The Impact of Migration on Child Labor: Empirical Evidence from Brazil

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October 2014

Abstract

In this paper we focus on Brazil and analyze the impact of internal migration on child labor outcomes. We develop a theoretical model and evaluate it using Brazilian Census data from IPUMS International for the years 1991, 2000 and 2010. In the theory the main channel, through which the effect of migration on child labor works, is the labor market. Thus we complement the individual-level child-labor analysis with the empirical study of the labor-market impact of migration. To address endogeneity of internal migration shares both in the municipality and individual-level regressions, we implement an instrumental variable strategy which follows Card (2001). Ou results show that internal migration of a given skill level has a negative and significant impact on corresponding wages. We further find that the unskilled (skilled) migration share has a negative (positive) and significant impact on child labor.

JEL Classification Numbers: F22, J61, O12

Key Words: Child Labor, Migration

Acknowledgements: We thank participants at the 7th International Conference on Migration and Development in Oxford for insightful comments.

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1 Introduction

Child labor is a persistent phenomenon, ultimately related to poverty in developing countries (Basu and Van (1998) and Baland and Robinson (2000)). In this paper we focus on Brazil and analyze the impact of migration on child labor outcomes. We develop a theoretical model and evaluate it using Brazilian Census data from IPUMS International for the years 1991, 2000 and 2010. We argue that the analysis of the effect of migration on child labor is important for two main reasons. First, there has been great interest in the recent literature in the effect of globalization, in particular trade, on child labor outcomes in developing countries (Edmonds and Pavcnik (2005)). However, empirical evidence on the impact of other dimensions of globalization – specifically migration – on this phenomenon is scarce (among the few papers on this topic, see Epstein and Kahana (2008) and Mendola and de Paoli (2012)). Second, child labor is likely to represent an important dimension through which the economy of the migrants' destination adjusts to foreign workers' arrival, especially in middle and low income countries. The existing migration literature has pointed out that, besides changes in wages, the local economy adjusts to inflows of migrants through a number of different channels, ranging from native workers' outflows from the host location (Borjas (2006)) to slower technology adoption rates due to the arrival of unskilled migrants (Lewis (2011)). However, in developing countries, where child labor is prevalent, another channel of adjustment to migration is likely to be child labor. The latter dimension has not yet been analyzed in the literature.

Our focus is on the effect of *internal* migration within Brazil. Internal migration is in general larger than international migration, especially in middle and low-income countries where child labor is prevalent. The estimated number of international migrants worldwide was 230 million people in 2012. There are no good statistics on the magnitude of internal migration, however an approximate estimate for the year 2005 is 760 million people (Bell and Charles-Edwards 2013). In developing countries, the difference in the scale of internal vs. international migration is even larger. For example, in 2000 in Indonesia more than 10 percent of the native population lived in a province different from that of birth (Fasani and Farrè 2013), while in 2010 the stock of international

migrants as a percentage of the population was only 0.1 (World Bank 2011). The 2001 Indian Census counted around 19 percent of the Indian population at the time as internal migrants, while the stock of international migrants as a percentage of the population was only 0.4 in 2010 (World Bank 2011). Finally, in Brazil, in 2010 more than 4.5 percent of the native population lived in a municipality different from that of birth (based on the authors' calculations), while the stock of international migrants as a percentage of the population was only 0.4 in 2010 (World Bank 2011). Finally note that, in those middle and low-income countries where international migration rates are non trivial – for example South Africa (see Facchini, Mayda and Mendola 2013) – disaggregated child labor statistics are not available. Thus, in this paper, we focus on the impact of internal migration in Brazil, where child labor is substantial.

From a theoretical point of view, one key variable that affects the impact of migration on child labor is the skill composition of migrants. Assuming that children are substitutes of unskilled migrants, they compete with them in the labor market. If migrants are unskilled, their impact on child labor outcomes is ambiguous, due to the fact that the income effect on the one hand and the substitution effect and the effect on the returns to education on the other hand work in opposite directions. If unskilled wages decrease as a consequence of unskilled migration, then through the substitution effect children's labor supply goes down, while it increases through the income effects (Cigno and Rosati (2005), Manacorda and Rosati (2010)). At the same time, it also increases the return to education which tends to decrease labor supply unless there is strong complementarities between consumption and education. In contrast, children are not substitute of skilled migrants. When skilled migration takes place, skilled wages are negatively affected, which decreases the return to education. Hence, schooling should decrease and, child labor should increase provided that the complementarity between education and consumption is not too large.

In our main specification, which is at the individual level, we regress a measure of child labor on, respectively, the share of unskilled and skilled internal migrants to the municipality where the child lives and on individual-level controls of both children and

parents (in particular, their age and education). Since the main channel through which the effect of migration works in the theoretical model is the labor market, we also estimate a specification – at the municipality level – of wages on the share of internal migrants by skill. In other words, in the latter specification, we exploit the variation across municipalities, years and skills (we differentiate between skilled and unskilled labor). Note that it is widely recognized that immigrants are not randomly distributed but instead tend to cluster in specific locations. Thus, to address endogeneity both in the municipality and individual-level regressions, we implement an instrumental variable strategy. In particular, we follow Card (2001) and create a shift-share instrument which uses data on the distribution of immigrants across municipalities, by Brazilian state of origin, in 1980 (for which Census data are available). The instrument is based on evidence that networks are important determinants of migrants' location decisions (Munshi 2003). Our results suggest that this instrument is relevant, i.e. the first stage is strong. In addition, during the 1980's Brazil slowly returned to democracy, after a period of dictatorship. Thus, the political and economic environment of the early 1980's is substantially different from that of the period we analyze, which lends credibility to the exclusion restriction.

At the aggregate level, we find that internal migration of a given skill-level in a given municipality has a negative and significant impact on corresponding wages. At the individual level, we find that child labor is affected by the socio-demographic characteristics of the child and household head, consistent with the existing literature. More importantly, our results show that child labor decreases as internal unskilled migration flows increase. In terms of the theoretical model of child labor, these findings suggest that the substitution-effect channel dominates the income-effect channel. In other words, when unskilled wages go down due to the arrival of unskilled internal migrants, households have less incentives to send children to work since children can earn less, although the household income has most likely decreased (since parents are likely to be unskilled as well). In addition, our results show that the skilled internal migration share has a positive and significant impact on child labor. The interpretation of this result is that, since the skilled internal migration share has a negative and significant impact on the

skilled wage, then the return to education decreases, which in turn implies lower school attendance (which we observe in the data) and higher child labor as a consequence of skilled migration. Finally, we find that although the arrival of unskilled internal migrants in a municipality decreases child labor, schooling of children, if anything decreases (for the children who were working just a few hours a week). This is suggestive of some complementarity between child labor and education when education is costly.

The rest of the paper is organized as follows. Section 2 provides an overview of the related literature. Section3 presents the theoretical framework which guides the empirical analysis. 4 presents the data sources. Section 5 discusses our empirical strategy and presents our estimates. Finally, Section 6 gives our conclusions.

2 Related literature

Our paper is related to three strands of the literature. First, and most importantly, it represents one of the first systematic analyses of the impact of migration on child labor outcomes. Thus our paper is related to the large literature on child labor (among others, Basu and Van (1998), Baland and Robinson (2000), Edmonds (2006, 2008)) and, in particular, on the incidence of this phenomenon in Brazil (see, for example, Manacorda and Rosati (2011), Cardoso and Souza (2004), and Emerson and Souza (2008)). According to this literature, determinants of child labor are ultimately related to local labor market conditions, returns to schooling and poverty (Edmonds 2005). At the same time, a growing body of works has been studying the role of globalization and market integration in shaping child time allocation in low-income countries through their impact on the local labor market. Yet, while evidence on the impact of trade liberalization on the employment of child labor in developing countries is relatively abundant (e.g. Cigno et al, 2002; Edmonds and Pavcnik 2005, 2006), there are very few papers in the literature investigating the link between migration and child labor-market outcomes in either origin or destination countries. Among the few exceptions, Dinopoulos and Zhao (2007) use a general equilibrium-model to show that emigration of unskilled (skilled) workers

increases (reduces) the incidence of child labor via a labor substitution effect. On the contrary, Epstein and Kahana (2008) consider both the cost of (temporary) migration and the benefit of receiving remittances, and argue that the household income effect would reduce labor supply, increase wages and allow both migrant- and non-migrant-households to take their children out of the labor force. Finally, Mendola and De Paoli (2012) use a cross-country approach to empirically show that international emigration from a large set of developing countries significantly reduces child labor in disadvantaged households at origin through changes in the local labor markets.

Second, our analysis is a contribution to the large body of works which study the labor market effect of migration. To understand the wage effect of migration within Brazil, we follow the "spatial correlation" methodology, which exploits variation in the number of migrants across different geographical areas (see Card (1990), Hunt (1992) and Friedberg (2001) among others). Most of the studies in this tradition find only a limited impact of immigration on labor market outcomes (Friedberg and Hunt 1995), with one exception being the recent study by Glitz (2012) – which shows a sizable employment effect of immigration in Germany – and Facchini, Mayda and Mendola (2014) which estimates a negative and significant impact on natives' labor market opportunities of international migration to South Africa. We contribute to this literature by showing that, in developing countries, an important dimension of adjustment of the local economy to unskilled immigrant inflows is through child labor.

Finally, since our paper provides evidence on the patterns and impact of internal migration in Brazil, it is related to works which focus on internal migration, both in developed countries (see, for example, Molloy, Smith and Wozniak (2011) and Wozniak (2010)) and in developing ones (Lucas (1997), Fasani and Farrè (2013), Beine and Coulombe (2014), among others).

3 Theoretical framework

This Section reviews the expected impact of unskilled and skilled immigration on labor markets, in particular on child labor.

Labor demand. We start by the labor demand. Following Borjas (1999, 2005), we assume that the labor demand function for skill j, where $j = u$ stands for unskilled and $j = s$ stands for skilled, in a given region at time t is given by

$$w_{jt} = X_j L_{jt}^{\eta} \tag{1}$$

where w_{jt} is the wage for skill j, $\eta < 0$ is the factor price elasticity and L_{jt} is the total labor of skill j employed at time t.

Unskilled Labor supply. One key contribution of our paper is to recognize that child labor and unskilled migrants complete for similar jobs, and that therefore unskilled migration is lily to impact child labor. The unskilled labor supply is composed of the supply of adult natives N_t^u and migrants M_{jt}^u, but also includes the supply of child labor C_t.

Following Basu and Van (1998), we assume that adults and children labor are substitutes and that a unit of child labor is equivalent to γ units of unskilled labor, where $0 < \gamma < 1$. Hence, the unskilled labor supply in adult equivalent is given is

$$L_{ut} = N_{ut} + M_{ut} + \gamma C_t. \tag{2}$$

Adults receive the wage w_{jt} while children receive $w_{ct} = \gamma w_{jt}$ for their labor. Each native adult has one child. They live for two periods and have a unit of time in each period. We assume that all adults are supplying their labor inelastically. In the first period, children divide their time between school, rest and labor. In the second period, children, who have now become adults, work and make decisions about their own children. We assume for simplicity that migrants are childless so that any child labor comes from the children of the natives.

Consider a family with an income, excluding children's earnings, of y and let w_c be the going child wage.

Parents decide on the labor supply of their children $\ell \in [0,1]$ and their schooling $s \in [0,1]$. The remaining time, denoted by $r = 1 - s - \ell$, is devoted to leisure and rest. When making this decision, parents take into account that the more their child goes to school the more skilled they become. If they have not gone to school, children, once adult, earn the unskilled wage w_u, but if they spend time s in school they will earn

$$w(s) = w_u + p(s)\Delta \quad ; \; \Delta \equiv \overline{w}'_s - w'_u \tag{3}$$

where $p(s) = s^\alpha$, $\alpha \in (0,1)$ and $\overline{w}'_s$ is an upper bound on the skilled wage in the next period and w'_u is the unskilled wage in the next period.

The cost of going to school $k(s)$ consists in a fixed cost $\kappa > 0$ and a constant marginal cost k per unit

$$k(s) = \kappa + ks. \tag{4}$$

Parents choose ℓ and s in $[0,1]$ to maximize the following utility

$$U(y + \ell w_c - k(s), 1 - s - \ell, w(s)). \tag{5}$$

where U is strictly increasing and concave in each term and the marginal utility of each of this term is infinite at 0. Assume also that $U_{12} \geq 0$ and $U_1 3 \geq 0$, that is the utility of leisure and consumption are complementary and the utility of one's own consumption and one's child earnings are complementary.

For any child who works $\ell > 0$, the first order conditions tells us that

$$U_1 w_c = U_2, \tag{6}$$

while the right hand side dominates for children who do not work.

Given the fixed cost of schooling, children who go to school spends at least a minimum

amount of time in school The first order condition tells us that for interior solutions

$$U_1 k + U_2 = U_3 \ \alpha s^{-(1-\alpha)} \Delta \quad if \ s > 0. \tag{7}$$

From (6) and (7), we see that for children who both go to school and work

$$U_1(k + w_c) = U_3 \ \alpha s^{-(1-\alpha)} \Delta \quad if \ \ \ell, s > 0. \tag{8}$$

An increase in w_u has the following different effects on the supply of child labor:

A substitution effect: $dw_c/dw_u = \gamma > 0$. An increase in the child wage makes labor relatively more attractive, and increases the opportunity cost of schooling and leisure .

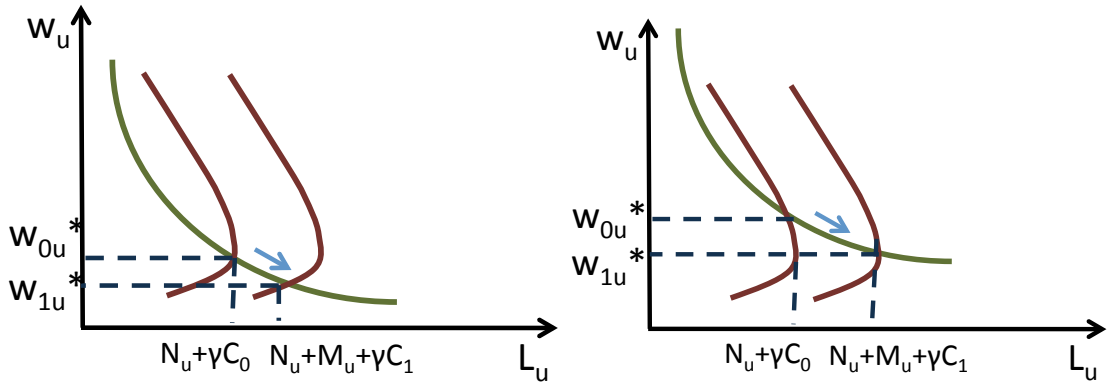
Two income effects: An increase in the child wage increases the value of the endowment in time of children. In addition, for unskilled parents dy/dw_u is positive so that parental earnings increase. Both these income effects makes schooling and leisure relatively more attractive compared with child labor.

A return to school effect: $dw'_u/dw_u > 0$ and $d\Delta/dw_u < 0$. An increase in unskilled wage today should imply a lower unskilled wage tomorrow as well, thereby reducing the return to school. Unless, there are strong complementarities between child labor and schooling, this effect favors child labor and leisure at the cost of schooling.

The presence of the income effects implies that the labor supply can be backward bending over some range of wages.

Unskilled Wages. Even if the child labor supply is not increasing everywhere, the resulting labor supply in (2) and the labor demand (1) most likely intersect only once. This is illustrated in Figure 1. We see that in this case, an immigrant inflows – that pushes the labor supply to the right – decreases the equilibrium wage. Child labor can decrease as in panel (a) or increase if the income effect is sufficiently large as in panel (b).

However, as shown by Basu and Van (1998), if the income effect is particularly strong



(a) (a) Child labor decreases

(b) (b) Child labor increases

Figure 1: The effect of unskilled migration on the unskilled labor market

it is theoretically possible to have multiple intersections between the labor supply and labor demand. In this case, there are multiple equilibria and the effect of unskilled migration on unskilled wages is ambiguous as the economy could potentially switch from one equilibrium to the next.

Skilled Labor supply. Children are not substitute for skilled labor. Hence, the supply of skilled labor is only composed of skilled native adults N_t^s and skilled migrants M_t^s:

$$L_{st} = N_{st} + M_{st}. \tag{9}$$

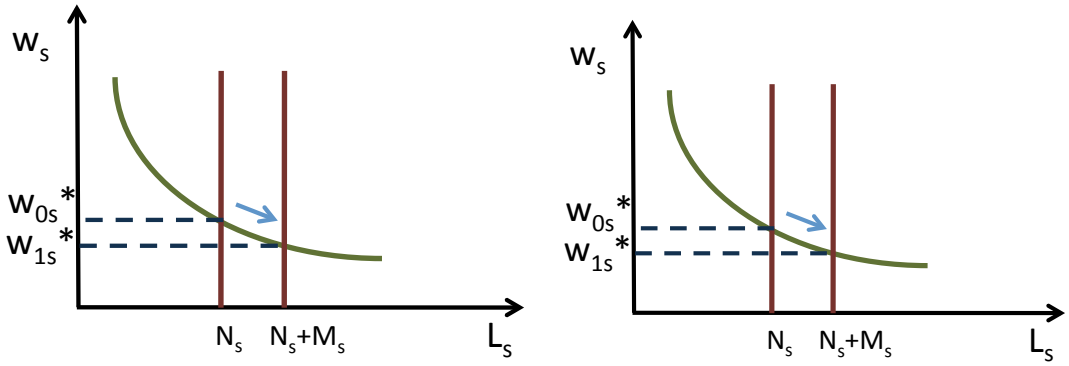
Skilled Wages. The equilibrium skilled wage is therefore such that

$$log(w_{st}) = log(X_s) + \eta log(N_{st} + M_{st}). \tag{10}$$

It follows that, if at time 0 there was only the native population, but time 1 sees an influx of immigrants (and no outflow of natives) then

$$log(w_{s1}) \approx log(w_{s0}) + \eta m_{s1}; \tag{11}$$

where m_{s1} is the share of migrants in the skilled population.



(a) On the skilled market

(b) On child labor.

Figure 2: The effect of skilled migration.

As illustrated in Figure 2a panel (a), more skilled immigration lowers the skilled wage.

Skilled Immigration on Child Labor. Finally notice that skilled immigration affects the unskilled labor market. We just saw that skilled immigration lowers the skilled wage. This reduces the return to schooling Δ and therefore reduces children education. Unless there are particularly strong complementarities between child labor and schooling or multiple equilibria, we expect child labor to increase and the unskilled wage to decrease. This is illustrated in Figure 2 panel (b).

4 Data

For our analysis we use data from three Censuses carried out in, respectively, 1991, 2000 and 2010, by the Instituto Brasileiro de Geografia e Estat'stica[1], which are available through the International IPUMS website.[2] In both 1991 and 2000 the data are a 10 percent sample in municipalities with an estimated population greater than 15,000 inhabitants and a 20 percent sample for the remaining municipalities. In the 2010 sample,

[1]For our IV estimation, we also use data from the 1980 Census.
[2]See https://international.ipums.org/international/.

there are instead five distinct sample fractions.[3]

A wealth of information is collected in the Census data sets, including labor market outcomes and important individual-level characteristics. First, we know whether an individual was born in the municipality of current residence or outside. We define as immigrants those individuals whose most recent move (if any) was either between different states or between different municipalities within the same state of residence.[4] Our main measure of immigration is given by p_{ijt}, i.e. the share of recently-arrived adults in the working age (i.e. 16-65) population of a particular skill group i in municipality j at time t, which is defined as:

$$p_{ijt} = M_{ijt}/(M_{ijt} + N_{ijt});$$

where M_{ijt} is the number of internal migrants in skill group i in municipality j at time t and N_{ijt} represents the corresponding number of resident workers. The level of skill – which we construct using information on the respondent's education can only take on two values, skilled and unskilled. Specifically, an unskilled resident or migrant is defined as having up to primary school completed, while a skilled resident or migrant is defined as having some secondary or above. However, the Brazilian education system changed over the period of time we analyze, in particular primary-education changed from a 4–year to a 6-year system in 2006. Thus, to construct a measure which is comparable across years, we define unskilled individuals as having up to 6 years of schooling in all of our sample years. To conclude, our focus is on internal, recent, migration of adults, who can be either skilled or unskilled.

As for measures of labor market outcomes, we have information on each individual's wage and total income. The latter is defined as the respondent's total personal income

[3]The 2010 sample includes a 5 percent sample of the population in municipalities with estimated populations greater than 500,000; a 10 percent sample of the population in municipalities with estimated populations between 20,000 and 500,000; a 20 percent sample of the population in municipalities with estimated populations between 8,000 and 20,000; a 33 percent sample of the population in municipalities with estimated populations between 2,500 and 8,000; and a 50 percent in the remaining municipalities.

[4]We exclude from the analysis those born outside of Brazil, since international migrants represent a very small fraction of the population.

from all sources in a previous month. The individual's wage is defined as monthly earnings from his/her labor (from wages, a business, or a farm) divided by hours of work in a previous month. To construct the average wage and total income of each municipality in a given year, we restrict the sample to the resident adult (i.e. age 16-65) population of that municipality and year.

We construct various measures of child labor-market outcomes, as the latter are highly heterogeneous and there is no measurement standard in the definition of child labor (Edmonds, 2005). First, we create a dummy variable which indicates whether a child works or not. This dummy equals 1 when the child works at least one hour per week and 0 otherwise. We also construct (i) a more inclusive child-labor variable which equals 1 if the child belongs to the labor force, 0 otherwise; (ii) a more restrictive dummy variable equal to 1 when the child works at least twenty hours per week and 0 otherwise. Next, we construct a dummy variable which indicates whether the child carries out paid work; a dummy variable which indicates whether the child carries out unpaid work ; and, finally, a continuous variable measuring the child's hours of work per week. Besides work, children can also go to school or remain idle. Thus, we further analyze the impact of migration on "school attendance" and being "idle." Leaving aside idle children, we decompose the child-labor and school attendance outcomes into three mutually exclusive categories/dependent variables, namely "child labor only" (i.e., no school), "both work and school" and "school attendance only" (i.e., no labor).

Table 1 presents summary statistics of the main variables we use in the empirical analysis. Panel A reports the incidence of child labor (according to the definition of the extensive and intensive margins described above) among resident (i.e. non-migrant) children of 10-14 years of age in Brazil. The share of resident children involved in any work activities (either paid or unpaid) slightly decreased from 8 percent to 4.5 percent between 1991 and 2010, while school attendance increased from 80 percent to 97 percent in the same years. Average hours of work span from 38 per week in 1991 to 21 in 2010. Across years, the majority of child labor is employed in paid activities and children typically work while in school.

Panel B reports average immigration rates, by skill, and average resident adults' income and wage at the level of the municipality. Over the period, around 5 percent of the native population migrated internally within Brazil, while the share of both skilled and unskilled migrants over the skill-specific total working-age population increased sharply between the 90s and the 2000s exceeding the rate of 40 percent.

***** Insert Table 1 *****

5 Empirical analysis

The empirical analysis in this paper aims at assessing the impact of internal migration on child labor in Brazil. To do so we first investigate the wage effect of internal migration in the adult labor market at the level of municipality. Next, we focus on children and estimate individual-level regressions of child outcomes as a function of internal migration shares.

5.1 The labor market effect at municipality level

In this section we describe the details of the empirical analysis of the labor market effect of internal migration within Brazil. The large size of the three Census samples allows us to fully exploit the spatial dimension of internal migration, taking advantage of the heterogeneity in the distribution of internal migrant workers across localities. In particular, we use information at the municipality level – there are 1447 municipalities in Brazil – and exploit the variation across municipalities within Brazil in the distribution of internal migrant workers – of different skill levels – over time. We restrict the analysis to either both men and women, or only men, in their working age (i.e. 16-65). Following the literature (see Borgas 2006), we estimate the following specification:

$$L_{ijt} = s_i + r_j + q_t + \beta_p p_{ijt} + \beta_x X_{ijt} + \varepsilon_{ijt}. \tag{12}$$

where the dependent variable L_{ijt} is a labor market outcome for resident workers in skill group i (2 skill groups: skilled and unskilled), municipality j (1447 municipalities), and Census year t (3 years); p_{ijt} is the main variable of interest. Controls include a vector of fixed effects s_i, indicating the skill level; a vector of fixed effects r_j indicating the municipality of residence, and a vector of fixed effects q_t indicating the time of the observation. These fixed effects control for differences in labor market outcomes across skill groups, local labor markets and over time. Note that the labor market outcomes (L_{ijt}) we analyze are the log of wage and the log of total income.

An immediate concern, though, is that the fixed effects estimates may suffer from endogeneity bias due, in particular, to reverse causality. Indeed, it is widely recognized that immigrants are not distributed randomly but instead tend to cluster in specific (e.g. economically stronger) locations. At the same time, it is well known that immigrants tend to settle in geographic areas where earlier migrants from the same origin have established themselves (Bartel 1989). Following Card (2001), our instrument is based on the idea of migrant networks. Assume that the total number of internal migrants from a given origin Brazilian state is independent from the labor–demand conditions prevailing in any particular municipality of the country. Then we can decompose the actual inflow of internal migrants from a given source state to a municipality into an exogenous supply component – based on the total number of internal migrants from the given source state and the share of internal migrants from that state who went to that municipality at an earlier period of time (in our case 1980)[5] – and a residual component – that reflects short term fluctuations from the long term patterns. Card's shift-share instrument is based on the idea that the exogenous supply component represents the supply shifter that can be used as an instrumental variable.

More precisely, let M_{ot} be the number of immigrants from source state o at time t. Following Cortes and Pan (2013) – to address the possible concern that the total number of internal migrants from a given state may be correlated with local conditions at the skill/municipality level – we omit the contribution of skill/municipality i, j to M_{ot} when

[5]See below for an argument why this share is likely to be exogenous.

constructing the instrument for the same skill/municipality cell. Furthermore, let λ_{oj} be the share of immigrants from source state o who were observed living in municipality j at an earlier period of time. Finally, let τ_{oit} be the fraction of internal migrants from origin state o that in year t belong to skill group i. Our shift–share instrument is then defined as

$$SS_{ijt} = \sum_{o} M_{ot}\lambda_{oj}\tau_{oit}. \tag{13}$$

To construct λ_{oj} we use information from the 1980 Census. As mentioned in the Introduction, during the 1980's Brazil slowly returned to democracy, after a period of dictatorship. Thus, the political and economic environment of the early 1980's is substantially different from that of the period we analyze, which lends credibility to the exclusion restriction.

***** Insert Table 2 *****

The results of the analysis of the labor-market impact of internal migration are reported in Table 2. Note that, in all our specifications, standard errors are clustered at the skill-district level. We find that, both in the OLS and IV specifications, internal migration of a given skill-level has a negative and significant impact on corresponding earnings. In our wage specification, the magnitude of the negative effect of one percentage point increase in the share of migrants of a given skill-level in a municipality range between 30 percent in the OLS specification and 90 percent in the IV regression. Yet, while the former is an estimate of the average treatment effect over the entire population, the latter estimates the local effect such that our instrument may be shifting the behavior of a subgroup of migrants with a larger impact on local wages than average (namely those with more connections at destination through networks). Overall, the strong and negative impact of internal migration on residents' wages may in turn affect child labor-market outcomes, as we investigate in what follows.

5.2 Child labor estimates at the individual level

In this section we describe the details of the empirical analysis of the impact of internal migration on child labor outcomes. We estimate individual-level regressions where we focus on more than two million Brazilian children aged 10 to 14.

We estimate the following specification:

$$CO_{ijt} = r_j + q_t + \beta_p p_{jt} + \beta_x X_{ijt} + \varepsilon_{ijt}; \tag{14}$$

where the dependent variable CO_{ijt} is the outcome variable that we analyze for child i, in municipality j (1447 municipalities), and Census year t (3 years); p_{jt} is the main variable of interest, i.e. immigration share in municipality j and year t. Controls include a vector of municipality and year fixed effects. X_{ijt} is a vector of individual-level control variables, which include: the child's age, gender, racial background, location in an urban area, household size, whether the head in the child's household is a male and, finally, the household head's educational attainment.

The child outcomes that we analyze are: child labor force participation, child labor, school attendance, paid work, unpaid work, hours of work, child labor only, school attendance only, both work and school and, finally, idle. Results are reported in Table 3.

***** Insert Table 3 and 4 *****

We find that child labor is affected by the socio-demographic characteristics of the child and household head, consistent with the existing literature. In particular, older, male, black children are more likely to work; those living in urban areas, in smaller families with an educated household head are less likely to be employed. More importantly, our results show that child labor decreases as internal unskilled migration flows increase. Ceteris paribus, a 10 percent increase in low-skilled immigration share generates 3.2 percentage points (p.p.) decrease in the probability of children to work in any activity and

a reduction of child employment for more than 20 hours per week by 1.8 p.p. In terms of the theoretical model of child labor, these findings suggest that the substitution-effect channel dominates the income-effect channel. In other words, when unskilled wages go down due to the arrival of unskilled internal migrants, households have less incentives to send children to work since children can earn less, although the household income has most likely decreased (since parents are likely to be unskilled as well). In addition, our results show that the skilled internal migration share has a positive and significant impact on child labor. A 10 percentage points increase in the share of skilled migrants in a municipality leads to a 9.1 p.p. increase in the children's likelihood to work (the probability to work more than 20 hours increases by 8.5 p.p.). The interpretation of this result is that, since the skilled internal migration share has a negative and significant impact on the skilled wage, then the return to education decreases, which in turn implies lower school attendance - which we observe in the data (see column (3)) - and higher child labor as a consequence of skilled migration.

Moreover, by looking at the last four columns where we report results on mutually exclusive dependent variables, we find evidence that the reduction (increase) of child labor due to unskilled (skilled) immigration is coming significantly from a drop (increase) in the fraction of children who both work and attend school. We interpret these results as consistent with the predictions of our theoretical model, where fixed costs of schooling imply lower (more) schooling in correspondence of lower (more) child labor.

Finally, one might be curious to see whether our results are homogenous across gender. Notice that Brazil is one of the few countries where female education is larger than men both at the primary and secondary level.[6] Table 5 and 6 show that the effect of immigration on child labor and schooling of girls and boys are remarkably similar.

***** Insert Table 5 and 6 *****

[6] Agénor PR, Canuto O (2013) Gender inequality and economic growth in Brazil: a long-run analysis. Policy research working paper no. 6348, World Bank.

6 Conclusions

In this paper we have analyzed the impact of internal migration within Brazil on child outcomes. The main channel through which the effect of migration works, in the theoretical model, is the labor market. Thus we complement the individual-level analysis of child outcomes with the empirical investigation of the labor-market effect of internal migration.

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Table 1: Summary statistics

	1991	2000	2010
PANEL A			
Individual Level			
Child labor	8.25%	6.54%	4.48%
Child labor force participation	10.13%	9.16%	7.23%
School attendance	80.01%	94.87%	97.06%
Hours of work*	38.18	29.02	21.23
Paid child labor	5.78%	3.65%	2.84%
Unpaid child labor	2.47%	2.89%	1.64%
Child labor only (no school)	4.54%	0.97%	0.47%
School attendance only (no work)	76.29%	89.30%	93.04%
School and work	3.71%	5.57%	4.02%
Idle	15.46%	4.15%	2.48%
Obs.	820904	824586	605280
*Obs.	75521	63393	44400
PANEL B			
Community level			
Internal immigration rate	5.43%	5.73%	4.49%
International immigration rate	0.05%	0.12%	0.19%
Unskilled internal immigration rate	19.40%	44.30%	42.82%
Skilled internal immigration rate	25.90%	45.53%	43.31%
Residents' Hourly Wage	428.85	2.11	5.89
Residents' Monthly Income	47410.13	238.08	598.17
Obs.	1447	1447	1447

Notes: The invidual level sample includes resident (i.e. non-migrant) children of age 10-14.
Income and wage figures at the municipality level are not adjusted for inflation or devaluation.

Table 2- The labor market impact of internal immigration on adult residents: results at the skill-municipality level

	OLS results		
	(1)	(2)	(3)
VARIABLES	*First stage*	Log hourly wage	Log monthly income
Immigration share		-0.289***	-0.543***
		(0.087)	(0.126)
Municipality, skill, year FE		*yes*	*yes*
Observations		7,897	7,897
R-squared		0.997	0.997
	IV results		
Immigration share	0.019***	-0.902**	-2.686***
	(0.006)	(0.444)	(0.599)
Municipality, skill, year FE	*yes*	*yes*	*yes*
F-test	11.49		
	0.000		
Observations	7,897	7,897	7,897
R-squared	0.902	0.993	0.989

Robust standard errors clustered at the skill-municipality-year level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1
Notes: The estimation sample includes the working age (18-65) population. Immigration share is measured over total population (residents and migrants). The skill level is measured on the basis of two categories, i.e. those with less and more than primary education completed.

Table 3- The labor market effect of internal immigration on children: IV results at the child level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	Child labor force participation	Child labor	School attendance	Paid work	Unpaid work	Hours of work	Work ONLY	School ONLY	School and work	idle
Unskilled immigration share	-0.219***	-0.329***	-0.331	-0.167*	-0.161***	6.906	0.022	0.019	-0.351***	0.309
	(0.066)	(0.100)	(0.231)	(0.086)	(0.054)	(17.644)	(0.063)	(0.235)	(0.052)	(0.192)
Skilled immigration share	0.426***	0.915***	-2.082**	0.411***	0.504***	-19.191	0.664***	-2.334***	0.252**	1.419**
	(0.131)	(0.278)	(0.840)	(0.153)	(0.190)	(19.326)	(0.232)	(0.866)	(0.116)	(0.623)
Age	0.038***	0.030***	-0.019***	0.022***	0.007***	1.732***	0.012***	-0.037***	0.018***	0.007***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.062)	(0.001)	(0.002)	(0.001)	(0.001)
Male	0.062***	0.054***	-0.016***	0.029***	0.025***	0.384***	0.022***	-0.048***	0.032***	-0.006***
	(0.003)	(0.003)	(0.002)	(0.001)	(0.002)	(0.101)	(0.002)	(0.003)	(0.002)	(0.002)
White	-0.006***	-0.003***	0.019***	-0.006***	0.003***	-0.417***	-0.003***	0.018***	0.001	-0.016***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.127)	(0.001)	(0.002)	(0.001)	(0.001)
Urban	-0.067***	-0.062***	0.084***	-0.007***	-0.055***	1.068***	-0.025***	0.120***	-0.036***	-0.059***
	(0.005)	(0.005)	(0.003)	(0.002)	(0.004)	(0.190)	(0.001)	(0.005)	(0.004)	(0.003)
HH size	0.005***	0.004***	-0.007***	0.002***	0.002***	0.265***	0.002***	-0.009***	0.002***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.018)	(0.000)	(0.001)	(0.000)	(0.000)
HH head male	-0.013***	-0.006***	0.022***	-0.012***	0.006***	-0.843***	-0.006***	0.021***	0.000	-0.016***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.106)	(0.001)	(0.001)	(0.001)	(0.001)
HH head Educational attainment	-0.016***	-0.010***	0.017***	-0.009***	-0.001**	-1.840***	-0.003***	0.024***	-0.007***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.081)	(0.000)	(0.001)	(0.000)	(0.001)
Municipality fe	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fe	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	2,250,770	2,250,770	2,250,770	2,250,770	2,250,770	183,314	2,250,770	2,250,770	2,250,770	2,250,770
Number of municipalities	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447

Robust standard errors clustered at municipality-year level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

Notes: The estimation sample includes resident children of age 10-14. Unskilled (skilled) immigration share is measured over total unskilled (skilled) resident population. Child labor is defined on the basis of employment status.

Table 4- The labor market effect of internal immigration on children: IV results at the child level

VARIABLES	(1) Child labor force participation	(2) Child labor	(3) School attendance	(4) Paid work	(5) Unpaid work	(6) Hours of work	(7) Work ONLY	(8) School ONLY	(9) School and work	(10) idle
Unskilled immigration share	0.110***	-0.182*	-0.331	-0.129	-0.053	-5.601	0.013	-0.137	-0.195***	0.319
	(0.040)	(0.097)	(0.231)	(0.081)	(0.053)	(12.893)	(0.059)	(0.249)	(0.043)	(0.203)
Skilled immigration share	-0.489***	0.845***	-2.082**	0.454***	0.391**	42.381**	0.601***	-2.327**	0.245***	1.482**
	(0.170)	(0.280)	(0.840)	(0.163)	(0.164)	(19.227)	(0.205)	(0.906)	(0.095)	(0.654)
Age	0.008***	0.024***	-0.019***	0.018***	0.005***	1.150***	0.011***	-0.032***	0.012***	0.008***
	(0.000)	(0.001)	(0.002)	(0.001)	(0.000)	(0.049)	(0.001)	(0.002)	(0.000)	(0.001)
Male	0.009***	0.039***	-0.016***	0.023***	0.017***	-0.350***	0.020***	-0.035***	0.019***	-0.004**
	(0.000)	(0.002)	(0.002)	(0.001)	(0.001)	(0.122)	(0.002)	(0.002)	(0.001)	(0.002)
White	-0.003***	-0.003***	0.019***	-0.004***	0.001***	-0.239***	-0.003***	0.019***	-0.000	-0.016***
	(0.000)	(0.001)	(0.002)	(0.001)	(0.000)	(0.091)	(0.001)	(0.002)	(0.000)	(0.001)
Urban	-0.006***	-0.035***	0.084***	-0.002*	-0.033***	1.764***	-0.022***	0.097***	-0.013***	-0.062***
	(0.001)	(0.003)	(0.003)	(0.001)	(0.002)	(0.255)	(0.001)	(0.004)	(0.002)	(0.003)
HH size	0.001***	0.003***	-0.007***	0.002***	0.001***	0.097***	0.002***	-0.009***	0.001***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.017)	(0.000)	(0.001)	(0.000)	(0.000)
HH head male	-0.007***	-0.007***	0.022***	-0.010***	0.002***	-0.833***	-0.005***	0.024***	-0.002***	-0.016***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.115)	(0.000)	(0.001)	(0.000)	(0.001)
HH head Educational attainment	-0.006***	-0.008***	0.017***	-0.008***	-0.000*	-1.512***	-0.003***	0.022***	-0.005***	-0.014***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.136)	(0.000)	(0.001)	(0.000)	(0.001)
Municipality fe	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fe	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	2,250,770	2,250,770	2,250,770	2,250,770	2,250,770	147,763	2,250,770	2,250,770	2,250,770	2,250,770
Number of municipalities	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447

Robust standard errors clustered at municipality-year level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

Notes: The estimation sample includes resident children of age 10-14. Unskilled (skilled) immigration share is measured over total unskilled (skilled) resident population. Child labor is defined on the basis of working hours, i.e. a child is defined as a laborer when he works for no less than 20 hours per week.

Table 5- The labor market effect of internal immigration on children: IV results at the child level by gender

VARIABLES	(1) Child labor force participation	(2) Child labor	(3) School attendance	(4) Paid work	(5) Unpaid work	(6) Hours of work	(7) Work ONLY	(8) School ONLY	(9) School and work	(10) idle
					MALE					
Unskilled immigration share	-0.297***	-0.445***	-0.411	-0.233**	-0.212**	5.047	0.061	0.095	-0.506***	0.350
	(0.091)	(0.137)	(0.277)	(0.112)	(0.091)	(22.087)	(0.083)	(0.291)	(0.075)	(0.226)
Skilled immigration share	0.859***	1.433***	-2.170**	0.615***	0.818***	-6.275	0.981***	-2.622***	0.452***	1.188*
	(0.249)	(0.429)	(0.936)	(0.208)	(0.313)	(25.344)	(0.340)	(1.011)	(0.169)	(0.621)
Observations	1,149,548	1,149,548	1,149,548	1,149,548	1,149,548	125,746	1,149,548	1,149,548	1,149,548	1,149,548
					FEMALE					
Unskilled immigration share	-0.137***	-0.206***	-0.249	-0.098	-0.108***	13.331*	-0.018	-0.061	-0.188***	0.267
	(0.051)	(0.067)	(0.190)	(0.060)	(0.018)	(7.917)	(0.046)	(0.183)	(0.032)	(0.166)
Skilled immigration share	-0.024	0.376***	-1.993***	0.198**	0.179***	-44.483***	0.336***	-2.033***	0.040	1.657***
	(0.098)	(0.133)	(0.747)	(0.100)	(0.066)	(11.000)	(0.125)	(0.720)	(0.077)	(0.637)
Observations	1,101,222	1,101,222	1,101,222	1,101,222	1,101,222	57.559	1,101,222	1,101,222	1,101,222	1,101,222
Number of municipalities	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447

Robust standard errors clustered at municipality-year level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

Notes: The estimation sample includes resident children of age 10-14 by gender. Unskilled (skilled) immigration share is measured over total unskilled (skilled) resident population. Child labor is defined on the basis of employment status. Included controls are the same as in Table 3 and 4.

Table 6- The labor market effect of internal immigration on children: IV results at the child level by gender

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	Child labor force participation	Child labor	School attendance	Paid work	Unpaid work	Hours of work	Work ONLY	School ONLY	School and work	idle
					MALE					
Unskilled immigration share	0.148***	-0.239*	-0.411	-0.172*	-0.067	-8.686	0.041	-0.131	-0.280***	0.370
	(0.051)	(0.129)	(0.277)	(0.102)	(0.082)	(14.145)	(0.076)	(0.301)	(0.062)	(0.244)
Skilled immigration share	-0.574***	1.260***	-2.170**	0.633***	0.627**	54.564***	0.893***	-2.536**	0.366***	1.276*
	(0.193)	(0.405)	(0.936)	(0.215)	(0.257)	(20.130)	(0.300)	(1.033)	(0.134)	(0.668)
Observations	1,149,548	1,149,548	1,149,548	1,149,548	1,149,548	125,746	1,149,548	1,149,548	1,149,548	103,679
					FEMALE					
Unskilled immigration share	0.069**	-0.123*	-0.249	-0.085	-0.038	5,531	-0.018	-0.144	-0.105***	0.266
	(0.029)	(0.067)	(0.190)	(0.059)	(0.024)	-13,668	(0.045)	(0.200)	(0.025)	(0.171)
Skilled immigration share	-0.401***	0.414***	-1.993***	0.268**	0.147**	16,438	0.298***	-2.109***	0.116**	1.694***
	(0.149)	(0.156)	(0.747)	(0.113)	(0.069)	-25,181	(0.112)	(0.779)	(0.056)	(0.652)
Observations	1,101,222	1,101,222	1,101,222	1,101,222	1,101,222	44,067	1,101,222	1,101,222	1,101,222	1,101,222
Number of municipalities	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447

Robust standard errors clustered at municipality-year level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

Notes: The estimation sample includes resident children of age 10-14. Unskilled (skilled) immigration share is measured over total unskilled (skilled) resident population. Child labor is defined on the basis of working hours, i.e. a child is defined as a laborer when he works for no less than 20 hours per week. Included controls are the same as in Table 3 and 4.