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Article

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Wage structure differential and disability in Brazil — Underperformance or discrimination?

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Abstract

In 2013, 7.32% of the Brazilian population, or almost 15 million people, declared that they had some disability. Based on empirical evidence, this study sought to answer the following three questions: 1) Are men with disabilities paid less in the Brazilian labor market? 2) If so, is this predominantly due to differences in individual socioeconomic characteristics, underperformance, or is it a case of discrimination? 3) What are the main determinants of wage differential among disabled men? To answer these questions, we used data from a sample of men aged 18–65 working in Brazil's private sector to estimate Tobit wage equations and perform a twofold decomposition of the disabled-nondisabled wage differential by applying the traditional Oaxaca-Blinder technique. DeLeire (2001) methodology was then employed to isolate the roles of discrimination and underperformance in the analysis, which was performed separately by the severity of the disability effect on activities. It was found that male employees with disabilities that limit daily activities earn lower wages than comparably employed nondisabled men and that this difference increases with the severity of the disability; that the estimated wage differentials were associated with both discrimination and underperformance, especially the latter; that there was a wage “reward” for the disabled positively correlated with their level of education; that the onset period of a disability did not significantly affect wages; and that men with intellectual disabilities are the most wage disadvantaged. These results provide useful information for policy makers in Brazil when allocating resources to support people with disabilities.

JEL classification: I19; J24; J31

Keywords: Labor market; Health; Person with disabilities statute

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1. Introduction

Prior to 1970, public policy makers believed that disabled persons should not work. This belief led to the disabled's exclusion from the labor market and the application of public resources to subsidize their maintenance (Blanck, 2001). The lack of employment opportunities for disabled persons was addressed by the United Nations in 1981. The first

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legally binding treaty asserting that disabled persons have a right to enter the labor market was promulgated in 1983 by the United Nations' International Labor Organization's (ILO) Vocational Rehabilitation and Employment Convention No. 159, which was ratified by 70 countries and has been enforce since 1985 (Lopes, 2005; Fonseca, 2006).

Based on the ILO agreement, Brazil adopted the "Quota Law for Companies" (Law No. 8,213/1991), which mandated that two to five percent of the employees of companies with 100 or more employees be reserved for disabled individuals. However, the guarantee of employment mandated by the Quota Law did not resolve other issues, such as the provision of equal pay and promotion for the disabled, as the law did not establish training programs to improve disabled individual's capacities or promote workplace anti-discriminatory policies.

The right to equal treatment of the disabled in the labor market has since been addressed by several countries (the 1990 American Disabilities Act, the 1995 UK Disability Discrimination Act, the 2000 Africa Decade of Disabled People Program). Brazil's main effort to fight discrimination against the disabled in the workplace occurred in 2015 with passage of the [Person with Disabilities Statute \(EPD - Law No. 13,416, dated July 6, 2015\)](#). Article 34 of the EPD guarantees that "persons with disabilities are entitled, on an equal basis with other persons, to just and favorable conditions of work, including equal remuneration for work of equal value."

In Brazil, 14.7 million individuals were reported as having at least one disability in 2013, which represented 7.32% of the population. For men, who are the focus of this study, the figures are 7.4 million or 7.62% of all men. Only 46.5% of the working-age Brazilian disabled men are in the country's labor force, whereas this figure is 75.2% for nondisabled men ([National Health Survey – PNS, 2013](#)). Explanations for this labor market participation discrepancy arise from multiple factors and can be analyzed from the perspective of labor supply and demand.

On the supply side, the lack of necessary facilities and infrastructure can make it costlier to employ disabled persons ([Gottlieb et al., 2010](#)). The dearth of public and/or private environments set-up for disabled persons limits their access to various goods and services, especially transportation services, putting them at a significant disadvantage. In addition, depending on the type, severity, and onset of the disability, this group may require more job flexibility to accommodate their treatment regimens ([Gottlieb et al., 2010](#)). On the demand side, many organizations are reluctant to absorb this category of worker ([Ribeiro and Carneiro, 2009](#)), possibly due to the social perception of lower productivity, the cost of adapting the work environment¹ ([Garcia and Maia, 2014; Jones, 2008](#)), or the fear of stigmatization by fellow employees leading to friction ([Gottlieb et al., 2010; Jones, 2008](#)).

Regarding wages, the wage differential between disabled and nondisabled workers may be the result of disability-related limitations, observable and unobservable characteristics, performance, and an effect of discrimination. To this last consideration, studies of in OECD countries have found evidence of a disability related discriminatory effect in the wage differential ([Baldwin and Johnson, 2000; Kidd et al., 2000; Lechner and Vazquez-Alvares, 2004](#)). [Contreras et al. \(2006\)](#) found wage differentials between disabled and nondisabled workers associated with unobservable characteristics on the order of 8.5% in Chile and 18% in Uruguay. [Baldwin and Johnson \(2000\)](#) found wage differentials associated with unobservable characteristics of 15.7% for men with less prejudicial disabilities and 16.4% for men with more severe disabilities. Regarding the Brazilian case, [Garcia and Maia \(2014\)](#) showed that in 2010, the average disabled persons' wages of were 33% lower than those of nondisabled persons, and 21% of this differential was the result of unobservable characteristics. Nonetheless, the authors' data did not permit the isolation of discrimination as a cause.

In studies of other countries, researchers have been able to separate the share of the wage gap related to discrimination. [Jones et al. \(2006\)](#) point out that discrimination against people with disabilities in the United Kingdom represented 21% of the wage differential in 1997 and 8% in 2003. [DeLeire \(2001\)](#) found that in the United States between 1984 and 1993 only 3.7 percentage points of the 53.6% wage gap was due to discrimination. [Baldwin and Choe \(2014\)](#) associated 11% of the wage differential with discrimination in 2004 in the United States.

The present research follows this theme in relation to the Brazilian male labor market intending to isolate the importance of discrimination in any wage gap between disabled and nondisabled workers. Specifically, we seek to answer the following three questions: 1) Are disabled men paid less than nondisabled men in the Brazilian labor market? 2) If so, is this predominantly due to differences in individual socioeconomic characteristics, underperformance or is it potentially a case of discrimination? 3) What are the main determinants of wage differential among disabled men?

¹ Some studies show that the suitability of the work environment for workers with disabilities does not represent significant costs to employers and may well lead to the provision of a suitable environment for clients with disabilities. For more details, see [Schartz et al. \(2006\)](#) and [Ethos Institute \(2002\)](#).

To answer these questions, we estimate Tobit wage equations for disabled and nondisabled men (DM and NDM, respectively) aged 18–65 employed in the private sector and decompose the differential using the Oaxaca-Blinder technique.

The wage-gap analysis was performed separately, and disabilities were disaggregated by the severity of their effect on activities. The data used were provided by the 2013 Brazilian National Health Survey (PNS), the most current survey conducted throughout Brazil. The main results of the study indicate that disabled men who face difficulties carrying out their activities have lower wages than the nondisabled. This differential increases as the severity of the disability's effect more extensively limits activities, reaching a 38.5 percent differential in relation to the nondisabled for those whose disability greatly limits their activities.

A main contribution of our work was to isolate the roles of potential discrimination and productivity underperformance in the unexplained wage gap using DeLeire's (2001) methodology. According to this author, the presence of a disability may directly reduce a person's productivity and explain part of any wage gap between a DM and a NDM; however, when carrying out wage gap analyses, researchers generally assume that the entire wage structure differential is due to discrimination (Deleire, 2001). DeLeire's (2001) conjecture was supported during our analysis of wage differential literature that focused on Brazil: no empirical work was found that separated the roles of discrimination and under-productivity on the wage structure of disabled individuals in Brazil.

Brazil deserves special attention due to differences in the labor market for disabled persons when compared to labor markets in the OECD countries that form the basis for most previous studies. Institutional differences between Brazil and these other countries are the most significant, since the institutions that regulate Brazil's EPD are relatively new and not fully integrated into the workplace or society in general. The EPD was enacted in 2015, at least 20 years after implementation of similar regulations in the countries mostly analyzed by the literature. In addition, although the Quota Law was enacted in 1991 and represents important advances in terms of securing disabled person employment related rights, there are issues that affect its complete implementation, mainly related to supervision and enforcement.

Measures adopted by each country to secure disabled individuals' work-related rights differ. Those adopted in liberal regimes, such as the United Kingdom between 1990 and 2008, are often related to integration (supply side), offering training and rehabilitation programs and altered the focus of public education for the disabled. Corporatist countries, such as Hungary and Spain, tended to adjust compensation and opportunities (demand side) with employment quotas, wage subsidies and employer assistance. Socio-democratic regimes, such as the Netherlands and Denmark, usually combine both types of policies (European Commission, 2016). The Brazilian case before 2015 (the period analyzed in by our study), was more aligned to that of a corporatist regime.

According to García (2014), 316 thousand Brazilian disabled persons, on average, were in the country's formal labor market between 2007 and 2010, which represents approximately 5% of the 6.5 million working age disabled persons in Brazil during this period. These data show that the disabled are underrepresented in Brazil's formal labor market, a condition found in many countries of the Global South, and underrepresentation increases a group's vulnerability (Rogers and Lange, 2013). The results obtained by our study provide evidence that can be analyzed in a more general context for all countries in the Global South, countries that contain 80% of the world's disabled population (Parnes et al., 2009).

The results of our study provide new information that policy makers should find useful when allocating resources and eliminating contradictory strategies during the design and implementation of additional public policies supporting the disabled. These issues are of particular importance since scarce resources should be directed to the most effective programs. While the fact that disabilities may limit labor productivity is not controversial, the debate on whether underperformance or discrimination is the main obstacle to equal treatment of the disabled in the workplace is relevant when choosing corrective policies (Baldwin and Johnson, 2000). For example, the Brazilian Quotas Law and the EPD presuppose that disabled persons are discriminated against in the labor market and need assistance to have the same opportunities and wages that nondisabled persons have. On the other hand, Brazil established the Continuous Cash Provision Program (BPC) in 1996² to unconditionally direct income transfers to disabled, assuming that disability hinders paid and productive employment.

The question of whether to support the disabled through direct income transfer or by creating equal employment opportunities is also part of the broader context of differences in economic development between countries. The

² Despite being part of the Organic Law of Social Assistance, promulgated in 1993, BPC began to be granted in January 1996.

necessary conditions for the improvement of public welfare are economic growth associated with a long-term social policy intended to reduce social disparities, ensure inclusion, and reduce the productive sectors' internal dualism, which is a significant feature of Latin American countries (Ocampo, 2005). In this context, programs and policies to prepare disabled persons for integration into the labor market while preparing the labor market to receive these people would be desirable as part of an inclusive society's broad economic development policy.

This study is structured as follows: Section 2 presents all methodological aspects, addressing the adopted concepts and definitions, the data and sample, and the modeling and empirical design; Section 3 presents and discusses the results; and Section 4 presents the final considerations.

2. Methodology

2.1. Concepts and definitions

This study incorporates microdata from the 2013 National Health Survey (PNS) prepared by the Brazilian Institute of Geography and Statistics (IBGE). The survey is a household sample and each individual in the household need not be individually questioned. Residents over 18 years of age and considered apt could provide the information for the other residents. The survey's sample plan ensured the statistical representation of Brazil. The 2013 PNS survey is the most current available and provides health status, lifestyle information, and demographic and socioeconomic statistics for 205,546 individuals and 63 thousand households within Brazil.

According to Jones (2008), Baldwin and Johnson (2000), and Johnson and Favreault (2001), the effect of a disability may differ between genders as the impacts of particular limitations can be distinct: men's labor may be more adversely affected by loss of mobility and strength; women's labor may depend more on sensory incapacity and appearance. Considering gender specificities related to the above mentioned challenges for the disabled in the labor market and the fact that the effect of gender discrimination could bias the estimations of a disability's effect, this research focuses on the case of men—as did research by Harkness (1993), Baldwin and Johnson (2000), Kidd et al., 2000, and DeLeire (2000).

The study compared two broad groups of individuals: disabled men and nondisabled men. Both groups are made up of men between 18 and 65 years of age, employed in the private sector, with a declared amount of schooling but not currently attending classes. Individuals' responses to PNS survey questions determined their group. The broad groups were determined based on the individual's answer to the PNS survey question “do you have intellectual, physical, auditory, or visual disability?” — therefore, a self-reported state. The group of the disabled men is comprised of individuals that declared themselves to have one or more of these disabilities. Appendix Table A1 lists the specific deficiencies considered in the disabled group and are delineated according to PNS (2013) classifications.

Therefore, the concept of disability adopted is based on data availability and the PNS (2013) definition was used, which treats disability as an individual characteristic, which may or not limit the individual performance in activities. This definition is in line with the understanding of the World Health Organization in that “Disability is the umbrella term for impairments, activity limitations and participation restrictions, referring to the negative aspects of the interaction between an individual (with a health condition) and that individual's contextual factors (environmental and personal factors)” (WHO, 2011). This definition is also in accordance with the Brazilian legislation in force at the time, which adopted the model of the UN Convention on the Rights of Persons with Disabilities, through decree 186 of 07/09/2008 and the International Classification of Functioning (CIF) in force within the framework of the WHO.

The type and severity of a disability in respect to an individual's job activity is also an important factor that, as noted by Garcia and Maia (2014), should account for the differentiation in wages among the disabled. Therefore, we created sub-groups of disabled men to separately analyze the correlation between disability and wages according to their disability's self-reported effect on their activities. Activity limitations are presumed to be a proxy for work limitations, which will be dealt in the following subsections.

In summary, the group of disabled men was disaggregated into the following sub-groups for analysis: Disabled Men whose disability greatly limits their activities (DM-G); Disabled Men whose disability moderately limits their activities (DM-M); Disabled Men whose disability limits their activities little (DM-L); and Disabled Men whose disabilities do not limit activities (DM-W). These groups are compared in the analysis with the group of Nondisabled Men (NDM). The nomenclature in parentheses will be used hereafter in the study. For men with more than one disability, the greatest degree of self-reported limitation was considered to classify them among the groups.

Men allocated among the groups were those who worked or interned for at least one hour at some wage paying activity during the week of July 21–27, 2013 (the research reference week). To prevent conflicts between work and study of men that had some schooling, only those that were not currently attending school were considered. We considered only employees working in the private sector rather than public sector employees, employers, or the self-employed since wage formation in these cases follows different rules. Fig. A1 of the appendix details the sample losses resulting from each applied filter.

The PNS sample does not distinguish between employees working in the formal and informal labor markets. If this separation were applied it would have an important effect since the Brazilian informal labor market accounted for 24% of those employed that were more than 10 years of age in 2010 (National Household Sample Survey – PNAD, 2017). In addition, informal workers cannot benefit from the basic rights guaranteed by Brazilian work regulations. The individual's wage refers to their gross monthly income in *Reals* (Brazilian currency) received from the individual's main job. The number of hours that an individual normally worked per week in the main job was used to calculate the wage received per hour of work.

2.2. Empirical modeling and selected variables

In pioneering articles on Human Capital Theory, Schultz (1961) and Becker (1962) posit that an individual's salary can be expressed as a function of their professional qualities represented by years of schooling, training, and experience. In this context, Mincer (1974) proposed an equation where the neperian logarithm of wage is linear in years of formal education and linear and quadratic in years of job experience. The results from estimation of wage equations allow the decomposition of the wage differential between different groups into a part explained by the observable and controlled characteristics and another that cannot be explained by these attributes.

In both, the estimation of wage equations and subsequent decomposition, there is a sample selectivity problem since these estimates rely on a sample that was not selected randomly but limited to employees who earn salaries, as suggested by the theoretical model (Kidd et al., 2000). Therefore, estimating the Mincer equation with regular ordinary least squares (OLS) can cause bias and inconsistency in the OLS estimator. To address this issue, one can use models for censored data, such as the Type I Tobit, which eliminates the selectivity problem, or the two-stage Heckman's procedure, which starts from the sample selection term estimation through a preliminary Probit employment function used as the explanatory variable in the wage equation (Baldwin and Choe, 2014). If the second option is adopted, it is still necessary to consider how the selection term is treated in the wage decomposition. The strategies developed by Reimers (1983) and Neuman and Oaxaca (2004) are most commonly used to remedy selection term considerations. One problem with estimation of the sample selection term is the difficulty in identifying these models, with exclusion restrictions being particularly strong when considering disabled persons even though standard in the literature (Amemiya, 1985; Deleire, 2001; Baldwin and Choe, 2014).

We chose to follow the Deleire approach (2001) in our study and estimate Tobit wage equations to control the fact that the sample is restricted to employed individuals who earn wages. Specifically, two types of wage equations are estimated. First, we estimate the equations to be used in wage decomposition (Eq. (1)). Afterwards, we estimate a wage equation that is not considered in the decomposition step, including additional variables of interest only to the disabled men's group for deeper exploration of disabled men's wage determinants (Eq. (2)). In both cases, we use a log-linear specification and the neperian logarithm of the wage per hour from the main job, $\ln wage$, as the dependent variable for each i -th worker. The specification of our wage equations models can be summarized as follows:

$$\ln wage_i = \alpha + H'_i \delta_j + X'_i \beta_s + \varepsilon_i \quad (1)$$

$$\ln wage_i = \alpha + H'_i \delta_j + X'_i \beta_s + D'_i \gamma_a + \varepsilon_i \quad (2)$$

In Eqs. (1) and (2), H_i is the vector of Human Capital Theory's explanatory variables, with δ_j being the associated coefficients; X_i is the vector of the additional socio-demographic, job and health characteristics control variables, with β_s being the associated coefficients; α is the constant parameter; and ε_i represents random errors with the usual properties. In Eq. (2), D_i is the vector of explanatory variables specific to the disabled (described in more detail below), with γ_a being the associated coefficients. Table 1 presents the complete description of all variables considered by the study's wage equation empirical model used for the differential decomposition.

Table 1
Description of the variables used in the empirical model.

Variable	Description
<i>lnwage</i>	Gross salary per hour of work (ln);
<i>health1</i>	1 if self-reported very good health condition and 0 otherwise (benchmark category);
<i>health2</i>	1 if self-reported good health condition and 0 otherwise;
<i>health3</i>	1 if self-reported regular health condition and 0 otherwise;
<i>health4</i>	1 if self-reported bad health condition and 0 otherwise;
<i>health5</i>	1 if self-reported very bad health condition and 0 otherwise;
<i>onset_born</i>	1 if the individual was born with the disability and 0 otherwise;
<i>onset_young</i>	1 if the individual acquired disability when young and otherwise;
<i>onset_adult</i>	1 if the individual acquired disability when adult and otherwise;
<i>intellectual</i>	1 if self-reported intellectual disability and 0 otherwise;
<i>physical</i>	1 if self-reported physical disability and 0 otherwise;
<i>auditory</i>	1 if self-reported auditory disability and 0 otherwise;
<i>Visual</i>	1 if self-reported visual disability and 0 otherwise;
<i>Age</i>	Individual's age;
<i>age2</i>	Individual's age squared;
<i>no schooling</i>	1 if it has schooling and 0 otherwise (benchmark category);
<i>incomplete basic schooling</i>	
<i>complete basic schooling</i>	
<i>incomplete secondary schooling</i>	
<i>complete secondary schooling</i>	1 if it has the schooling level and 0 otherwise;
<i>incomplete college education</i>	
<i>complete college education</i>	
<i>White</i>	1 if is white and 0, otherwise (benchmark category);
<i>Black</i>	1 if is black, and 0 otherwise;
<i>nonwhiteblack</i>	1 if is yellow, brown or indigenous and 0, otherwise;
<i>urban domicile</i>	1 if resides in urban area and 0, otherwise;
<i>metropolitan domicile</i>	1 if resides in metropolitan area and 0, otherwise;
<i>agricultural sector</i>	1 if works in the agricultural sector and 0 otherwise (benchmark category);
<i>industrial sector</i>	1 if works in the industrial sector and 0 otherwise;
<i>service sector</i>	1 if works in the service sector and 0 otherwise;
<i>Married</i>	1 if is married and 0 otherwise;
<i>northeast</i>	1 if lives in the region and 0 otherwise (benchmark category);
<i>center-west</i>	
<i>southeast</i>	
<i>South</i>	1 if lives in the region and 0 otherwise;
<i>North</i>	
<i>cbo1_directors</i>	1 for managers and 0 otherwise (benchmark category);
<i>cbo2_science</i>	1 for science professionals and 0 otherwise;
<i>cbo3_tec</i>	1 for technicians and associate professionals and 0 otherwise;
<i>cbo4_clericalsupport</i>	1 for clerical support workers and 0 otherwise;
<i>cbo5_serv</i>	1 for services and sales workers and 0 otherwise;
<i>cbo6_agri</i>	1 for skilled agricultural/forestry/fishery workers and 0 otherwise;
<i>cbo7_craft_trades</i>	1 for craft and related trades workers and 0 otherwise;
<i>cbo8_operators</i>	1 for machine and plant operators and assemblers and 0 otherwise;
<i>cbo9_elementary</i>	1 for elementary occupations and 0 otherwise.

Source: prepared by the authors based on [PNS \(2013\)](#).

Since health conditions can limit the type or amount of work a person can perform ([DeLeire, 2001](#)), the individual's self-reported state of health (*health*) is therefore included in the regression and assumed to refer to an observed effect on productivity. The nine dummy variables at the end of [Table 1](#) represent the major groups of occupations listed in the “domiciliary” version of Brazil's occupational classification system (*cbo*).

Wage Eq. (2) was estimated for only one group. That group consisted of all individuals who reported some disability in the sample (DM). Unfortunately, additional disaggregation was not considered since the limitation of degrees of freedom prevented an accurate estimation of the coefficients. To estimate Eq. (2), which is not used in the wage decomposition, two sets of dummy variables were included to capture aspects that are specific to individuals with

disabilities. The first set consists of variables that mark the individuals age at disability onset: individuals born with the disability (*onset_born*, benchmark category); individuals who became disabled after birth to 18 years of age (*onset_youth*), and those who became disabled after reaching 18 years of age (*onset_adult*). The second set of dummy variables represent the type disability (*intellectual*, *physical*, *auditory* and *visual*), with the group of men with only intellectual disability as the benchmark category. In all, 15 dummies were included in this set to represent all possible combinations among the four different types of disabilities.

It is important to note that we did not model the possible endogeneity of some of our explanatory variables; therefore, it was not possible to identify causal effects, and our results must be interpreted as conditional correlations.

After estimating the wage equations, the wage differential between the groups is evaluated using the decomposition procedure developed by Oaxaca (1973) and Blinder (1973). We opted for a “*twofold decomposition*” so that the total differential between the two groups of workers’ wages is divided into two components: an “explained effect” that is the part of the differential explained by the differences in the two groups’ average characteristics (productive and personal attributes and other aspects derived from their labor market entry), and an “unexplained effect” that refers to the part of the differential not explained by the average characteristics. To perform a “*twofold decomposition*” it is necessary to assume that there exists some vector of non-discriminatory coefficients, β^* . In this study, the vector was estimated using a pooled model including a group indicator as an additional covariate, as suggested by Jann (2008).

2.3. *Discrimination and unobserved productivity fallings*

As pointed out by Jann (2008), many published studies have attributed the unexplained part of any wage differential to discrimination in the labor market. This is probably due to difficulties decomposing the unexplained part of the differential and data constraints regarding the specific job-related limitations caused by the disability. However, the unexplained differential can easily arise due to productive heterogeneity rather than discrimination, especially in a case that assesses differences between the disabled and the nondisabled, since disability-related functional limitations can have important effects on productivity (Jann, 2008; Baldwin and Choe, 2014).

It is very important to note that the unexplained wage difference component includes all wage differences caused by unobserved variables. The possible relevance of discrimination and underperformance on any wage differential between the disabled and the nondisabled necessitates a strategy to properly control for these aspects when estimating the differential. To differentiate between the effects of discrimination and unobserved productivity effects on wages, our study employed a strategy proposed by DeLeire (2001) that uses a group of disabled who self-reported that their usual activities were not affected by the disability. The PNS microdata used in our study contains a self-reported answer to the question “to what extent does disability limit your activities?” and the answers to this question made that comparison possible. Assuming that the self-reported data is correct, any unexplained difference between the wages of those who report that their disabilities do not limit their activities and the wages of the nondisabled working at a comparable job is likely to be due to discrimination (DeLeire, 2001).

Three interrelated concerns arise when using this variable. Firstly, self-declaration may lead to some types of bias: the presence of financial incentive programs for disabled persons may cause individuals to over report their disability (Kerkhofs et al., 1999), or the fear of social stigmatization due to a disability may cause underreporting (Bound, 1989, 1991). There is no consensus regarding this issue; however, in Brazil, the main financial incentive program directed toward disabled persons (BPC) is not based on self-reported criteria. Jones (2008) points out that despite limitations inherent in the use of self-reported disability information, this type of research has been extensively used to investigate this issue due to its greater availability and large-scale application, which allows statistical representativeness for the analysis.

Secondly, our variable is not just linked with employment related activities but to activities in general; therefore, we assume activity limitations as a proxy for work limitation. Thirdly, self-declaration can also cause endogeneity with respect to wages that is related to a possible measurement error. A disabled person may overestimate their ability since their responses to questions regarding activity limitations depend on their perception and, possibly, there is some selectivity in the allocation of jobs and activities to the disabled (to simpler rather than more complex jobs/activities).

Our use of a proxy for work activity limitation and the problem of endogeneity are addressed in a paper by Oguzoglu’s (2012). According to the author, in models corrected for endogeneity, the effects of measures of activity limitation are very close to the effects of measures of work limitation. He notes that for models that do not correct for the endogeneity, measures of activity limitation are much less affected by the justification bias and by the effect of measurement error,

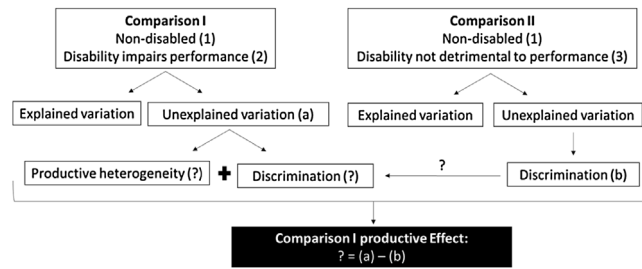


Fig. 1. Decomposition of the *lnwage* differential.

Source: prepared by the authors based on DeLeire (2001).

demonstrating that the effect of endogeneity is minimal when using measures of general activity limitation (our proxy) rather than measures of work limitation. Oguzoglu (2012) also observes that information about work disability is rarely collected in health research and many surveys do not include the data necessary to instrumenting endogeneity, as is the case in Brazil. Since our proxy is the only alternative that compensates for a lack of data availability in Brazil and has been shown to be a reasonable alternative, we consider it to be the most viable and appropriate indicator of the aspects we attempt to measure.

The procedure to ascribe wage differences between the disabled and the nondisabled due to discrimination or unobserved productivity used in our study consists of making two different comparisons, which are schematically represented in Fig. 1. In Comparison I, the two following groups are compared: group (1) contains nondisabled men (NDM) and group (2) contains men with disabilities that affect their activities. The group of disabled men is further subdivided into three sub groups reflecting the amount the disability affects their activities: a little, moderately, or severely, DM-L; DM-M; DM-G, respectively. According to DeLeire (2001), any unexplained difference between groups (1) and (2) is likely to be due to the effects of both unobserved underperformance and discrimination. Comparison II is between group (1) and group (3), which contains men with disabilities but without self-reported activity limitations (DM-W). Any unexplained difference in wages between individuals from groups 1 and 3 is likely due to discrimination (DeLeire, 2001).

Considering the results from comparisons I and II, measurement of how much of the unexplained wage difference can be attributed to discrimination and how much can be attributed to unobserved productivity fallings caused by the disability becomes essential (Fig. 1). Note that following the proposed methodology the NDM group is the same throughout the different severities comparisons (DM-L, DM-M, DM-G).

It is important to point out that the proposed methodology relies on two assumptions noted by DeLeire (2001). The first is that the severity of the disability is not exactly correlated with the disabled individual's productivity at work. For this reason, our use of self-reported information regarding the extent to which the disability affects activities, which makes isolation of the importance of discrimination and productivity possible, is important. This disaggregation is usually beyond the capabilities of other wage gap studies due to data limitations.

The second assumption is that disabled persons with limitations at work (and different degrees of limitation) and disabled persons without limitation at work face the same amount of discrimination. According to Jones (2006), if discrimination and severity of work limitation are positively related, the second assumption will not hold. The effect of severity of disability on discrimination cannot be isolated in this framework; therefore, it can be assumed that the discrimination effect found in the analysis of workers who have a non-limiting disability should be interpreted as a lower bound of discrimination.

2.4. Selected sample

The PNS complete sample included 13,569 Brazilians who reported a disability (6.65% of the entire sample), of which 6,874 were men. Our study considers sub-sample drawn from this complete PNS sample. The sub-sample consisted of 23,970 men, 1,046 who declared themselves as disabled (4.36%).

Of the sub-sample's population of men reporting a disability, 52.87% reported that the disability does not interfere with their activities at all (DM-W), 25.62% reported that the disability impairs activity only a little (DM-L), 12.33% reported that the disability moderately affects activities (DM-M), and 9.18% reported that the disability greatly disrupts

activities (DM-G). It is important to note that the sample factor associated to each observation was used for weighted. [Table 2](#) contains the main average observable characteristics (and standard deviations) of the groups being compared: NDM, DM-W, DM-L, DM-M, DM-G.

The proportion of individuals who declared themselves to have very good health (*health-1*) is significantly higher for the NDM and for the DM-W groups than it is for those in the other disabled groups. At the other health extremes, the proportion of individuals who report a poor or very poor health (*health-4*, *health-5*) is much higher for those whose disability limits their activities to some extent.

The data in the [Table 2](#) indicate a negative relationship between the degree to which the disability affects activities and its time of onset. For DM-L, there is a greater concentration of men whose disabilities appeared in adulthood (*onset_adult*); for DM-G, there is a greater concentration of men whose disability appeared in their youth (*onset_young*) or in their adulthood (*onset_adult*). Additionally, visual disability (*visual*) predominates in all the disabled groups. Auditory disability (*auditory*) is also highlighted for the DW-L group. Participations of individuals with physical or intellectual disabilities, in turn, increase as the extent the disability increasingly affects activities. For DM-W group only 1.5% of the men have more than one disability, while for the other groups, this participation ranges between 7% and 8.3%.

The distribution of individuals among the education levels is similar for the NDM and for the DM-W groups. On the other hand, there is greater percentage of individuals with only basic schooling and lower percentage of individuals with college education (completed or in progress) among those with disabilities that limit activities to some extent than in either the NDM or the DM-W groups.

In the DM-W group, there is a greater proportion of white individuals, individuals residing in urban areas, and individuals that reside in Brazil’s South when compared with all other groups. There is also a relative high percentage of men in the groups with disabilities that moderately or greatly affect their activities (DM-M, DM-G) living in Brazil’s Northeast, the country’s most underdeveloped region. Less developed regions usually contain a higher proportion of disabled persons due to adverse living conditions that hamper childhood development, less available treatment of disabilities, and diseases that can generate disabilities ([França, 2014, p. 106](#); [Elwan, 1999, p. 16](#)).

Regarding the different occupations (*cho1* to *cho9*), there is a relatively smaller participation of disabled men with more limiting deficiencies in management and science positions. These individuals are more likely to be tasked with

Table 2
Compared groups’ Descriptive statistics: NDM, DM-W, DM-L, DM-M, DM-G.

Variable	NDM		DM-W		DM-L		DM-M		DM-G	
	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
<i>lnwage</i>	1.82	0.70	1.90	0.78	1.66	0.67	1.65	0.79	1.51	0.71
<i>health1</i>	0.14	0.35	0.12	0.33	0.07	0.25	0.07	0.26	0.04	0.19
<i>health2</i>	0.65	0.48	0.57	0.49	0.50	0.50	0.38	0.49	0.32	0.47
<i>health3</i>	0.18	0.39	0.27	0.45	0.32	0.47	0.46	0.50	0.46	0.50
<i>health4</i>	0.02	0.13	0.03	0.17	0.09	0.29	0.06	0.24	0.13	0.33
<i>health5</i>	0.00	0.05	0.00	0.06	0.02	0.14	0.03	0.16	0.05	0.22
<i>onset_born</i>	–	–	0.13	0.34	0.18	0.39	0.28	0.45	0.20	0.40
<i>onset_young</i>	–	–	0.23	0.42	0.21	0.41	0.25	0.43	0.33	0.47
<i>onset_adult</i>	–	–	0.65	0.48	0.63	0.48	0.51	0.50	0.49	0.50
<i>intellectual</i>	–	–	0.01	0.10	0.03	0.16	0.05	0.21	0.05	0.22
<i>physical</i>	–	–	0.08	0.26	0.17	0.38	0.22	0.42	0.24	0.43
<i>auditory</i>	–	–	0.22	0.42	0.24	0.43	0.19	0.39	0.15	0.36
<i>visual</i>	–	–	0.68	0.47	0.49	0.50	0.46	0.50	0.48	0.50
<i>intellectual + physical</i>	–	–	0.00	0.00	0.00	0.00	0.01	0.09	0.01	0.08
<i>intellectual + auditory</i>	–	–	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08
<i>intellectual + visual</i>	–	–	0.00	0.00	0.00	0.05	0.00	0.06	0.01	0.08
<i>physical + auditory</i>	–	–	0.00	0.00	0.01	0.07	0.01	0.11	0.01	0.08
<i>physical + visual</i>	–	–	0.00	0.05	0.01	0.10	0.01	0.09	0.01	0.08
<i>auditory + visual</i>	–	–	0.01	0.11	0.05	0.22	0.05	0.21	0.04	0.19
<i>int + phy + vis</i>	–	–	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>int + phy + aud</i>	–	–	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>int + vis + aud</i>	–	–	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00
<i>phy + vis + aud</i>	–	–	0.00	0.00	0.00	0.05	0.00	0.00	0.01	0.08

Table 2 (Continued)

Variable	NDM		DM-W		DM-L		DM-M		DM-G	
	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
<i>phy + vis + aud + int</i>	–	–	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>age</i>	34.74	11.05	40.91	12.19	40.95	12.40	40.44	11.84	40.98	12.48
<i>no schooling</i>	0.08	0.27	0.11	0.31	0.16	0.36	0.13	0.34	0.24	0.43
<i>incomplete basic schooling</i>	0.19	0.39	0.18	0.38	0.30	0.46	0.26	0.44	0.21	0.41
<i>complete basic schooling</i>	0.10	0.31	0.12	0.33	0.12	0.33	0.09	0.29	0.12	0.32
<i>incomplete secondary schooling</i>	0.06	0.24	0.06	0.24	0.06	0.23	0.05	0.23	0.05	0.22
<i>complete secondary schooling</i>	0.41	0.49	0.38	0.49	0.27	0.45	0.34	0.48	0.27	0.45
<i>incomplete college education</i>	0.03	0.16	0.02	0.14	0.02	0.15	0.04	0.19	0.04	0.19
<i>complete college education</i>	0.13	0.34	0.13	0.34	0.08	0.26	0.09	0.28	0.07	0.26
<i>white</i>	0.40	0.49	0.46	0.50	0.36	0.48	0.41	0.49	0.32	0.47
<i>black</i>	0.10	0.30	0.10	0.30	0.12	0.32	0.10	0.30	0.14	0.35
<i>nonwhiteblack</i>	0.51	0.50	0.44	0.50	0.52	0.50	0.49	0.50	0.54	0.50
<i>urban domicile</i>	0.88	0.32	0.90	0.30	0.80	0.40	0.85	0.36	0.84	0.37
<i>metropolitan domicile</i>	0.69	0.46	0.67	0.47	0.58	0.49	0.64	0.48	0.50	0.50
<i>agricultural sector</i>	0.08	0.27	0.08	0.27	0.17	0.37	0.11	0.31	0.16	0.37
<i>industrial sector</i>	0.17	0.38	0.18	0.38	0.15	0.36	0.14	0.34	0.10	0.31
<i>service sector</i>	0.75	0.43	0.75	0.44	0.68	0.47	0.76	0.43	0.73	0.44
<i>married</i>	0.37	0.48	0.46	0.50	0.39	0.49	0.33	0.47	0.35	0.48
<i>center-west</i>	0.13	0.34	0.11	0.31	0.15	0.36	0.12	0.32	0.14	0.35
<i>southeast</i>	0.27	0.45	0.26	0.44	0.23	0.42	0.22	0.42	0.17	0.37
<i>south</i>	0.13	0.34	0.23	0.42	0.16	0.37	0.17	0.38	0.13	0.33
<i>northeast</i>	0.29	0.45	0.24	0.43	0.25	0.43	0.31	0.46	0.38	0.49
<i>north</i>	0.18	0.38	0.16	0.37	0.21	0.41	0.17	0.38	0.19	0.39
<i>cbo1_directors</i>	0.05	0.21	0.05	0.21	0.04	0.19	0.03	0.17	0.02	0.15
<i>cbo2_science</i>	0.07	0.26	0.07	0.26	0.04	0.19	0.05	0.21	0.03	0.17
<i>cbo3_tec</i>	0.09	0.29	0.10	0.30	0.06	0.24	0.08	0.27	0.03	0.17
<i>cbo4_clericalsupport</i>	0.07	0.26	0.08	0.27	0.03	0.18	0.12	0.32	0.03	0.17
<i>cbo5_serv</i>	0.22	0.41	0.20	0.40	0.19	0.39	0.20	0.40	0.21	0.41
<i>cbo6_agri</i>	0.02	0.13	0.02	0.13	0.02	0.15	0.02	0.14	0.05	0.22
<i>cbo7_craft_trades</i>	0.14	0.35	0.15	0.36	0.15	0.36	0.14	0.34	0.21	0.41
<i>cbo8_operators</i>	0.12	0.32	0.12	0.33	0.12	0.33	0.09	0.29	0.07	0.25
<i>cbo9_elementary</i>	0.17	0.38	0.17	0.37	0.28	0.45	0.23	0.42	0.30	0.46

Source: prepared by the authors based on [PNS \(2013\)](#).

duties that involve essentially simple, routine tasks requiring the use of hand-held tools and considerable physical effort (elementary occupations) ([International Labor Office – ILO, 2012](#)).

Focusing specifically on the sample's unemployed men, interesting information regarding the time an individual was actively seeking employment sheds light on the difficulties the disabled encounter relative to the nondisabled when attempting to secure employment. According to information from the [PNS \(2013\)](#), 73.6% of the unoccupied nondisabled men spent less than one year seeking employment, while only 60.9% of the disabled found employment within a year. On the other hand, 12.1% of the nondisabled and 16.5% of the disabled sought employment for a period of one year but less than two years; and for periods equal to or greater than two years, the percentages were 14.3% and 22.6% for nondisabled and disabled, respectively.

3. Results and discussion

[Table 3](#) presents the predicted wage and *lnwage* values of for different groups of men. [Table 4](#) presents the Oaxaca-Blinder decomposition and is composed of four columns that show the results from comparisons between the NDM group and the four groups of disabled men (DM-W, DM-L, DM-M and DM-G).

The wage differential shown in [Table 3](#) is much greater between the NDM group and the DM-M and DM-G groups than it is between the other disability groups, an expected result. The table's first row (*eform*) shows the DM-M group's predicted average hourly wage to be R\$ R\$4.599 and the DM-G group's predicted average hourly wage to be R\$4.512,

Table 3
Predicted values for different groups of men.

Description	NDM	DM-L	DM-M	DM-G	DM-W
Prediction_iform*	6.249***	5.466***	4.599***	4.512***	6.680***
Prediction_lnwage	1.832***	1.699***	1.526***	1.507***	1.899***

Source: prepared by the authors based on PNS (2013).

Predicted wages after re-transform then to their original scale (R\$/hour). * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Table 4
Oaxaca-Blinder decomposition for *lnwage* difference.

Group x NDM	DM-L (1)	DM-M (2)	DM-G (3)	DM-W (4)
<i>lnwage</i> Difference	0.134***	0.307***	0.326***	−0.067*
Unexplained	0.044	0.184**	0.096	0.018
Explained	0.090***	0.123***	0.229***	−0.085***
- <i>health</i>	0.033***	0.057***	0.070***	0.016***
- <i>schooling</i>	0.051***	0.060***	0.062***	−0.005
- <i>other</i>	−0.042***	−0.057***	−0.029*	−0.065***
- <i>domicile</i>	0.016***	0.012**	0.020***	0.001
- <i>sector</i>	0.022***	0.009	0.020**	0.000
- <i>region</i>	−0.015***	0.016	0.017	−0.019***
- <i>cbo</i>	0.025***	0.026*	0.069***	−0.012

Source: prepared by the authors based on PNS (2013).

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Note: *health*: *health2-health5*; *schooling*: *no schooling, incomplete and complete basic schooling, incomplete and complete secondary schooling, incomplete and complete college education*; *other*: *age, age2, black, nonwhiteblack, married*; *domicile*: *urban domicile, metropolitan domicile*; *sector*: *industrial sector, service sector*; *region*: *center-west, southeast, south, north*; *cbo*: *cbo2_science, cbo3_tec, cbo4_clericalsupport, cbo5_serv, cbo6_agri, cbo7_craft_trades, cbo8_operators, cbo9_elementary*.

respectively, a 35.9% difference and a 38.5% difference compared to the NDM group's hourly wage of R\$6.249. Those in the DM-L group earn R\$5.466 per hour, a 14.3 percent difference compared to those in the NDM group, while those in the DM-W group earn R\$6.88, 7 percent more than those in the NDM group.³

These wage differentials are higher but close to those determined by Garcia and Maia (2014) for Brazil. These authors found a differential of 33% for *lnwage* between employees with a severe disability and nondisabled employees and of 11% of *lnwage* between employees with functional limitations only and nondisabled employees. The 2006 study by Contreras et al. of the wage gap between disabled men and nondisabled men found that the differential was 8.5% in Chile and 18% in Uruguay. Kidd et al. (2000) assessed wage equations for nondisabled and disabled men aged 16–64 in the United Kingdom in 1996, before the Discrimination Disability Act, and found that the disabled earned on average 13.32%–14.1% less, depending on the specification adopted. Jones et al. (2006) found that substantial differences in the probability of employment and in wages still remained after full implementation of the UK Disability Discrimination Act in 1997. The authors determined that in 1997, the wages of disabled men with work-limiting disabilities were 86.1% of the nondisabled and that wages for those with a non-limiting work disability were basically equal to the nondisabled (100.65%); in 2003 the figures were 86.0% and 98.2% respectively. Lechner and Vazquez-Alvares (2004) assessed the case of Germany from 1984 to 2002 using panel data and found that annual earnings were 16% less for disabled men than nondisabled men. In a simple and general way, the total difference seems higher in undeveloped countries.

An analysis of column 4 of Table 4 shows that in 2013 the percentage wage difference was negatively influenced by the “explained effect” (−8.1 percentage points) on the DM-W group's wages. That is, if the average observable characteristics of the DM-W group were equal to those of the NDM group, the first group's average wage per hour

³ As Hertz et al. (2008), our wage data information are all in natural logarithms. So, the percentage differences are approximations for the log point differences. According to the authors, differences of 40 log points or less are reasonably close approximations of standard arithmetic percentage differences.

Table 5
DeLeire's (2001) decomposition for *lnwage* difference.

Decomposition	DM-L (1)		DM-M (2)		DM-G (3)		DM-W (4)	
	diff.	%	diff.	%	diff.	%	diff.	%
Explained (except explained health)	0.06	43%	0.07	22%	0.16	49%	−0.10	151%
Explained Health (relation to Productivity)	0.03	24%	0.06	19%	0.07	22%	0.02	−24%
Productivity (unobserved)	0.03	19%	0.17	54%	0.08	24%	0.00	0%
Discrimination	0.02	13%	0.02	6%	0.02	6%	0.02	−27%
Total	0.13	100%	0.31	100%	0.33	100%	−0.07	100%

Source: prepared by the authors based on [PNS \(2013\)](#).

Note: This Table should be analyzed together with [Table 4](#) to infer about the statistical significance.

would fall to R\$ 6.14 per hour, a reduction of 0.54 R\$/h, which indicates that observable characteristics are more positive for the DM-W group than for the NDM group. Similarly, if the average observable characteristics of the NDM were equal to those of the DM-W group, their average wage would increase to R\$ 6.79 per hour. Why, then, is the average wage of the DM-W group not R\$ 6.79? Because there is something that is not explained by observable characteristics that reduces their wage by 0.11 R\$/hour – equal to 2 percentage points of their wage, which according to the hypotheses adopted in this study is caused by discrimination.⁴

These Brazilian results converge somehow with those from similar studies of countries that are very different than Brazil. [DeLeire \(2001\)](#) analyzed data from the United States using panels between 1984 and 1992/1993 and found that only 3.7 percentage points (of 53.6) of the earnings gap between disabled and nondisabled men is attributable to discrimination. [Baldwin and Choe \(2014\)](#) used data from a 2004 United States panel found that 11% of the observed wage differential is potentially due to discrimination. [Malo and Pagán \(2012\)](#) analyzed the cases of Spain, Portugal, Italy, the United Kingdom, Austria, Belgium, Denmark, Finland, Ireland, the Netherlands and Germany and found a small wage differential between nondisabled and disabled that are not hampered by their disability in daily activities, as well as a small discrimination effect. Among the 11 countries analyzed, only in the United Kingdom did discrimination cause a significant reduction in the earnings for men (0.26 euro/h). [Jones et al. \(2006\)](#) conducted an analysis of data from the United Kingdom between 1997 and 2003 and found that the discrimination effect against disabled men is responsible for only a small percentage of the overall wage gap and that this effect has declined over time.

Countries such as Spain, Italy, Austria, the Netherlands and Germany have disability quota schemes as one of their main labor-market inclusion and antidiscrimination measures, despite different integration policies ([Thornton and Lunt, 1997](#)). The United States, the United Kingdom and Denmark have policies oriented toward employment qualification, rehabilitation and vocational adjustment to facilitate the inclusion of disabled persons into their labor markets, keeping quotas as secondary measures or even eliminating them ([Thornton and Lunt, 1997](#)). It seems, therefore, that policies aimed at integration and compensation working together could generate quite effective results to combat discrimination against the disabled.

Assuming that discrimination does not change according to the degree of disability and in order to understand how much of the unexplained wage differentials observed in columns (1), (2) and (3) of [Table 4](#) are due to discrimination and how much are due to unobserved productive failings, [DeLeire \(2001\)](#) suggests that the unexplained effect should be disaggregated in each comparison because disabled persons with work limitations may be both less productive, as a result of their health condition, and face discrimination.

The results of this disaggregation are shown in [Table 5](#) which presents the summary of the wage differential decomposition among its components. The last row in the table shows the total differential (sum of the above components, which is the same as found in [Table 4](#)). The total explained effect in [Table 4](#) was decomposed into two components in [Table 5](#): Explained (except explained health) and Explained Health. The former is the difference between the total explained effect and the contribution of the health variable (self-declared state of health) to this effect. The discrimination percentage in [Table 5](#) was derived from the results shown in [Table 4](#) and follows the [DeLeire \(2001\)](#) hypothesis.

⁴ As [DeLeire \(2001\)](#), we reaffirm that it is assumed here that those individuals who have declared that they have a disability that does not limit their activities do not have lower productivity as a result of the disability.

In [Table 5](#), the Productivity (unobserved) effect refers to the remainder of the unobserved difference that could not be attributed to discrimination.

It can be seen that for the DM-G group, a large part of the differential, 49% (0.16), is related to the observable characteristics of the group's individuals other than their self-declared state of health, which is also relevant, contributing 22% to the differential.

[Table 4](#) shows that the educational level, occupation, and health of those in the DM-G group are the main factors in the Explained (observable) differential. This finding is in line with what was expected since the analysis of descriptive statistics found in [Table 2](#) shows that this group has the lowest percentage of individuals with a complete college education, a higher concentration of individuals in elementary occupations, and a smaller number of individuals in management and science occupations. Referring again to [Table 2](#), it can be seen that among all groups, the DM-G group has the lowest percentage of individuals declaring themselves to be in good health and the greatest percentage of individuals declaring themselves to be in poor or very poor health. Data for this group in [Table 5](#) indicate that six percent (0.02) of the differential was related to unobserved discrimination and 24% (0.08) to unobserved effects on productivity. Combining the unobserved productivity effect and the observed productivity effect related to the self-declared state of health in [Table 5](#) accounted for about 46% of the wage differential.

For the DM-M group, the results can be summarized as follows: the productivity effect (observed or unobserved) represents about 73% of the differential, discrimination is responsible for six percent of the differential, and other observed characteristics except for the self-declared state of health are responsible for 22% of the differential. For this group, the observed characteristics other than health play a less important role than they did for the DM-G group, but the level of schooling remains the main observed effect.

The DM-L group's disability only minimally affects their activities and so that the productivity effect has a relatively low negative weight on wages. We estimated that the productivity effect (observed or unobserved) represents about 43% of the differential, mainly related to the self-declared state of health, while other observed characteristics also represent 43% of the differential. We estimated that discrimination accounted for 13% of the wage differential.

[Table 6](#) presents the estimation results of the Tobit wage equation for the disabled group as a whole. As the sample of disabled men has some degrees of freedom limitation for certain characteristic subdivisions, many coefficients could not be estimated accurately. As expected, the results in [Table 6](#) indicate a relationship between self-reported health status and wages, with wage losses for individuals in categories from *health2* to *health5* when compared to those reporting very good health (*health 1*—the benchmark).

Regarding educational levels, no significant difference was found between the benchmark category (*no schooling*) and levels up to *incomplete secondary schooling*. Disabled men with *complete secondary schooling* and *complete college education* earn higher wages than the benchmark category, 15.39% and 84.13%, respectively, indicating that schooling levels have a relevant positive correlation with the wages of disabled men.

[Baldwin and Choe \(2014\)](#) noted that men with physical disabilities earn higher returns to college than nondisabled workers highlighting that investment in human capital could protect the disabled from wage losses to some extent. However, analyzing studies for Brazil, the wage return to college education appears to be higher for groups other than of the disabled. Using individuals with up to 3 years of schooling as the benchmark, [Silva et al. \(2016\)](#) found that men and women in Brazil in 2014 had wage gains of 10.5%, 20.7%, 51.6% and 224.4% for the years schooling categories of 4–7 years, 8–10 years, 11–14 years and 15, respectively. [Pereira et al. \(2013\)](#), analyzing men based on data from the 2009 PNAD survey found that, on average, for each additional year of study, there is a gain of 31.83% in hourly wages for Brazilian urban workers and a gain of 9.72% for Brazilian rural workers.

We also estimate that disabled men residing in metropolitan areas (*metropolitan domicile*) receive wages 13.95% higher than those residing in other areas. This result is convergent with those of [Silva et al. \(2016\)](#) and [Aguiar and Vaz \(2016\)](#). [Silva et al. \(2016\)](#) found that there is a gain of 11.8% for living in metropolitan areas over other areas. [Aguiar and Vaz \(2016\)](#), analyzing data from the 2014 PNAD for Brazil as a whole, found average wages to be 12.6% higher in metropolitan areas.

Disabled men working in the *industrial sector* and *service sector* earned wages on average 44.36% and 41.30% higher than those employed in the benchmark agriculture category, respectively. [Silva et al. \(2016\)](#) found average wages to be 25% and 18.4% higher in the industry and services sectors, respectively, when compared to the agriculture sector, indicating that the gains from working in sectors other than agriculture may be greater for the disabled than for the nondisabled.

Table 6
Tobit wage equation estimates for the Disabled Men (DM).

<i>lnwage</i>	Coef.	Percentage difference ^a
<i>health2</i>	−0.11	−10
<i>health3</i>	−0.24***	−21.55
<i>health4</i>	−0.01	−1.02
<i>health5</i>	−0.19	−17.26
<i>onset_young</i>	−0.01	−1.03
<i>onset_adult</i>	0.01	0.81
<i>physical</i>	0.29*	33.14
<i>auditory</i>	0.32*	37.25
<i>visual</i>	0.32**	37.43
<i>intellectual + physical</i>	−0.41	−33.39
<i>intellectual + auditory</i>	0.96	161.16
<i>intellectual + visual</i>	0.14	14.61
<i>physical + auditory</i>	0.79**	121.04
<i>physical + visual</i>	−0.01	−0.59
<i>auditory + visual</i>	0.24	27.12
<i>int + phy + vis</i>	(omitted)	−
<i>int + phy + aud</i>	(omitted)	−
<i>int + vis + aud</i>	0.54	71.99
<i>phy + vis + aud</i>	−0.04	−3.51
<i>phy + vis + aud + int</i>	(omitted)	−
<i>age</i>	0.02*	−
<i>age2</i>	0.00	−
<i>incomplete basic schooling</i>	−0.05	−4.68
<i>complete basic schooling</i>	0.01	0.85
<i>incomplete secondary schooling</i>	−0.09	−8.73
<i>complete secondary schooling</i>	0.14*	15.39
<i>incomplete college education</i>	0.28	32.23
<i>complete college education</i>	0.61***	84.13
<i>black</i>	−0.09	−8.43
<i>nonwhiteblack</i>	−0.04	−3.75
<i>urban domicile</i>	−0.01	−1.15
<i>metropolitan domicile</i>	0.13***	13.95
<i>industrial sector</i>	0.37***	44.36
<i>service sector</i>	0.35***	41.3
<i>married</i>	0.10*	10.29
<i>center-west</i>	0.40***	49.75
<i>southeast</i>	0.35***	42.5
<i>south</i>	0.38***	45.99
<i>north</i>	0.14*	14.54
<i>cbo2_science</i>	0.39***	48.01
<i>cbo3_tec</i>	−0.02	−1.62
<i>cbo4_clericalsupport</i>	−0.36***	−30.01
<i>cbo5_serv</i>	−0.40***	−32.82
<i>cbo6_agri</i>	−0.32*	−27.48
<i>cbo7_craft_trades</i>	−0.23**	−20.38
<i>cbo8_operators</i>	−0.24**	−20.98
<i>cbo9_elementary</i>	−0.53***	−41.02
<i>affects_little</i>	−0.03	−2.62
<i>affects_moderately</i>	−0.15*	−13.62
<i>affects_greatly</i>	−0.08	−7.63
<i>constant</i>	0.62*	−

Source: prepared by the authors based on PNS (2013).

^a Percentage difference compared to benchmark category: $100[\exp(\text{coefficient})-1]\%$. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Average higher salaries were estimated in Brazil's Center-west, Southeast, South, and North regions when compared to those paid in the country's Northeast region, the benchmark and the country's least developed region. The wage differential between our benchmark and Brazil's *North* was the least, 14.54%. Regarding geographical locals, there does not seem to be a significant difference when comparing the determinants of disabled individuals' wages with determinants for the Brazilian labor market in general. Comparing Brazil's Northeast with the country's other areas, [Silva et al. \(2016\)](#) found higher average wages in the North, Southeast, South and Central-west parts of the country, 19%, 26.3%, and 31.5%, respectively. [Aguiar and Vaz \(2016\)](#) also noted higher wages were paid in Brazil's North, Southeast, South and Central-west relative to its Northeast, with average gains of 29.4%, 41.3%, 46.5% and 54.5%, respectively.

As for the occupations, with the positions of manager being the benchmark (*cbo1_directors*), higher wages were estimated for disabled men working in science and the other intellectually challenging occupations (*cbo2_science*); lower wages were estimated for the other groups of occupations, with percentages varying between –20% and –41%, and slightly more negative for those in the least challenging occupations (*cbo9_elementary*) (–41.02%). The results reported in this paragraph reflect the general wage distribution pattern in Brazil.

Focusing on the specific variables reflecting disability onset, no significant differences were found in the wage differential between men who were born with the disability and those who became disabled in their youth (*onset_young*) or adulthood (*onset_adult*). According to [Jones \(2008\)](#) and [Baldwin and Johnson \(2001\)](#), the labor market issues faced by those who have been disabled since childhood are distinct from those who became disabled later in life. Those born with the disability may face discrimination from the start of school through entry into the job market. Those that became disabled later in life, in turn, may face discrimination when returning to work after illness ([Jones, 2008](#); [Baldwin and Johnson, 2001](#)). The challenges faced by those who are disabled since birth may be more closely related to entering the job market, but once employed, the period of disability onset does not seem to influence wages.

Regarding the disability's nature, the benchmark category is composed of men with only intellectual disability. For individuals with only one disability, estimates show that, on average, those with a *physical*, *auditory* or *visual* disability earn wages that are respectively 33.14%, 37.25% and 37.43% higher than the average for the intellectually disabled. Among men with two concurrent disabilities, a statistically significant relationship was found for only those with both auditory and physical disabilities (*physical + auditory*). Even though this group is composed of men with two disabilities, it is still estimated that the average wage is higher than that of the benchmark category. [Mann and Wittenburg \(2015\)](#) also showed that wage gaps between disabled and nondisabled adults are larger for those with mental limitations or any type of severe limitation. Sample constraints did not allow for accurate estimates for groups consisting of individuals with three or four concurrent disabilities (*int + phy + vis*, *int + phy + aud*, *phy + vis + aud + int*).

Regarding the three severity of the disability's effects on activities categories (*affects_little*, *affects_moderately* and *affects_greatly*), lower mean wages were estimated when compared with the base group (*without limitation*), but only the estimate for the *affects_moderately* variable is statistically significant.

4. Conclusion

The study's main results indicate that disabled men who face difficulties when carrying out their activities receive lower wages than nondisabled men. This differential increases as the disability's severity increasingly limits activities, reaching a differential of 38.5% in relation to the nondisabled when the disability greatly limits activities.

In a general way, the estimated differentials were associated with both the effect of discrimination in the labor market and the disability's negative effect on productivity. When wages for the nondisabled were compared with wages for the disabled whose disability did not limit activity, the base comparison used to isolate discrimination from underproductivity, discrimination was found to reduce wages for the disabled by only two percentage points. Considering this same amount of discrimination for the other comparison groups, the disability-related discrimination weight in the total wage differential ranged between 6% and 13%. The effect of underperformance was quite relevant in determining wage differentials, both for observed productivity (measured by self-declaration of health status) and not observed productivity (residually obtained). It was found that this is especially true for the disabled whose disability affects their activities moderately or severely.

There was also a definite wage "reward" for a disabled individual's level of education – the more educated, the greater the reward, indicating that investment in this group's human capital would help reduce the wage gap. In addition, the onset of the disability does not have significant correlation with wage among the disabled, which may indicate

that policies focused on this specific issue may be more effective if they are directed to pre-employment stages. And those with an intellectual disability were the most disadvantaged disabled group in terms of wages, indicating that this specific group deserves special attention in the formulation of Brazilian policies to assist the disabled.

We stress the importance of continued enforcement of the Brazilian [Persons with Disabilities Statute \(Law n. 13,416, of July 6, 2015\)](#) to ensure that disabled persons receive the same remuneration as the nondisabled for work of equal value. Although this statute, when properly applied and enforced, guarantees that the disabled are able to participate in the labor market and receive equal reward for their labor, additional resources should be allocated to provide the training and expertise needed to develop these individuals' full productive potential. We are in agreement with recommendations made by [Bordieri and Drehmer \(1986\)](#) and [Parent and Everson \(1986\)](#) in this regard.

The results obtained were anchored in two assumptions. The first is that the severity of the disability is not exactly correlated with the individual's employment related productivity. The application of this assumption made it possible to isolate the discrimination effect using self-reported information about the extent to which a disability affects activities. The second assumption is that disabled people with different degrees of limitation at work and disabled people without limitation at work face the same amount of discrimination. Additionally, we did not model the possible endogeneity of some of our explanatory variables; therefore, it was not possible to identify causal effects, and our results must be interpreted as conditional correlations.

Although future studies of discrimination as it relates to the disabled in 21st century Brazil are recommended, many will be constrained by data availability. One such study would be an investigation of the discrimination effect on Brazilians with disabilities before and after the country's Person with Disabilities statute was fully implemented in January, 2016, similar to comparative evaluations carried out in OEDC countries. Unfortunately, data for the latter period will be available no sooner than 2020. Another relevant analysis would an investigation of the wage gap in the context of Brazil's Quotas Law. However, data for this analysis is only available for the formal sector, which employs a small percentage (about 5%) of persons with disabilities in Brazil.

Appendix A

Table A1
Disability description.

Disability	Includes individuals who were born or who acquired
Intellectual (below-normal development)	Down Syndrome, Autism, Cerebral Palsy or some other syndrome or developmental disorder.
Physical	Permanent paralysis of one side of the body or of the legs and arms (both or only one); amputation or absence of leg, arm, hand or foot; congenital or acquired deformity in one or more limbs; motor disability due to poliomyelitis or childhood paralysis; ostomy, dwarfism, or some other unspecified type of physical disability
Hearing (partial or total loss of hearing)	Deafness of two ears, deafness of one ear and reduced hearing of the other, deafness of one ear and normal hearing of the other and hearing reduced in both ears (either birth or acquired throughout life)
Visual (partial or total loss of seeing)	Blindness of both or one of the eyes, the other eye being reduced or normal vision, and those with low vision in both eyes or one eye

Source: prepared by the authors based on [PNS \(2013\)](#).

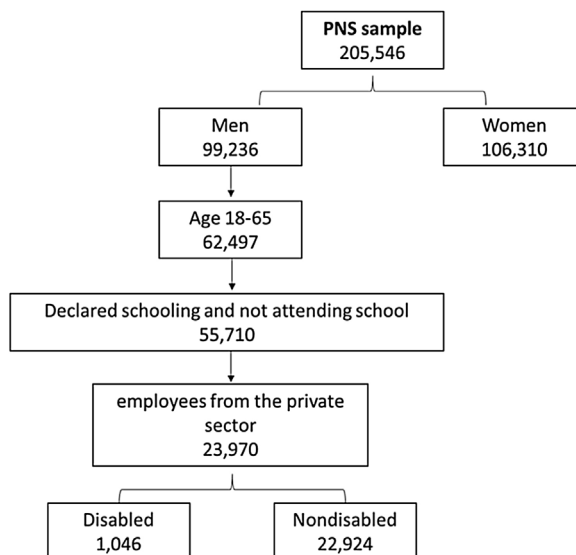


Fig. A1. Sample losses with the application of each filter.

Source: prepared by the authors based on PNS (2013).

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