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# Kids at Risk: Children's Employment In Hazardous Occupations in Brazil ♦

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## Abstract

While the literature on child labor in Brazil is large, it is not comprehensive: in particular, there are few studies on children's work in risky occupations, and those that exist tend to be qualitative and based on limited samples. In this paper, we aim to paint a broader picture of children's engagement in risky labor force work, based on quantitative evidence from PNAD data. We document associations between parental characteristics and children's work, using both descriptive statistics and multivariate modeling to understand the determinants of child participation in risky labor force work. Brazilian children engaged in risky occupations are less likely than other employed children to be enrolled in school, and more likely to work long hours and experience a variety of working conditions that may be unsafe. Parental education, indicators of household wealth and owning a family farm are particularly strongly associated with the incidence of risky work among children, and girls are over-represented in risky jobs due to their work in domestic service.

## Keywords

Child Labor, Risky Work, Multivariate Models, Brazil

## Resumo

A literatura a respeito do trabalho infantil no Brasil é vasta, porém mantém uma lacuna no que se refere ao trabalho considerado perigoso e como se dá a entrada das crianças nesse tipo de ocupação. O objetivo deste trabalho é investigar o trabalho infantil perigoso utilizando os dados da PNAD, complementando os estudos qualitativos já existentes, por meio de análises descritivas e um modelo multivariado.

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Os resultados mostram que, ao menos no Brasil, as crianças em ocupações de risco têm menores chances de estudar e tendem a ter jornadas mais longas, inclusive quando comparadas a outras crianças trabalhadoras. Além disso, existem diferenças importantes entre meninas e meninos, e elas estão super-representadas nas ocupações de risco.

**Palavras-Chave**
Trabalho Infantil, Trabalho Perigoso, Modelos Multivariados, Brasil

**Classificação JEL**
J13

## 1. Introduction

The policy imperative to reduce child labor in Brazil is much smaller than in past decades, due to an impressive decline in children's labor force participation since the 1980s. There remains, however, a substantial number of children ages 10 to 17 who are engaged in labor force work: 3.58 million (12.9 % of those aged 10 to 17) as of 2011 (IBGE 2011).[1] Moreover, there is evidence (discussed below) of a variety of negative outcomes for children engaged in hazardous work, in comparison to children who are not employed and children engaged in other types of work. We refer here to potentially hazardous work as "risky." While the literature on child labor in Brazil is large, it is not comprehensive: in particular, there are few studies on children's work in risky occupations, and those that exist tend to be qualitative and based on limited samples. In this paper, we aim to paint a broader picture of children's engagement in risky labor force work, based on quantitative evidence from a large and representative sample, though one that is in some respects less detailed than qualitative studies can be. Following the United Nations Convention on the Rights of the Child, we define "children" as being people under the age of 18. We focus on four categories of work that satisfy two criteria: (1) they include large numbers of workers under age 18, and (2) the occupations and/or industries are considered hazardous because they may harm a child's "health, safety or morals" (ILO Convention 182, Article 3). Given the evidence of undesirable outcomes for children engaged in hazardous work in Brazil, enhancing our understanding of how children end up in

[1] There were 1,026 million youth ages 10 to 14 (that is, 6.0% of people at this age range) and 2,557 million youth ages 15 to 17 (or 24.2%) working in 2011. Work is forbidden in Brazil for persons under 14 and permitted under certain conditions (apprenticeship) for 14 to 16 year-olds. Activities considered hazardous are forbidden to persons under 18.

such occupations is valuable for informing policy. Yet little attention has been given to the question of how children come to enter different kinds of work, in Brazil or elsewhere. We speculate that characteristics of parents, especially those that influence their own labor force participation and type of work, play an important role in children's labor force entry and types of first jobs. Ideally this would be studied using long-term panel data that would allow for the identification of causal pathways. Because such data do not exist, we resort to cross-sectional data to document associations between parental characteristics and children's work that are suggestive of underlying behavioral relationships, using both descriptive statistics and multivariate modeling to better understand the determinants of child participation in risky labor force work.

The literature concerning child labor in Brazil is extensive. A number of studies focus on determinants of child labor, such as poverty, parents' low levels of education, large family sizes, and unappealing educational alternatives (examples include Barros et al. 1994; Di Giovani 2004; Kassouf 2002; Portela and Emerson 2000). As programs aimed at reducing hazardous child labor, reducing poverty and/or increasing school attendance came into being – PETI, *Bolsa Escola*, and later *Bolsa Família* – so too did studies evaluating those policies (e.g., Cardoso and Souza 2003; Ferro and Kassouf 2005; Ferro et al. 2010; Yap et al. 2003). There are few studies, however, that go into detail about occupational choices of children in Brazil, let alone choices considered as risky, in spite of the need for policy interventions in this area. Among those papers dealing with risky child labor in Brazil, the majority derive from qualitative studies of small numbers of children based on non-representative samples. In general, such research focuses primarily on psychological health and deviant behavior, or on physical health, rather than on the circumstances leading to children's employment in hazardous work. We briefly summarize those studies for Brazil that are most relevant to our research in a section below, which discusses the categories of work on which we focus.

Looking beyond Brazil, there is a large literature on "child labor" in developing countries, including a number of review articles.[2] This research has focused broadly on characteristics associated with chil-

[2] See, for example, Basu (1999), Basu and Tzannatos (2003), Dorman (2008), Edmonds (2008), and Edmonds and Pavcnik (2005).

dren doing labor market work, most often measured as a simple yes/no variable, and sometimes in conjunction with analysis of domestic chores and/or school enrollment. In contrast, we are interested in children's participation in "hazardous" work as opposed to other types of labor market work. We know of no other paper that focuses on children's pathways to particular types of work in poor countries, although case studies may speak to it indirectly (e.g., Madsian 2004). In some settings, such pathways are obvious, as in some rural areas where all jobs are related to agriculture. However, this is often not the case. In many parts of the world, children are employed in multiple industries and occupations, both legally and illegally. This is true in much of the more populated regions of Brazil. How children end up working in particular occupations is, therefore, a highly relevant question for the case of Brazil.

What are the pathways for children to particular types of occupations, in particular industries in Brazil? We speculate that in less developed countries, the tradition of children following adult relatives, especially parents, into particular types of work remains the dominant pattern. This contrasts to industrialized countries, where connections to acquaintances outside one's immediate family and social circle ("weak ties") are especially beneficial for job-seekers (Granovetter 1973). We seek to determine whether the empirical evidence supports the hypothesis of "strong ties" in Brazil, *i. e.*, of systematic associations between parental characteristics and children's engagement in hazardous work.

In our previous research on children's employment in Brazil (DeGraff, Levison and Robison 2009; DeGraff and Levison 2009), we find evidence of correlations between children's and mothers' labor force participation, each measured as simple yes/no variables, as well as in numerous characteristics of their employment. In additional previous analysis (DeGraff, Ferro and Levison 2012), we move beyond the simple dichotomous classification of labor force participation and consider various outcomes for children engaged in hazardous work, compared to children who are employed in other types of work and children not in the labor force. We find, for example, that children ages 10 to 17 who are engaged in hazardous work in Brazil (as we define it), are on average not only less likely to be enrolled in school than children not in the labor force (73.1% vs. 92.1% ), but are also less likely to be in school in comparison to chil-

dren employed in other types of work (84.4%).[3] Among employed children, those engaged in hazardous work tend to work longer hours than their counterparts in other jobs (32.6 hours per week vs. 28.6), and are also less likely to be working with or near family (with the exception of family farms) or in places where they can be observed by the general public. These conditions are likely to render them more vulnerable to various forms of abuse and exploitation. Furthermore, to the limited extent that our data allow us to examine the physical conditions of work, we also see evidence of greater risk for children in jobs categorized as hazardous. Specifically, we find a greater incidence in the use of machinery or chemicals in the hazardous occupations, on average, and a lower incidence of providing safety equipment or training for children working with such inputs. In sum, even without ideal data for examining short-run effects, and lacking data to assess potential longer terms effects, we see substantial evidence that is suggestive of negative consequences for children of working in hazardous occupations in Brazil.

In this paper, we explore the case of children engaged in "hazardous" work with the goal of better understanding how they come to work in these occupations. We seek in particular to identify systematic associations with characteristics of their parents that could be easily identified and, thus, help to better target interventions aimed at reducing children's participation in hazardous work. We focus on occupations and industries with known problematic aspects for young people as defined by the government of Brazil and/or child labor experts.

## 2. Data and Methods

We focus in this paper on children's employment in the labor force, as defined under the United Nations' System of National Accounts (ILO 1982, 2002). While we realize that many children, especially girls, are engaged in time-consuming and valuable household chores, we do not consider such activities in this analysis. In addition to wage labor outside the family, children engaged in labor force em-

[3] Our method of identifying categories of hazardous work for children in Brazil is discussed in the next section.

ployment may work for their parents or other relatives and still be doing labor force work. They also need not be paid a monetary wage to meet the definition of labor force work; they may be compensated in kind or work as unpaid family laborers. Following standard practice, we use the week prior to the survey as the reference period for measuring whether any individual is engaged in labor force work, and consider engagement in such activity for any number of hours to constitute participation in the labor force.[4] As mentioned above, in keeping with the United Nations Convention on the Rights of the Child, we use the term "child" to denote persons younger than 18. This analysis focuses on children ages 10 to 17, generally considered as a group, but with robustness checks via separate analyses for samples of 10 to 14 year-olds, 10 to 15 year-olds and 16 to 17 year-olds.

The first step of our analysis was to identify occupations and/or industries to designate as hazardous for children. The Brazilian government, as a signatory of the UN Convention on hazardous work, approved a law containing a description of activities considered hazardous (BRASIL, 2008) – and therefore forbidden to persons under 18 in any conditions – that is, a list of "worst forms" of work activities in which persons under 18 are not allowed to work as regular employees or in apprenticeships. For non-risky activities, the age limits are 16 for regular work and 14 for apprenticeships. Then, to the extent possible, we matched the "hazardous work list" to the categories of occupations and industries available in the Census of 2000, which is based on Classificação Brasileira de Ocupações – CBO (Brazilian Occupational Categories).[5] Among the available occupation/industry categories that were on the CBO list, or have been identified by child labor experts as problematic, we identified four occupations in which children were concentrated and on which – according to our reading of the child labor literature – it would be especially useful to focus. These are domestic services, street workers (such as street vendors or shoe-shines), construction workers, and farm workers engaged in the cultivation and processing of particular crops: tobacco, coffee, sugar cane, and manioc. The characteristics of these jobs are discussed in the following section, but all are either

[4] Levison *et al.* (2007) have shown that this reference period leads to substantial undercounts of the number of children who have engaged in labor force work in a 4-month period, but our goal in this paper is not to count child workers but to better understand the situations of those we can identify using the PNAD survey.

[5] We used the 6 percent sample of Brazil's population census of 2000 made available by IPUMS-International (Minnesota Population Center 2008).

designated as hazardous for children by Brazil's Ministry of Labor and Employment or are considered hazardous by child labor experts (or both), and can be identified given the coding of the data and contain large numbers of children.[6]

With these categories of hazardous work defined, we use Brazil's annual household survey, the *Pesquisa Nacional por Amostra de Domicílios*, from the year following the population census (PNAD-2001), to conduct this exploratory analysis. The PNAD-2001, which included supplements on child work and on worker health and safety, is a nationally representative sample survey of 126,898 households and 378,837 individuals. Our analysis focuses on children ages 10 to 17 and their parents (if present), with the children defining the analysis sample. We include all persons aged 10 to 17 in our analysis sample, regardless of their demographic circumstances. For example, children identified as family or household heads, or children living with relatives but with no parent present, are often excluded from analysis of child outcomes. We aim to be as comprehensive as possible in the representation of children and, therefore, do not make such sample exclusions. The total number of 10 to 17 year-olds in the sample is 60,678,[7] of whom more than seventeen percent (17.6%) are employed in labor force work in the reference week; of these, 24.8 percent are in the risky categories of interest to us (see Tables 1 and 2).

[6] Note that our methodology is in some respects more inclusive than the Brazilian government's designations in that we also rely on the child labor literature to help identify potentially risky jobs for children, while in other respects it results in a narrower definition because we must be able to find the risky jobs in the data.

[7] In the vast majority of the 60,678 cases, the biological mother of a child was in the household and coded as the family head or spouse. In such cases, we assumed the father to be the person married to her, if such a person was present (fathers are not identified in the data). However, some children did not have a biological mother in the household either because she is deceased or no longer living in the household. Here, because fathers are not identified, we used information about relationships to the family head and the ages of males in comparison to the child's age to assign a father. If a likely father could be identified, we then used information about relationships to the family head and the ages of women in comparison to the father to assign a step-mother. We assigned approximately 800 step-mothers in this manner. In addition, we also assigned fathers in cases where, according to information about a child's biological mother and ages, it appeared that the mother was in the household but there were errors in the family relationship codes. In such cases, we assumed that the identity of the biological mother was correct, and used age information to identify a father. We assigned approximately 1,500 fathers in this manner. The algorithms used to assign step-mothers and fathers to children are available upon request.

**Table 1 - Distribution of Children 10 to 17 by Employment Situation**

| | % | n |
|---|---|---|
| **Not Employed** | **82.43** | **50,544** |
| **Employed in Risky Work** | **4.36** | **2,608** |
| Domestic Service | 1.82 | 1,129 |
| Street Work | 0.44 | 281 |
| Construction | 0.65 | 399 |
| Hazardous Farming | 1.45 | 799 |
| **Employed in Other Work** | **13.21** | **7,536** |
| **Total, Children 10-17** | **100.00** | **60,678** |

We generate descriptive statistics for children and their families according to the work status of the children: employed in risky work (in one of the four categories defined here), employed in "other" types of work, or not employed.[8] In addition, we examine employment outcomes for children conditional on parental employment characteristics. Finally, we estimate a multivariate model of children's employment which distinguishes between risky jobs versus other forms of work, in order to identify relationships between children engaging in risky work and parental characteristics, while controlling for multiple factors.

In the descriptive analysis, we not only explore differences between children employed in risky work and those employed in "other work" or not employed, we also look for differences across the four categories of risky work. These more detailed results are not included in the tables and figures, but are noted in the text when they provide additional insights. In addition, the multivariate analysis, as well as some of the descriptive analysis, is disaggregated in order to allow for the possibility of differences by gender and, as mentioned previously, by age group. Details on the multivariate methods are provided following the descriptive analysis.

[8] We refer to all types of labor force work that we have not categorized as risky (hazardous) as "other" work. This does not mean that "other" work is completely non-hazardous for children.

The categories of risky work we identify above are domestic service, street work, construction work and farming of selected crops. Following is a brief description of each of these types of work in Brazil (as also presented in DeGraff, Ferro and Levison (2012)).

### *Domestic Service*

A large majority of Brazil's 440 thousand child domestic servants (as of 2000) – over 94 percent of them – were girls. Domestic service is one of the most common jobs for girls: in 2000, 25.7 percent of employed 10 to 14 year-old girls worked as domestics, as did 32.2 percent of employed 15 to 17 year-old girls. While most (382 thousand) female and male child domestics lived with their own families and worked in the homes of other families, about 58 thousand were "live-in" servants (Levison and Langer 2010). In addition to being mainly female, children working as domestic servants in Brazil are mostly non-white and urban, with parents who have lower incomes than those of non-working children. Child domestic servants have low salaries, but they earn more than children in other occupations, making domestic service an attractive job (Saboia 2000). Domestic service is considered risky because of the isolation of domestic workers from other workers; child domestics, especially, are vulnerable to overwork, physical abuse, sexual abuse, and verbal abuse (Alberto et al. 2006; ILO 2003; Lamarão 2000). Live-in domestics, who often do not have regular contact with family or friends, may not even have anyone to tell about abuse. The literature is full of horror stories about the lives of child domestics – although domestic service, for some, is a welcome escape from rural or slum poverty and may provide the only possibility for some children to go to school.[9]

### *Street Work*

Working in "the street" implies a different, although related, set of hazards for children. Regardless of whether young people work at a fixed location or move about (for example, peddling wares), being in the street exposes them to abusive language and/or behavior from

[9] See Bourdillon *et al.* (2010), Chapter 8, for a discussion of both serious problems with domestic service, and the substantial advantages it provides to some children.

passersby, customers, and even the police. In Brazil's major cities, the police have a particularly bad reputation with respect to children working (and living) in the street, with documented behavior ranging from the extortion of bribes to physical violence. Young people are also exposed to and offered illicit drugs, glue for sniffing, and the services of prostitutes, as well as being propositioned themselves. Yet street work has low costs of entry insofar as a street vendor need only have a small inventory to go into business, and children's occasional or part-time work on the street may be a fall-back source of income to poor families in times of financial stress. Cruz and Assunção (2008) investigate child street workers in Belo Horizonte; they show that parental presence neither reduces the risks to which children are exposed nor increases apprenticeship opportunities for children.

### *Construction Work*

A great deal of building in urban areas takes place at sites located away from where workers live yet near busy streets, so many of the dangers for children of street work also apply to construction work. In addition, construction work more generally has its own set of hazards. These include carrying heavy building materials, using or being near potentially dangerous equipment or hazardous materials without proper training or oversight, and working at unsafe heights without safety precautions. Also, children and youth working in construction are likely to be employed in the informal sector where hazardous conditions are relatively more common than in the formal sector.

### *Farm work – tobacco, coffee, sugar cane, manioc*

There are many children in Brazil working in agricultural occupations which can be considered risky due to exposure to pesticides and other chemical products. Nicolella *et al*. (2008) show that children working in agriculture have the same chances of health problems compared to children working in other occupations. Feitosa and Dimenstein (2004) interview mothers of children working in agricultural enterprises and conclude that the parents of such

children were themselves likely to have worked as children; such parents consider work to be a good alternative to children being in the streets or engaged in criminal activities.

Substantial numbers of young farm workers in Brazil are engaged in the cultivation or processing of four particular crops – tobacco, coffee, sugar cane, and manioc – which have been identified as potentially hazardous. Farm work in general poses hard-to-quantify threats to the health of workers, as relatively little is known about long-term effects of exposure to the many different chemical combinations used in herbicides, pesticides, and fertilizer. It is clear, however, that there are at least short-term problems. Herbicides and pesticides explicitly contain toxins (to kill weeds and insect pests). Children, because they are still growing, are thought to be particularly vulnerable to exposure to various chemicals, which could stunt or harm their development. In addition, children may use farm machinery without adequate training or protection.

It is important to note, however, that neither the Census nor the PNAD survey is detailed enough to specify what children *actually do* when they engage in farm work or any of the other categories of risky work that we consider. Their activities may, for example, include tasks that are clearly hazardous, such as handling crops newly sprayed with pesticides. However, it is possible that, even among those crops where farm labor is labeled risky for children, they do nothing that puts them at risk. Agricultural production processes, and thus the nature of children's activities in production, can differ substantially, even for the same crop, depending on location and on whether it is a small-scale family farm or a large agricultural enterprise. Furthermore, it is possible that children working in occupations that are not considered risky, might at times be exposed to unhealthy working conditions of some form. The way that data about occupations and industries are typically collected does not permit us to separate child workers by tasks, only by economic products. More detailed information about specific tasks that children perform at work would greatly facilitate research on children's employment in hazardous work.

### *Descriptive Analysis: Children in Risky Work and Their Families*

We first examine characteristics of the children and their families to identify simple bivariate patterns in relationships to children's employment situation (i.e., not employed, employed in risky work, employed in other work).[10] While both groups of employed children are somewhat older on average than those who are not employed, there is no appreciable difference in the average age of those in risky work and those in other work (14.9 years vs. 14.7 years). We do, however, observe statistically significant differences by gender and urban/rural residence.[11] In Table 2 we see that a slightly higher percentage of girls than boys is employed in risky work (4.5% vs. 4.2%, significantly different at 10%). Furthermore, among those children who are employed, a much higher percentage of girls work in the hazardous occupations, compared to boys (36.4% vs. 18.6%). These dynamics are largely driven by the very high representation of girls among children working in domestic service, making up more than 90 percent of this category of risky work. In contrast, boys are greatly over-represented in the construction industry relative to girls, but this is a much smaller employment category for children.

**Table 2 - Children's Employment in Risky Work, by Demographic Group**

| Group | % of Group Employed in Risky Work | Of Those in Group Who Are Employed, % Employed in Risky Category |
|---|---|---|
| All 10 to 17 | 4.36 | 24.82 |
| Female | 4.52 | 36.42 |
| Male | 4.20 | 18.56 |
| Urban | 3.33 | 25.75 |
| Urban Female | 3.91 | 39.73 |
| Urban Male | 2.76 | 17.22 |
| Rural | 8.87 | 23.35 |
| Rural Female | 7.34 | 30.21 |
| Rural Male | 10.26 | 20.34 |

[10] All descriptive statistics are adjusted for sample weighting to make them representative of the population.

[11] In the discussion of descriptive results based on Tables 2 and 3 and Figures 1 and 2, all differences mentioned are statistically significant at a five percent level or less unless otherwise noted.

Table 2 also shows that employment of children in risky occupations in Brazil is much more likely in rural areas than in urban areas (8.9% vs. 3.3%). This is, of course, due to the prevalence of hazardous farming in rural areas. The other categories of hazardous work (domestic service, street work and construction) are more common among urban than rural children. However, even though risky work considered as a whole is more common for children in rural areas, the percentage of all child employment that falls into our four risky categories is slightly greater in urban areas (25.8% vs. 23.4%).

Consistent with Table 2, we see in Table 3 that children who are employed in risky work are much more likely to be female (51.4%) than are children engaged in other types of employment (29.6%). Table 3 also suggests that children employed in risky work may be disadvantaged in various ways in comparison to children engaged in other work and children who are not employed. Specifically, they tend to come from larger families (2.8 siblings vs. 2.4 and 1.9 siblings), are less likely to have a mother in the household (82.2% vs. 88.3 and 89.7%), and are less likely to have a father in the household (68.3% vs. 76.3 and 73.9%). Children employed in domestic service are particularly likely to be lacking a parent (not shown). Furthermore, among children with parent(s) present, the parents of children in risky work have lower levels of education on average, especially in comparison to the parents of children who are not employed. Schooling levels are particularly low for parents of children engaged in hazardous farming, at 2.1 years for mothers and 1.8 years for fathers. This is partly a by-product of these families being concentrated in rural areas where schools were less available when the parents were of school age. Overall, the results regarding demographic characteristics and parental education suggest that children whose family circumstances are likely indicative of greater economic vulnerability are more likely to end up working in hazardous occupations.

**Table 3 - Characteristics of Children and Families, by Child's Employment Situation**

| | Among Not-Employed Children: | Among Children Employed in Other Work: | Among Children Employed in Risky Work: |
|---|---|---|---|
| % Female | 52.64 | 29.58 | 51.36 |
| Number of Siblings | 1.91<br>(1.52) | 2.42<br>(1.84) | 2.79<br>(2.01) |
| % with Mother | 89.70 | 88.32 | 82.22 |
| Mother's Years of School | 5.96<br>(4.38) | 4.07<br>(3.74) | 3.04<br>(3.02) |
| % with Father | 73.86 | 76.31 | 68.34 |
| Father's Years of School | 5.74<br>(4.53) | 3.55<br>(3.67) | 2.68<br>(2.95) |
| Family Income per Capita in m.s. | 1.26<br>(2.20) | 0.92<br>(1.27) | 0.58<br>(0.53) |
| % of Family Income from Child (if paid) | -- | 23.94 | 24.78 |

Notes: Standard deviations for mean values are in parentheses. Family income includes earned and unearned income of all family members.

A similar picture emerges when looking at income data. The families of children employed in hazardous work have a substantially lower total income per capita than the families of children engaged in other work or not employed (0.58 minimum salaries vs. 0.92 and 1.26 minimum salaries).[12] However, among employed children who are paid, those employed in hazardous occupations and those employed in other types of paid work contribute a substantial fraction (approximately 25%) and similar proportion to family income (the difference is not statistically significant, even at a 10% level). Thus, it does not appear to be the case that families with children engaged in risky work are especially reliant on children for income in comparison to other families with employed kids. The percentage contribution to family income also does not vary substantially across types of risky work.

Figures 1 and 2 present evidence on children's employment conditional on their mother's and father's employment situations. We see that the probability of children being employed in risky work is greater if their mothers are employed in those occupations, in

[12] In Brazil, family income is often measured in units of monthly minimum salaries, usually on a per capita basis. A monthly minimum salary in October 2001 was 180 Reals, or about US$75.

comparison to when mothers are employed in other work or are not employed (11.2% vs. 3.0 and 2.5%).[13] This holds for each of the sub-groups shown, and is especially strong in rural areas because of the prevalence of family farming. This positive association between children's and mother's employment in risky work is just as pronounced for boys as for girls, if not more so. The results conditional on father's employment are highly similar overall (13.2% vs. 4.8% and 2.1%), though with the relationship being much stronger for boys than for girls.[14] We also see for both parents, but especially for fathers, that children whose parents are employed in other work are even less likely to be in risky work than if the parent is absent or not employed. Overall, the results regarding children's type of labor force work conditional on type of parental employment support the strong ties hypothesis of parents "pulling" children into risky work or other types of work through their own work experience.

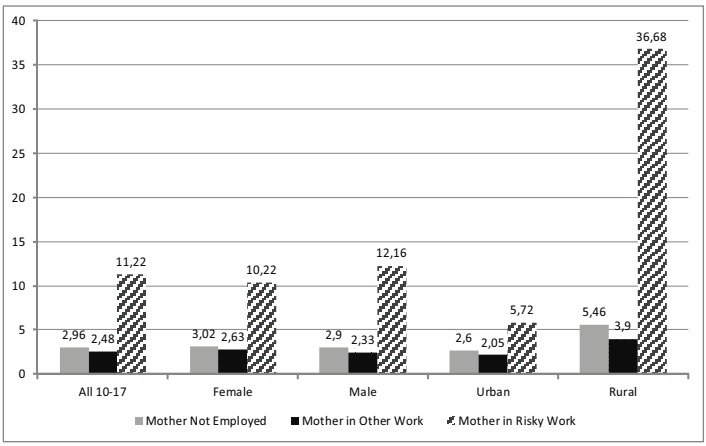


**Figure 1 - Probability of Children being in Risky Work Conditional on Mother's Employment Situation, by Demographic Group**

[13] Children without a mother present are not included in Figure 1. For such children, the probability of being employed in risky work is 7.4 percent.

[14] For fathers, the category of no father present is combined with father not employed, given that non-employment of adult males in Brazil is a signal of serious incapacity (e.g., due to physical or mental illness or lack of responsibility).

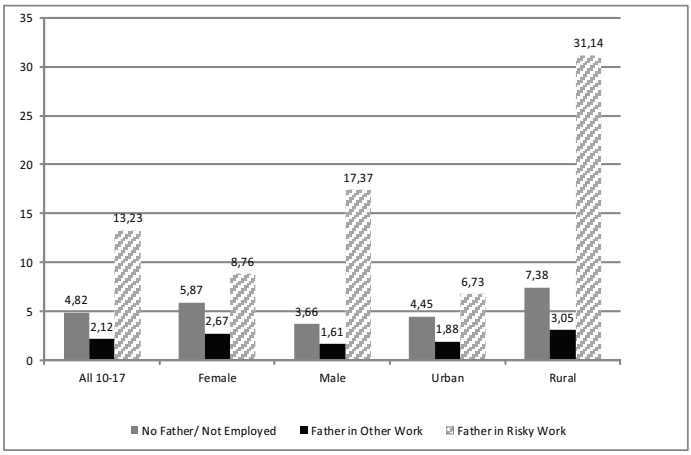


**Figure 2 - Probability of Children being in Risky Work Conditional on Father's Employment Situation, by Demographic Group**

## *Multivariate Model and Estimation Issues*

To explore more fully possible relationships between parental characteristics and children engaging in risky work, we estimate a multivariate model of children's employment, using multinomial logistic regression to distinguish between three outcomes: not employed, employed in other work, or employed in risky work. We adopt this approach rather than using a selection model owing to the lack of exogenous variables that could be used to statistically identify the employment decision from the hazardous work vs. other work outcome. The analysis sample consists of all children aged 10 to 17 (inclusive). As a robustness check, we also conducted the analysis for sub-samples of children and youth ages 10 to 14, 10 to 15, and 16 to 17; the results for these sub-samples, however, are very similar to those we present for the 10 to 17 year-olds, so we only discuss differences by age group that yield additional insights. The model is estimated using the cluster option to correct estimated standard errors for intra-family correlation because some families contribute more than one child to the sample.

The explanatory variables are based on our past research on children's labor force participation in Brazil (DeGraff, Ferro and Levison, 2012) and the descriptive statistics above, as well as the broader child labor literature. The model assumes that households

act to maximize well-being subject to income and time constraints, in part by choosing how to allocate children's time, including whether or not children engage in hazardous work. We further assume that decisions regarding the time allocation of other children and all women in the household are endogenous to decisions about children's labor force participation. Such decisions pertaining to the father and other adult males in the household are assumed exogenous to decisions about the children, however, their participation in hazardous employment is considered endogenous. While we only model the labor force outcome for children ages 10 to 17, these endogeneity assumptions have implications for the specification of explanatory variables. In general terms, the explanatory variables fall into distinct conceptual sets: characteristics of the children (age, gender), characteristics of parents (presence, age, education, mother's predicted wage), economic characteristics of the family (business or farm ownership, exogenous income, wealth), household demographic characteristics, and locational characteristics. The model is estimated for the full sample and also separately for boys and girls. Definitions of variables and descriptive statistics are included in the Appendix. We turn now to selected estimation issues before presenting the empirical results.

### *Missing Parents*

One of our primary interests is to examine how the characteristics of parents relate to whether children are engaged in risky work. However, some children in the sample do not have a mother and/or a father in the household. As discussed above, we do not want to exclude such children from the analysis as they may be particularly vulnerable. Therefore, for this subset of children, we set the measures of parental characteristics equal to zero, and control for the absence of parents with dummy variables.

### *Wage Proxy*

In view of the possible close connections between mother's and children's time allocation, we control for mother's wage earning potential in the model of children's employment. Because some of the mothers either do not work in the labor market or do so on an

unpaid basis, we are able to observe wages for only a subset of the mothers.[15] The percentage of women with observed wages is large enough that we can impute wages for all women. We do so by first estimating wage equations separately for rural and urban areas, controlling for selection into paid employment using a full information maximum likelihood Heckman procedure, for a sample of women in an age range to potentially have children ages 10 to 17. Based on these results, we impute wages for the mothers of children in the analysis sample.[16] As mentioned, some children in the sample are without a mother, thus, mother's wage cannot be imputed. For these children, we adopt an approach similar to that described above for missing parents, adjusted to take into account that we use the natural log of mothers' wage.[17]

### *Income and Wealth Measures*

We include three measures of "exogenous" income – total labor income of males ages 25 and older in the family, receipt of employment benefits by any male age 25 and older, and non-labor family income. However, income is generally not considered to be reliably measured in the PNAD surveys. To get a better measure of a family's long-term resources, we follow the example of Filmer and Pritchett (2001), DeGraff and Levison (2009), and Assaad, Levison and Zibani (2010), and construct a proxy for household wealth. First, we create a linear index for wealth from information on asset ownership, using factor analysis.[18] The factor analysis is

[15] For those with observed earnings from labor, the observed hourly wage is calculated as follows: hourly wage = monthly labor earnings / (usual *paid* hours worked per week * 4.2).

[16] The variables used to identify the selection equation from the wage equation are husband's presence, and education and skin color if present, exogenous measures of family income and wealth, and state-level wage proxies. Each of these variables is likely to affect a woman's participation in paid employment, but should have no effect on wage offers as they do not reflect her own labor market potential or local labor market conditions. The majority of these variables are statistically significant. The variables used to identify the wage equation from the children's employment equation are the standard higher order variables: mother's education-squared and age interacted with education. Both are statistically significant.

[17] Because we convert wages to natural logs, we cannot simply set the wage to zero for those cases with no mother as its natural log would be undefined. Instead, we set the estimated natural log of wage to a value clearly below the minimum predicted for the sample of mothers. The model presented here uses a value of -3.0, but results are not sensitive to using a value as low as -10.0 (the lowest predicted value is about -2.5).

[18] Information on assets is based on details about the residence – materials of walls and roof, access to piped water, private toilet, garbage collection, lighting – as well the household's

conducted separately for urban and rural residents, and the results scored to derive a continuous variable representing wealth for each sub-sample, with higher wealth associated with higher scores.[19] To facilitate interpretation of the wealth variable, we divide the urban and rural wealth indices into approximate quintiles (heaping precludes exact quintiles) and create five dummy variables for each index corresponding to wealth quintile. Each child is then assigned wealth quintile dummy variables according to their score and urban or rural residence.

## 3. Multivariate Results: Who does Risky Work?

The full set of regression results are presented in the Appendix. While our interest lies primarily with the results for the risky work outcome, we first briefly discuss the results for participation in "other work," the much more common work outcome for employed children. Results for "other work" vs. "not employed" for the full sample show that the model as a whole performs well and is consistent with our previous research on Brazil. The pseudo R-squared value is greater than 20 percent and many variables are statistically significant in the expected direction. Boys are more likely to be employed in other work than girls, as are older children with each progressive year of age. Children of more highly educated parents are less likely to be employed, and children from families with greater income potential, as measured by mother's predicted wage and the exogenous income measures, are less likely to be engaged in other work. Ownership of a family farm or business, which can generate demand for family labor as well as provide easy access to employment for children, positively affects employment among children. The wealth indices also behave as expected, with children from wealthier families being less likely to engage in other work than those in the lowest wealth quintile. The controls for household demographic composition, taken as a whole, suggest a pattern in which the presence of a larger number of children increases the likelihood of children engaging in other work, whereas a greater number of

possession of a telephone, refrigerator, freezer, washing machine, gas or electric stove, radio, color TV, black and white TV, or computer.

[19] The analysis was conducted using maximum likelihood estimation without rotation. Only one factor was retained, as in the sources cited previously.

adults decreases children's employment. The locational characteristics indicate that children in rural and non-metropolitan areas are more likely to be employed in other work, with results for the regional dummy variables being consistent with regional differences in level of economic development in Brazil.

Rather than discussing the detailed results, we summarize in Table 4 the relative risk (odds) ratios for the explanatory variables of greatest interest to us. The upper panel of the table pertains to "risky work" vs. "not employed," and the lower panel pertains to "risky work" vs. "other work." All numerical results in the table are derived from statistically significant coefficients at a five percent level of significance or lower, unless otherwise noted. Relative risk ratios allow for direct comparison of the magnitude of effects, as well as the direction. Based on a standardized reference point of 1.00, values between 0 and 1.00 correspond to a negative relationship, while values greater than 1.00 correspond to a positive relationship, with the distance from 1.00 indicating the magnitude of the estimated effect.

The first evidence of gender differences in the multivariate analysis can be seen in the results for the female dummy variable in the full sample. Girls are much less likely than boys to be employed in risky work relative to not being employed (0.76). However, girls are much more likely than boys to be employed in risky work relative to being employed in other work (2.25). This pattern is also found for each of the age-based sub-samples (not shown). Thus, the result from the descriptive analysis that employed girls are over-represented in risky work holds, even when controlling for all other explanatory variables.

**Table 4 - Relative Risk Ratios from Multinomial Logit Models of Children's Employment Outcomes**

| Employment Outcome<br>Explanatory Variables | Full Sample | Boys | Girls |
|---|---|---|---|
| **Risky Work vs. Not Employed**[a] | | | |
| Female | .76 | NA | NA |
| Mother present | 1.82 | 2.27 | NS |
| Father present | NS | NS | NS |
| Mother's education | .92 | .95 | .89 |
| Father's education | .95 | .95 | .95 |
| Exogenous labor income | .98 | .97 | .98 |
| Mother's predicted wage | NS | .75 | NS |
| Family business | 1.42 | 1.97 | NS |
| Family farm | 2.22 | 3.23 | 1.47 |
| Wealth quintile (ref: poorest) | | | |
| Second | .84 | NS | .73 |
| Third | .65 | .70 | .59 |
| Fourth | .63 | .63 | .63 |
| Fifth (wealthiest) | .45 | .37 | .54 |
| Urban | .39 | .21 | .67 |
| **Risky Work vs. Other Work** | | | |
| Female | 2.25 | NA | NA |
| Mother present | NS | NS | NS |
| Father present | NS | NS | NS |
| Mother's education | .93 | NS | .88 |
| Father's education | .98* | NS | .96 |
| Exogenous labor income | .98 | .97 | NS |
| Mother's predicted wage | NS | .82* | 1.41 |
| Family business | NS | 1.24 | .69 |
| Family farm | .80 | NS | .58 |
| Wealth quintile (ref: poorest) | | | |
| Second | NS | 1.26 | NS |
| Third | .83 | NS | .69 |
| Fourth | .77 | NS | .66 |
| Fifth (wealthiest) | .65 | .62 | .61 |
| Urban | 1.16 | .77 | 1.62 |

[a] All results reported in Table 4 are statistically significant at ≤ 5% unless indicated otherwise as follows: NA -- not applicable; NS -- not statistically significant; * -- significant at 10%.
Full regression results are reported in Appendix Tables A.3, A.4 and A.5.

We also see that higher levels of parental education, as expected, are associated with a reduced likelihood that children engage in risky work, either when compared to the "not employed" category or to the "other work" category. What is of greater interest is that this negative effect of parental education is generally stronger for mother's education than for father's education, and for girls than for boys. Indeed, the effects of parental education on boys are very small and of the same magnitude for mothers and fathers in the

comparison between risky work and not employed (0.95 and 0.95), while in the comparison between risky work and other work are not statistically significant. Overall, whether girls end up working in hazardous jobs is more strongly associated with parental education, especially mother's education, than is the case for boys (0.89 vs. 0.95 and 0.88 vs. not significant). This result is likely driven, at least in part, by the preponderance of females in domestic service work, the ease of entry into domestic service for women with little or no formal education, and the relatively easy entry of girls into domestic service when their mothers are so employed. The analysis by age sub-samples also shows that father's education is not statistically significant for the older age group (16-17) in distinguishing risky work from other work, but mother's education maintains significance for this comparison across all age groups.

The results for exogenous family labor income are highly similar for girls and boys. We see a negative income effect, as expected, on the likelihood that children from higher income families participate in risky employment. The effects, however, are very small, both when compared to the "not employed" category and to the "other work" category (0.98 for both in the full sample and not statistically significant for girls (or for the younger sub-sample) in distinguishing risky work from other work). Note that the small magnitude of the estimated effects is not an artifact of units of measurement, as income is measured in hundreds of Reals with a mean value of about five. Parental education seems to be a more important influence on whether children engage in risky work than is family income as measured in the PNAD.

In contrast, the results for the mother's wage are strikingly different for boys and girls. The wage effect is more complicated because in addition to traditional income effects, it potentially embodies traditional substitution (price) effects as well as less well recognized effects such as access to employment through networks. Overall, boys experience a substantial negative association with a higher maternal wage, both for "risky work" relative to "not employed" and relative to "other work" (0.75 and 0.82). This suggests dominance of a sizeable income effect of mother's wage on the likelihood of risky work among boys. For girls, however, the relationship of mother's wage to participation in "risky work" versus "not employed" is not statistically significant, although it is positive and significant with respect

to participation in "other work" (1.41). In other words, among girls who are employed, those whose mothers have higher wage earning potential are more likely to be engaged in risky work (after controlling for other factors, mother's education in particular). This result is consistent with dominance of a networks/access effect for girls, whereby mothers in comparatively well-paid but risky work (such as domestic service) pull their daughters into similar work.

Ownership of a family business and especially of a family farm, have strong positive effects (1.97 and 3.23) on the likelihood that boys are engaged in risky work relative to not being employed. The demand for family labor combined with ease of entry into employment seems to encourage the participation of boys in these family enterprises, even if the work is in the risky category. This effect is much less pronounced for boys when comparing "risky work" to "other work" (1.24 and not significant), suggesting that the practice of boys joining the family enterprise is almost as likely in the context of other work as for risky work. For girls, the pattern is less clear. The presence of a family business has no effect on their participation in risky work relative to non-employment, whereas a family farm has a modest positive effect (1.47). In contrast, both forms of family enterprise substantially decrease the likelihood of risky work relative to other work among girls (0.69 and 0.58). Taken as a whole, these results suggest that girls are less likely than boys to work in a family enterprise if the production activity is in the hazardous category.

The results for the set of dummy variables representing wealth quintiles are largely as expected. In general, being in a family with greater wealth holdings substantially decreases the likelihood that children are employed in risky jobs. These associations appear to be stronger in distinguishing "risky work" from "not employed" than from "other work," and are more consistent for girls than for boys, although note that boys from households in the highest wealth category have very low predicted odds of engaging in risky work relative to not being employed (0.37). These findings regarding longer term economic status are consistent with the positive current income effects already discussed. Similarly, at the aggregate level, we see a sizeable negative relationship between residing in the more economically developed urban areas and employment in risky work, especially for boys (0.21 for boys, 0.77 for girls). The one exception here is that girls who reside in urban areas are much more likely to

be employed in "risky work" relative to being employed in "other work" (1.62). This finding is consistent with the high concentration of females in domestic service in urban areas.

Finally, returning to one of the striking results from the descriptive analysis, we see that once we control for a variety of parental and family characteristics, the presence of a mother or a father generally does not have a statistically significant association with children's employment in risky work. The one exception is the large positive association of mother's presence (i.e., negative association of mother's absence) with the likelihood that boys are employed in risky work relative to not being employed at all. Other than this exception, which itself runs counter to the vulnerability hypothesis, the greater vulnerability of children without a mother or father is well captured by family income and wealth measures, parental education, and other explanatory variables. This, of course, does not imply that children missing a parent are not particularly likely to engage in hazardous work, as lacking a parent tends to be fairly highly correlated with those characteristics that are statistically significant. It does suggest, though, that the absence of a parent as a catalyst for children engaging in risky work can to some degree be offset, for example, by a better education or income potential of the remaining parent, if present. It also suggests that even children from two-parent households are particularly vulnerable to risky work if their parents rank low on specific social and economic indicators.

In order to better understand the magnitude of predicted effects on the overall probability of risky work, we conduct simulations to isolate the impact of changes in these key social and economic indicators.[20] The results of this exercise suggest sizeable impacts. For example, if the minimum level of mothers' education is set at 6 years, corresponding to completion of primary school (the mean is 5.6 years), the average predicted probability of risky work declines from 4.30 to 3.58, a decline of 16.74 percent. Similarly, moving children in the lowest wealth category into the second wealth category results in an average predicted decline of 26.74 percent. Perhaps of greater interest are simulations which compare "reference" children to "vulnerable" children. We consider four reference cases, urban girls aged 13 and 16, and rural boys aged 13 and 16. For each case,

[20] These simulations are conducted using the full sample, the full set of estimated coefficients, and the actual values of explanatory variables for all variables except the one selected for simulation.

the quantitative explanatory variables are set to their mean values for the sample, the third wealth quintile is assigned, and the other dummy variables are set to the most common category. The vulnerable child for each case is assigned the same characteristics as the reference child, with the following exceptions: mother's and father's education are set to zero, exogenous family labor income is set to one (the median is approximately two), and the lowest wealth quintile is selected. The simulations are conducted alternatively using the estimated coefficients from the full sample and the estimated coefficients from the gender-based sub-samples. The results of these simulations are summarized in Table 5. For example, using the total sample the model predicts a 3.28 percent chance of the reference 16-year-old urban girl engaging in risky work, whereas her vulnerable counterpart is more than three times as likely to engage in risky work (10.23 percent). Overall for girls, for either age or sample, the vulnerable girl is at least three times as likely to be in risky work than the corresponding reference girl. For boys the differences are not quite as pronounced but are still sizeable, with the probability of risky work for the vulnerable boy ranging from about 1.5 times to more than twice as large as for the reference boy, depending on age and sample.

**Table 5 - The Probability (%) of Engaging in Risky Work: Simulations Comparing "Reference" Children to "Vulnerable" Children**

| | Probabilities Calculated Using Estimated Coefficients from: | | | | | |
|---|---|---|---|---|---|---|
| | Total sample | | Girls' sample | | Boys' Sample | |
| | reference | vulnerable | reference | vulnerable | reference | vulnerable |
| Girls age 16, urban | 3.28 | 10.23 | 3.57 | 14.92 | -- | -- |
| Girls age 13, urban | 0.97 | 3.34 | 1.22 | 5.61 | -- | -- |
| Boys age 16, rural | 6.96 | 15.18 | -- | -- | 11.59 | 17.08 |
| Boys age 13, rural | 4.12 | 10.66 | -- | -- | 6.75 | 11.95 |

Note: Reference children are assigned mean values for quantitative variables and the most common value for dummy variables. Vulnerable children are assigned the same values as reference children except for the following: mother's and father's education are set to zero, exogenous family labor income is set to one, and the lowest wealth quintile is selected.

## 4. Discussion

An important purpose of exploratory analyses such as this is to point to directions for future research and policy. Funding aimed at the social protection of children is limited, and there are many different – and worthy – purposes to which it could be put. In the child labor arena, ILO Convention 182 has already established that children in convention-defined "worst forms" and country-defined "hazardous" work should be targeted. Our analysis documents that, in the case of Brazil at least, children engaged in such risky occupations are, on average, less likely than even other employed children to be enrolled in school, and more likely to work long hours and experience a variety of working conditions that may be unsafe. We also see that there are likely to be vast differences between girls and boys in their experience working in hazardous occupations, and that girls are overrepresented in risky jobs in Brazil. Moreover, we believe that more generally some children doing hazardous work are at greater risk than others, and this should also be a criterion for targeting.

But in a context where much child labor is already illegal, how can children in these situations be identified? Such children's work will tend to be hidden from authorities. One approach suggested by our research is to target adults working in occupation/industry categories that are thought to be hazardous for children. The daughters and sons of such adults have been shown to be at increased risk of following their parents' footsteps into hazardous work. In particular, daughters of women engaged in higher wage work are more likely to be employed in risky work than in other types of work. Furthermore, the ownership of a family farm is strongly associated with children, especially boys, engaging in hazardous work relative to not participating in the labor force. Reducing hazardous child farm work is a challenge around the world, as much child farm labor is legal because it takes place in a family enterprise. However, certain tasks – those that are hazardous to children – are forbidden for children. Targeting interventions in regions where the most problematic crops are grown, both to educate parents about steps of the production process that are especially harmful for children, as well as providing alternative non-hazardous work alternatives for youth, could prove especially beneficial.

In addition, low levels of parental education, especially of mothers, show a strong relationship to children engaging in risky work. Similarly, a very low level of wealth, as indicated by structural features of the home and ownership of basic material assets, is fairly strongly associated with children's employment in hazardous work. Such characteristics are relatively easily identifiable and could therefore aid in targeting households. The absence of parents is also a potentially important targeting mechanism. We have shown that, when not controlling for more detailed socioeconomics characteristics, such children are especially vulnerable. This could be a useful condition to target as it may be even more easily identified than some of the underlying socioeconomic characteristics highlighted in the multivariate analysis.

In sum we argue, and believe most would agree, that programs should aim to protect the most vulnerable children from the most problematic work. Our research suggests ways in which existing information about parents and families can be used to help target intervention. In addition, our work points to a number of areas in which information tends to be lacking, especially information pertaining to what children actually do during the course of their labor force work. In countries such as Brazil where much child labor takes place in agriculture, it would be particularly useful to gain a better understanding of how the production activities of children differ across crops, and for the same crop grown under varying conditions, in order to more effectively target interventions. It is our hope that this study of kids in risky work in Brazil will encourage further thinking along these lines.

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**Table A1 - Variable Definitions for Multinomial Regressions**

| Variable Name | Variable Definition |
|---|---|
| empgoodbad | Dependent variable: child is not employed=0, employed in "other" work=1, employed in "risky" work=2 |
| female | Child is female |
| age | Age of child |
| age10 | Child is age 10 (omitted category) |
| age11 | Child is age 11 |
| age12 | Child is age 12 |
| age13 | Child is age 13 |
| age14 | Child is age 14 |
| age15 | Child is age 15 |
| age16 | Child is age 16 |
| age17 | Child is age 17 |
| anymomin | Child's mother (or step-mother) is present |
| mage | Mother's age (=0 if no mother) |
| momeduc | Mother's years of schooling (=0 if no mother) |
| mlwghatall | Mother's predicted log wage (=-3 if no mother) |
| anydadin | Child's father (or step-father) is present |
| dage | Father's age (=0 if no father) |
| deduc | Father's education (=0 if no father) |
| fambus2 | Family owns a business |
| famfarm2 | Family owns a farm |
| fmexlby100 | Exogenous family labor income/100 |
| fmnonlby100 | Family non-labor income/100 (unadjusted for missing values) |
| nonlby | Family non-labor income/100 (with missing adjusted to 0) |
| nonlbymiss | Indicator for non-labor income missing |
| famexben | Exogenous family employment benefits |
| wealth1 | Family is in lowest wealth quintile (omitted category) |
| wealth2 | Family is in second wealth quintile |
| wealth3 | Family is in third wealth quintile |
| wealth4 | Family is in fourth wealth quintile |
| wealth5 | Family is in fifth wealth quintile |
| sibs0_3 | # of siblings age 0-3 in household |
| sibs4_5 | # of siblings age 4-5 in household |
| sibs6_9 | # of siblings age 6-9 in household |
| gsb10_14 | # of female siblings age 10-14 in household |
| gsb15_17 | # of female siblings age 15-17 in household |
| bsb10_14 | # of male siblings age 10-14 in household |
| bsb15_17 | # of male siblings age 15-17 in household |
| kidrl0_3 | # of relatives age 0-3 in household |
| kidr14_5 | # of relatives age 4-5 in household |
| kidr16_9 | # of relatives age 6-9 in household |
| gr110_14 | # of female relatives age 10-14 in household |
| gr115_17 | # of female relatives age 15-17 in household |
| br110_14 | # of male relatives age 10-14 in household |
| br115_17 | # of male relatives age 15-17 in household |
| fhh18_59 | # of females 18-59 in household |
| fhh60_up | # of females 60+ in household |
| mhh18_59 | # of males 18-59 in household |
| mhh60_up | # of males 60+ in household |

**Table A1 - Variable Definitions for Multinomial Regressions** *(Continuation)*

| Variable Name | Variable Definition |
|---|---|
| urban | Urban residence (rural is omitted category) |
| metro2 | Metropolitan area residence (non-metropolitan is omitted category) |
| regionne | Region – Northeast (omitted category) |
| regionn | Region – North |
| regionse | Region – Southeast |
| regions | Region – South |
| regioncw | Region – Central West |

**Table A2 - Descriptive Statistics for Full Sample 10-17**

| Variable | Mean | Std. Dev. | Variable (cont.) | Mean | Std. Dev. |
|---|---|---|---|---|---|
| empgoodbad | 0.2258 | 0.5107 | wealth4 | 0.1650 | 0.3712 |
| female | 0.4966 | 0.5000 | wealth5 | 0.1665 | 0.3725 |
| age | 13.5568 | 2.2689 | sibs0_3 | 0.1510 | 0.4193 |
| age10 | 0.1184 | 0.3230 | sibs4_5 | 0.1150 | 0.3422 |
| age11 | 0.1185 | 0.3232 | sibs6_9 | 0.3500 | 0.6124 |
| age12 | 0.1240 | 0.3296 | gsb10_14 | 0.2621 | 0.5124 |
| age13 | 0.1268 | 0.3328 | gsb15_17 | 0.1429 | 0.3761 |
| age14 | 0.1287 | 0.3349 | bsb10_14 | 0.2693 | 0.5220 |
| age15 | 0.1301 | 0.3365 | bsb15_17 | 0.1683 | 0.4067 |
| age16 | 0.1299 | 0.3362 | kidrl0_3 | 0.0885 | 0.3501 |
| age17 | 0.1235 | 0.3290 | kidr14_5 | 0.0337 | 0.1973 |
| anymomin | 0.8871 | 0.3165 | kidr16_9 | 0.0476 | 0.2522 |
| mage | 35.3311 | 14.3308 | gr110_14 | 0.0551 | 0.2677 |
| momeduc | 5.0007 | 4.4552 | gr115_17 | 0.0654 | 0.2663 |
| mlwghatall | -0.3668 | 1.1640 | br110_14 | 0.0525 | 0.2590 |
| anydadin | 0.7291 | 0.4444 | br115_17 | 0.0371 | 0.2033 |
| dage | 31.7858 | 20.7544 | fhh18_59 | 0.3365 | 0.6478 |
| deduc | 3.8785 | 4.4853 | fhh60_up | 0.0831 | 0.2825 |
| fambus2 | 0.2024 | 0.4018 | mhh18_59 | 0.4230 | 0.7359 |
| famfarm2 | 0.0940 | 0.2918 | mhh60_up | 0.0446 | 0.2090 |
| fmexlby100 | 4.8496 | 11.1033 | urban | 0.8358 | 0.3705 |
| fmnonlby100 | 1.3141 | 4.0554 | metro2 | 0.3569 | 0.4791 |
| nonlby | 1.3104 | 4.0504 | regionne | 0.3524 | 0.4777 |
| nonlbymiss | 0.0028 | 0.0524 | regionn | 0.1217 | 0.3269 |
| famexben | 0.2205 | 0.4146 | regionse | 0.2766 | 0.4473 |
| wealth1 | 0.2324 | 0.4223 | regions | 0.1427 | 0.3498 |
| wealth2 | 0.2070 | 0.4052 | regioncw | 0.1066 | 0.3086 |
| wealth3 | 0.2292 | 0.4203 | | | |
| N | 60678 | | | | |

**Table A3 - Regression Results for Full Sample 10-17**

| | Employed in Other Work vs. Not Employed | | | Employed in Risky Work vs. Not Employed | | | Employed in Risky Work vs. Other Work | | |
|---|---|---|---|---|---|---|---|---|---|
| empgoodbad | Coef. | Robust Std. Err. | | Coef. | Robust Std. Err. | | Coef. | Robust Std. Err. | |
| female | -1.08033 | 0.03134 | * | -0.26978 | 0.04835 | * | 0.81055 | 0.05321 | * |
| age11 | 0.21611 | 0.07491 | * | 0.42411 | 0.14815 | * | 0.20800 | 0.16309 | |
| age12 | 0.67726 | 0.06913 | * | 0.82761 | 0.13787 | * | 0.15035 | 0.15013 | |
| age13 | 0.98682 | 0.06693 | * | 1.26924 | 0.13258 | * | 0.28242 | 0.14464 | ** |
| age14 | 1.34375 | 0.06672 | * | 1.78829 | 0.12821 | * | 0.44453 | 0.14033 | * |
| age15 | 1.84738 | 0.06664 | * | 2.11300 | 0.12968 | * | 0.26563 | 0.14180 | ** |
| age16 | 2.28553 | 0.06660 | * | 2.58710 | 0.12975 | * | 0.30157 | 0.14087 | * |
| age17 | 2.62071 | 0.06716 | * | 2.93720 | 0.13006 | * | 0.31650 | 0.14108 | * |
| anymomin | 0.28054 | 0.15848 | ** | 0.59672 | 0.27223 | * | 0.31617 | 0.29402 | |
| mage | 0.00114 | 0.00293 | | -0.00745 | 0.00495 | | -0.00859 | 0.00530 | |
| momeduc | -0.01684 | 0.00726 | * | -0.08652 | 0.01274 | * | -0.06968 | 0.01361 | * |
| mlwghatall | -0.11191 | 0.04188 | * | -0.04380 | 0.07833 | | 0.06812 | 0.08382 | |
| anydadin | 0.02420 | 0.12896 | | 0.15014 | 0.21862 | | 0.12594 | 0.23719 | |
| dage | 0.00026 | 0.00249 | | -0.00278 | 0.00431 | | -0.00303 | 0.00465 | |
| deduc | -0.02999 | 0.00601 | * | -0.05043 | 0.01095 | * | -0.02044 | 0.01183 | ** |
| fambus2 | 0.41479 | 0.04448 | * | 0.34811 | 0.07503 | * | -0.06668 | 0.08088 | |
| famfarm2 | 1.01393 | 0.05487 | * | 0.79643 | 0.08545 | * | -0.21750 | 0.09018 | * |
| mexlby100 | -0.00428 | 0.00197 | * | -0.02367 | 0.00608 | * | -0.01940 | 0.00616 | * |
| nonlby | -0.03518 | 0.00625 | * | -0.06884 | 0.01711 | * | -0.03366 | 0.01777 | ** |
| nonlbymiss | 2.63561 | 0.47652 | * | 6.75507 | 0.42832 | * | 4.11947 | 0.42274 | * |
| famexben | -0.24936 | 0.04652 | * | -0.37350 | 0.08501 | * | -0.12413 | 0.09186 | |
| wealth2 | -0.25037 | 0.04622 | * | -0.17331 | 0.06847 | * | 0.07706 | 0.07483 | |
| wealth3 | -0.25134 | 0.04688 | * | -0.43244 | 0.07606 | * | -0.18110 | 0.08247 | * |
| wealth4 | -0.19847 | 0.05413 | * | -0.45811 | 0.09285 | * | -0.25963 | 0.09986 | * |
| wealth5 | -0.36126 | 0.06630 | * | -0.79240 | 0.12186 | * | -0.43114 | 0.12991 | * |
| sibs0_3 | 0.05231 | 0.04061 | | 0.05881 | 0.05977 | | 0.00651 | 0.06754 | |
| sibs4_5 | 0.03529 | 0.04852 | | 0.11750 | 0.07677 | | 0.08221 | 0.08328 | |
| sibs6_9 | 0.05440 | 0.02832 | ** | 0.15644 | 0.04400 | * | 0.10204 | 0.04779 | * |
| gsb10_14 | 0.13567 | 0.02908 | * | 0.14261 | 0.04503 | * | 0.00693 | 0.04769 | |
| gsb15_17 | 0.09575 | 0.04219 | * | 0.11119 | 0.06935 | | 0.01544 | 0.07305 | |
| bsb10_14 | 0.08925 | 0.02949 | * | 0.20188 | 0.04415 | * | 0.11264 | 0.04736 | * |
| bsb15_17 | 0.13596 | 0.03796 | * | 0.18848 | 0.05974 | * | 0.05253 | 0.06514 | |
| kidrl0_3 | 0.08847 | 0.04642 | ** | 0.16804 | 0.06145 | * | 0.07958 | 0.06877 | |
| kidrl4_5 | -0.08638 | 0.08691 | | 0.03148 | 0.11121 | | 0.11786 | 0.13011 | |
| kidrl6_9 | -0.09028 | 0.06707 | | -0.00210 | 0.08456 | | 0.08818 | 0.09434 | |
| grl10_14 | -0.05862 | 0.07227 | | 0.12666 | 0.09205 | | 0.18528 | 0.10703 | ** |
| grl15_1 7 | -0.09723 | 0.06443 | | -0.02638 | 0.09164 | | 0.07086 | 0.10111 | |

**Table A3 - Regression Results for Full Sample 10-17** *(Continuation)*

| | Employed in Other Work vs. Not Employed | | | Employed in Risky Work vs. Not Employed | | | Employed in Risky Work vs. Other Work | | |
|---|---|---|---|---|---|---|---|---|---|
| empgoodbad | Coef. | Robust Std. Err. | | Coef. | Robust Std. Err. | | Coef. | Robust Std. Err. | |
| brl10_14 | 0.05666 | 0.06908 | | 0.03861 | 0.10543 | | -0.01805 | 0.11496 | |
| brl15_17 | 0.28216 | 0.06354 | * | 0.13295 | 0.10243 | | -0.14920 | 0.10770 | |
| fhh18_59 | -0.01182 | 0.02646 | | 0.05089 | 0.04090 | | 0.06271 | 0.04437 | |
| fhh60_up | -0.18854 | 0.06254 | * | -0.09330 | 0.10474 | | 0.09525 | 0.11244 | |
| mhh18_59 | -0.05478 | 0.02244 | * | 0.04402 | 0.03514 | | 0.09880 | 0.03706 | * |
| mhh60_up | -0.13938 | 0.08222 | ** | -0.21773 | 0.13661 | | -0.07835 | 0.14895 | |
| urban | -1.09195 | 0.04664 | * | -0.94073 | 0.07104 | * | 0.15122 | 0.07523 | * |
| metro2 | -0.35800 | 0.03669 | * | -0.52567 | 0.06299 | * | -0.16766 | 0.06844 | * |
| regionn | -0.26755 | 0.05685 | * | 0.10826 | 0.08662 | | 0.37581 | 0.09349 | * |
| regionse | 0.12692 | 0.04379 | * | 0.44458 | 0.07384 | * | 0.31766 | 0.08001 | * |
| regions | 0.56977 | 0.04910 | * | 0.74454 | 0.08569 | * | 0.17477 | 0.09258 | ** |
| regioncw | 0.17987 | 0.05381 | * | 0.47871 | 0.09065 | * | 0.29883 | 0.09722 | * |
| cons | -2.15938 | 0.15434 | * | -3.85133 | 0.28571 | * | -1.69194 | 0.30756 | * |
| Number of obs | 60408 | | | | | | | | |
| Wald chi2(98) | 8935.83 | | | | | | | | |
| Pseudo R2 | 0.2021 | | | | | | | | |

* Statiscally significant at ≤5%. ** Statiscally significant at 10%

**Table A4 - Regression Results for Boys 10-17**

| | Employed in Other Work vs. Not Employed | | | Employed in Risky Work vs. Not Employed | | | Employed in Risky Work vs. Other Work | | |
|---|---|---|---|---|---|---|---|---|---|
| empgoodbad | Coef. | Robust Std. Err. | | Coef. | Robust Std. Err. | | Coef. | Robust Std. Err. | |
| age11 | 0.22861 | 0.09429 | * | 0.31926 | 0.18742 | ** | 0.09066 | 0.20063 | |
| age12 | 0.77077 | 0.08672 | * | 0.73752 | 0.17791 | * | -0.03325 | 0.18745 | |
| age13 | 1.05773 | 0.08559 | * | 1.15850 | 0.16961 | * | 0.10077 | 0.18037 | |
| age14 | 1.48631 | 0.08385 | * | 1.69397 | 0.16309 | * | 0.20766 | 0.17257 | |
| age15 | 2.05022 | 0.08385 | * | 2.11636 | 0.16378 | * | 0.06614 | 0.17364 | |
| age16 | 2.47996 | 0.08364 | * | 2.67947 | 0.16396 | * | 0.19951 | 0.17209 | |
| age17 | 2.83486 | 0.08444 | * | 3.03553 | 0.16499 | * | 0.20067 | 0.17288 | |
| anymomin | 0.22649 | 0.19432 | | 0.82086 | 0.35550 | * | 0.59437 | 0.36846 | |
| mage | -0.00131 | 0.00358 | | -0.00705 | 0.00669 | | -0.00574 | 0.00684 | |
| momeduc | -0.02311 | 0.00905 | * | -0.04664 | 0.01691 | * | -0.02353 | 0.01754 | |
| mlwghatall | -0.09350 | 0.05350 | ** | -0.28921 | 0.09897 | * | -0.19571 | 0.10306 | ** |
| anydadin | -0.09858 | 0.15475 | | 0.12409 | 0.30151 | | 0.22267 | 0.30975 | |
| dage | 0.00350 | 0.00297 | | -0.00107 | 0.00588 | | -0.00457 | 0.00600 | |
| deduc | -0.03808 | 0.00725 | * | -0.04741 | 0.01516 | * | -0.00933 | 0.01579 | |
| fambus2 | 0.46554 | 0.05379 | * | 0.67878 | 0.10183 | * | 0.21324 | 0.10494 | * |
| famfarm2 | 1.15749 | 0.06725 | * | 1.17245 | 0.11250 | * | 0.01496 | 0.11111 | |
| fmexlby100 | -0.00433 | 0.00255 | ** | -0.03222 | 0.01152 | * | -0.02789 | 0.01158 | * |
| nonlby | -0.04064 | 0.00852 | * | -0.04984 | 0.02377 | * | -0.00920 | 0.02437 | |
| famexben | -0.23820 | 0.05681 | * | -0.38100 | 0.12782 | * | -0.14281 | 0.13251 | |
| wealth2 | -0.26570 | 0.05597 | * | -0.03178 | 0.09506 | | 0.23393 | 0.09789 | * |
| wealth3 | -0.29105 | 0.05676 | * | -0.35472 | 0.10729 | * | -0.06368 | 0.11055 | |
| wealth4 | -0.27558 | 0.06696 | * | -0.45949 | 0.13114 | * | -0.18391 | 0.13475 | |
| wealth5 | -0.52013 | 0.08224 | * | -0.99496 | 0.17392 | * | -0.47482 | 0.17784 | * |
| sibs0_3 | 0.12734 | 0.05071 | * | 0.19569 | 0.08473 | * | 0.06835 | 0.08764 | |
| sibs4_5 | 0.08025 | 0.05929 | | 0.12712 | 0.10696 | | 0.04687 | 0.10988 | |
| sibs6_9 | 0.04690 | 0.03448 | | 0.18545 | 0.05739 | * | 0.13855 | 0.05979 | * |
| gsb10_14 | 0.12202 | 0.03567 | * | 0.07567 | 0.06167 | | -0.04635 | 0.06250 | |
| gsb15_17 | 0.05657 | 0.04887 | | -0.05898 | 0.09214 | | -0.11555 | 0.09444 | |
| bsb10_14 | 0.09712 | 0.03674 | * | 0.14083 | 0.06512 | * | 0.04371 | 0.06445 | |
| bsb15_17 | 0.16035 | 0.04729 | * | 0.17540 | 0.08188 | * | 0.01505 | 0.08391 | |
| kidr10_3 | 0.06291 | 0.05892 | | 0.22810 | 0.09494 | * | 0.16519 | 0.10025 | ** |
| kidr14_5 | -0.17283 | 0.09928 | ** | 0.08438 | 0.16246 | | 0.25720 | 0.17701 | |
| kidr16_9 | -0.15122 | 0.08625 | ** | -0.25465 | 0.14774 | ** | -0.10343 | 0.14754 | |
| grl10_14 | -0.04296 | 0.10239 | | 0.07572 | 0.16186 | | 0.11868 | 0.16893 | |
| grl15_1 7 | 0.19164 | 0.10265 | ** | 0.29239 | 0.18029 | | 0.10074 | 0.17916 | |
| brl10_14 | 0.08030 | 0.07724 | | 0.04474 | 0.14430 | | -0.03556 | 0.15246 | |
| brl15_17 | 0.27876 | 0.07951 | * | 0.10257 | 0.14140 | | -0.17619 | 0.14351 | |
| fhh18_59 | -0.03464 | 0.03294 | | -0.08252 | 0.06364 | | -0.04789 | 0.06538 | |

**Table A4 - Regression Results for Boys 10-17** *(Continuation)*

| | Employed in Other Work vs. Not Employed | | | Employed in Risky Work vs. Not Employed | | | Employed in Risky Work vs. Other Work | | |
|---|---|---|---|---|---|---|---|---|---|
| empgoodbad | Coef. | Robust Std. Err. | | Coef. | Robust Std. Err. | | Coef. | Robust Std. Err. | |
| fhh60_up | -0.26811 | 0.07695 | * | -0.49918 | 0.15818 | * | -0.23107 | 0.16276 | |
| mhh18_59 | -0.01626 | 0.02728 | | 0.06535 | 0.04892 | | 0.08161 | 0.04887 | ** |
| mhh60_up | -0.22631 | 0.09794 | * | -0.09286 | 0.18403 | | 0.13345 | 0.18821 | |
| urban | -1.29319 | 0.05878 | * | -1.55848 | 0.10002 | * | -0.26529 | 0.09953 | * |
| metro2 | -0.47591 | 0.04467 | * | -0.43541 | 0.09093 | * | 0.04050 | 0.09552 | |
| regionn | -0.18838 | 0.06833 | * | 0.07467 | 0.12316 | | 0.26305 | 0.12651 | * |
| regionse | 0.10397 | 0.05415 | ** | 0.51078 | 0.10203 | * | 0.40681 | 0.10680 | * |
| regions | 0.47159 | 0.06059 | * | 0.69984 | 0.11865 | * | 0.22824 | 0.12259 | ** |
| regioncw | 0.24730 | 0.06599 | * | 0.38821 | 0.13516 | * | 0.14090 | 0.13861 | |
| cons | -1.92001 | 0.19343 | * | -4.01014 | 0.36070 | * | -2.09013 | 0.37647 | * |
| Number of obs | 30400 | | | | | | | | |
| Wald chi2(94) | 5283.87 | | | | | | | | |
| Pseudo R2 | 0.2114 | | | | | | | | |

* Statiscally significant at ≤5%. ** Statiscally significant at 10%

**Table A5 - Regression Results for Girls 10-17**

| | Employed in Other Work vs. Not Employed | | | Employed in Risky Work vs. Not Employed | | | Employed in Risky Work vs. Other Work | | |
|---|---|---|---|---|---|---|---|---|---|
| empgoodbad | Coef. | Robust Std. Err. | | Coef. | Robust Std. Err. | | Coef. | Robust Std. Err. | |
| age11 | 0.21630 | 0.13192 | | 0.63111 | 0.25407 | * | 0.41481 | 0.28425 | |
| age12 | 0.52814 | 0.12544 | * | 1.03272 | 0.23984 | * | 0.50457 | 0.26838 | ** |
| age13 | 0.91654 | 0.11813 | * | 1.55233 | 0.23148 | * | 0.63578 | 0.25692 | * |
| age14 | 1.15667 | 0.11882 | * | 2.05492 | 0.22348 | * | 0.89825 | 0.25012 | * |
| age15 | 1.56591 | 0.11743 | * | 2.32133 | 0.22592 | * | 0.75542 | 0.25125 | * |
| age16 | 2.06746 | 0.11622 | * | 2.72687 | 0.22528 | * | 0.65941 | 0.24962 | * |
| age17 | 2.36854 | 0.11626 | * | 3.10247 | 0.22495 | * | 0.73393 | 0.24860 | * |
| anymomin | 0.26918 | 0.25324 | | 0.31601 | 0.39250 | | 0.04684 | 0.44565 | |
| mage | 0.00637 | 0.00470 | | -0.00690 | 0.00686 | | -0.01327 | 0.00783 | ** |
| momeduc | 0.00272 | 0.01151 | | -0.12163 | 0.01765 | * | -0.12435 | 0.01993 | * |
| mlwghatall | -0.18365 | 0.06428 | * | 0.15755 | 0.11384 | | 0.34120 | 0.12494 | * |
| anydadin | 0.27406 | 0.21891 | | 0.18505 | 0.29867 | | -0.08902 | 0.35124 | |
| dage | -0.00726 | 0.00431 | ** | -0.00499 | 0.00592 | | 0.00227 | 0.00692 | |
| deduc | -0.01182 | 0.00969 | | -0.05510 | 0.01492 | * | -0.04328 | 0.01714 | * |
| fambus2 | 0.35953 | 0.07187 | * | -0.01708 | 0.10888 | | -0.37661 | 0.12387 | * |
| famfarm2 | 0.92712 | 0.08902 | * | 0.38597 | 0.11888 | * | -0.54115 | 0.13502 | * |
| fmexlby100 | -0.00405 | 0.00280 | | -0.01638 | 0.00819 | * | -0.01234 | 0.00851 | |
| nonlby | -0.02696 | 0.00802 | * | -0.10121 | 0.02423 | * | -0.07426 | 0.02521 | * |
| nonlbymiss | 1.89589 | 0.72602 | * | 6.85610 | 0.48069 | * | 4.96021 | 0.64334 | * |
| famexben | -0.27283 | 0.07547 | * | -0.37617 | 0.11083 | * | -0.10334 | 0.12853 | |
| wealth2 | -0.17714 | 0.07661 | * | -0.31804 | 0.09044 | * | -0.14090 | 0.10898 | |
| wealth3 | -0.16022 | 0.07734 | * | -0.52749 | 0.09754 | * | -0.36726 | 0.11589 | * |
| wealth4 | -0.04241 | 0.08619 | | -0.46471 | 0.11850 | * | -0.42230 | 0.13803 | * |
| wealth5 | -0.12200 | 0.10360 | | -0.61934 | 0.15449 | * | -0.49734 | 0.17580 | * |
| sibs0_3 | 0.00436 | 0.06513 | | -0.05788 | 0.07426 | | -0.06224 | 0.09198 | |
| sibs4_5 | -0.06749 | 0.07672 | | 0.09750 | 0.09476 | | 0.16499 | 0.11274 | |
| sibs6_9 | 0.06385 | 0.04451 | | 0.09696 | 0.06049 | | 0.03311 | 0.07044 | |
| gsb10_14 | 0.14476 | 0.04771 | * | 0.21036 | 0.06167 | * | 0.06560 | 0.07132 | |
| gsb15_17 | 0.14991 | 0.07009 | * | 0.27738 | 0.09243 | * | 0.12747 | 0.10712 | |
| bsb10_14 | 0.06734 | 0.04804 | | 0.26239 | 0.05824 | * | 0.19505 | 0.06924 | * |
| bsb15_17 | 0.09728 | 0.06073 | | 0.20914 | 0.07909 | * | 0.11185 | 0.09235 | |
| kidr10_3 | 0.11428 | 0.07161 | | 0.10044 | 0.07588 | | -0.01384 | 0.09456 | |
| kidr14_5 | 0.07403 | 0.13190 | | -0.00182 | 0.14547 | | -0.07585 | 0.17534 | |
| kidr16_9 | -0.02087 | 0.10011 | | 0.14929 | 0.09928 | | 0.17016 | 0.12706 | |
| grl10_14 | -0.08363 | 0.11371 | | 0.15263 | 0.10846 | | 0.23627 | 0.14768 | |
| grl15_1 7 | -0.05421 | 0.09902 | | -0.01193 | 0.11179 | | 0.04227 | 0.13922 | |
| brl10_14 | -0.02387 | 0.13043 | | -0.00267 | 0.15137 | | 0.02120 | 0.17935 | |
| brl15_17 | -0.11272 | 0.16098 | | -0.04351 | 0.19690 | | 0.06921 | 0.23557 | |
| fhh18_59 | 0.00593 | 0.04167 | | 0.13757 | 0.04923 | * | 0.13164 | 0.05958 | * |
| fhh60_up | -0.18132 | 0.10292 | ** | 0.18839 | 0.13413 | | 0.36971 | 0.15813 | * |
| mhh18_59 | -0.12199 | 0.03762 | * | 0.03174 | 0.04513 | | 0.15373 | 0.05379 | * |
| mhh60_up | -0.01211 | 0.13286 | | -0.40429 | 0.20336 | * | 0.39218 | 0.22919 | ** |
| urban | -0.88617 | 0.07388 | * | -0.40249 | 0.09667 | * | 0.48368 | 0.11048 | * |

**Table A5 - Regression Results for Girls 10-17** *(Continuation)*

| | Employed in Other Work vs. Not Employed | | | Employed in Risky Work vs. Not Employed | | | Employed in Risky Work vs. Other Work | | |
|---|---|---|---|---|---|---|---|---|---|
| empgoodbad | Coef. | Robust Std. Err. | | Coef. | Robust Std. Err. | | Coef. | Robust Std. Err. | |
| metro2 | -0.13775 | 0.05722 | * | -0.60313 | 0.08370 | * | -0.46538 | 0.09691 | * |
| regionn | -0.51092 | 0.10041 | * | 0.14822 | 0.11421 | | 0.65914 | 0.14271 | * |
| regionse | 0.16595 | 0.06809 | * | 0.39101 | 0.09894 | * | 0.22506 | 0.11241 | * |
| regions | 0.72221 | 0.07439 | * | 0.82102 | 0.11216 | * | 0.09881 | 0.12712 | |
| regioncw | 0.01481 | 0.09176 | | 0.58290 | 0.11476 | * | 0.56809 | 0.13818 | * |
| cons | -3.58076 | 0.24248 | * | -4.09814 | 0.42335 | * | -0.51739 | 0.47228 | |
| Number of obs | 30008 | | | | | | | | |
| Wald chi2(96) | 3332.62 | | | | | | | | |
| Pseudo R2 | 0.1668 | | | | | | | | |

* Statiscally significant at ≤5%. ** Statiscally significant at 10%