Is Child Labor Harmful?
The Impact of Working Earlier in Life on Adult Earnings

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Abstract

This paper explores the question: is working as a child harmful to an individual in terms of adult outcomes in earnings? Though an extremely important question, there are currently no good estimates of the effect of child labor on adult outcomes. This question is explored through the utilization of a unique set of instruments that control for the decision to work as a child *and* the decision of how much schooling to acquire. These instruments are combined with two large household survey data sets from Brazil that include retrospective information on the child labor and schooling of working-age adults: the 1988 and 1996 PNAD. Estimations of the earnings model are performed first by using OLS without controlling for the potential endogeneity of child labor and schooling, and then by using a GMM estimation of instrumental variables models that include the set of instruments for child labor and schooling. The findings of the empirical investigations show that child labor has a large negative impact on adult earnings for male children even when controlling for schooling. In addition, the negative impact of starting to work as a child reverses at around age 13. Finally, different child labor activities are examined to determine if some are beneficial while others harmful with the finding that working in agriculture as a child appears to have negative impact over and above the loss of education for all child entry ages. On the other hand, working in manufacturing and service sectors may have particular attributes that enhance the expected adult earnings for those that start to work as adolescents.

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I. Introduction

Child labor is widespread in today's world; the International Labour Organization estimates that 182 million of the world's children are child laborers, most living in developing countries.[1] Recently, there has been a renewed interest in child labor issues, and this renewed interest has led to a series of studies that aim to understand the causes and consequences of child labor in order to guide appropriate policy responses (see Edmonds and Pavcnik (2005), Basu and Tzannatos (2003), and Basu (1999) for useful overviews and surveys of the theoretical and empirical literature). Among the policy options discussed are banning child labor and/or sanctioning countries that allow the practice. These types of policy responses have been widely debated among economists (see e.g., Emerson and Knabb, 2005a, 2005b, 2004; Horowitz and Wang, 2004; Basu, 2002; Dessy and Pallage, 2001; Baland and Robinson, 2000; Dessy, 2000; Basu and Van, 1998). Most of these studies emphasize the trade-off between child labor and human capital accumulation to justify policy interventions, arguing that there are large negative consequences from child labor. Child labor, however, is a broad term that encompasses a diversity of activities and working conditions, thus the belief that child labor is detrimental to human capital accumulation, may or may not be *generally* true, and, even if accurate, at what age does this adverse effect cease to exist, and does the initial occupation matter, are open questions.[2] Studying and providing

[1] Child labor was also common in developed countries until fairly recently, see, e.g., Kruse and Mahony, 2000; Parsons and Goldin, 1989.

[2] It should be noted that there are some forms of child labor the are unequivocally bad: those that are detrimental to a child's health and well-being, those that involve indentured servitude or deny children their basic human rights, and those that involve psychological distress, to identify but a few. Some of these activities

robust estimates of the effects of starting to work as a child on adult earnings will allow future studies of child labor, and discussions of appropriate policy responses, to be informed by this research.

Despite the fact that there is a large and growing literature on child labor, this one fundamental question remains unanswered: does child labor harm participants? Though it has often been assumed to be detrimental, the potential effects of child labor on adult earnings are potentially twofold. On one hand, child labor can be detrimental through the hindering of the acquisition of formal education, both quantitatively and qualitatively, and causing irreparable damage to health, reputation or other things that effect adult human capital, which could lead to lower wages in the adult labor market.[3] On the other hand, there are many reasons why one might expect that there can be positive pecuniary benefits to young labor: vocational training, learning by doing, general workplace experience as well as the potential for making contacts, learning job market strategies, etc. In other words, there are many reasons to expect that a young laborer can gain some human capital from their workplace experience (e.g., Horn, 1994). Thus the net effect of starting to work as a child is an empirical issue. Though virtually all studies of child labor assume it is harmful, there is as yet no reliable measure of the effects of working as a child on adult outcomes.

The effects of working early in life will also likely depend on the particular type of labor the child undertakes because some jobs may lead to the acquisition of job specific human capital while others may not. For example it could be that a child that works as manual laborer in agriculture does not learn many skills that the adult labor market values.

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may not be detrimental to the adult earnings of the individual, but are indefensible nonetheless and we do not wish to suggest otherwise.

[3] Spindel (1985) argues that adolescent workers are more likely to end up in dead-end jobs that hamper their human capital development.

However, a child that works as a manual laborer in a blacksmith shop, say, may learn many skills of the blacksmith trade that are valuable on the adult labor market. For instance, French (2002) finds that child workers in shoe manufacturing industries in Brazil have positive attitudes toward their jobs if their work is associated with more autonomous and self-directed tasks. This may be due to the perception that the skills that they are acquiring will pay off in the adult labor market. Furthermore, child labor could be a way to finance education that an individual would not otherwise have access to, which, in turn, could lead to better outcomes for older child or adolescent workers (see, e.g., Akabayashi and Psacharopoulos, 1999; Psacharopoulos, 1997).

While there has been a large body of empirical research seeking to understand the causes of child labor, very little is known about the consequences of child labor. There do, however, exist three related works that start to address the consequences of child labor which deserve mention. In Emerson and Souza (2003), we included an estimate of the impact of child labor on adult earnings in Brazil in a paper that was primarily concerned with the intergenerational transmission of child labor. In that paper we found results that are similar to the OLS results in the current study, but we were unable to control for potentially endogenous variables, however, and the results were, therefore, of limited use.[4] Illahi, Orazem and Sedlacek (2001) present results of a related exercise using similar data from Brazil but where a dichotomous child labor variable is utilized and the impact of having been a child laborer is measured on adult earnings and the incidence of poverty. They find a negative effect of child labor on adult wages, both through the loss of schooling and over and above the loss of schooling, and a higher probability of being impoverished if an individual

[4] Also related is an earlier version of the present study, which did not control for the effects of potentially endogenous variables: Emerson and Souza (2002).

was a child laborer. The use of the dichotomous variable prevents the study of the effects of starting to work at different ages, as is done in this paper. That study also suffers from the inability to properly control for potentially endogenous variables, however, and thus the results must be considered with a modicum of caution. The present study is a direct attempt to move this literature forward by properly controlling for the potential bias arising from the inclusion of endogenous variables and to examine the decision to work over a broad range of ages. Finally, Beegle, Dehejia and Gatti (2004) examine the effect of child labor on the education and incomes of a small group of rural Vietnamese schoolchildren. They exploit a data set that observes a group of 8-13 year old children who are currently enrolled in school, some of whom work and some who don't, and examine the effect of having worked at the time of the first observation with their school attendance, school attainment, school progress and work and wage outcomes five years later. Most interestingly, perhaps, is the impact that child labor had on lowering school attendance and achievement. However, since they were still no more than 18 years old at the second observation, they were unable to look at adult outcomes. In addition, as the data were from a very small group of rural Vietnamese schoolchildren, it is difficult to extrapolate to a wider population.[5]

Two reasons that help explain the lack of prior studies of this type are: one, the paucity of good data and, two, the confounding effects of potentially endogenous variables. The present study is able to overcome both limitations.

The first limitation is particular to developing countries where data of a high enough quality and a proper set of variables are hard to find. The Brazilian government, however, has been a pioneer in the collection and dissemination of data and thus Brazil presents a

[5] Kassouf, et. al., (2001) examines the impact of early labor market entry on adult health outcomes in Brazil but does not address the endogeneity issue.

source of data that is adequate to address this complex relationship. The data utilized in this paper come from three sources. The first source is a very large household survey from Brazil that includes information on current working-age adults' attributes and incomes as well as retrospective information on the age at which they first started to work and the degree of school completion. Importantly, these data also include information on the educational attainment of the *parents* of many of the current working-age adults allowing controls for the family background of the subject individuals. The second source is the historical series of the Brazilian census bureau (IBGE) where data include population, number of schools by state and year, and number of teachers by state and year. The third source is the Institute of Applied Economics Research (IPEA) of the Brazilian government who have compiled GDP data by state and year. These three agencies provide a rich source of data with which we perform the analysis.

The second limitation is common to all studies that try and estimate the human capital - earnings relationship, which can be traced back to the seminal research of Becker and Chiswick (1966), Chiswick (1974) and Mincer (1974). Because of the strong likelihood that there are unobserved attributes (e.g. ability, ambition, etc.) that affect both the schooling choice of an individual and the individual's adult earnings, estimates that do not attempt to address this issue are considered unreliable. Much of the recent research into this relationship using US data has relied on the use of instrumental variables to overcome the confounding effects of these unobserved attributes (Cameron and Taber, 2004; Carneiro and Heckman, 2002; Card, 2001; Card, 1995a; Card, 1995b). The main drawback of this type of approach is that it demands a robust set of instruments for the schooling choice of an individual which is a challenge. What makes this approach particularly challenging in the

context of child labor is that schooling and child labor are likely jointly determined, so a set of suitable instruments must include instruments for *both* choices. To assemble a rich enough set of instruments, data on the number of primary and secondary-level schools per school aged population in each Brazilian state for each year from 1939 to 2000 was collected, along with the number of teachers per school in each state and year and the state-by-state per capita GDP for each year. These institutional variables are hypothesized to be correlated with the work and schooling decisions of children (regardless of who made these choices), yet uncorrelated with the unexplained variation in adult incomes (after controlling for family background and other confounding effects). Statistical tests do not reject the validity of these instruments.[6]

With these two obstacles overcome, it is possible to provide a very detailed description of the effects of child labor on adult incomes both including the effect of lost education and the effect over-and-above the effect on education. These results should be of vital interest to researchers of child labor in their quest to understand both the causes and consequences of child labor. This study then presents the results of tests for differences in these observed effects of starting to work as a child by the occupation choice the person made when they first started to work.

The rest of this paper is organized as follows. Section 2 discusses the empirical strategy employed to explore the central questions of the paper. Section 3 describes the data utilized in this study. Section 4 presents the results of the empirical estimations. Section 5

[6] Duflo (2001, 2004), in a set of very interesting studies, exploits a rapid expansion of education supply in Indonesia and the varying treatment effects for individuals depending on the amount of exposure to the expansion the individual experienced. Brazil experienced no equivalent rapid expansion of education supply so we are unable to utilize similar methodology.

discusses the role of different child labor activities. Section 6 discusses the results and implications.

II. Empirical Strategy

In order to fix ideas, consider the typical Mincerian framework of the effect of schooling on adult earnings in the high income country context. The discussion of the empirical issues usually begins with a presentation of a standard two equation system that describes schooling (S_i) and log wages ($\ln Y_i$), for an individual i:

$$(1) \qquad S_i = X_i\delta + \nu_i ,$$

$$(2) \qquad \ln Y_i = X_i\gamma + S_i\beta + \upsilon_i .$$

In this case X_i is a vector of observed attributes of the individual and ν_i and υ_i are the random error terms that are assumed to be uncorrelated with X_i. The coefficient β is a measure of the 'returns to education,' or average returns to education if this varies across individuals if ν_i and υ_i are uncorrelated.

It is quite likely that schooling is correlated with the unobserved component of the log earnings equation, however, due to, for example ability bias or measurement error in schooling (see, e.g. Griliches, 1977).[7] Ability bias arises when individuals of high ability both acquire higher levels of schooling (because the returns are higher and/or the costs are lower) and earn higher wages in the adult labor market. If this is true for our sample, an estimation of the β coefficient will be biased upwards. Measurement error in schooling can

[7] See Card (1999) for an excellent overview of the issues and evidence concerning estimating the causal effect of education on earnings.

also bias the results if it induces a negative correlation between the errors of the observed schooling and earnings, which would bias the estimate of β downward.

The context of a low income country in which child labor is widespread presents another confounding effect: child labor itself. The decision to work as a child is likely correlated with the schooling decision and is also likely correlated with adult earnings. Fortunately, one aspect of child labor is observed: the age at which individuals first started to work. Therefore, in the low income country context, where child labor is widespread the schooling and child labor decision are both likely to affect adult incomes and are likely correlated, a description of this process would involve a three equation system for and individual i:

(3) $$S_i = X_i\delta + \nu_i,$$

(4) $$CL_i = X_i\alpha + \psi_i,$$

(5) $$\ln Y_i = X_i\gamma + S_i\beta + CL_i\phi + \upsilon_i.$$

Where CL_i is the age at which the individual first started to work, and ψ_i is the unobserved random error term. In order for ϕ to be a measure of the effect of starting to work at a certain age (or average if it varies across individuals), ψ_i and υ_i must be uncorrelated.

These error terms are likely correlated because the same ability bias that causes high ability individuals to choose more schooling may *also* cause those individuals to choose to start to work at an older age (biasing the coefficient estimate upward) or they may choose to start working at a younger age because ability may pay off in the child labor market as well as the adult labor market (biasing the coefficient estimate downward). Measurement error is another source of potential bias for the age started to work coefficient.

In this case, consistent estimates for the return to education and the effect of starting to work as a child can be obtained if there is a set of regressors, Z_i, that can be added to the vector X_i that affect schooling but do not affect the unexplained component of earnings, and that affect the age an individual starts to work but not the unexplained component of earnings. This set of regressors must be sufficiently correlated with both schooling and the age started to work (i.e. have enough separate correlation with both variables that is separate from the correlation among the two variables), and sufficiently uncorrelated with the unexplained variation in adult earnings that they can be legitimately excluded from the earnings equation.

In this study, as we have information on the age the individual first started to work, the years of schooling the individual has obtained and their current log earnings, we shall estimate the following system of equations using a GMM instrumental variables regression:

$$(6) \qquad S_i = X_i \mid Z_i\delta + \nu_i ,$$

$$(7) \qquad CL_i = X_i \mid Z_i\alpha + \psi_i ,$$

$$(8) \qquad lnY_i = X_i\gamma + S_i\beta + CL_i\phi + \upsilon_i ,$$

with the estimating assumption that $E(Z_i\upsilon_i) = 0$. We shall estimate the model both with and without the years of schooling variable to evaluate the impact of early entry into the labor market both including the effect on schooling and then, when including the schooling variable, the effect of early entry over and above the impact on schooling.

To estimate the models presented above, we run both a series of OLS regressions (i.e. ignoring potential endogeneity concerns) and a series of GMM IV regressions in order to capture the effect of being a young laborer on adult earnings. The first set of regressions will estimate the direct impact *and* indirect impact (i.e. controlling for schooling) of being a

young laborer on adult earnings. The second set of regressions will identify the first job occupations that are associated with higher or lower earnings conditional on having been an adolescent laborer.

III. The Data

3.1 Main Data

The main sources of data utilized in this study are two rounds of the *Pesquisa Nacional por Amostragem a Domicílio* (PNAD), from *Instituto Brasileiro de Geografia e Estatística* (IBGE), the Brazilian census bureau: 1988 and 1996. The PNAD is a yearly and nationally representative household survey (excepting the rural Amazon region) similar to the Current Population Survey in the U.S. It covers close to one hundred thousand households and includes information on the demographic and labor market characteristics of the households. Additionally, and of particular utility for the present study, the 1988 and 1996 surveys obtain retrospective information from the household head and the spouse (that are in the labor market) about the age they entered the labor market, their first occupation, the educational attainment of their parents as well as the occupation of their fathers when they (head and spouse) first entered the labor market, the state in which they were born and the state in which they currently reside.[8,9]

The parental education variables are crucial to our analysis. These provide important controls for the family background of the individual. As parental income is highly related to

[8] If the two states were different, a follow-up question was asked about the number of years the individual had lived in the current state. This information was coded 1 through 10+ years. Because of the truncated and incomplete data, we are not able to construct a complete picture of migration, but we are able to utilize the information on those that are currently residing in a state that is not their birth state as a control for migration. A detailed discussion appears in section 4.3.

education, especially in Brazil, these variables, when included as explanatory variables, control for things like wealth, nutrition, overall education level in the household in which the individual grows up and parental decisions about where to live, what schools to send the children to and their own educational inputs for the children.[10]

Our sample consists of all males who were identified as household heads or the spouse of the household head between 25 and 55 years of age at each survey year. We exclude younger and older men in an attempt to avoid potential selectivity bias of labor market participation decisions. We also exclude females for three reasons: first, there is a large selection issue relating to the women who choose to work (less than 50 percent of women in the 1988 and 1996 PNADs were listed as currently employed); second, many girls work in the household rather than in the labor market leading to under-measurement of female child labor; and third, fertility issues complicate the school and work decisions of females. Because of these three concerns, females are excluded from the current study though their outcomes are no less important. The impact of working as a child on females is therefore left to future research. Unlike women, most of these prime age male workers are likely to participate in the labor market (see below).

Table A.1 of Appendix A presents the number of observations kept in our sample due to each criteria of the selection process. The 1988 and 1996 pooled sample of 25-to-55-year-old males encompasses 108,229 observations. Of these 101,901, or 94.15 percent, participate in the labor market, and 95,337, or 88.09 percent, work with strictly positive earnings in the

[9] The 1982 PNAD collects identical retrospective information of the heads and spouses as well. However, it does not contain information about their immigration status which is crucial to assign the corresponding instrument to the individual.

[10] See Lam and Schoeni (1993) for an excellent study of family background effects in Brazil. There is also a large and growing literature on the intergenerational transmission of human capital (see, e.g., Black, et. al., 2005; Maurin, 2002; Keane and Wolpin, 2001; Neri, et. al., 2000; Shea, 2000; Blau, 1999; Lam and Duryea,

labor market.[11] Of all prime age male workers with strictly positive earnings, 80,587, or 84.53 percent, are listed as the head of the household or the spouse of the head. We restrict the sample to heads and spouses since we have information about age started to work and family background only for these individuals.[12] Among all prime age head and spouse males working in the labor market with strictly positive earnings, we restrict the sample to those who declared their age started to work to be between 7 and 25 years old. 97.54 percent started to work in this age range. Finally, we further restrict the sample to those with valid information on their parent's schooling and birth state information. Doing so, we end up with a sample of 62,745 observations. The drop in the number of observations is mostly due to the lacuna of parental education information. Some respondents declared that they do not know their father's and/or their mother's educational attainment. Since we want to control for family background, we exclude these individuals from our final sample as well.[13]

We perform all of our subsequent analyses on the pooled sample of the 1988 and 1996 PNADs. In our regression analysis, we control for both from which sample the

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1999) that suggests that it is vitally important to control for family background. Family income is also important in Brazil specifically, see Duryea (1998).

[11] All earnings are in 1996 Reais. To convert the 1988 earnings, we used the Brazilian national CPI (specifically the INPC from IBGE).

[12] The 1996 PNAD contains the age start to work information for all workers. However, the family background information and first job occupation are asked of the heads and spouses only. Since we will make use of the father's occupation and first job occupation information, and want to be consistent with the 1988 PNAD, we keep in our sample only the heads and spouses for the 1996 PNAD.

[13] Individuals that have missing parental education information have disproportionately lower education, slightly lower earnings and started to work slightly earlier than those that do have information on their parents' education. Because this sample selection may bias the results, we estimated the same regression models including those that do not have parental education and assigning them the sample average parental education and included an indicator variable for them. The results were qualitatively identical and quantitatively very similar. Results are available upon request.

information was obtained and the cohort of the individual.[14] The basic statistics of the sample are presented in Table A.2 of Appendix A.

It is informative to examine the distribution of the age the individuals in our sample first started to work, their schooling distribution, and their schooling attainment and log-earnings by the age they first started to work. Figure 1 shows the distribution of age started to work for all individuals in our sample. Note that there are spikes at 10 years old, the age at the end of the lower primary school, 12 years old, the legal minimum working age until 1988, 14 years old, the end of upper primary school, and 18 years old, then end of secondary school. Figure 2 shows the years of schooling distribution. The distribution presents four major spikes corresponding to the Brazilian education system. Around 15 percent are illiterate (0 years of schooling), 18 percent have 4 years of schooling (lower primary completion), 9 percent have 8 years of schooling (upper primary completion), and 13 percent have 11 years of schooling (high school completion). Note that less then 10 percent have completed a college degree (corresponding to 15 years of schooling or more).

The Figures 1 and 2 collapse all individuals that come from different cohorts, and it is likely that the educational attainment and entry age in the labor market have evolved during the interval in question. Figure 3 presents the average years of schooling and the average age started to work by the year of birth of the individuals in the sample. The oldest individuals in our sample were born in 1933 and the youngest individuals in 1971. Although the average schooling and average age started to work increased along the years, as one would expect, it is perhaps remarkable for how slowly these have increased. Indeed, the average years of schooling among our sample individuals is around 3.5 years of schooling for individuals born

[14] The cohorts are split by those that were born before 1959 and those that were born after 1958. The reason for this particular division was that those in the younger cohort are the ones that would have been affected by the

in 1933, and 7 years of schooling for those born in 1971. Not only is the schooling level low compared to other developing economies, it has also progressed at a slower rate - it took almost 40 years to double this number.[15] Similarly, the average age started to work increased very little. Among those born in 1933, this average was around 12 years old. For those born in 1971, it was 13.5 years old. That is, during the intervening 38 years it increased by only 1.5 years. Thus, for the generations in our sample, by the beginning of their adolescence the majority of the Brazilian male individuals were engaged in labor market activities.

Figures 1 to 3 tell us three things: (i) the average Brazilian male worker has low educational attainment and starts to work at a relatively young age; (ii) the average years of schooling and average age started to work have increased during the sample window, but not by very much; and (iii) there is a sizable dispersion of the years of schooling and of the age started to work distributions. It is useful to explore how they are related to each other, and how both are related to the earnings of the individual when they are adults. Figure 4 allows us to begin to do so. It shows the schooling attainment and log-earnings by age started to work. Note that both the schooling by age started to work and the log-earnings by age started to work are increasing in general and appear to be moving together. This begs the question, is there a causal relation between age started to work and adult earnings? If a causal relationship between age-started-to-work and adult earnings exists, is the impact of starting to work at a younger age on log-earnings only a schooling effect? In other words, the effect of starting to work at a younger age could be indirect (through education), direct (over and above the effect on educational attainment), or both.

3.2 Age Started to Work

education reform enacted in 1972 that increased the mandatory schooling age from 10 to 14.

[15] See, for example, Birdsall and Sabot's (1996) discussion on educational outcomes in Brazil.

In order to investigate the transition to work of individuals in Brazil, we utilize the response to the question posed in both rounds of the PNAD which we employ, "at what age did you start to work?" This question is asked for those heads and spouses active in the labor market in the 1988 PNAD, and for all occupied individuals in the 1996 PNAD.

Though it is impossible to say precisely how respondents understood this question, there is a fair amount of evidence to believe that they understood it to mean regular work. First, this question is only asked for those currently engaged in labor market activities. Second, the age started work question belongs to the part of the questionnaire devoted to the mobility characteristics in 1988 and to the labor market characteristics in 1996. In both cases it is preceded by a series of questions asking the respondents about their current work, earnings, hours, occupation, sector, their previous work and occupations, and then was followed by questions asking about their occupation in the job in which they indicated they first started to work in, and their father's occupation at that time. For this reason it seems very likely that the respondents understood that the interviewer was interested in regular work. Third, we can construct incidence rates from our retrospective data on age started to work and compare it with other estimates of historical child labor incidence in Brazil.

We construct the level of child labor incidence in our data in the following way, for both surveys we determined which 25-to-55-year old male individuals were 10 to 14, 15 to 19 and 20 to 24 in the years 1950, 1960, 1970, 1980 and 1990. We then determined if they had reported that they had already begun to work.[16] We then found the ratio of male workers to all male individuals in each age category for each year. We compare these with the

[16] For those that were working at the time of the survey. For the others we assumed that they were not working. For instance, a 46-year-old individual in 1996 was born in the year 1950. If he had declared that started to work at age 10 or below we assigned him as a child laborer in the 10 to 14 age range in the year 1960 and in the 20 to 24 age range in 1970. We would consider him a non-child laborer in this age range otherwise.

estimates of child labor incidence among Brazilian males for the same age categories and for the same years from the International Labour Organization (ILO). The ILO figures refer to individuals currently active in the labor market at that time. These comparisons are presented in Table 3. A couple of patterns are worth noting. First, for the 10 to 14 age range, the contemporaneous incidence of child labor (ILO data) is smaller than the retrospective information for all years (PNAD data). Second, for the 15 to 19 and 20 to 24 age ranges, the ILO and PNAD figures are similar and in most cases the PNAD figures are somewhat smaller than the ILO ones. If the individuals had interpreted the age started to work question as it referred to sporadic or irregular work, we would observe higher incidence for the retrospective information for all age ranges.

The significant differences seem to concentrate in the 10 to 14 age range only. These discrepancies may be due to the fact that the work of those that responded to have started to work younger in life are more likely to be part-time work, home farming, or home production that the ILO figures may not capture.

3.3 School and Work

To further understand how Brazilian children used their time during the period of study, we examine the joint nature of the work and school decisions. The formal primary and secondary school hours in Brazil are only 4 a day: either the entire morning or the entire afternoon. It is, therefore, quite possible for a child or adolescent to attend school in one period and work in the other. In fact, in our sample the majority of those that worked as a child also attended school. It is precisely because of the simultaneity of work and school activities that we are able to empirically identify the trade-off between work and school. To

support this point, we present two complementary pieces of information that provide further insight into the time allocation decisions of Brazilian boys in Appendix B.

3.4 First Job Occupation

The 1988 and 1996 PNADs collected data on individuals' first job occupation, first job sector, and the first job occupation type as a part of the mobility questionnaire. The first job occupation categories are the three-digit occupation categories identical to the current job occupation categories. They are categories formally set by IBGE and used for most IBGE labor market surveys. From this we know the occupation category of the individuals' jobs at the age they started to work.

We classify the individuals of our sample into eight first job occupation categories. Workers in technical and clerical occupations are divided into two categories, workers in manual labor occupations are divided into five categories, and there is one undefined occupation category. The technical/clerical worker categories are technical (engineers, doctors, etc.), and administrative (directors, managers, etc.). The manual labor workers are divided into farm workers, manufacturing workers, commerce workers, transport and communications workers, and service workers.[17] Agricultural workers make up the majority of very young laborers (those that started to work under 10 years old), and for those that started to work between 10 and 14 agricultural work was still the main category but followed closely by manufacturing.

The first job occupation types are: salaried employees, unpaid workers, self-employed individuals, and employers. Unpaid workers represent a large number of very young workers

[17] Appendix C (Table C.1) presents the classification of the three-digit occupation categories into the eight broader categories described in the text.

and are very common among those that started to work at age 14 or below and those that are from the older cohort (born between 1933 and 1958).

A detailed discussion of the first job occupation categories, occupation types and their distributions is presented in Appendix C, but, in general, it seems that for most of the very young child laborers (age started to work 9 or below), they were unpaid or salaried workers in the agriculture sector seconded by unpaid or salaried workers in the manufacturing sector. For individuals that started to work at age 10 to 14, most of them appear to be divided between salaried or unpaid workers in the agriculture or manufacturing sector. We will explore this information below in an attempt to determine if there are any particular first job occupation categories associated with higher earnings as adults if an individual first begins to work at a young age.

3.5 The Instruments

As mentioned in the empirical strategy section, in order to properly control for the potential endogeneity of the age started to work and schooling variables in the earnings regressions, the instruments must be both relevant and valid: well-correlated with the potentially endogenous variables and uncorrelated with the unexplained variation in earnings. One set of variables that may fulfill this requirement are the number of schools per children in the individual's state in the year that they are 7 years old, 11 years old and 15 years old, the number of teachers per school in the individual's state in the year that they are 7 years old, 11 years old and 15 years old, and the individual's state's GDP per capita when the individual was 12 years old. The presence of more schools in the same state of the individual lowers the cost of attending school as travel costs are reduced and students are more likely to be able to live at home and attend school. Age 7 is the age when an individual first enters

school, 11 is the start of the upper primary levels of school and 15 is the beginning of secondary school for a normally progressing child (i.e. no delays). Lower cost of education should increase investments in education, and cause delay in starting to work. This variation in the cost of schooling is also exogenous to the individual decision maker and should be uncorrelated with adult incomes once the family background is controlled for. Similarly the number of teachers per school is potentially an exogenous variation in both the benefit and cost of attending school. The assumption is that the number of schools per children and number of teachers per school are proxies for exogenous supply of education. The GDP per capita is a measure of the local labor market conditions, and the age of 12 is critical decision year as 12 was (until 1988) the minimum legal working age in Brazil. This variation in local labor market conditions is exogenous to the individual decision maker and is likely correlated with the decisions to enter the labor market and to finish schooling. These data are the set of instruments employed in all instrumental variable regressions. A similar set of instruments was used by Card (1995) and Cameron and Taber (2004).

The data on the number of primary and secondary schools by state and year, the number of teachers per state per year, and the population by state and year come from the IBGE Historical Series, 2003. Data on the GDP per state per year were obtained from the IPEA historical series.[18] In order to match each individual with the number of schools, teachers and the GDP in their state for each year that they were school aged, we give the individual the schools, teachers and GDP of their birth state.[19]

[18] IPEA is the research institute of the Ministery of Planning of the Brazilian Federal Government. These series can be obtained on line in http://www.ipeadata.gov.br/ipeaweb.dll/ipeadata?1026025750.

[19] 38% of our sample are formed by individuals that the current state of residence is not the state of birth. Our procedure assumes that these individuals were likely to attend schools in their birth state. However, we do not know when they left their birth state. In order to check the robustness of our results, we also followed two procedures. First, we replicate the exercise adding a migrant indicator variable as control. This procedure is presented in the results. Second, if the individual was a current resident of the same state in which they were

Thus, the instruments we use for the results presented below are the birth state number of primary and secondary schools per thousand children aged 5 to 19 when the individual was 7, 11 and 15 years old, and the birth state number of teachers per primary and secondary school when the individual was 7, 11, and 15 years old. We also use the birth state GDP per capita at age 12. The GDP is given in thousands of Reais (Brazilian currency) for year 2000. Their basic statistics are shown in Table A.2 of Appendix A. The details of how these series were constructed are given in Appendix D.

There are 25 states and 39 birth years from 1933 to 1971.[20] Thus each instrument has 975 different values and these are the source of the variation that we exploit to identify the model. The figures for Brazil and some selected states from different regions are presented in Figures 5.a to 5.c. São Paulo and Piauí are the richest and poorest states in Brazil, respectively. Minas Gerais and Rio Grande do Sul are states with GDP per Capita similar to the country's GDP per Capita. The number of schools per thousand children aged 5 to 19 years old for the country ranged from between 2 and 3 in the early 1940s to 4 to 5 in the early 1980s. The number of teachers per school ranged from 2 in the beginning of the 1940s to 6 in 1985. The GDP per Capita remained relatively stable from the 1940s to the late 1960s. The 1970s experienced a rapid economic growth where the GDP per Capita doubled in ten years, the so-called 'Brazilian economic miracle' years. After the economic crisis in the early 1980s, the GDP per capita leveled off and growth has been relatively slow. More importantly for our analysis, there are sizable variations across states. Interestingly, some

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born, we assume that they have not migrated and give them the number of schools associated with that state. If they list a birth state different from the state in which they were current residents of and the migration information does not allow us to determine exactly when they moved, we give them the national average number of schools for each year they were of school age. The results are qualitatively the same.

[20] Brazil has 27 states currently. We collapsed the states of Goias and Tocantins, and the states of Mato Grosso and Mato Grosso do Sul. Tocantins and Mato Grosso do Sul were created recently from a division of the old

states like Sao Paulo have below average schools per children but above average teachers per school. Thus there appears to be two ways to expand schools in states, build more schools, or expand current ones with more teachers.

IV. Estimation and Results

4.1 The Effect of Working Earlier in Life

In order to estimate the effect of having been a child worker on current adult earnings, we start by estimating two separate earnings equations that include the age the individual first started to work variable and its square, the age of the individual and its square, indicator variables that equal one if the individual is classified as black and another if the individual is classified as 'pardo,' or mixed race. Included in all estimations are measures of the father's and mother's education levels. For both, these are indicators for each level of education completed: some to completed lower primary, beyond lower primary to completed upper primary, beyond upper primary to completed secondary and beyond secondary to completed college. The reference category is if the parents have not attended any school. For these estimations, an indicator variable that equals one if the individual resides in a rural area is included, as is the year of the survey and the cohort control. The difference in the two separate earnings equations is that in the first estimations the years of schooling of the individual are not included and in the second set, the years of schooling are included. These exercises are replicated with a set of regressions where the birth region indicator variables are added, and another set where country region and father's occupation at the age the individual entered the labor market are included.

Goias and old Mato Grosso, respectively. Some territories were transformed into states and some states were merged along the 20th century. For details of how the sates were aggregated see Appendix E.

We begin by estimating the earnings model first by OLS and then using the set of instruments described above in a GMM IV framework. The first set of regressions does not control for the individual's educational attainment. The fact that an individual worked during childhood or adolescence will likely mean that individual will have attained less education than a similar individual that did not work. So, as a first step, the coefficients of the age started work variables when not controlling for education capture the expected forgone adult earnings of a young worker. Then, when controlling for schooling, the coefficients on the age started to work variables capture the effect on adult earnings holding education constant.

Table 2 presents the OLS results for the pooled sample. The first and third columns show the coefficient estimates where years of schooling is first excluded and then included. The first column estimates indicate that there is a benefit to delaying entry into the work force and that its effect is slightly convex. The third column results indicate that there is about an eleven percent per year increase in adult earnings for each additional year of schooling. Additionally, as we are interested in the young laborer status of the individual and its impact on his adult earnings, the coefficient estimates show that the older the individual enters the labor market, the higher are his earnings (even after we control for the effect of the loss of education). Comparing the results of first regression without schooling (model 2.a) with the second regression with schooling (model 2.b), we realize that there is no maximum value of earnings within the age started to work support (7 to 25 years old) when we do not control for schooling. That is, the marginal gains in earnings as individuals postpone their entry in the labor market by a year (and go to school) always increase as age started to work increases. Moreover, when we control for years of schooling in model 2.b, the optimal age to start to work is around 24 years old as shown by the last line of Table 2. Similar results are

obtained when we add regional controls, and region and father's occupation controls, except that the squared term of the age started to work variable is no longer significant in the last specification (models 2.e and 2.f). If we take these results at their face value, we would be inclined to conclude that starting to work at a younger age is highly costly in terms of adult earnings. There is a negative impact of child labor through foregone earnings (due to foregone schooling), and there is also a negative impact over and above schooling well into adulthood.

However, as argued at length above, both years of schooling and age started to work and its square are likely endogenous in the OLS regressions. Therefore we turn to the GMM IV regressions. We first estimate the GMM IV models without controlling for years of schooling and we then include schooling controls.[21] We again replicate the exercise adding regional controls and region and father's occupation controls. We also add birth region indicator variables in an attempt to control for regional specificities (e.g., educational policies or labor market institutions) associated with schooling, age started to work and earnings. The birth regions are North, Northeast, East, South and Center-West and follow the official administrative group of states as of the late 1960s.[22]

We next estimate another alternative specification that adds the father's occupation categories as controls. It can be argued that parents' education together with their occupation categories are better proxies for the family's permanent income. The father's occupation categories are the same as the individual's categories as discussed above and refer to the father's occupation at the age the individual entered the labor market. Not properly controlling for the family's permanent income can bias our results. Richer children are more

[21] All GMM IV regressions allow for clusters by birth state and year.
[22] The regional division is presented in Appendix E.

likely stay in school and enter the labor market later and poorer children more likely to abandon school and start to work early. If we are not properly controlling for family background we may be underestimating the turning point of the age started to work.[23]

Although it may be true that parents' education and occupation together are a better measure for a family's permanent income, it could also add another source of bias in our estimations. Since father's occupation is contemporaneous to the age the individual entered the labor market, they could be jointly determined and thus father's occupation could be endogenous as well. Nonetheless, we present estimations that include birth regions and the seven father's occupation category indicator variables. Professional and technical workers are the omitted category.

Table A.3.1 to A.3.3 of Appendix A presents the first-stage regression results for this specification (models 3.a to 3.f). For both the age started to work and its square, the F test of the included instruments is in general above 11, indicating that they are jointly strongly correlated with the endogenous variables (except for models 3.e and 3.f which the F-test is no less than 6). The number of schools per children and the number of teachers per school are positively associated with age started to work and its square and GDP per capita is negatively associated with age started to work and its square. As expected, lower cost of schooling and lower opportunity cost of schooling is likely to delay the child's entry in the labor market.

Tables A.3.1 to A.3.3 of Appendix A also present the first stage regressions for the model that control for schooling. The instruments are jointly strongly correlated with the variable years of schooling as shown by the F tests no less than 14.

Table 3 presents the results of the second stage IV estimation of the models without region and father's occupation controls (models 3.a and 3.b), with region controls (models

[23] Note that father's occupation are also proxies for rural/urban location of the individual when he was a child.

3.c and 3.d), and with region and father's occupation controls (models 3.e and 3.f). The IV estimates of age started to work are significantly higher than the OLS, but the squared term is now negative and significant, so the overall effect depends on the age of analysis. These IV results suggest that the overall negative effect of starting to work at a younger age end at around ages 13-14 as presented in the last line of Table 3. Thus, for all models in Table 3 that do not control for schooling (models 3.a, 3.c and 3.e) there is a negative and significant impact on adult earnings if a male individual started to work as a child at or below the age of 13, but that effect becomes positive for individuals who started to work at age 14 or above. The Hansen's J-Statistic test of over-identifying restrictions confirms that the null hypothesis (of instrument orthogonality to the error terms) is not rejected.

The next estimation was performed on the model where the variable 'years of schooling' is included as a control variable in the second stage. The second stage regression results are presented in the models 3.b, 3.d and 3.f of Table 3. Here, the coefficient estimates of the age started to work variable reflect the effect on adult earnings of having been a young laborer over-and-above the loss of education. Note that in the IV estimation, the coefficient on the years of schooling variable ranges from more than an 11% to an over 17% increase in adult earnings per additional year of schooling. The age started to work coefficient estimate is again positive but its square is negative. This is consistent with the results of the estimation of the model that excluded years of schooling in that the age at which the negative effect ceases is around 13 to 14. Interestingly, there are no significant differences of the age started to work that maximizes adult earnings when education is controlled for. Thus, starting to work below 13 to 14 years old harms the expected adult earnings *even if* the individual attends school regularly.

For all six estimations, the other coefficient estimates have the expected signs. Older individuals have higher earnings but this increases at a decreasing rate, black and pardo individuals have systematically lower earnings than white individuals, individuals in rural areas have lower earnings, and, the more educated the parents, the greater are the earnings of the individuals. The '33-'58 cohort indicator variable estimate is positive and significant in all cases and, interestingly, individuals from the earlier sample, 1988, have systematically lower earnings, perhaps reflecting the growth of the Brazilian economy over the intervening years.[24] Individuals born in the North and the Northeast regions, historically the two poorest regions of the country, have lower earnings. Also, individuals that have parents working in blue-collar occupations have lower earnings as adults.[25]

There are a number of reasons that our estimates of the log earnings equations may still be biased. In the sub-sections below we address three main possibilities: the fact that persistence in differential state labor market conditions could explain the result, the fact that certain types of individuals might have migrated to look for better schools and/or better wages and thus this opportunistic migration is driving the result, and that school quality may not be properly controlled for and is contaminating the result.

4.2 Potential Bias from Differences in Adult Labor Markets

The results of Table 3 suggest that there is indeed a negative impact of being a child laborer both including the effect on educational attainment and over and above the impact on education. However, this effect seems to subside and turn positive at around age 13-14. Of course, these results are valid under our assumption of the exclusion restrictions. Cameron and Taber (2004), among others, argue that earlier labor market conditions are possibly

[24] The 1998 indicator variable could also capture some systematic differences in the surveys themselves.

correlated with later labor market conditions. If this is the case, the use of previous labor market condition proxies as instruments is only valid if we control for later labor market conditions as well. For instance, better labor market conditions when the individual is, say, 12 years old, may be associated with dropping out of school and starting to work earlier in life. It may also be associated with better labor market conditions when the individual is adult (say, 25 years old). If we do not control for adult labor market conditions, we may be attributing earlier labor market experience to higher adult earnings when in fact it is due to the overall labor market conditions. In other words, our 'ideal' labor market entry age is biased downward. It may also be the case that good labor market conditions as a child may delay entry in the labor market as adult incomes in the household may be sufficient to provide adequate nutrition and thus freeing children to attend more school – potentially biasing the 'ideal' entry age upward. In order to control for this potential bias problem, we estimate an alternative specification that includes the birth state GDP per capita when the individual was 25 years old as an exogenous variable. The second stage regression results are presented in Table 4.[26] Models 4.a, 4.c, and 4.e of Table 4 are the regressions without years of schooling and models 4.b, 4.d, and 4.f are the regressions with years of schooling. For all models, there is a negative impact of being a child labor both including the effect on schooling and over and above the impact on schooling. This effect seems to subside and turn positive at around age 11 to 13. Thus, the results of Table 3 remain qualitatively the same when we control with a proxy for adult labor market conditions.

4.3 Potential Bias from Opportunistic Migration

[25] We also estimated the regressions with years of schooling and its square. The coefficients of the squared term were not statistically different from zero.
[26] The first stage regressions are presented in Appendix A, Tables A.4.1 to A.4.3.

Another source of potential bias in the estimations above is the lack of a control for migration. 38 percent of the observations in our sample consist of individuals living in a state different from their birth state. The potential for bias arises if there is some underlying selection process where the migration decision depends on some unobservable individual characteristics correlated with schooling or child labor and associated with adult earnings. For example, ability and motivation could be positively correlated to schooling, earnings, and willingness to migrate. A higher ability or more motivated individual may be more likely to migrate to a place where one can get a better education and a better job as an adult. In this case the migrant is potentially more likely to postpone the entry in the labor market. Without controlling for migration our estimations may be biased upward. On the other hand, there may be a selection process that biases the estimations downward. For instance, a higher ability or more motivated individual may be more likely to migrate to a place where one can get a better job as a child and where it is possible to move up the income distribution faster through occupational choices.

Table 5 presents the results for all six models where we keep the birth state GDP per capita and add the migrant indicator variable as a control.[27] Since migration is a choice variable it is very likely to be endogenous and we treat it as such. Thus, the models 5.a, 5.c, and 5.e have three endogenous variables (age started to work and its square, and migrant indicator), and the models 5.b, 5.d, and 5.f have four endogenous variables (schooling is added). The instruments are the same ones as before. The bottom of Table 5 shows the F-test for all endogenous variables. Note that migrant is highly correlated with the instruments - the F-tests are all around 16.

[27] The first stage regressions are presented in Appendix A, Tables A.5.1 to A.5.3.

All the results are qualitatively similar to the ones of Tables 3 and 4 with the caveat that the returns to schooling become somewhat greater now. More importantly for our purpose here, however, the turning point of age to start to work ranges around 11 to 13 years old. Again, for all models, there is a negative impact of being a child labor both including the effect on schooling and over and above the impact on schooling. This effect seems to subside and turn positive at around age 11 to 13.

4.4 Potential Bias from Differential School Quality

In our basic specifications we use the number of schools per population of children in the state as an instrument for the schooling and work decisions. Our use of number of teachers may be proxying for school quality, however, and school quality may matter in terms of human capital accumulation and adult productivity. If this is true than the number of teachers would potentially be correlated with unexplained adult earnings and would not be valid instruments. Therefore, as a further robustness check we estimated models where the average number of teachers per school from when the individual was 7 to 14 years old was included in the second stage regressions to control for school quality (the number of teachers per school were thus not used as instruments). We keep the migrant indicator variable as an endogenous variable and birth sate GDP per capita at age 25 as a control. Note that in the cases in which schooling is controlled for, there are four instruments and four endogenous variables and so the model is just identified.

Table 6 presents the second stage results for all six models.[28] The results are qualitatively the same and the average number of teachers per school variable is not significant. This may be due to the fact that as the education of the mother and father are included as controls in the earnings equations, and as parental education is, in general, a very

good proxy for family income and wealth, and they are likely to be strong correlates of school quality, local labor market conditions, etc.[29]

Once more, for all models, there is a negative impact of being a child labor both including the effect on schooling and over and above the impact on schooling. This effect seems to subside and turn positive at around age 13 to 15.

4.5 Discussion

Our results suggest that there is a negative impact of being a child laborer on the individuals' adult earnings. This negative effect ceases around age 13 and there appears to be positive impacts on adult earnings from adolescent labor. The negative effects before 13 and positive effects after 13 operate both through the effect on schooling as well as over and above the effect on schooling.

In order to illustrate the magnitudes of the impacts of early entry in the labor market, Figures 6.a to 6.c depict the marginal impacts (in log points) of the age started to work on adult log-earnings. The marginal impacts are evaluated at each age started to work from age 9 to 18. The lighter bar illustrates the impact when we do not control for schooling and the darker bar illustrates the impact when we control for years of schooling. The figures were computed from the coefficients of models 3.e & 3.f (Figure 6.a), 4.e & 4.f (Figure 6.b), 5.e & 5.f (Figure 6.c). Interestingly, the estimated marginal impacts without schooling and with the schooling control are not statistically different to each other for all evaluated ages from 7 to 25 (at the 5 percent level). This suggests that most of the negative effect of child labor works over and above the effect on schooling. The point estimates tell us that an individual at age 11 that postpones the entry in the labor market for a year is expected to increase his adult

[28] The first stage regressions are presented in Appendix A, Tables A.6.1 to A.6.3.

earnings (ceteris paribus including schooling) by 0.32 (0.09) log points according to model 3.f (4.f). An individual at age 15 that postpones the entry in the labor market for one year is expected to decrease his adult earnings by 0.14 (0.22) log points according to model 3.f (4.f).

Although the point estimates vary across models, the trend is always the same: there is a downward trend where the marginal impact reverses its sign around 13 years of age. Table 7 shows the point estimate of the age started to work that maximizes adult earnings for all models. It also includes the standard deviations and the 95% confidence interval. The estimates vary a little across models but the qualitative result is the same: there is a negative impact on adult earnings if an individual starts to work early in life. This negative effect seems to subside and becomes positive around age 13.

Our estimation also allows us to estimate the adult earning trade-off between work and school. Figure 7 presents an 'iso-earnings' curve that represents the trade-off between education and child labor based on the estimated coefficients from column 5.f of Table 5. The slope of this curve illustrates how much extra schooling is needed if the individual enters the labor market one year earlier in order to keep the same earnings level as an adult. For younger individuals this slope can be greater than one in absolute value. It means that if a child starts to work one year earlier and does not go to school, the loss in his adult earnings is equivalent to having lost more than one extra year of schooling. Conversely, if older children postpone their entry in the labor market by one year, the loss in his adult earnings is potentially equivalent to having lost more than one extra year of schooling.

Even though we are interested in years of schooling primarily as a control, our results are related to the returns to education literature in the U.S. Like similar studies of the

[29] Parental education and family income and wealth are highly correlated in Brazil. See, e.g., Emerson and Souza (2003).

education – earnings relationship in the United States and elsewhere, our IV regression coefficient estimates on the schooling variable are never lower than the OLS coefficient estimates. This may seem counter-intuitive if one believes that ability bias biases the OLS schooling coefficient estimates upward. However, as ability may also increase the opportunity cost of schooling (because high ability children may earn more in the child labor market), this could lead to a downward bias in the OLS estimates. In addition, as Griliches (1977) and others have pointed out, measurement error in the schooling variable can lead to a downward attenuation bias in the OLS schooling coefficient estimate, something that IV, as long as the instruments are not correlated with the measurement error, corrects for. As we are using retrospective information on schooling, there may be a large degree of mis-measurement. Finally, as Card (1999) points out, if the individuals for whom school location is most important in determining their education (perhaps due to credit constraints) are also the ones who have the highest marginal impact from schooling, then school location as an instrument will emphasize their contribution to the overall effect.

As our primary research question is based on the estimate of the age started to work coefficient, similar questions can be raised about the difference in the OLS and IV estimates. The point estimates for the age started to work coefficient rise considerably and the coefficient on the age started to work squared term are also large and significant in contrast to the OLS estimates. This may be due to similar issues with attenuation bias as retrospective information on individuals first work experience is likely to suffer from mis-measurement. Ability bias could also be important for age started to work as well as. In addition if there are heterogeneous returns to working early that are correlated with the proximity to schools, the coefficients could be capturing this as well. If the instruments are

valid than these biases would disappear in the IV estimates and could account for the difference between them and the OLS estimates.

V. The Role of Different Child Labor Activities

The different activities in which children may engage when they work may have very different vocational, learning by doing or general job skills training aspects to them, we next attempt to identify if there are particular activities that appear to have positive human capital accumulation associated with them, even if children begin these activities at a very young age. The summary statistics for the first job occupation variables are given in Table A.1 and the discussion of the distribution by cohort is discussed in Appendix C. Most individuals that started to work below age 10 were farm workers, and farm and manufacturing workers encompassed most of the individuals that started to work between 10 to 14 years old. Most of these younger laborers were unpaid workers or salaried employees as well.

The existence of a high incidence of individuals that declared to have started to work before they were 10 years old as unpaid workers and farm workers may raise a suspicion that they are driving our results. Unpaid workers may be strongly associated with temporary activities and have a weak attachment to the labor market. Young farm workers may be helping the parents from time to time or just working in a specific time of the year during crop seasons, for instance. In other words, they may not represent a regular occupation as a child and pooling them with the other child occupations may not be correct. To check this, we estimated the IV regressions specified as Model 3 with regional and father's occupation controls for three different samples. In the first sample we dropped all individuals that started to work as unpaid workers; in the second sample we dropped all individuals that started to

work as farm workers; and the third sample we dropped both unpaid and farm workers. The second stage results are presented in Table 8.[30] Surprisingly, the results are remarkably similar except for the education coefficients in the second and third samples which are now larger. For all models, earnings are maximized at around entry age 13 as presented in the last row of the Table 8. That is, even when we drop all individuals that declared to have started to work as unpaid and/or farm workers, still we obtain the result that starting to work before the age of 13 decreases adult earnings and that this effect subsides and becomes positive after that.

Are there any particular occupations that are associated with positive human capital accumulation of young workers? To answer this question we run three IV regressions with the same specification as Model 3 with regional and father's occupation controls for three groups of occupations that the individuals started to work: farm workers, manufacturing workers, and service workers and others.[31] The second stage results are presented in Table 9.[32] Among those that started to work as farm workers the squared term of the age started to work is not significant so it is dropped from the regressions. The age started to work is positive and significant even after controlling for schooling. The results suggests that there is a negative effect on adult earnings for individuals that started to work earlier in life and this effect does not disappear as age started to work increases. It seems that there is a negative effect of starting to work earlier in agriculture both through the loss of schooling and over and above the loss of schooling.

In manufacturing, and services and others, the results are distinct from the farm workers and similar to the overall results. There is a negative impact of being a child labor

[30] The first stage regressions are presented in Appendix A, Tables A.7.1 to A.7.3.
[31] The other activity categories had sample sizes too small for proper identification of the model.

both including the effect on schooling and over and above the impact on schooling. This effect seems to subside and turn positive at around age 13. Thus, it seems that there are gains to start to work as adolescent in the manufacturing or service sectors.

VI. Conclusion

In this paper, we investigated the effect of starting to work as a child laborer on an individual's adult earnings in order to fill a substantial gap in our understanding of the consequences of child labor. We find that child labor is associated with lower adult earnings, partly due to the trade-off associated with educational attainment and mostly partly due to the effect over and above the impact on educational attainment, but that this negative net effect appears to reverse around age 13. Additionally, although there appears to be a decrease in adult earnings in general from child work beyond schooling, we find that for agricultural activities there appears to be adverse effect that never subsides. However, manufacturing and service sector occupations may have particular attributes that enhance the expected adult earnings for those that start to work as adolescent.

It should be noted that it would be wrong to conclude from these findings that, for contemporary male children in Brazil, the ideal age to start to work is in adolescence (age 14 or so) if the aim is to maximize adult earnings. However, when considering the environment that the individuals in this study grew up in, their decisions to start working could have been rational. Since the individuals in our sample are males born between 1933 and 1971 (for the older cohort especially) most of the individuals were living in poor families in rural areas. By today's standards those individuals, on average, faced a narrow supply of schools and teachers and had low life expectancy. For instance, a 10-year-old male individual in 1940

[32] The first stage regressions are presented in Appendix A, Tables A.8.1 to A.8.3.

had a life expectancy of 55 years. There were also large regional differences, for example, a 10-year-old male in 1940 living in São Paulo had a life expectancy of 60 years, while a 10-year-old male in 1940 living in Salvador has a life expectancy of 48 years.[33] The capital market was also not very well developed at this time in Brazil, and therefore it is quite likely that most poor Brazilians faced some credit constraints. With relatively high interest rates and relatively low life expectancy it may have been quite rational to discount the future very highly and decide to start to work younger in life to earn income immediately rather than delay in order to capture potentially higher income in the future. For contemporary children, the environment has changed quite dramatically and therefore, it may well be better to delay the work commencement age well into adolescence. Contemporary Brazil is, however, quite farther advanced, in terms of GDP per capita, than many other low income countries. For contemporary economies that are similar to the Brazil of this era, the results presented in this paper are potentially quite relevant.

What is perhaps the most striking element of the results presented here is the fact that, even in a very low income environment where opportunities are scarce, there are negative consequences of entering the labor market at a young age. This presents, then, a challenge to policy makers who are attempting to reduce the incidence of young work: even if economic conditions are very poor, children who work ay very young ages appear to suffer significant negative consequences as adults. It is also striking that the negative effects of starting to work at a very young age exist even when controlling for the years of schooling. This suggests perhaps that children that start to work early are starting in occupations that lead to limited career mobility and thus children, in a sense, get stuck on a less lucrative career track. Understanding the processes that drive these results is, therefore, an important area of future

[33] These figures comes from IBGE Historical Series (2003).

research in order to better inform policy makers. Overall, however, given the improvement in the situation of Brazilian children through time, it may be that the most effective policy interventions to combat child labor are those that improve life expectancy, school availability and quality, and those that ease credit constraints.

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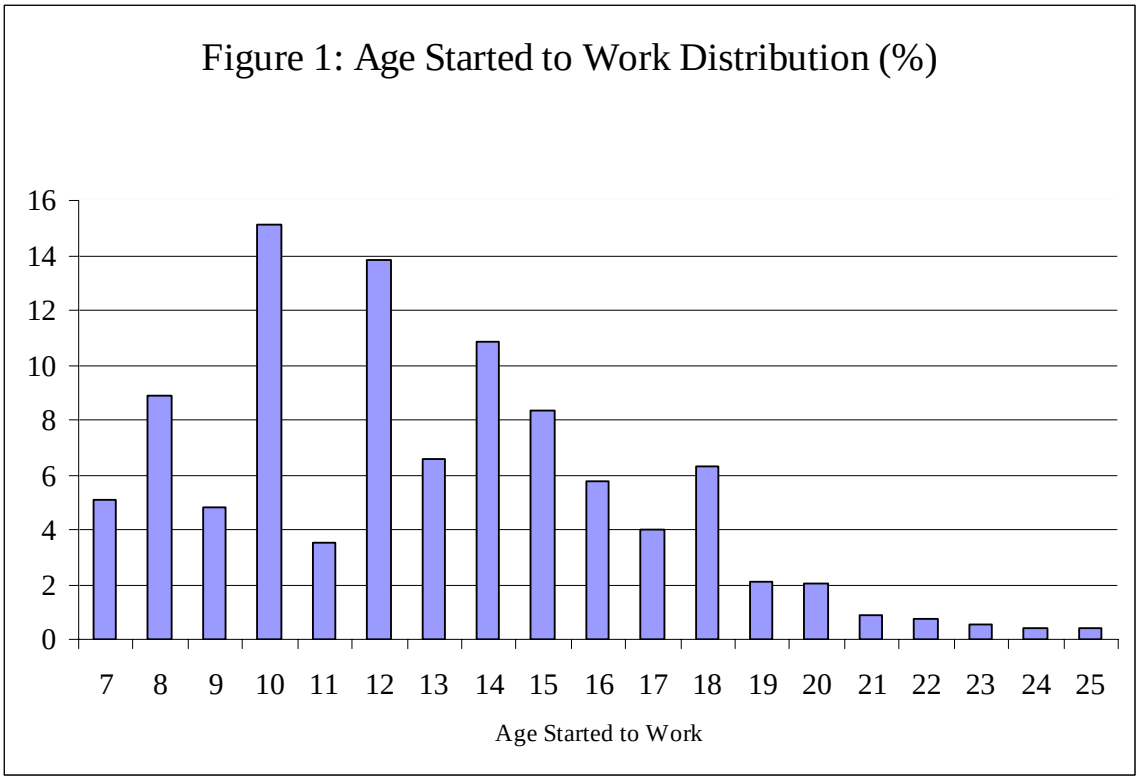
Figure 1: Age Started to Work Distribution (%)
16
14
12
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8
6
4
2
0
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Age Started to Work

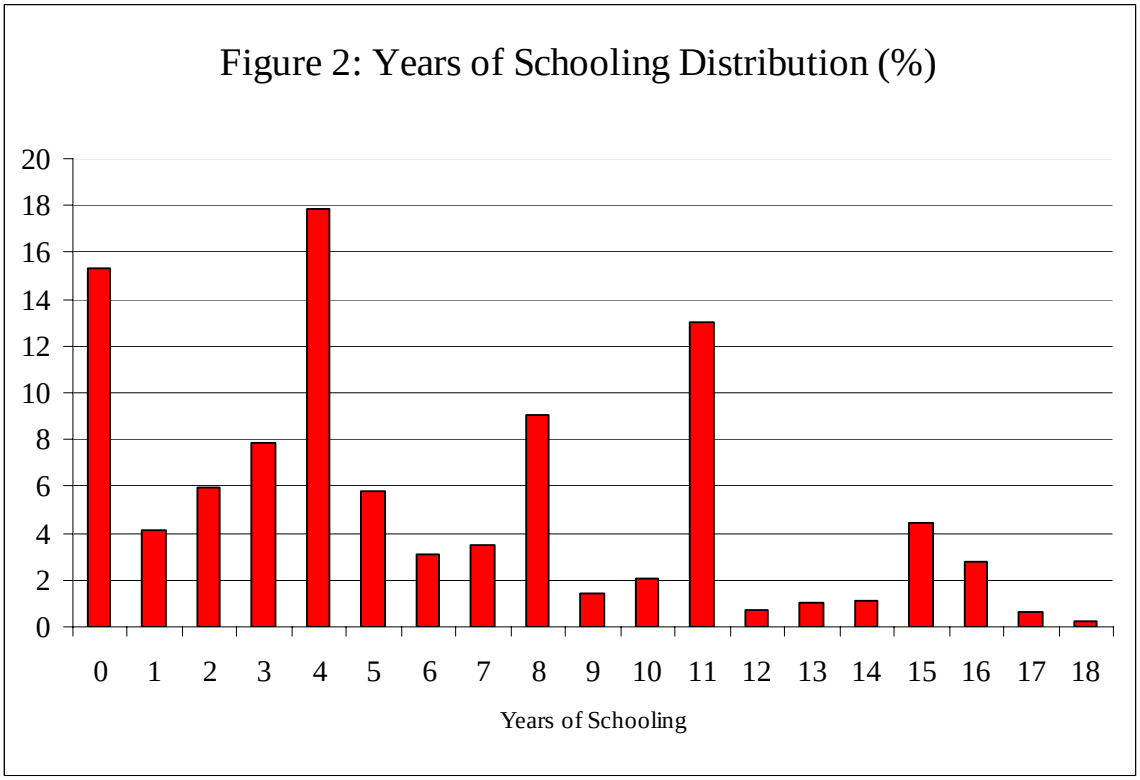
Figure 2: Years of Schooling Distribution (%)
20
18
16
14
12
10
8
6
4
2
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0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Years of Schooling

Figure 3: Averages of Years of Schooling and Age Started to Work by Year of Birth

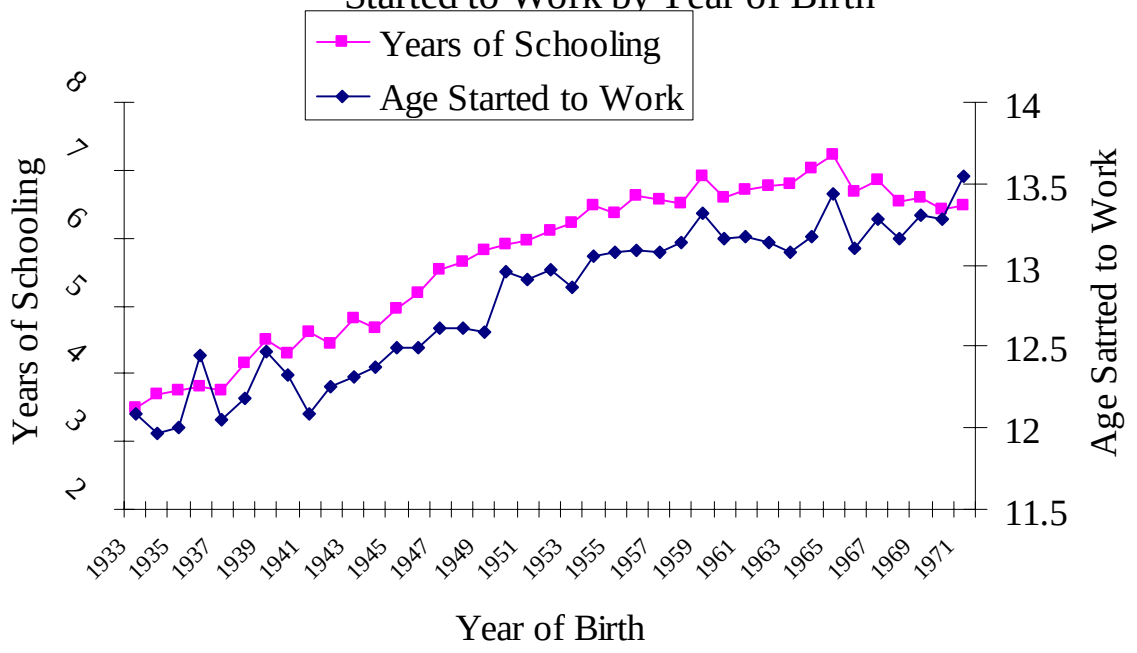


Figure 4: Averages of Log-Earnings and Years of Schooling by Age Started to Work

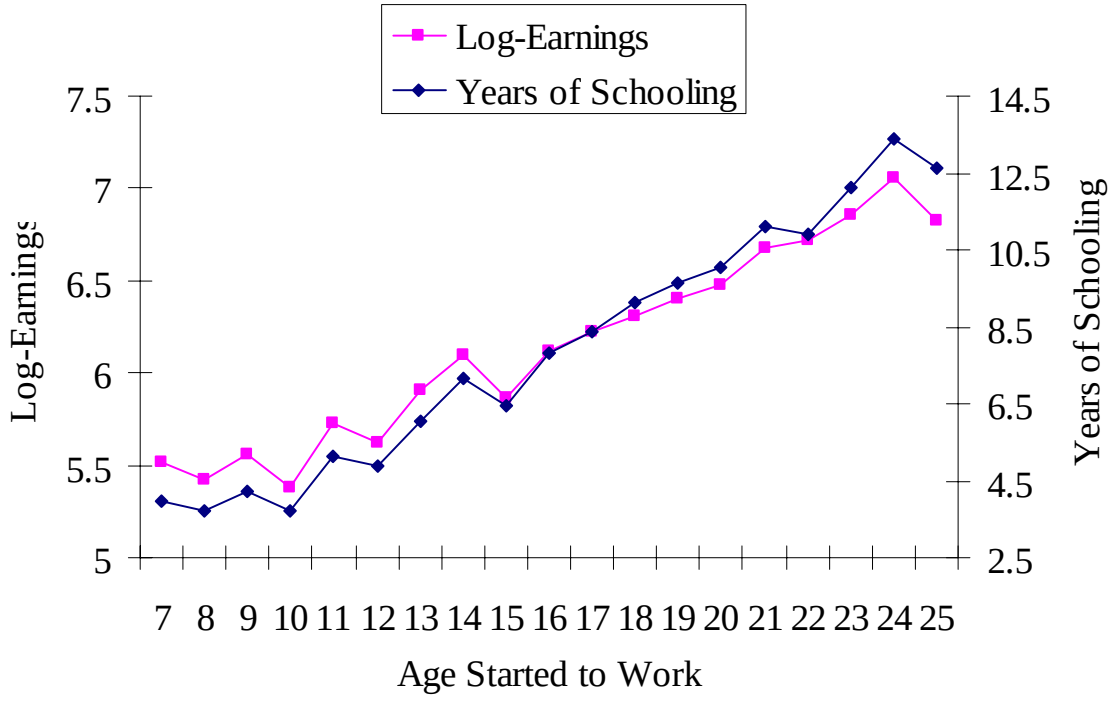


Figure 5.a: Number of Schools per 1,000 Children by Year: Brazil and Selected States

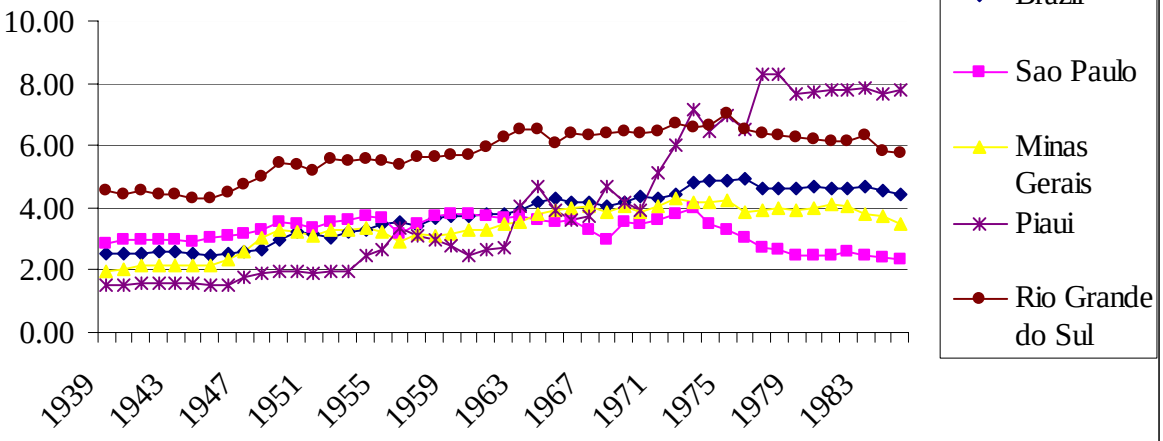


Figure 5.b: Number of Teachers per School by Year: Brazil and Selected States

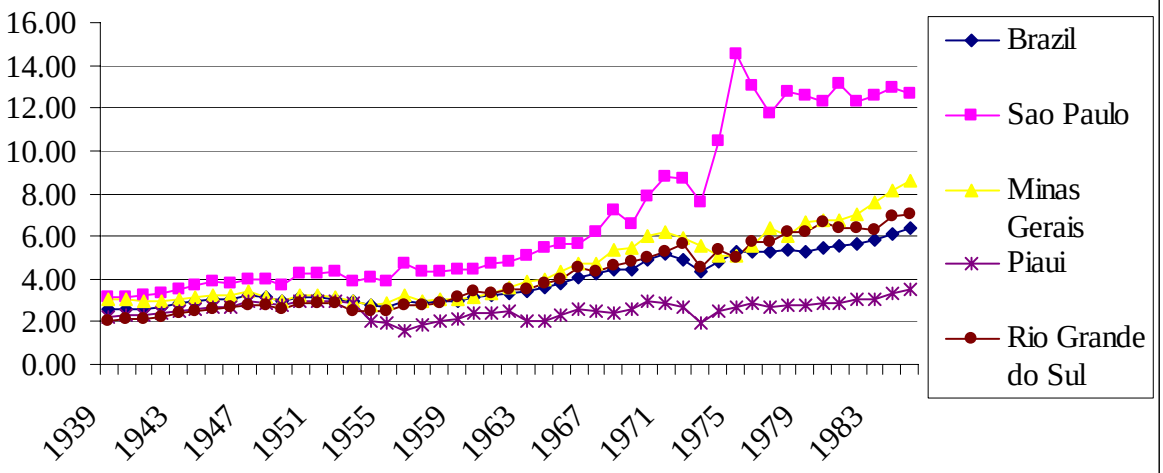


Figure 5.c: GDP per Capita by Year: Brazil and Selected States (Reals of 2000)

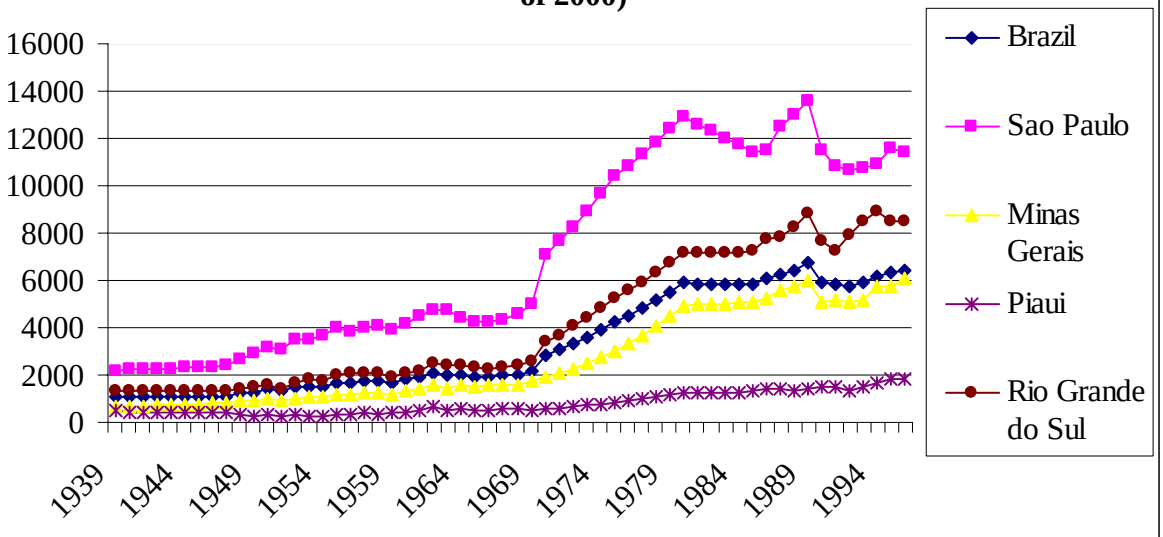


Figure 6.a: Marginal Impact of Age Started to Work Based on Models 3.e and 3.f (Log Points)

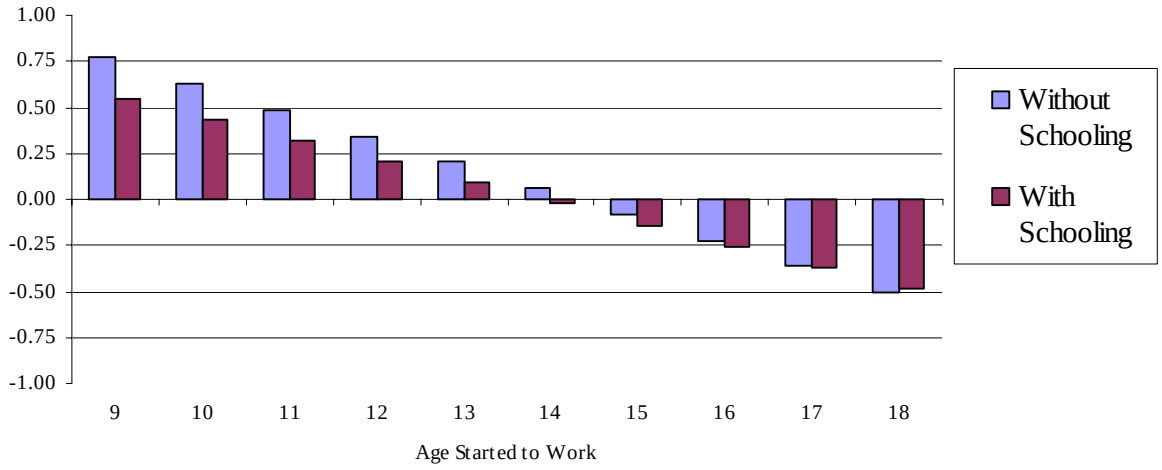
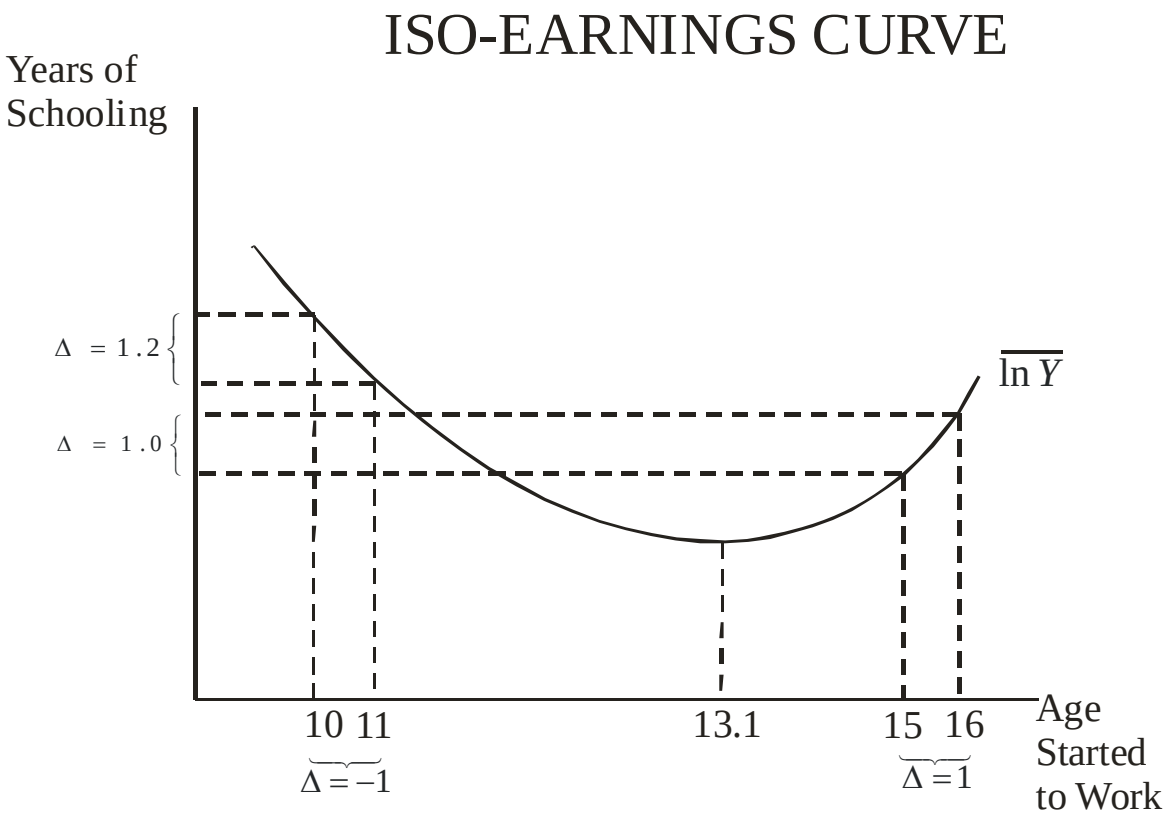


Figure 6.b: Marginal Impact of Age Started to Work Based on Models 4.e and 4.f (Log Points)

Figure 6.c: Marginal Impact of Age Started to Work Based on Models 5.e and 5.f (Log Points)

Figure 7:



Source: IV regression coefficient estimates from model 5.f.

Table 1: Male Child Labor Incidence: Contemporaneous and Retrospective Information
ILO versus 1988 and 1996 PNADs (%)

Age	1950		1960		1970		1980		1990	
	ILO	PNAD	ILO	PNAD	ILO	PNAD	ILO	PNAD	ILO	PNAD
						1988 PNAD				
10 to 14	34.78	46.42	32.43	44.91	29.13	31.93				
15 to 19			81.24	77.99	77.68	70.60				
20 to 24			94.27	84.49	93.52	86.84	92.97	70.26		
						1996 PNAD				
10 to 14			32.43	49.76	29.13	44.96	26.78	39.28		
15 to 19			81.24	76.03	77.68	81.64	75.14	80.62		
20 to 24					93.52	90.49	92.97	93.84	92.23	91.99

Table 2: OLS on Logarithim of Earnings

	2.a		2.b		2.c		2.d		2.e		2.f	
Variables	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Years of Schooling			0.1103	0.0010			0.1072	0.0010			0.1032	0.0010
Age Started to Work	0.0168	0.0056	0.0163	0.0050	0.0117	0.0056	0.0122	0.0050	0.0313	0.0011	0.0082	0.0010
Age Started to Work Squared	0.0007	0.0002	-0.0003	0.0002	0.0010	0.0002	-0.0001	0.0002				
Age	0.0915	0.0048	0.0748	0.0044	0.0879	0.0048	0.0725	0.0043	0.0885	0.0049	0.0717	0.0045
Age Squared	-0.0011	0.0001	-0.0008	0.0001	-0.0010	0.0001	-0.0008	0.0001	-0.0010	0.0001	-0.0008	0.0001
Black	-0.4101	0.0145	-0.2677	0.0131	-0.3582	0.0145	-0.2310	0.0132	-0.3512	0.0152	-0.2296	0.0139
Pardo	-0.3861	0.0074	-0.2624	0.0068	-0.2744	0.0080	-0.1792	0.0073	-0.2625	0.0083	-0.1753	0.0076
Father's Education												
Some or Completed Lower Primary	0.2755	0.0087	0.0937	0.0081	0.2316	0.0086	0.0652	0.0080	0.1850	0.0090	0.0543	0.0084
Some or Completed Upper Primary	0.4758	0.0197	0.1263	0.0178	0.4398	0.0195	0.1084	0.0176	0.3358	0.0203	0.0766	0.0185
Some or Completed High School	0.6509	0.0228	0.2059	0.0208	0.6131	0.0226	0.1892	0.0207	0.4959	0.0238	0.1516	0.0219
Some or Completed College	0.8490	0.0274	0.3439	0.0256	0.8004	0.0273	0.3207	0.0255	0.7200	0.0290	0.3035	0.0271
Mother's Education												
Some or Completed Lower Primary	0.2819	0.0086	0.1012	0.0079	0.2734	0.0084	0.0998	0.0078	0.2435	0.0087	0.0959	0.0082
Some or Completed Upper Primary	0.5117	0.0199	0.1752	0.0180	0.5169	0.0197	0.1888	0.0179	0.4603	0.0204	0.1786	0.0187
Some or Completed High School	0.6829	0.0223	0.2671	0.0209	0.7003	0.0222	0.2924	0.0208	0.6241	0.0230	0.2650	0.0215
Some or Completed College	0.7004	0.0368	0.2715	0.0340	0.7093	0.0369	0.2903	0.0340	0.6405	0.0381	0.2686	0.0351
Father's Occupation												
Administrative Worker									0.1862	0.0188	0.1187	0.0169
Agriculture Worker									-0.2453	0.0160	-0.0906	0.0144
Manufacturing Worker									-0.0645	0.0174	-0.0303	0.0155
Commerce Worker									0.1416	0.0241	0.0698	0.0217
Transport Worker									0.0461	0.0190	0.0118	0.0171
Service Worker									0.0020	0.0373	-0.0109	0.0330
Others									-0.0765	0.0189	-0.0548	0.0169
Other Indicator Variables												
Rural Area	-0.6443	0.0091	-0.4167	0.0086	-0.6307	0.0090	-0.4122	0.0086	-0.5755	0.0094	-0.4050	0.0090
1933 to 1958 Birth Year Cohort	0.0882	0.0125	0.0680	0.0113	0.0918	0.0123	0.0709	0.0112	0.0922	0.0127	0.0712	0.0117
1988 Year	-0.3975	0.0082	-0.3286	0.0074	-0.3847	0.0081	-0.3208	0.0073	-0.3742	0.0086	-0.3215	0.0078
Great Regions												
North					-0.0824	0.0165	-0.0585	0.0151	-0.0714	0.0176	-0.0556	0.0162
Northeast					-0.2225	0.0095	-0.1682	0.0087	-0.2147	0.0098	-0.1700	0.0091
South					0.1953	0.0087	0.1527	0.0078	0.1963	0.0090	0.1534	0.0082
Center-West					0.1113	0.0143	0.0659	0.0129	0.1181	0.0147	0.0695	0.0133
Intercept	3.6858	0.1015	3.5641	0.0920	3.7185	0.1001	3.5946	0.0913	3.7470	0.0969	3.7130	0.0892
R-Squared	0.383			0.499	0.400		0.509		0.420		0.514	
Number of Observations	62,736			62,575	62,736		62,575		57,194		57,037	
Earnings are Max Starting at Age			23.68	5.39								

Note: White-Huber robust standard errors were computed.

Table 3: IV Estimates - Second Stage Regression on Logarithm of Earnings

	3.a		3.b		3.c		3.d		3.e		3.f	
Variables	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Years of Schooling			0.175	0.062			0.134	0.059			0.115	0.063
Age Started to Work	3.589	0.372	2.045	0.613	1.964	0.413	1.467	0.416	2.044	0.470	1.583	0.481
Age Started to Work Squared	-0.130	0.013	-0.078	0.021	-0.070	0.016	-0.056	0.015	-0.071	0.017	-0.057	0.017
Age	0.153	0.016	0.103	0.021	0.121	0.012	0.096	0.016	0.122	0.013	0.100	0.018
Age Squared	-0.002	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000
Black	-0.570	0.045	-0.262	0.113	-0.473	0.036	-0.287	0.089	-0.434	0.035	-0.285	0.089
Pardo	-0.453	0.024	-0.224	0.082	-0.353	0.025	-0.225	0.061	-0.331	0.025	-0.226	0.062
Father's Education												
Some or Completed Lower Primary	0.157	0.042	-0.030	0.072	0.177	0.027	0.028	0.070	0.149	0.027	0.033	0.069
Some or Completed Upper Primary	0.557	0.121	0.126	0.170	0.480	0.095	0.185	0.153	0.339	0.100	0.130	0.147
Some or Completed High School	1.051	0.160	0.386	0.258	0.826	0.142	0.413	0.218	0.606	0.143	0.314	0.206
Some or Completed College	2.279	0.266	1.196	0.435	1.552	0.291	1.033	0.344	1.270	0.297	0.894	0.346
Mother's Education												
Some or Completed Lower Primary	0.230	0.046	0.024	0.078	0.244	0.031	0.081	0.076	0.188	0.035	0.065	0.074
Some or Completed Upper Primary	0.718	0.112	0.227	0.189	0.615	0.091	0.284	0.166	0.511	0.095	0.257	0.165
Some or Completed High School	1.323	0.161	0.599	0.285	1.023	0.154	0.591	0.236	0.838	0.157	0.507	0.236
Some or Completed College	1.445	0.215	0.670	0.315	1.091	0.185	0.643	0.254	0.873	0.177	0.533	0.249
Father's Occupation												
Administrative Worker									0.210	0.044	0.146	0.053
Agriculture Worker									-0.033	0.078	0.027	0.072
Manufacturing Worker									-0.305	0.064	-0.216	0.075
Commerce Worker									0.042	0.052	-0.011	0.052
Transport Worker									-0.096	0.048	-0.080	0.040
Service Worker									-0.225	0.079	-0.179	0.071
Others									-0.222	0.049	-0.151	0.058
Other Indicator Variables												
Rural Area	-0.446	0.082	-0.285	0.076	-0.523	0.050	-0.368	0.079	-0.466	0.053	-0.350	0.078
1933 to 1958 Birth Year Cohort	0.167	0.043	0.112	0.033	0.135	0.031	0.105	0.028	0.107	0.031	0.084	0.029
1988 Year	-0.354	0.027	-0.251	0.038	-0.366	0.019	-0.281	0.038	-0.374	0.017	-0.311	0.036
Great Regions												
North					-0.137	0.034	-0.080	0.039	-0.150	0.037	-0.101	0.042
Northeast					-0.171	0.023	-0.109	0.032	-0.174	0.025	-0.121	0.035
South					0.099	0.044	0.037	0.046	0.145	0.044	0.082	0.050
Center-West					0.133	0.038	0.025	0.055	0.172	0.042	0.076	0.061
Intercept	-20.293	2.575	-9.707	4.214	-9.394	2.674	-5.860	2.782	-10.237	3.162	-6.953	3.280
Number of Observations	62,736		62,575		62,736		62,575		57,194		57,037	
Overidentification Test of All Instruments												
Hansen J-Statistic Chi-Square	5.138		4.217		5.877		5.758		4.674		4.330	
P-value (Degrees of Freedom)	0.399	(5)	0.377	(4)	0.318	(5)	0.218	(4)	0.457	(5)	0.363	(4)
Earnings are Max at Starting Age	13.82	0.19	13.11	0.46	14.01	0.32	13.18	0.50	14.43	0.45	13.78	0.57

Note: Clustered standard errors by birth year and birth state.

Table 4: Alternative Specification of IV Estimates - Second Stage Regression on Logarithm of Earnings with Labor Market Controls

	4.a		4.b		4.c		4.d		4.e		4.f	
Variables	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Years of Schooling			0.140	0.060			0.125	0.057			0.122	0.048
Age Started to Work	0.976	0.453	1.388	0.477	0.793	0.392	1.011	0.372	0.742	0.400	0.951	0.361
Age Started to Work Squared	-0.039	0.016	-0.055	0.017	-0.034	0.014	-0.041	0.014	-0.033	0.014	-0.039	0.013
Age	0.107	0.011	0.096	0.012	0.102	0.010	0.090	0.012	0.104	0.011	0.089	0.011
Age Squared	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000
Black	-0.410	0.031	-0.265	0.069	-0.409	0.029	-0.272	0.068	-0.399	0.026	-0.259	0.062
Pardo	-0.333	0.020	-0.226	0.049	-0.327	0.020	-0.221	0.051	-0.309	0.019	-0.209	0.044
Father's Education												
Some or Completed Lower Primary	0.308	0.026	0.062	0.109	0.327	0.030	0.098	0.107	0.265	0.026	0.079	0.077
Some or Completed Upper Primary	0.753	0.061	0.280	0.208	0.802	0.088	0.333	0.224	0.673	0.096	0.269	0.180
Some or Completed High School	1.112	0.084	0.534	0.254	1.162	0.124	0.572	0.284	1.016	0.133	0.480	0.240
Some or Completed College	1.762	0.194	1.210	0.292	1.802	0.239	1.160	0.359	1.726	0.252	1.072	0.347
Mother's Education												
Some or Completed Lower Primary	0.367	0.026	0.114	0.111	0.393	0.034	0.152	0.113	0.350	0.036	0.131	0.092
Some or Completed Upper Primary	0.804	0.059	0.349	0.197	0.848	0.082	0.397	0.214	0.781	0.091	0.362	0.183
Some or Completed High School	1.218	0.097	0.698	0.239	1.256	0.127	0.710	0.273	1.170	0.137	0.634	0.249
Some or Completed College	1.244	0.126	0.739	0.238	1.285	0.155	0.744	0.279	1.171	0.162	0.644	0.254
Father's Occupation												
Administrative Worker									0.273	0.037	0.169	0.051
Agriculture Worker									-0.439	0.086	-0.155	0.133
Manufacturing Worker									-0.150	0.054	-0.140	0.049
Commerce Worker									0.151	0.046	0.034	0.060
Transport Worker									0.082	0.043	0.002	0.049
Service Worker									-0.024	0.069	-0.088	0.066
Others									-0.061	0.043	-0.076	0.037
Other Indicator Variables												
Rural Area	-0.776	0.051	-0.436	0.154	-0.829	0.060	-0.501	0.156	-0.744	0.057	-0.468	0.119
1933 to 1958 Birth Year Cohort	0.112	0.026	0.101	0.025	0.119	0.026	0.101	0.024	0.110	0.025	0.085	0.024
1988 Year	-0.309	0.015	-0.255	0.026	-0.310	0.017	-0.264	0.025	-0.327	0.016	-0.285	0.021
State GDP Per Capita at Age 25	0.045	0.006	0.017	0.014	0.041	0.007	0.017	0.013	0.034	0.006	0.015	0.009
Great Regions												
North					-0.015	0.033	-0.034	0.032	-0.006	0.038	-0.032	0.035
Northeast					-0.101	0.022	-0.087	0.021	-0.094	0.025	-0.084	0.023
South					-0.037	0.041	-0.015	0.039	-0.019	0.044	0.002	0.041
Center-West					0.033	0.032	-0.008	0.035	0.039	0.037	0.009	0.035
Intercept	-2.269	3.051	-5.190	3.248	-0.770	2.610	-2.509	2.519	-0.017	2.751	-2.024	2.528
Number of Observations	62,736		62,575		62,736		62,575		57,194		57,037	
					Overidentification Test of All Instruments							
Hansen J-Statistic Chi-Square	9.815		5.353		9.16		7.261		9.508		7.009	
P-value (Degrees of Freedom)	0.081 (5)		0.253 (4)		0.103 (5)		0.123 (4)		0.090 (5)		0.135 (4)	
					Test of Excluded Instruments in the First Satge Regressions							
	F(7,916)	Partial R-2	F(7,916)	Partial R-2	F(7,916)	Partial R-2	F(7,916)	Partial R-2	F(7,916)	Partial R-2	F(7,916)	Partial R-2
Years of Schooling			7.00	0.0012			5.14	0.0008			7.07	0.0012
Age Started to Work	14.55	0.0046	14.37	0.0046	10.14	0.0017	9.94	0.0007	6.05	0.0007	5.86	0.0009
Age Started to Work Squared	13.92	0.0046	13.78	0.0045	9.51	0.0016	9.34	0.0007	5.79	0.0008	5.6	0.0007
Earnings are Max at Starting Age	12.37	0.70	12.66	0.43	11.71	0.96	12.23	0.63	11.19	1.40	12.17	0.87

Note: Clustered standard errors by birth year and birth state.

Table 5: Alternative Specification of IV Estimates - Second Stage Regression on Logarithm of Earnings with Labor Market and Migration Controls

	5.a		5.b		5.c		5.d		5.e		5.f	
Variables	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Years of Schooling			0.144	0.066			0.192	0.067			0.168	0.060
Age Started to Work	0.852	0.523	1.436	0.602	0.819	0.403	1.050	0.359	0.783	0.419	0.980	0.347
Age Started to Work Squared	-0.035	0.019	-0.057	0.022	-0.035	0.015	-0.040	0.013	-0.036	0.015	-0.037	0.013
Migrant	-0.105	0.154	0.025	0.166	0.066	0.161	-0.217	0.183	0.130	0.184	-0.173	0.196
Age	0.105	0.013	0.097	0.013	0.104	0.011	0.079	0.014	0.107	0.012	0.080	0.014
Age Squared	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000
Black	-0.413	0.030	-0.261	0.074	-0.408	0.030	-0.204	0.077	-0.396	0.028	-0.211	0.071
Pardo	-0.340	0.020	-0.222	0.056	-0.326	0.021	-0.167	0.059	-0.309	0.020	-0.172	0.052
Father's Education												
Some or Completed Lower Primary	0.317	0.028	0.053	0.125	0.337	0.039	-0.061	0.145	0.280	0.036	-0.014	0.112
Some or Completed Upper Primary	0.765	0.057	0.264	0.229	0.834	0.119	-0.032	0.326	0.730	0.134	0.030	0.284
Some or Completed High School	1.120	0.080	0.517	0.275	1.206	0.162	0.109	0.413	1.095	0.183	0.160	0.379
Some or Completed College	1.744	0.204	1.202	0.297	1.876	0.298	0.563	0.544	1.876	0.340	0.602	0.566
Mother's Education												
Some or Completed Lower Primary	0.374	0.026	0.105	0.126	0.405	0.045	-0.018	0.156	0.371	0.050	0.018	0.137
Some or Completed Upper Primary	0.811	0.055	0.335	0.215	0.875	0.106	0.059	0.306	0.832	0.124	0.127	0.282
Some or Completed High School	1.212	0.100	0.686	0.248	1.299	0.164	0.265	0.403	1.257	0.191	0.301	0.397
Some or Completed College	1.245	0.125	0.727	0.246	1.332	0.195	0.288	0.414	1.262	0.221	0.306	0.407
Father's Occupation												
Administrative Worker									0.285	0.043	0.110	0.072
Agriculture Worker									-0.485	0.116	0.019	0.209
Manufacturing Worker									-0.154	0.057	-0.132	0.048
Commerce Worker									0.160	0.052	-0.025	0.077
Transport Worker									0.097	0.053	-0.054	0.070
Service Worker									-0.032	0.073	-0.108	0.064
Others									-0.054	0.048	-0.093	0.040
Other Indicator Variables												
Rural Area	-0.804	0.063	-0.419	0.188	-0.842	0.069	-0.279	0.207	-0.762	0.067	-0.335	0.165
1933 to 1958 Birth Year Cohort	0.114	0.025	0.101	0.026	0.119	0.026	0.089	0.025	0.108	0.027	0.076	0.024
1988 Year	-0.274	0.055	-0.262	0.056	-0.325	0.044	-0.189	0.064	-0.359	0.051	-0.226	0.066
State GDP Per Capita at Age 25	0.050	0.010	0.014	0.020	0.043	0.007	-0.001	0.017	0.036	0.007	0.005	0.013
Great Regions												
North					0.003	0.056	-0.103	0.063	0.029	0.066	-0.090	0.071
Northeast					-0.097	0.024	-0.095	0.023	-0.082	0.030	-0.097	0.027
South					-0.067	0.084	0.096	0.097	-0.077	0.095	0.089	0.104
Center-West					0.031	0.033	-0.023	0.036	0.036	0.040	0.005	0.034
Intercept	-1.397	3.542	-5.530	4.132	-0.887	2.675	-3.137	2.436	-0.133	2.891	-2.705	2.488
Number of Observations	62,736		62,575		62,736		62,575		57,194		57,037	
					Overidentification Test of All Instruments							
Hansen J-Statistic Chi-Square	10.081		5.004		8.474		5.870		7.83		6.463	
P-value (Degrees of Freedom)	0.039	(4)	0.171	(3)	0.076	(4)	0.118	(3)	0.098	(4)	0.091	(3)
					Test of Excluded Instruments in the First Satge Regressions							
	F(7,916)	Partial R-2	F(7,916)	Partial R-2	F(7,916)	Partial R-2	F(7,916)	Partial R-2	F(7,916)	Partial R-2	F(7,916)	Partial R-2
Years of Schooling			7.00	0.0012			5.14	0.0008			7.07	0.0012
Age Started to Work	14.55	0.0046	14.37	0.0046	10.14	0.0017	9.94	0.0016	6.05	0.0010	5.86	0.0009
Age Started to Work Squared	13.92	0.0046	13.78	0.0045	9.51	0.0016	9.34	0.0015	5.79	0.0010	5.60	0.0009
Migrant	15.96	0.0128	15.66	0.0127	16.66	0.0125	16.42	0.0125	16.99	0.0118	16.72	0.0118
Earnings are Max at Starting Age	12.09	1.04	12.70	0.51	11.57	1.04	12.97	0.75	10.88	1.56	13.09	1.23

Note: Clustered standard errors by birth year and birth state.

Table 6: Alternative Specification of IV Estimates - Second Stage Regression on Logarithm of Earnings with Labor Market, Migration, and School Quality Controls

	6.a		6.b		6.c		6.d		6.e		6.f	
Variables	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Years of Schooling			0.208	0.209			0.170	0.159			0.088	0.136
Age Started to Work	1.416	0.953	3.297	2.350	2.085	1.000	2.489	1.200	2.212	1.000	2.227	1.041
Age Started to Work Squared	-0.051	0.032	-0.118	0.082	-0.075	0.033	-0.086	0.039	-0.077	0.031	-0.075	0.032
Migrant	-0.296	0.238	0.273	0.640	0.085	0.224	-0.136	0.309	0.119	0.233	-0.046	0.349
Age	0.107	0.018	0.114	0.026	0.119	0.017	0.100	0.027	0.119	0.015	0.104	0.028
Age Squared	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000
Black	-0.466	0.048	-0.271	0.209	-0.477	0.059	-0.305	0.176	-0.434	0.043	-0.336	0.159
Pardo	-0.375	0.029	-0.207	0.173	-0.356	0.032	-0.215	0.137	-0.331	0.028	-0.257	0.118
Father's Education												
Some or Completed Lower Primary	0.223	0.078	-0.224	0.464	0.185	0.113	-0.190	0.372	0.152	0.088	0.004	0.250
Some or Completed Upper Primary	0.530	0.160	-0.270	0.839	0.523	0.257	-0.299	0.820	0.369	0.273	0.011	0.632
Some or Completed High School	0.864	0.176	-0.051	0.946	0.892	0.294	-0.137	1.007	0.655	0.350	0.174	0.834
Some or Completed College	1.486	0.277	0.868	0.700	1.684	0.391	0.480	1.204	1.387	0.502	0.725	1.168
Mother's Education												
Some or Completed Lower Primary	0.271	0.079	-0.176	0.465	0.253	0.118	-0.149	0.397	0.191	0.126	0.013	0.311
Some or Completed Upper Primary	0.626	0.122	-0.081	0.728	0.652	0.201	-0.111	0.744	0.540	0.234	0.176	0.618
Some or Completed High School	0.998	0.157	0.292	0.734	1.095	0.250	0.139	0.935	0.889	0.324	0.395	0.845
Some or Completed College	1.051	0.178	0.397	0.693	1.172	0.268	0.216	0.944	0.939	0.333	0.438	0.865
Father's Occupation												
Administrative Worker									0.216	0.065	0.131	0.152
Agriculture Worker									-0.033	0.306	0.215	0.504
Manufacturing Worker									-0.321	0.121	-0.295	0.128
Commerce Worker									0.035	0.097	-0.053	0.175
Transport Worker									-0.100	0.132	-0.166	0.177
Service Worker									-0.255	0.161	-0.280	0.174
Others									-0.229	0.120	-0.239	0.126
Other Indicator Variables												
Rural Area	-0.613	0.178	0.112	0.775	-0.527	0.234	0.026	0.577	-0.452	0.207	-0.242	0.395
1933 to 1958 Birth Year Cohort	0.095	0.031	0.084	0.042	0.102	0.033	0.080	0.040	0.076	0.035	0.062	0.040
1988 Year	-0.225	0.087	-0.348	0.167	-0.358	0.070	-0.252	0.122	-0.380	0.069	-0.308	0.131
State GDP Per Capita at Age 25	0.068	0.015	-0.005	0.076	0.043	0.009	0.003	0.039	0.045	0.008	0.028	0.028
Average Teacher per School at Age 7 to 14	-0.021	0.011	-0.024	0.017	-0.025	0.016	-0.027	0.018	-0.027	0.015	-0.025	0.015
Great Regions												
North					-0.117	0.100	-0.222	0.147	-0.131	0.121	-0.187	0.156
Northeast					-0.130	0.038	-0.134	0.045	-0.134	0.049	-0.139	0.052
South					-0.038	0.104	0.115	0.179	-0.001	0.121	0.091	0.192
Center-West					0.157	0.101	0.134	0.120	0.208	0.118	0.186	0.127
Intercept	-5.737	6.685	-18.948	16.537	-10.191	7.152	-13.646	8.781	-11.357	7.617	-12.060	8.051
Number of Observations	62,736		62,575		62,736		62,575		57,194		57,037	
			Overidentification Test of All Instruments									
Hansen J-Statistic Chi-Square	2.339		10.09		1.576				0.445			
P-value (Degrees of Freedom)	0.126 (1)		7.580		0.209 (1)				0.505 (1)			
	Test of Excluded Instruments in the First Satge Regressions											
	F(4,916)	Partial R-2	F(4,916)	Partial R-2	F(4,916)	Partial R-2	F(4,916)	Partial R-2	F(4,916)	Partial R-2	F(4,916)	Partial R-2
Years of Schooling			10.09	0.0009			4.92	0.0004			7.71	0.0007
Age Started to Work	7.52	0.0010	7.58	0.001	5.65	0.0006	5.60	0.0006	3.47	0.0003	3.43	0.0003
Age Started to Work Squared	8.27	0.0011	8.33	0.0011	7.01	0.0007	6.96	0.0007	4.79	0.0005	4.74	0.0005
Migrant	19.27	0.0085	19.08	0.0085	12.49	0.0077	12.34	0.0076	13.51	0.0075	13.36	0.0074
Earnings are Max at Starting Age	13.80	0.82	13.99	0.50	13.87	0.87	14.49	0.89	14.31	1.18	14.81	1.42

Note: Clustered standard errors by birth year and birth state; The intruments are number of school at ages 7, 11, and 15, and the state GDP per capita at age 12.

Table 7: Age Started to Work Turning Point

Model	Age	Std. Dev.	95% Conf. Interval	
	No Schooling Control			
3.a	13.82	0.19	13.44	14.19
3.c	14.01	0.32	13.39	14.63
3.e	14.43	0.45	13.56	15.31
4.a	12.37	0.70	10.99	13.74
4.c	11.71	0.96	9.83	13.59
4.e	11.19	1.40	8.45	13.92
5.a	12.09	1.04	10.06	14.12
5.c	11.57	1.04	9.53	13.61
5.e	10.88	1.56	7.82	13.93
6.a	13.80	0.82	12.20	15.40
6.c	13.87	0.87	12.17	15.57
6.e	14.31	1.18	12.00	16.63
	Schooling Control			
3.b	13.11	0.46	12.20	14.01
3.d	13.18	0.50	12.20	14.17
3.f	13.78	0.57	12.66	14.89
4.b	12.66	0.43	11.82	13.50
4.d	12.23	0.63	11.00	13.45
4.f	12.17	0.87	10.46	13.88
5.b	12.70	0.51	11.71	13.70
5.d	12.97	0.75	11.49	14.45
5.f	13.09	1.23	10.67	15.51
6.b	13.99	0.50	13.02	14.97
6.d	14.49	0.89	12.75	16.23
6.f	14.81	1.42	12.02	17.60

Note: The point estimates are constructed using the coefficients of the variables age started to work and its square. The standard deviations are obtained by the delta-method.

Table 8: IV Estimates - Second Stage Regression of Logarithm of Earnings

	Non-Unpaid First Occupation		Non-Farm Worker First Occupation		Non-Unpaid and Non-Farm Worker			
Variables	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Years of Schooling			0.131	0.084			0.216	0.054			0.214	0.055
Age Started to Work	3.343	1.008	2.277	1.004	2.994	0.921	1.645	0.659	2.881	0.966	1.680	0.684
Age Started to Work Squared	-0.120	0.036	-0.084	0.035	-0.109	0.034	-0.062	0.024	-0.104	0.035	-0.063	0.025
Age	0.169	0.028	0.122	0.037	0.180	0.029	0.090	0.030	0.178	0.031	0.092	0.030
Age Squared	-0.002	0.000	-0.001	0.000	-0.002	0.000	-0.001	0.000	-0.002	0.000	-0.001	0.000
Black	-0.460	0.061	-0.281	0.126	-0.494	0.064	-0.155	0.098	-0.478	0.065	-0.158	0.096
Pardo	-0.382	0.047	-0.246	0.095	-0.380	0.048	-0.142	0.068	-0.382	0.050	-0.155	0.069
Father's Education												
Some or Completed Lower Primary	0.187	0.054	0.047	0.100	0.209	0.046	-0.083	0.080	0.234	0.048	-0.061	0.083
Some or Completed Upper Primary	0.528	0.155	0.223	0.228	0.563	0.132	-0.025	0.174	0.586	0.140	0.006	0.177
Some or Completed High School	0.927	0.220	0.470	0.338	0.959	0.199	0.121	0.252	0.961	0.208	0.153	0.252
Some or Completed College	2.024	0.495	1.282	0.614	2.061	0.471	0.732	0.462	2.004	0.489	0.771	0.460
Mother's Education												
Some or Completed Lower Primary	0.259	0.061	0.087	0.120	0.285	0.045	-0.052	0.091	0.291	0.048	-0.039	0.092
Some or Completed Upper Primary	0.733	0.157	0.357	0.269	0.770	0.139	0.083	0.197	0.766	0.146	0.106	0.197
Some or Completed High School	1.261	0.271	0.714	0.410	1.235	0.235	0.280	0.292	1.258	0.260	0.331	0.299
Some or Completed College	1.336	0.324	0.782	0.440	1.322	0.297	0.351	0.321	1.345	0.319	0.406	0.329
Father's Occupation												
Administrative White-Collar Worker	0.256	0.082	0.164	0.086	0.218	0.068	0.073	0.057	0.238	0.075	0.088	0.062
Agriculture Blue-Collar Worker	-0.109	0.090	0.014	0.100	-0.051	0.070	0.182	0.070	-0.058	0.072	0.177	0.072
Manufacturing Blue-Collar Worker	-0.457	0.125	-0.292	0.139	-0.460	0.116	-0.169	0.101	-0.460	0.123	-0.187	0.104
Commerce Blue-Collar Worker	0.028	0.086	-0.015	0.068	-0.088	0.090	-0.093	0.054	-0.049	0.087	-0.059	0.054
Transport Blue-Collar Worker	-0.150	0.082	-0.113	0.062	-0.146	0.074	-0.082	0.046	-0.145	0.077	-0.096	0.048
Service Blue-Collar Worker	-0.311	0.129	-0.218	0.110	-0.332	0.124	-0.164	0.088	-0.301	0.121	-0.146	0.087
Others	-0.298	0.091	-0.197	0.093	-0.291	0.080	-0.118	0.066	-0.295	0.084	-0.140	0.067
Other Indicator Variables												
Rural Area	-0.434	0.087	-0.282	0.117	-0.355	0.064	-0.047	0.089	-0.370	0.061	-0.082	0.085
1933 to 1958 Birth Year Cohort	0.143	0.051	0.111	0.039	0.148	0.054	0.101	0.031	0.153	0.059	0.118	0.034
1988 Year	-0.395	0.062	-0.295	0.075	-0.274	0.049	-0.231	0.030	-0.273	0.064	-0.227	0.041
Great Regions												
North	-0.038	0.065	-0.021	0.049	-0.090	0.061	-0.052	0.041	-0.047	0.065	-0.035	0.042
Northeast	0.033	0.071	0.037	0.052	0.051	0.072	0.051	0.045	0.085	0.087	0.074	0.056
South	-0.049	0.093	-0.028	0.068	-0.070	0.096	-0.023	0.060	-0.066	0.101	-0.034	0.062
Center-West	0.169	0.072	0.056	0.088	0.159	0.075	-0.019	0.063	0.162	0.077	-0.027	0.068
Intercept	-19.297	6.965	-11.779	7.016	-16.965	6.347	-7.487	4.584	-16.245	6.683	-7.716	4.778
Number of Observations	40,908		40,766		34,862		34,719		32,487		32,347	
				Overidentification Test of All Instruments								
Hansen J-Sattistic Chi-Square	1.117		1.76		8.705		7.398		8.343		6.367	
P-value (Degrees of Freedom)	0.833	(5)	0.780	(4)	0.121	(5)	0.116	(4)	0.138	(5)	0.173	(4)
				Test of Excluded Instruments in the First Stage Regressions								
	F(7,916)	Partial R-2	F(7,916)	Partial R-2	F(7,916)	Partial R-2	F(7,916)	Partial R-2	F(7,916)	Partial R-2	F(7,916)	Partial R-2
Years of Schooling			12.18	0.0020			10.04				10.47	0.0021
Age Started to Work	7.52	0.0018	7.37	0.0018	11.27	0.0033	11.16		10.69	0.0032	10.55	0.0031
Age Started to Work Squared	7.05	0.0017	6.92	0.0017	10.09	0.0029	10.01		9.47	0.0027	9.37	0.0027
Earnings is Maximized at Age At Worl	13.97	0.34	13.55	0.50	13.79	0.27	13.28	0.39	13.79	0.30	13.25	0.42

Note: Clustered standard errors by birth year and birth state.

Table 9: IV Estimates - Second Stage Regression of Logarithm of Earnings by First Job Occupation Groups

	Farm Workers				Manufacturing Blue-Collar				Service Blue-Collar and Others			
Variables	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Years of Schooling			0.078	0.065			0.232	0.099			0.307	0.096
Age Started to Work	0.328	0.085	0.244	0.096	4.241	1.784	2.790	1.482	3.350	1.628	2.172	1.381
Age Started to Work Squared					-0.157	0.067	-0.108	0.055	-0.123	0.060	-0.080	0.051
Age	0.082	0.014	0.077	0.013	0.141	0.038	0.084	0.042	0.154	0.031	0.057	0.040
Age Squared	-0.001	0.000	-0.001	0.000	-0.002	0.000	-0.001	0.001	-0.002	0.000	0.000	0.001
Black	-0.373	0.038	-0.289	0.076	-0.369	0.111	-0.169	0.121	-0.398	0.067	0.029	0.144
Pardo	-0.283	0.023	-0.221	0.053	-0.235	0.064	-0.127	0.067	-0.407	0.075	-0.076	0.119
Father's Education												
Some or Completed Lower Primary	0.127	0.019	0.057	0.062	0.100	0.068	-0.087	0.098	0.146	0.062	-0.288	0.141
Some or Completed Upper Primary	0.092	0.127	-0.023	0.158	0.426	0.178	-0.028	0.249	0.363	0.120	-0.455	0.263
Some or Completed High School	0.260	0.182	0.031	0.262	0.805	0.343	0.053	0.386	0.787	0.217	-0.332	0.393
Some or Completed College	-0.262	0.289	-0.323	0.264	2.289	0.969	0.999	0.921	1.634	0.494	0.050	0.651
Mother's Education												
Some or Completed Lower Primary	0.120	0.024	0.055	0.060	0.160	0.051	-0.086	0.116	0.206	0.058	-0.233	0.144
Some or Completed Upper Primary	0.202	0.112	0.048	0.161	0.431	0.163	-0.039	0.237	0.543	0.107	-0.277	0.273
Some or Completed High School	0.304	0.176	0.104	0.226	0.932	0.316	0.189	0.409	0.923	0.198	-0.208	0.390
Some or Completed College	0.598	0.275	0.177	0.422	1.003	0.593	0.159	0.603	1.142	0.360	-0.014	0.466
Father's Occupation												
Administrative White-Collar Worker	0.214	0.071	0.160	0.077	0.321	0.177	0.134	0.162	0.139	0.088	-0.047	0.090
Agriculture Blue-Collar Worker	0.040	0.060	0.027	0.054	0.274	0.199	0.336	0.154	-0.018	0.115	0.374	0.146
Manufacturing Blue-Collar Worker	-0.138	0.091	-0.135	0.080	-0.151	0.104	-0.133	0.082	-0.288	0.118	-0.073	0.115
Commerce Blue-Collar Worker	0.015	0.128	0.003	0.115	-0.017	0.140	-0.080	0.115	-0.129	0.119	-0.126	0.099
Transport Blue-Collar Worker	-0.109	0.103	-0.091	0.092	0.048	0.135	-0.027	0.112	-0.045	0.078	0.019	0.065
Service Blue-Collar Worker	-0.248	0.222	-0.191	0.191	0.015	0.215	0.056	0.174	-0.370	0.165	-0.235	0.144
Others	-0.109	0.100	-0.076	0.089	0.091	0.143	0.048	0.106	-0.250	0.081	0.002	0.099
Other Indicator Variables												
Rural Area	-0.505	0.022	-0.417	0.076	-0.202	0.107	-0.050	0.102	-0.383	0.079	0.184	0.186
1933 to 1958 Birth Year Cohort	0.045	0.038	0.042	0.034	0.265	0.113	0.175	0.090	0.144	0.060	0.111	0.049
1988 Year	-0.391	0.026	-0.343	0.044	-0.540	0.117	-0.339	0.119	-0.244	0.043	-0.285	0.036
Great Regions												
North	-0.274	0.084	-0.193	0.095	0.041	0.139	0.028	0.107	-0.034	0.084	0.026	0.072
Northeast	-0.264	0.026	-0.231	0.036	-0.011	0.090	0.088	0.078	-0.006	0.083	0.052	0.073
South	0.336	0.041	0.244	0.081	-0.261	0.229	-0.243	0.170	-0.073	0.161	-0.050	0.128
Center-West	0.122	0.033	0.088	0.040	-0.071	0.170	-0.240	0.145	0.262	0.116	0.086	0.113
Intercept	0.415	1.086	1.096	1.061	-23.855	11.598	-13.936	9.797	-18.452	10.813	-10.971	9.122
Number of Observations	22,146		22,132		10,879		10,826		16,918		16,867	
					Overidentification Test of All Instruments							
Hansen J-Sattistic Chi-Square	5.526		5.346		3.411		1.071		9.228		3.97	
P-value (Degrees of Freedom)	0.478 (5)		0.375 (4)		0.637 (5)		0.899 (4)		0.100 (5)		0.410 (4)	
					Test of Excluded Instruments in the First Stage Regressions							
	F(7,832)	Partial R-2	F(7,832)	Partial R-2	F(7,811)	Partial R-2	F(7,811)	Partial R-2	F(7,862)	Partial R-2	F(7,862)	Partial R-2
Years of Schooling			8.82	0.0027			9.00	0.0057			4.27	0.0013
Age Started to Work	3.62	0.0014	3.48	0.0014	5.96	0.0046	5.83	0.0045	6.75	0.0045	6.69	0.0044
Age Started to Work Squared					5.28	0.0042	5.19	0.0041	6.15	0.0041	6.09	0.0041
Earnings is Maximized at Age At Work					13.50	0.37	12.87	0.57	13.63	0.26	13.50	0.34

Note: Clustered standard errors by birth year and birth state.