

Child Labor Hazard on Mental Health: Evidence from Brazil

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Abstract

Background: Child labor is usually alleged to negatively affect health. However, most of the studies which investigate this hypothesis only considered the physical health. As a unique contribution, we allege the hypothesis that the impact of child labor transcends physical to the mental health of individuals.

Aims of Study: The objective of this study was to investigate the probability of child laborers to develop symptoms of mental depression in adulthood. Moreover, this study innovates in that it accounts for possible genetic or maternal causal effect among family members.

Data and Methods: We used the 2008 National Household Sample Survey (PNAD, in Brazilian acronym) and its special supplements to estimate probit models.

Results: We found that individuals who started working between the age group of 15-17 have about 0.6 p.p. lesser risk of developing mental depression compared to those who started working between the age group of 10-14. Further reduction of this risk was observed for the age groups of 18-19 and 20-24. No statistical evidence was found regarding higher age groups. We also found that individuals with mentally depressed mothers have about 3.2 percentage points (p.p.) higher risk of presenting symptoms of mental depression. Similarly, chronic physical illness in mothers increases the risk of mental depression in 0.3 p.p..

Discussion and Conclusion: Results sustained the hypothesis that work during childhood increases the risk of developing mental depression in adulthood. Alongside, we found that family health status and chronic physical illness in individuals play a substantial role in their risk of developing mental depression.

Implications for Health Policies: Results suggest the provision of basic mental health care for child laborers withdrawn from work so as to reduce the risk of mental depression in adulthood. Still, our result emphasizes the importance of mental health care for individuals with family members with depression or physical chronic illness.

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Introduction

Depression is one of the global health challenges of the current generation. However, mental illness is yet to receive due attention compared to physical illness.¹ Particularly, basic health services to diagnose and treat mental illness are scarce and even non-existent in many developing countries. This mental disorder is characterized by depressed mood, loss of interest or pleasure, decreased energy, feelings of guilt or low self-worth, disturbed sleep or appetite, and poor concentration. In most chronic cases, depression comorbid with anxiety and impairs individuals of the ability to exercise their daily routines. Moreover, in worst cases, depression may lead to suicide.² According to The Economist,¹ mental disorders do not only affect the mood, intellectual and cognitive abilities of an individual but also provokes severe consequences to the society and economy as a whole through impaired human capital and cost of treatment.

According to Justus *et al.*,³ the rate of mental depression in Brazil slightly reduced over time – from 4.96% in 1998 to 4.13% in 2008. Nevertheless, these figures are still high and worrying because depression morbidity continues high among Brazilians. Silva *et al.*⁴ added that one in seven Brazilians has symptoms of mental depression and one in twelve has a twelve-month chronic mental disorder. Notwithstanding, these figures are potentially underestimated due to undiagnosed depression. According to Gonçalves *et al.*,⁵ alike in other OECD countries, depression has not been ranked among the major health concerns in Brazil.

There are numerous studies on the causes of depression in adults, but few concerning it causes in children and adolescents. However, Catani *et al.*⁶ pointed to a negative correlation between childhood trauma and cognitive abilities during adulthood of former child laborers. In 2014, about 4.5% of children and adolescents between age 5 and 15 worked as child laborers in Brazil. According to Kassouf,⁷ this rate was about 14.6% in 1992 and higher in preceding years. In light of this observation, we pose the question: is the current rate of mental depression in adults related to past child labor rates? According to Guarcello,⁸ “the literature is richer in hypothesizing negative effects of child work on health than it is in testing these hypotheses”. So far, there is no empirical study which tested the hypothesis of the alleged negative effect of child labor on mental health. Thus, we seek

to provide the first empirical evidence concerning this relationship. Specifically, we aim to test the hypothesis that work during childhood increases the risk of individuals to develop depressive symptoms during adulthood. This hypothesis is rooted in the argument that work stress and pressure in very early stages in life as result of child labor may lead to mental disorder.

Given the uniqueness of the hypothesis which we seek to test in this study, no previous empirical studies was found concerning the impact of child labor on the probability of individuals to develop mental depression. Thus, we review the determinants of mental depression from Brazilian and international literature, emphasizing the role of work and working conditions.

According to WHO,⁹ mental depression, alike most physical illness, is the aftermath of complex and interwoven combination of biological, psychological and socioeconomic factors. As per biological factors, Woodhead¹⁰ pointed that environmental pressures may significantly alter the level of hormones, immunity, and cortisol in individuals, which may lead to depressive symptoms, especially in children. Lohoff¹¹ and Ledford¹² added that genetics is a means through which mental depression may be transmitted from one generation of the same family to the other. As per psychological factor, Sokolova¹³ highlighted that children who had poor or insufficient nurture during childhood due to illness, separation, death or mental health problems of parents or caregiver have a high risk of developing mental dysfunctions, either during childhood or later in life. As per socioeconomic factors, Justus *et al.*³ found that income, urbanization, region of residence, level of education, work, gender and skin color influence the risk of developing depressive symptoms.

Numerous empirical studies are in consensus that work-related psychosocial stress increases the risk of mental depression (see¹⁴⁻²³). Specifically, Caplan *et al.*¹⁴ found that role ambiguity – proxy for work stress in working environments – is positively related to anxiety, depression, and resentment among male users. A similar result was observed by Pikhart *et al.*¹⁵ concerning work stress for three countries of Central and Eastern Europe. Siegrist²⁰ and Bonde²¹ complemented that the risk of mental depression is higher in individuals whose work is highly demanding but less controlled and in those who spend high effort in the combination of low-income rewards. Ylipaavalniemi *et al.*¹⁶ and Shields¹⁸ added that, apart from psychosocial factors, social interactions during work in form of team climate also play a key role in the mental health of workers. These latter authors further concluded that the effect of job strain is equal among male and female worker. However, female workers have a higher risk of depression due to higher personal stress and low co-worker support. Furthermore, Rao *et al.*²³ found that work workers in lower occupational positions (shop floor workers) experience more stress and lower mental health compared workers in higher positions (executives).

It is important to highlight that all reviewed studies concerning the effect of work on mental health focused on formal adult work. Given that neither the workload, income rewards, nor working condition of child labor is regulated,

and that most children and adolescents combine work with schooling and occupy low positions, it is expected that stress and effort-reward ratio are higher. Therefore, the risk of mental depression is prone to be high. Therefore, this study contributes in that it investigates the effect of child labor background of adults on their mental health.

Methodology

Data and Sample

In this study, we used the 2008 National Household Sample Survey (PNAD, in Brazilian acronym) data and its special supplements on health issues. In this year, the survey was composed by 391,868 individuals randomly selected in Brazilian territory. However, some observations were lost in the estimates due to missing observations in some variables. The sample was reduced to 313,389 observations. Moreover, to make the sample suitable for empirical modeling, and given the objective of this study, we had to filter the data sample (see **Figure 1**).

First, we excluded individuals below age 16 so as to focus on individuals at or above the minimum age for legal work and also to account for the childhood background of all individuals. With this age filter, about 86% of the overall sample was retained.

In order to obtain information concerning the child-labor background of individuals, we had to use data concerning the age at which they started working. This control engendered an undesired yet unavoidable filter to the database since it only covers individuals who were employed during the reference week surveys. As a result, about 30% of individuals were excluded from Sample I.

We highlight that family health status has been pointed by Sokolova,¹³ Lohoff¹¹ and Ledford¹² to be a relevant factor in the risk of developing depression. As a *proxy* for such control, we use data concerning individuals' mothers. In doing so, we focus on individuals who live with their mothers in the same household since the PNAD surveys only register as family individuals who live in the same household and declare one another as a family. The cost of such filter was relatively high (about 57% of Sample II) since most of the adults and elderly individuals do not live with their parents. In short, our final sample limits analyses to young adults. Acknowledging that such filter may cause engender bias, during estimation exercises we compare models with and without controls for mother's variables.

In **Table 1** we provide statistics from the overall and final samples for comparison. All estimates were computed using the weights or sample expansion factors provided by the IBGE in the data files.

From this table, we observe that about 2.3% of the population contained in the filtered sample was diagnosed with mental depression by a doctor or physician in 2008. This value is low compared to that presented by Justus *et al.*³ because we disconsidered observations with missing for other variables in the overall sample and because of the necessary filters in sample. Regarding the *proxy* variable to

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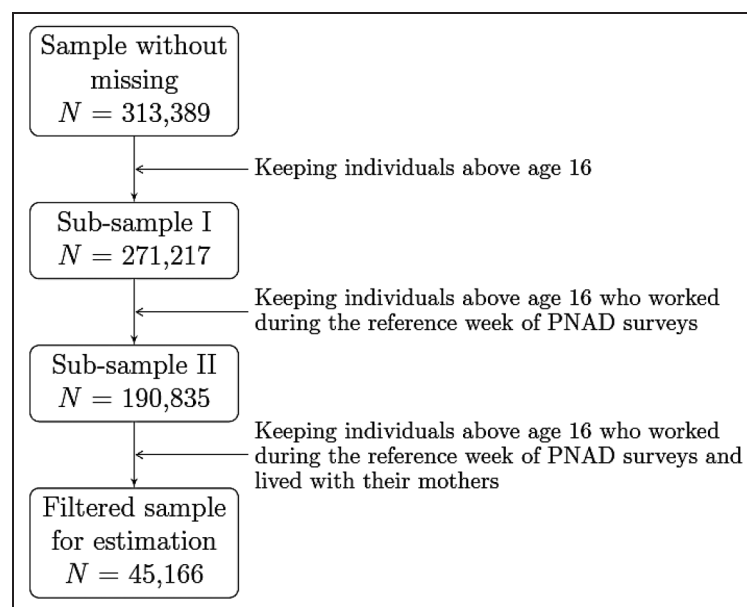


Figure 1. Sample Filtration Source: Prepared by Author.

Note: *N* denotes number of observations.

control for family genetics (depmom), approximately 10.1% of the individuals have mentally depressed mothers. It is interesting to note that about 44% of the individuals were child laborers. At this point, one perceives that child labor and, most likely, its long-run consequences may be largely present in the Brazilian society.

Empirical Model

In this study, our response variable (depress), is a dummy that assumes the value of 1 if individuals affirmed to be diagnosed by a doctor or medical practitioner with mental depression and 0 if otherwise. For this reason, we resorted to *probit* models Cameron *et al.*²⁴

The regressor of interest is *childlabor*, which is a dummy variable that takes 1 if the individual worked as child laborer and 0 if otherwise. This variable was replaced with six dummy variables to control for the age bracket at which individuals started work: 0-14 (reference group for child labor), 15-17, 18-19, 20-24, 25-29 and above30. We controlled for mother's mental health status with a dummy variable which is 1 if the individual's mother was diagnosed with mental depression and 0 if otherwise (depmom). This variable served as *proxy* for family genetics since the PNAD data does not provide data concerning other members of the family. In addition, we control for mother's physical health status using a dummy variable which is 1 if the individual's mother has at least one chronic physical disease³ diagnosed by a doctor and 0 if otherwise (chronmom).*

The other control variables are: number of family members (*famsize*); average per capita family income (*famincome*);

individual's mothers age (*agemom*); dummy variable which is 1 if the individual has at least one chronic physical disease and 0 if not (chronic); dummy variable which is 1 if the individual is enrolled in school and 0 if not (study); a dummy variable for individual's gender which is 1 if male and 0 if not (male); individual's age (*age*) and its square; dummy variable which is 1 if the individual works and 0 if he/she doesn't (work); number of individual's weekly working hours (*hourwork*); dummy variable which is 1 if the individual lives in an urban area and 0 if he/she doesn't (urban); four dummy variables to control for skin color (white and yellow as base group, black and mulatto),* and; five dummy variables to control for regional difference (south as base group, southeast, midwest, northeast and north).

Some variables are suspected to be endogenous. For example, work factors (work and *hourwork*) can influence the likelihood of an individual to develop symptoms of mental depression due to work stress. However, a depressed individual is prone to be jeopardized in his/her working place as a result of productivity loss which, in turn, can cost his/her job. Similarly, study and *famincome* are also suspected to be endogenous. However, the endogeneity of the latter variable depends on the weight of individual's income in total family income. Justus *et al.*³ observed that the effect of family income on the risk of mental depression is not linear. For this reason, the average per capita family income was logarithmized. Furthermore, these authors point that the relationship between individual's age and his/her risk of developing symptoms of mental depression is non-linear. For this reason, the square of age is included in the model specification.

* The chronic physical diseases considered are: chronic back or spine problem, arthritis or rheumatism, cancer, diabetes, bronchitis or asthma, hypertension, heart disease, chronic renal dysfunction, tuberculosis, tendonitis or tenosynovitis, and cirrhosis.

* The Brazilian Institute of Geography and Statistics (IBGE) classifies race/skin color according to physical appearance which is self-declared by individuals. These categories are: white, black, yellow (Asian-Brazilians), brown (Mulatto) and indigenous. We excluded Indigenous population due to the small number of observations.

Table 1. Summary Statistics.

Variable	Description	Filtered sample			Overall sample	
		Mean	Std.Dev	Mean	Std.Dev	
Variables of interest						
depress	1 if depressed and 0 otherwise	0.0225	0.1484	0.0462	0.2099	
childlabor	1 if he/she is or was a child laborer and 0 otherwise	0.4421	0.4966			
0-14	1 if he/she worked at age 10-14 and 0 otherwise	0.3333	0.6813			
15-17	1 if he/she worked at age 15-17 and 0 otherwise	0.3263	0.4689			
18-19	1 if he/she worked at age 18-19 and 0 otherwise	0.1996	0.3997			
20-24	1 if he/she worked at age 20-24 and 0 otherwise	0.1204	0.3254			
25-29	1 if he/she worked at age 25-29 and 0 otherwise	0.0167	0.1281			
30 above	1 if he/she worked at age 30 or above and 0 otherwise	0.0038	0.0612			
depmom	1 if mother is depressed 0 otherwise	0.1035	0.4851			
chronmom	1 if mother has physic. Chronic disease and 0 otherwise	0.6211	0.4851			
Control variables						
male	1 if male and 0 if female	0.5929	0.4913	0.4837	0.4997	
yellow	1 if skin color is yellow and 0 otherwise	0.0049	0.0698	0.0049	0.0701	
white	1 if skin color is white and 0 otherwise	0.4624	0.4986	0.4554	0.4980	
black	1 if skin color is black and 0 otherwise	0.0732	0.2605	0.0783	0.2687	
brown	1 if skin color is brown and 0 otherwise	0.4643	0.4987	0.4663	0.4989	
urban	1 if he/she resides in urban area and 0 otherwise	0.8595	0.3476	0.8467	0.3603	
midwest	1 if he/she resides in the Midwest and 0 otherwise	0.1037	0.3049	0.1102	0.3131	
northeast	1 if he/she resides in the Northeast and 0 otherwise	0.3206	0.4667	0.3182	0.4658	
north	1 if he/she resides in the North and 0 otherwise	0.1142	0.3180	0.1254	0.3312	
southeast	1 if he/she resides in the Southeast and 0 otherwise	0.3176	0.4655	0.2951	0.4561	
south	1 if he/she resides in the South and 0 otherwise	0.1439	0.3510	0.1511	0.3581	
chronic	1 if he/she has physic. Chronic disease and 0 otherwise	0.1657	0.3719	0.3337	0.4715	
study	1 if he/she is enrolled in school	0.2683	0.4431	0.2491	0.4325	
age	Age	26.36	8.99	36.18	18.25	
age(square)	Age square	775.89	257.87	600.07	1576.64	
work	1 if he/she currently works	0.8942	0.3076	0.5780	0.4939	
hourwork	Weekly working hours	39.90	16.93	22.73	22.27	
famincome	Average per capita family income	635.83	835.66	633.90	1088.93	
famsize	Family size	4.13	1.62	3.71	1.59	
mothereduc	Mother's level of education (in years of studies)	6.75	4.56			
agemom	Mother's age	53.26	11.50			

Number of observations for overall and filtered samples are 313,389 and 45,166, respectively.

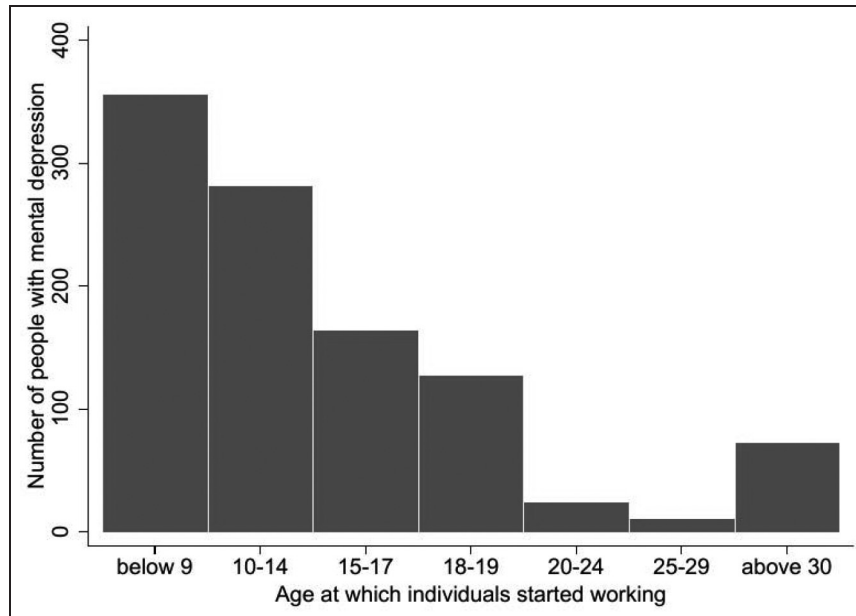


Figure 2. Number of People with Mental Depression by the Age at which They Started Working.

Source: Prepared using 2008 PNAD data.

Results

Descriptive Analysis

Figure 2 presents the distribution of the incidence of mental depression by age at which individuals started working. Clearly, one perceives that the distribution is skewed left, i.e., most individuals who were diagnosed with mental depression started working at early ages. This indicates a positive correlation between child labor and mental depression. It is interesting to observe that the incidence of mental depression reduced expressively from the age bracket of 10-14 to 15-17 and from 18-19 to 20-24. This observation shows that the risk of mental depression reduces remarkably for individuals who started working after the minimum age for work as an apprentice (at age 14) and such reduction is more pronounced for those who started working after the minimum age for night, hazardous or unhealthy works (at age 18). In short, through this figure, we clearly observe a higher risk of mental depression in individuals who were child laborers.

Table 2 presents the cross-frequency between some regressors and mental depression. In the same table, we present a test for equality of proportions within groups. Specifically, we test the null hypothesis of no difference between proportions of the same group. Except for few cases of a small number of observations, we conclude that the proportions are statistically different within the same group.

About 2.5% of the individuals who worked as child laborers were diagnosed with mental depression by a physician or health practitioner in the year 2008. Moreover, we also observe that the incidence is higher among these individuals compared to those who were not child laborers. As empirically verified by Justus *et al.*,³ chronic physical illness such as cirrhosis, cancer, tuberculosis, renal or heart

diseases, etc. may lead to mental depression through the psychological or biological channel. In the year 2008, approximately 6.9% of the individuals with chronic physical illness was diagnosed with mental depression. In line with this study, it is clear that the incidence of mental depression is higher among women (about 3.4%) compared to men (about 1.5%). Still on individual personal characteristics, **Table 2** shows a higher incidence of mental illness among individuals who are neither enrolled in school nor employed. Moreover, a higher incidence was also observed among white-skinned population compared to mulattos, blacks, and Asians. Similarly to these authors, there were expressively more cases of mental depression in urban areas, compared to rural areas. In addition, regional variables show a greater incidence of mental depression in the Southern and Southeast region compared other regions. Intuitive analysis of the ranking of this regional distribution leads to think of higher incidence of mental depression in more developed and colder regions, which also corroborates the results of these authors.

The two family variables, depmom and chronmum, are considered to serve as control for biological (genetics) and psychological (affection) channel through which mental depression may be passed from parents to offspring. On one hand, according to WHO,⁹ individuals may develop symptoms of mental depression as a result of affection for loved ones who are diagnosed with mental depression or chronic physical illness. On the other hand, based on Lohoff¹¹ and Ledford,¹² mental depression may stem as a result of family genetics. Quantitatively, about 2.1% of the individuals who were diagnosed with mental depression had mothers with chronic physical illness, while about 5.6% of the same individuals had mentally depressed mothers. This indicates that the relationship between mental depression among family members may be stronger than that of physical chronic illness with mental depression.

Table 2: Percentage of Mentally Depressed and Non-Depressed Individuals by Category of Variables, and Two-Sample Test of Proportions.

Variable	Mentally depressed (%)		Number of observations	Two-sample z test of proportion (p-value)
	Yes	No		
Child labor				
No	97.94	2.06	25.196	3.12 (0.0018)
Yes	97.50	2.50	19.97	
Chronic illness				
No	98.66	1.34	37.68	29.62 (0.0000)
Yes	93.13	6.87	7.486	
Gender				
Female	96.62	3.38	18.388	13.40 (0.0000)
Male	98.52	1.48	26.778	
Enrolled in School				
No	97.43	2.57	33.047	7.43 (0.0000)
Yes	98.60	1.40	12.119	
Employed				
No	96.59	3.41	4.779	5.65 (0.0000)
Yes	97.88	2.12	40.387	
Ethnicity				
white	97.13	2.87	20.887	8.28 (0.0000)
black	98.37	1.63	3.307	
mulatto	98.26	1.74	20.972	6.89 (0.0000)
yellow	98.19	1.81	221	
Mother with Chronic illness				
No	98.95	1.05	17.114	13.55 (0.0000)
Yes	97.01	2.99	28.052	
Mother with mental depression				
No	98.33	1.67	40.493	24.58 (0.0000)
Yes	92.70	7.30	4.673	
Urbanization				
urban	97.64	2.36	38.818	3.94 (0.0001)
rural	98.42	1.58	6.348	
Region				
Midwest	97.95	2.05	4.685	1.04 (0.2983)
Northeast	98.36	1.64	14.48	
North	99.01	0.99	5.156	6.52 (0.0000)
Southeast	97.23	2.77	14.344	
South	96.37	3.63	6.501	8.22 (0.0000)
Number of observations	44.148	1.018	45.166	

Note: Prepared using 2008 PNAD data; null hypothesis of z test is zero difference between proportions.

It is important to note that the proportions provided in this section are mere correlations, which may be confounded by mixed effect of observable and unobservable factors.

Analysis of Empirical Results

The hypothesis that we analyze in this section is that work during childhood increases the risk of individuals to develop depressive symptoms during adulthood. The empirical strategy used to reach this objective is the probit model estimated by maximum likelihood.

The marginal effects observed from the probit models are presented in **Table 3**. These effects were calculated for discrete changes in dummy variables and at means for continuous variables.

The first general perception from this table is that the standard errors observed for all variables are extremely small. Moreover, the signs obtained for statistical significant variables from all models corroborate the expectations which were set based on the literature survey presented in the Introduction. In model I, all the specified variables were included. In model II, the same model was estimated without mother's variables (depmom, agemom and chronmom). What we observe is that without filters regarding mother's

Table 3. Marginal Effects For Discrete Changes in Dummy Variables and at Means for Continuous Variables.

Response variable: depress				
Category of regressors	I	II	III	IV
Family's variables				
<i>log</i> (famincome)	-0.00215** (0.001)	-0.00254*** (0.001)		-0.00193** (0.001)
famsize	-0.00159*** (0.001)	-0.00201*** (0.001)	-0.00140*** (0.001)	-0.00161*** (0.001)
Mother's variables				
depmom	0.0400*** (0.003)		0.0405*** (0.004)	0.0398*** (0.003)
agemom	0.00000917 (0.000)		0.0000260 (0.000)	0.00000546 (0.000)
chronmom	0.00757*** (0.002)		0.00778*** (0.002)	0.00754*** (0.002)
Individual's variables				
childlabor	0.00386** (0.002)	0.00462*** (0.002)	0.00443*** (0.002)	
chronic	0.0338*** (0.003)	0.0405*** (0.003)	0.0343*** (0.003)	0.0337*** (0.003)
study	-0.00158 (0.002)	-0.00173 (0.002)		-0.00151 (0.002)
age	0.00115*** (0.000)	0.00122*** (0.000)	0.00106*** (0.000)	0.00112*** (0.000)
male	-0.0126*** (0.002)	-0.0125*** (0.002)	-0.0139*** (0.002)	-0.0129*** (0.002)
urban	0.00335 (0.002)	0.00468** (0.002)	0.00302 (0.002)	0.00433* (0.002)
black	-0.00894*** (0.002)	-0.00948*** (0.002)	-0.00809*** (0.003)	-0.00901*** (0.002)
mulatto	-0.00436** (0.002)	-0.00510*** (0.002)	-0.00332** (0.002)	-0.00448*** (0.002)
work	-0.00855** (0.004)	-0.00981** (0.004)		-0.00882** (0.004)
hourwork	-0.000173** (0.000)	-0.000162** (0.000)		-0.000174** (0.000)
Midwest	-0.00783*** (0.002)	-0.00985*** (0.002)	-0.00764*** (0.002)	-0.00787*** (0.002)
Northeast	-0.0106*** (0.002)	-0.0144*** (0.002)	-0.00909*** (0.002)	-0.0106*** (0.002)
North	-0.0145*** (0.002)	-0.0172*** (0.002)	-0.0141*** (0.002)	-0.0144*** (0.002)
Southeast	-0.00483** (0.002)	-0.00767*** (0.002)	-0.00485** (0.002)	-0.00465** (0.002)
15-17				-0.00616*** (0.002)
18-19				-0.00671*** (0.002)
20-24				-0.00564** (0.002)
25-29				-0.00559 (0.004)
above 30				0.00157 (0.009)
Number of observations	45,166	190,835	45,166	45,166
Pseudo R ²	0.159	0.126	0.152	0.160
Log likelihood	-4271.0	-4435.8	-4306.6	-4265.0
LR χ^2 (degree of freedom)	1157.5 (20)	1020.2 (17)	1130.5 (16)	1170.1 (24)

variables, other coefficients slightly higher. Apart from this, the pseudo-R² dropped from 0.157 to 0.120 and the LR test indicated that Model I is better adjusted. Nevertheless, the significance and signs of estimates continue unaltered.

Subsequently, model III was estimated with all variables in Model I, except those which were suspected to be endogenous (study, famincome, work and hourwork) as justified above. Aside the estimates of other variables being slightly overestimated, the pseudo-R² and the LR test indicated that model I is better. Having that other coefficients were not severely affected after excluding these variables, we opted to continue with model I.

Lastly, we estimate model IV, which is a similar version of model I. However, the child labor variable was replaced with age groups which control for the age bracket at which individuals started working. This group dummy variable is more informative than childlabor since it provides the marginal effect concerning each age group. Comparing Model I to model IV, it is notable that there was a slight increase of the pseudo-R² and the LR test indicates that model V is better. Hence, analyses will be based on this model.

First, we analyze the effect of family health status. Results indicate that individuals who have mentally depressed mothers are more likely to develop symptoms of mental depression compared to individuals without mentally depressed mothers. The coefficient observed for depmom had the highest value in the model. Thus, this variable turns out to be the most important factor which determines the risk of mental depression among all controlled variables. Quantitatively, individuals with mentally depressed mothers have about 3.2 percentage points (p.p.) higher risk of presenting symptoms of mental depression. However, this incidence can be attributed to either biological factor (genetics) or psychological factors (grief, sadness, affection, etc.) that link mother to child. However, this effect is further disentangled by observing the coefficient for chronnum, which estimate is only about 0.3 p.p. Having that the marginal effect of mental depression of mothers (depmom) is about five times the effect of chronic physical illness in mothers (chronmom) and that both are considered chronic diseases/illness, one can suitably attribute the magnitude of depmom to genetics. In so doing, we corroborate previous evidence from Lohoff¹¹ and Ledford¹² concerning the role of genetics on the risk of developing mental depression.

As emphasized by Justus *et al.*,³ chronic physical illness plays important role in the risk of developing mental depression. Aside from the direct impact on the psychological state of individuals, such illness also provokes a loss of productivity, restriction to certain physical leisure and sports activities and also social discrimination. The marginal effect found for chronic indicates that individuals with any of the controlled chronic physical illness have a higher risk of being mentally depressed.

No empirical evidence was found at usual statistical significant levels concerning the effect of mother's age. However, it was observed that the risk of mental depression slightly increases as individuals grow in age, but is prone to

reduce at old age. This is portrayed by the positive and negative signs found for age and age squared. This evidence supports results found by Justus *et al.*³ that the risk distribution of mental depression by age group is a downward facing parabola.

According to Baker *et al.*²⁵ and Abela *et al.*,²⁶ the incidence of mental depression varies widely between the male and female genders. The empirical evidence found in this study corroborates the findings of these authors in that females have higher risk of developing depressive symptoms compared to males. Furthermore, our empiric results also corroborate the relationship between family income and the risk of mental depression in the sense that it points to a negative relationship between both variables.

Results also show that residence in urban areas, skin color, family size and region of residence influence the risk of an individual to develop symptoms of mental depression. Regarding urban residence, results confirm higher incidence of mental depression in urban areas compared to rural areas, thus, corroborating findings of Justus *et al.*³ WHO⁹ reported that the nature of modern urbanization may have deleterious consequences on mental health as a result of the higher incidence of stress, pollution, overcrowding, dependence on a cash economy, discrimination, social class disparities and high violence. The group dummy variable for the region of residence upholds this finding, implying that the Southern Brazil, which is relatively highly urbanized, has a higher incidence of mental depression compared to the Southeast, Midwest, Northeast and North regions. Curiously, the estimates for this group variable are distributed among regions according to their urbanization rate.

As per skin color, our estimates uphold results from Justus *et al.*³ regarding the higher risk of mental depression among Brazilian white and Asian population compared to the mulatto and black-skinned population. Acknowledging the socioeconomic differences among individuals of different skin colors in Brazil, we add that the estimates found may be result of access to medical care and diagnosis across groups.

Inasmuch as stress and pressure from work may cause depressive symptoms, the marginal effects observed for the work and hourwork variables indicate that individuals who work, and inclusively, those who work more hours have a lesser risk of mental depression compared to those who do not work. Despite this result corroborates findings from literature, we suggest better specification concerning types of work. This is because, on one hand, work elevates self-esteem through social status and promotes more interpersonal interactions. The effect of higher interpersonal interactions is corroborated by the marginal effect found for famsize which implies that individuals from larger families have a lesser risk of mental disorders. On the other hand, excess work or work that involves high pressure can lead to stress, which is a potential cause of mental disorder. This is better portrayed when one considers the estimate for childlabor since it generally involves unregulated pressure and working conditions.

The coefficient observed for this variable, which is of primary interest, indicates that individuals who worked as child laborers have a higher risk of developing symptoms of

mental depression compared to those who entered the labor market at adult age (corroborating observation from **Figure 2**). Specifically, individuals who started working between the age group of 15-17 have about 0.6 p.p. lesser risk of developing mental depression compared to individuals who started working between the age group of 10-14. Greater reduction is observed for individuals who started working within the age of 18-19. Analogously, compared to child laborers, individuals who entered the labor market between age 20 and 24 have a lesser risk of mental depression. No statistical evidence was found regarding subsequent age brackets. Therefore, postponing entry into the labor market to the age of 14 is not enough to expressively reduce the risk of mental depression. This model suggests postponement to, at least, the age of 24, which is the average age at which most individuals finish undergraduate studies. Our finding here also corroborates that of Justus *et al.*²⁷ concerning the best age for individuals to enter the labor market in Brazil.

Using estimates from model I, we simulate the risk of developing mental depression. Specifically, we vary regressors concerning child labor, gender, skin color, urbanization, and health status. Moreover, continuous regressors were fixed at means and other dummy regressors were fixed at zero during simulations. In other words, the average individual of our analysis is assumed to be 26 years old, who resides in the southern Brazil, not enrolled in school, but work for about 40 hours per week. Furthermore, this individual is from a family of four members with per capita income of about R\$ 604 and the mother is about 53 years of age.

For the first simulation exercise, we observed that, *ceteris paribus*, the risk of developing mental depression is about 0.9% for a white-skinned woman who resides in an urban area; was not a child laborer; does not have any chronic illness, and; her mother is neither chronically ill nor mentally depressed. However, we notice that this risk increases to 1.2% if the same woman worked during childhood. Curiously enough, this risk drops by half (about 0.5%) for a male individual with the same characteristics. For such a male individual, the risk of mental depression is about 0.7% if he resides in the urban area. Moreover, we confirm that white-skinned individuals have a greater risk than mulattos and these have a greater risk than blacks, despite all having identical characteristics regarding other aspects.

Having that majority of the individuals contained in the sample are mulattos, we continue the simulation exercise with these – a mulatto who is male; resides in an urban area, and; was a child laborer. As per physical health, our model indicates that such individual has the risk of about 2.4% if he has any chronic physical illness. This risk increases expressively to about 7.6% if, aside from such illness, the individual's mother is mentally depressed. Moreover, if his mother is not only mentally depressed but also has a chronic physical illness, the risk increases to about 10.1%. Curiously, all cases of risks of mental depression above 10% have co-existence of chronic physical illness of individuals and mental depression of mothers. Still, we sustain that high risk of mental depression is common among women, child

laborers and individuals whose mothers have a chronic physical illness.

Implications and Contribution

In short, our findings permit not to reject the hypothesis that individuals who worked during childhood have a higher risk of developing symptoms of mental depression during adulthood. Moreover, we provide empirical evidence concerning the significant role of family biological and psychological linkages on the mental health of individuals. Still, our results also corroborate previous literature concerning the preeminence of mental depression among women and the adverse impact of chronic physical illness on the mental health of an individual.

Concluding Remarks

In this study, we investigated the relationship between child labor and the mental health of individuals. The hypothesis alleged was that individuals who venture into the labor market at early ages are more likely to develop mental depression during adulthood. The reason for this is that individuals who venture into the labor market at early ages accumulate childhood stress due to early labor, which in most cases is conciliated with studies. Consequently, during adulthood, such individuals may suffer psychological fatigue that, in turn, may sprout depressive symptoms. This hypothesis was tested using 2008 PNAD data and its supplements to estimate *probit* models. The empirical evidence found sustains the alleged hypothesis of a positive relationship between child labor and probability of mental depression. Specifically, individuals who started working at or before the age of 14 have a higher probability of developing depressive symptoms compared to those who started at subsequent ages.

The mental health of individuals, especially children, continues to be an issue which has not gained due attention in Brazil alike in most developing countries. The first suggestion we offer, in line with WHO⁹ and The Economist¹ is that mental disorders should not be faced exclusively as a biological or psychological problem, but also as a socioeconomic problem. Only this way it will be clear that child labor plays a role in the risk of developing mental depression.

Again, emphasizing the political suggestion concerning minimum age for work, results uphold that the risk of mental depression reduces if individuals defer the age at which they enter the labor market. One major reason for this that most children, adolescent, and youths who work end up also studying, and this may intensify their level of stress compared to adults who only work. During adulthood, these individuals who already internalized stress from early ages tend to be more prone to develop mental disorders. Furthermore, we suggest that basic mental health care should be provided for child laborers withdrawn from work.

Particularly, those engaged in the worst forms such as, for example, agriculture, prostitution, drug trafficking and other activities that involve slavery and exposure to toxic substances. The reason for this is that, in such cases, mere conditional cash transfer programs may leave the psychological hazard of child labor unsolved.

Empirical results also indicated that children from mentally depressed parents are more likely to develop depressive symptoms either through genetic or maternal bond. However, we are more convinced that the effect found is mainly attributed to family genetics because of the expressively lower effect found for other chronic physical illness in mothers. In this sense, we suggest that public health policies also pay attention to the offspring of individuals who are diagnosed with mental depression. This measure may help to anticipate and detect potential cases of depression at early stages.

We add that health specialists should provide, at least, basic education concerning mental depression to individuals who have a chronic physical illness and also suggest therapeutic activities to the same. This is because, depending on the type of illness in question, individuals may become psychologically unbalance when they over-contemplate their physical incapacities and/or internalize inferiority complex due to social discrimination.

Inasmuch as we acknowledge that the political suggestions offered here require substantial government expenditure, we believe that such expenses will earn not only health and social benefits but also economic benefits.

Last but not least, we emphasize that one of the major empirical challenges faced in identifying the effect of child labor on mental depression in adulthood is the influence of unobserved variables, such as childhood poverty, that also directly affect the risk of mental depression in adulthood. Moreover, due to limits of database and peculiarity of our objective, we needed to apply severe filters on data sample. Despite challenges, all results from this study point to a positive association between child labor and mental depression. Although the robustness of our estimates was checked in the light of different model specifications, any inferences of causality are only suggestive and tentative. Therefore, further empirical studies conducted with other data sets are needed to validate or invalidate the evidence found in this study for Brazilian citizens.

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