying. The results demonstrate the possibility that work can be combined with schooling and have minimum impact on school achievement if work is limited to a maximum of 2 hours per day, or 14 hours per week. This opens up a debate for policy makers, to try to distinguish among groups of children who work a minimal amount of time that is compatible with schooling and those children who work longer hours and are experiencing lower school achievement because of their work.

Educational policy can promote improvements in the quality of schooling that is offered, which would motivate both children and their parents to continue. In devising policies to combat child labor, it is essential to improve educational programs, to continue to improve and develop social programs such as PETI, and to evaluate the schooling progress of students to identify their learning difficulties.

Our results suggest that Brazilian students might benefit from having access to computers, especially students in secondary school. Televisions and VCRs do not seem to help students to learn. Laboratories are modestly associated with higher achievement test scores. Schools where teachers are more highly paid have students that obtain higher test scores. Although we control for students’ motivation in the regressions, we cannot say whether the school infrastructure matters, or whether, for example, schools whose teachers care about their students’ learning invest in equipment such as computers rather
than televisions. Nevertheless, our results are informative for Brazilian policymakers who might be considering further investments in school infrastructure.

Other important results in this study shed light on projects to improve education and to combat child labor. Parents’ schooling, especially mothers’ schooling has a strong positive impact on children’s school achievement, implying that policies to improve the schooling levels of adults are important. The effects of attending a public compared to a private school underline the great disparities in school quality between public and private institutions. Delays in school, as indicated by the significant number of students who are older than the appropriate age for their grade, are responsible for a great deal of the weak performance of students. To solve these problems requires educational policies that address the issues of school drop out, late entry into schools, incentives to improve school quality, and the poor school infrastructure that is found in some regions of the country. All of these factors, among others, discourage the continuity of studies.
References


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