

## Non-employment duration and subsequent wage losses in the Brazilian labour market

Paulo Aguiar do Monte<sup>1</sup>  
Hilton Martins de Brito Ramalho<sup>2</sup>  
Ignácio Tavares de Araújo Júnior<sup>3</sup>

### Resumo

Este artigo analisa o impacto do desemprego, e sua respectiva duração, no salário recebido pelo trabalhador no seu próximo emprego. Apesar de ser um tema muito discutido na literatura, as análises empíricas ainda são pouco exploradas no mercado de trabalho brasileiro. Tendo como base de dados a Pesquisa Mensal de Emprego (2008, 2009) e seguindo a proposta adotada por Tunali (1986), acrescida de uma análise de diferencial salarial, os resultados encontrados estão de acordo com os observados em trabalhadores anteriores (Keltzer, 1998; Burda e Mertens, 2001; Arulampalam 2001; Arranz et al., 2010), destacando que a duração do desemprego gera um custo adicional aos trabalhadores recém-empregados, representado em termos de perdas salariais. Em outras palavras, os trabalhadores que experimentaram um período de desemprego recente têm desvantagens em termos salariais comparativamente àqueles que permaneceram empregados ao longo do período de análise.

**[Palavras-chave:** Desemprego. Duração do desemprego. Salário. Probit bivariado].

### Abstract

This paper analyses the relationship between unemployment and its respective duration on subsequent salary. Despite of being a topic of intense debate in the labour market literature, there is little empirical evidence to support this perspective in the Brazilian labour market. Drawing on data from the Monthly Employment Survey (2008, 2009) and following the methodology proposed by Tunali (1986), plus an analysis of wage differential, the findings go in the same direction of earlier studies (e.g. Keltzer, 1998; Burda and Mertens, 2001; Arulampalam 2001; Arranz et al., 2010) by highlighting that unemployment duration generates a cost to employees represented in a subsequent wage loss. In other words, it seems that workers who have recently experienced unemployment spell have disadvantages in terms of wages compared to those who remained employed throughout the period under inquiry.

**[Key-words:** Unemployment. Unemployment duration. Wage. Bivariate Probit].

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Endereço: Programa de Pós-Graduação em Economia – UFPB. Jardim Cidade Universitária, Campus 1, João Pessoa – PB. CEP - 58.059-900. Fone: 0.xx.83.3216.7482

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<sup>1</sup>Professor at the Federal University of Paraíba.E-mail: [pauloaguiardomonte@gmail.com.br](mailto:pauloaguiardomonte@gmail.com.br)

<sup>2</sup>Professor at the Federal University of Paraíba.E-mail: [hiltonmbr@hotmail.com](mailto:hiltonmbr@hotmail.com)

<sup>3</sup>Professor at the Federal University of Paraíba.E-mail: [ignacio.tavares@gmail.com](mailto:ignacio.tavares@gmail.com)

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### **1. Introduction**

The relationship between wages and the duration of unemployment is a subject much discussed in the labour market literature lately. Burda and Mertens (2001) highlight that the importance of this subject is based on the causes of a possible reduction of reemployment wages and, therefore, should be considered in the application of public policies. In effect, Arulampalam (2001) argues that because of its impact on wages, the period of unemployment has interfered in the labour supply, and thus justifies the public intervention through policies of Minimum Wage and Unemployment Insurance. In many circumstances, the Government finances retraining programs to help with the reintegration of workers into the labour market with lower or no wage loss. Burda and Mertens (2001) also state that the macroeconomic theory would consider the consequences of unemployment on wages to the extent that persistent changes the product of its trend are related to both nominal and real rigidities in the economy, since the clearance work could represent a mechanism for macroeconomic adjustment comparable to the salary decreases or increases in unanticipated price level.

The explanations of the effects of previous unemployment duration on subsequent salary are not only referring to a theoretical framework, as highlighted by Arulampalam (2001) and Arranz et al. (2010). According to human capital theory, knowledge and skills acquired to a specific job are not necessarily transferable to other occupations. Moreover, long-term unemployment often leads to a significant loss in the stock of human capital which tends to lead to a salary reduction even after the worker gets a new job due to lack of use or obsolescence. As said by Pissarides (1992), the loss of skills due to long-term unemployment also increases the probability of remaining unemployed. On the other hand, asymmetric information about workers' productive abilities can affect the wage determination on the labour market into a lower level than before. In other words, the employer faces an adverse selection problem, without necessarily knowing *ex ante* the workers' productivity. In this case, the employer uses the workers' employment history to make inferences about his/her productivity. Thus, the greater the time spent in unemployment and the number of interruptions of employment, the lower the productivity expected by the employer and, consequently, the lower the salary gain by the employee in his/her new job.

Taken into consideration the persistence of unemployment as an involuntary act that will last until the worker finds a job in the labour market whose wage is greater than their reservation wage, some supporters of the Job Search Theory argue that remain in unemployed could be seen as a positive sign which can result in wage increases. The argument in this approach is based on the fact that employees leave voluntarily from their job in the hope of finding another job most compatible with their skills and knowledge. Authors such as Mortensen and Pissarides (1999) consider that the permanence on unemployment can be seen as an investment in human capital to the extent that the employee was, during this period, making the necessary investments for his/her return into a new job. However, it is important to note that the prolonged voluntary or involuntary on unemployment can reduce the worker's reservation wage (Addison et al., 2004). Borjas (2008), in turn, explain that there is a natural reduction of labour supply that prevents him/her from spending long periods of time looking for the best possible

chance of employment. Thus, the worker ends up accepting almost all the original proposals of employment.

According to Bertola and Rogerson (1997) and Arranz et al. (2010), the way the labour market is institutionally organised influences the effects of unemployment on wages. The authors state that excessive regulation could influence the labour market dynamics on the grounds that the thoughts of leaving the job without costs could result in job match sub-optimal for both workers and firms. Depending on the definition of values and the maximum duration of unemployment insurance, the unemployed may not have incentives to seek for a new job, increasing the duration of unemployment and, thus, resulting in a lower reemployment wages. For instance, the existence of Unemployment Insurance Programs also contributes to changing the structure of incentives to individual offer hours of work in the labour market. The beneficiary of the transfer could raise his/her reservation wage because he/she will lose the benefit if he/she gets a new job. Often, the salary is above what firms are willing to pay, given the low expected productivity of workers because of their skill levels, for example. The result is a greater duration of unemployment and, most likely, a future wage loss.

The empirical evidences on the subject highlight the negative consequences of unemployment, and its respective duration, on wages after the worker gets a new job. The studies have investigated the effects of job displacement on labour income and have found wage losses of about 17 percent in re-employment in the United States (Keltzer, 1998) and in Germany (Burda and Mertens, 2001). Jacobson et al. (1993), using data from the state of Pennsylvania, show that displaced workers have higher wage losses, even those who find jobs in similar firms. In England, according to Arulampalam (2001), the experiences on unemployment reduces wage of new jobs in 6 percent compared to a worker with the same traits, but who remained employed. Arranz et al. (2010) provide some evidence of wage losses in the transition from unemployment to employment in various European countries, among them, France, Spain and Germany, and show that wage losses are around between 3-4 percent, and in Portugal and in Italy, the losses are in tone of 5.5 and 6.6 percent respectively. Knight and Li (2006) show that in China, after 19 months on unemployment, the wage loss reaches 16 percent, and after 47 months, wages fall by 39 percent. In general, the economic literature that deal with this subject concludes that individuals who have experienced volunteer transitions have wage gains compared to those who have always remained in the same job, however, regarding those who were unwittingly exposed to unemployment the wage losses was greater.

In Brazil, after the monetary policy that stabilized the economy and the trade liberalization in the 90s, were observed deep structural changes, especially in the agricultural and industrial sector. The employment effects of these changes can be seen in Sesso Filho et al. (2010). According to the authors, only between 1995 and 1996, the increase in productivity led to a reduction of 3.1 million jobs. Despite the high average rates of unemployment there was also an increase in its duration in this period, a fact that deteriorates further in the status of Brazilian workers in the labour market and that has direct bearing on their occupational development. In fact, the unemployment experience in the post-trade liberalization in Brazil led to relevant wage cuts, as showed by Hoek (2006) based on data from the Monthly Employment Survey (PME). According to findings by Oliveira and Carvalho (2006), the duration of unemployment negatively affects the reservation wage of workers and women tend to remain unemployed longer. More recently, Monte et al. (2009) have revealed that the re-employed workers receive an average wage 30 percent shorter than those with similar traits in the Brazilian labour market.

The authors also concluded that for every additional month on unemployment, there is a penalty of about 3.0 percent on salary on his/her new job.

Based on the literature review, this paper aims to estimate the effects of the duration of unemployment on wages of reemployed Brazilian workers. To solve this question we will use the approach taken by Tunali (1986) by applying a bivariate probit model related to the individual's participation in the labour market. Moreover, we will add an analysis of wage differential, correcting the potential problems of selection bias in the sample and bringing up new results regarding the wage cost of unemployment in the Brazilian labour market.

This paper proceeds as follow. Section 2 presents the methodology used. Section 3 reports the estimation results and summarizes and interprets our findings. Finally, section 4 concludes.

## 2. Methodological considerations

### 2.1. Econometric Model

The empirical strategy used in this paper attempts to estimate the effects of the duration of unemployment on wage differences. For this purpose, initially, it is estimated a model of joint determination of employability and wages controlling for more than one source of selection bias in the sample, as have been used in several studies in the literature (see for instance, Tunali, 1997; Mohanty, 2005). Following this idea, we performed the decomposition of wage differentials according to the employment status of workers isolating the portion of the wage gap explained by the difference between workers who have been exposed to unemployment and those who have remained employed during the two-stage time. Firstly, consider the following bivariate probit sample selection:

$$y_{1i}^* = \theta_1 z_{1i} + u_{1i} \Leftrightarrow y_{1i} = \begin{cases} 1 & \Leftrightarrow y_{1i}^* > 0 \\ 0 & \Leftrightarrow y_{1i}^* \leq 0 \end{cases} \quad (1)$$

$$y_{2i}^* = \theta_2 z_{2i} + u_{2i} \Leftrightarrow y_{2i} = \begin{cases} 1 & \Leftrightarrow y_{2i}^* > 0 \\ 0 & \Leftrightarrow y_{2i}^* \leq 0 \end{cases} \quad (2)$$

Where,  $y_{1i}^*$  and  $y_{2i}^*$  are the latent variables that measure the benefit derived by employees,  $z_{ji} \forall j = 1, 2$  is a vector of variables that affect the costs of job search,  $\theta_1$  and  $\theta_2$  are vectors of parameters to be estimated,  $u_{1i}$  and  $u_{2i}$  are probabilistic error terms are correlated from the coefficient  $\rho = cor(u_{1i}, u_{2i})$ .

Equation (1) determines workers' allocation in the first period of the interview, i.e., the dummy variable takes a value of 1 if the individual was employed and 0 if he/she was unemployed (workers looking for jobs). In turn, equation (2) affects the employability in the second moment of the interview (final status), where the dummy variable takes the same values of the first equation (1 for employed workers and 0 for unemployed workers). Thus, the selection equation reported above assumes that the decision to seek employment in the second period is interdependent for the demand of employment in the first period. Hence, unobserved factors that impact both decisions are correlated.

Labour income is only available for those individuals who were employed in the last period of the interview ( $y_{2i} = 1 \forall y_{1i}$ ). Therefore, the two Mincerian equations can be estimated by:

$$\ln w_{1i} = \beta_1 x_{1i} + \varepsilon_{1i} \Leftrightarrow y_{1i} = 0; y_{2i} = 1 \quad (3)$$

$$\ln w_{2i} = \beta_2 x_{2i} + \varepsilon_{2i} \Leftrightarrow y_{1i} = 1; y_{2i} = 1 \quad (4)$$

Where,  $\ln w_{ji} \forall j = 1,2$  is the logarithm of hourly wage,  $x_{ji} \forall j = 1,2$  is a vector of personal characteristics and socioeconomic factors,  $\beta_1$  and  $\beta_2$  are vectors of parameters and  $\varepsilon_{1i}$  and  $\varepsilon_{2i}$  are the stochastic error terms.

Equation (3) affects the income of workers who were unemployed at the first interview (initial status) and employed at the second interview (final status), while equation (4) determines the earnings of those who were employed over time (during all the time, interviews). However, by making use of a sample data set, it is possible that the sample should not be random. This can occur because of unobserved productive attributes which affect the worker's employment status over time. For example, a worker who has remained employed in the second stage of the interview can register productive characteristics better than the one who were unemployed in the first stage of the interview. In this case, the estimate of Ordinary Least Squares (OLS), equation 3, would produce biased coefficients (Lee, 1978; Heckman, 1979) because the terms  $\varepsilon_{1i}$  and  $\varepsilon_{2i}$  would be correlated with  $u_{1i}$  and  $u_{2i}$ . One way to solve this problem is to use the correcting procedure for the dual source of selection bias. Tunali (1986) made an extension of Heckman's method (1979) which allows obtaining consistent estimates of (3) apart from the correlated variable with the decision of looking for a job. Briefly, the procedure adopted by Tunali (1986) suggests estimation in two stages.

First, the equations are estimated (1) and (2) - by bivariate probit Maximum Likelihood Method (ML) and computed the following correction terms:  $\lambda_{21} = \frac{f(C_1)F(-C_2^*)}{G(C_1, -C_2, -\rho)}$ ,  $\lambda_{22} = \frac{-f(C_2)F(C_1^*)}{G(C_1, -C_2, -\rho)}$ ,  $\lambda_{31} = \frac{f(C_1)F(C_2^*)}{G(C_1, C_2, \rho)}$  and  $\lambda_{32} = \frac{f(C_2)F(C_1^*)}{G(C_1, C_2, \rho)}$ , where  $C_1 = \hat{\theta}_1 z_i$  and  $C_2 = \hat{\theta}_2 z_i$  are linear predictions of (1) and (2), respectively,  $C_1^* = \frac{C_1 - \rho C_2}{\sqrt{1 - \rho^2}}$  and  $C_2^* = \frac{C_2 - \rho C_1}{\sqrt{1 - \rho^2}}$  are combinations of these predictions,  $G(C_1, -C_2, -\rho)$  is the probability that the individual is employed in the initial period and  $G(C_1, C_2, \rho)$  is the likelihood that the worker is employed in the final period, with  $f$  being the standard normal density function,  $F$  being the cumulative density function and  $G$  being the bivariate normal density function (Tunali, 1986, p.238, p.246, pp.272-274).

In the second stage, the variables mentioned above enter the wage equations as additional regressors, which are estimated by OLS in separate samples: the first consists of workers employed only at the last moment of the interview and the second consisting of workers employed in two stages. Thus, it is possible to correct the estimates for a dual source of selection bias, i.e., those involved in the condition of employed / unemployed in the first and second periods of the interviews. Formally, the expected values of the estimated equations are given by:

$$E(\ln w_{1i} | y_{1i} = 0; y_{2i} = 1) = \hat{\beta}_1 x_{1i} + \hat{\sigma}_1 \lambda_{21} + \hat{\sigma}_2 \lambda_{22} \quad (5)$$

$$E(\ln w_{2i} | y_{1i} = 1; y_{2i} = 1) = \hat{\beta}_2 x_{2i} + \hat{\sigma}_3 \lambda_{31} + \hat{\sigma}_4 \lambda_{32} \quad (6)$$

Where,  $\hat{\beta}_1$  and  $\hat{\beta}_2$  are vectors of coefficients and are corrected for selection bias in the sample, and,  $\hat{\sigma}_1$ ,  $\hat{\sigma}_2$ ,  $\hat{\sigma}_3$  e  $\hat{\sigma}_4$ , are respectively the estimates of covariances between the unobserved terms, that is, between,  $\varepsilon_{1i}$  and  $u_{1i}$ ,  $\varepsilon_{1i}$  and  $u_{2i}$ ,  $\varepsilon_{2i}$  and  $u_{1i}$  and  $\varepsilon_{2i}$  and  $u_{2i}$ .<sup>4</sup>

## 2.2 Wage differentials and the effect of unemployment duration

In order to verify the effect of unemployed on subsequent wages, we adopted the decomposition proposed by Oaxaca (1973). To do this, the method makes use of the coefficients from the wage equations to separate the portion of the wage differential explained by the difference between these parameters (valuation made by labour market for unobserved productive attributes) that related to inequalities in funding between two productive groups population (valuation of observed attributes). Formally:

$$\ln w_{1i} - \ln w_{2i} = \sum_{i=1}^n \bar{x}_1 (\hat{\beta}_1 - \hat{\beta}_2) + \sum_{i=1}^n \hat{\beta}_1 (\bar{x}_1 - \bar{x}_2) \quad (7)$$

Where,  $i = 1, \dots, n$  is the sample of workers and  $\bar{x}_1$  and  $\bar{x}_2$  are means of observed attributes.

The first part of the differential  $\sum_{i=1}^n \bar{x}_1 (\hat{\beta}_1 - \hat{\beta}_2)$  captures the portion of the earnings gap between workers in group 1 (unemployed workers in the initial period / employed workers in the end of the period) and workers in group 2 (employed workers during all the periods), as if worker in group 2 had the same observed attributes as worker in group 1. Therefore, this differential is explained by the diverse valuation that the labour market can perform on the unobserved productive attributes. So, if this component has a positive sign, it would indicate that this specific group of workers (group 1) receives a relatively higher average wage because of the positive self-selection on unobserved characteristics (consequences of the unemployment duration).

The second part of the differential  $\sum_{i=1}^n \hat{\beta}_1 (\bar{x}_1 - \bar{x}_2)$  captures the effect of the differential attributed in differences in allocations between the two groups observed. For example, a positive value of this component suggests that a specific group of workers, for instance group 1, is positively selected in observed attributes rather than group 2.

## 2.3 Data

The sample was constructed using information from the Monthly Employment Survey (PME) for the year 2008, which was collected by the Brazilian Institute of Geography and Statistics (IBGE). The PME covers six metropolitan regions of Brazil (Recife, Salvador, Rio de Janeiro, São Paulo, Belo Horizonte and Porto Alegre) and follow a rotation scheme and a monthly household panel structure, where each panel was surveyed for 4 consecutive months (the first round of interviews), then removed from the sample by 8 months, and returned again for more 4 consecutive months (the second round of interviews), when it is permanently

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<sup>4</sup> The standard deviations of the wage equations (5) and (6) may not be effective due to the presence of terms that correct the presence of selection bias (Nelson, 1984). However, the estimation of the data by resampling techniques (bootstrap) provides efficient results. (Cameron and Trivedi, 2005).

excluded. Given the methodology, it was possible to select the database by following individuals over the period.

The sample was selected from the group of individuals who responded to the survey for the first four consecutive months of the interviews. Thus, given that the PME provides indicators of their individual status in the labour market, it was possible to obtain the individual's condition in the first month (initial status) and last month of the interview (final status). And, for the cases of workers who were unemployed in the first interview (initial status) and achieved a job over the period, it was possible to obtain information from the full length of time of the unemployment duration.

The investigated variables were selected according to the economic literature. The variables used were: male (dummy variable, male or female), age (according to the equation may be a continuous variable which indicates the age in years, or a dummy variable that represent the each group of age), age squared (continuous variable), household head (dummy variable that have embraced the value 1 if the head and 0 otherwise), years of schooling (dummy variable representing the levels of schooling, in years), white (dummy variable assumes value 1 if white and 0 otherwise), number of household members (continuous variable), semester of the year (dummy variable that assumes value 1 if the interview occurs in the first semester year time), log hourly wage (continuous variable) and region (dummy variable for each metropolitan area). In particular, the variables *head of household* and *number of household members* are used to identify the structural model described in equations (1) to (4) and also to separate the determinants of the costs related to the job search process from those related to income (Gobillon and Le Blanc, 2003).

To make up the sample, we selected only individuals who were interviewed for four consecutive months. Individuals who failed to respond the interview at any of the four consecutive months and those aged below 16 and above 60 were excluded from the sample. It is important to highlight that those who were surveyed in a second round of interviews would only be selected if they had not been surveyed during the first time, thus avoiding double counting.

In this term, the sample consisted of 73,940 individuals (37,120 men and 36,820 women), distributed according to their respective metropolitan areas, such as: Recife (6,946), Salvador (8,813), Belo Horizonte (15,246), Rio de Janeiro (13,869), São Paulo (17,252) and Porto Alegre (11,814).

### **3. The impact of unemployment on subsequent wage**

#### *3.1 Descriptive analysis of the sample*

In Table 1, we present the summary statistics of the key variables used in this article, describing the individual labour market status according to their position obtained in the first interview (initial status) and in the last interview (final status). The rows describe the key variables used and the columns display the mean and standard deviation of group 1 (newly employed workers) and group 2 (stayers workers - workers employed during all the period)

In order to analyse table 1, it should be taken as a reference the perspective of the dynamics of the labour market. The argument is based on the fact that the characteristic of newly

hired workers (who were previously economically inactive or unemployed) is different from workers who were permanently employed, many of them for years employed at the same position and at the same company. Through the information contained in the table, it is observed that while men are the majority among those who remained permanently employed (53.00 percent), women (omitted category) are the majority among the newly hired employees (56.26 percent). It is noticed also that the percentage of young individuals (less than 30 years old) and individuals who acquired more schooling is higher among newly hired employed (group 1). These results confirm the argument quoted above regarding the difference in characteristics between these two groups of workers. Moreover, these data are consistent with those found in the literature about the subject which highlights the increasingly insertion of women, young individuals and workers with higher levels of schooling in the labour market (Machado and Moreira, 2001; Menezes-Filho and Rodrigues, 2003).

On these aspects, Goldin and Katz (2008) point out, for the labour market of the United States, the importance of skilled workers mainly apart from the 70's as a decisive variable for understanding the operation of demand and labour supply; while Card and Lemieux (2001) underscore the importance of female participation in the labour market, emphasizing the considerable increase in their level of schooling.

Table 1: Summary description of workers according to their status in the labour market

Variables	Group1		Group2	
	Newly employed workers (initial status: non-employed; final status: employed)		Workers employed during all the period (initial status: employed; final status: employed)	
	Mean	Standard deviation	Mean	Standard deviation
Male*	0.4374	0.4962	0.5300	0.4991
White*	0.4317	0.4955	0.5157	0.4998
Age	30.0451	9.7570	36.5597	10.7303
Age squared	997.8493	669.7333	1451.7520	817.6407
Years of schooling: 1 to 3* years*	0.0362	0.1869	0.0350	0.1838
Years of schooling: 4 to 7* years*	0.1608	0.3675	0.1841	0.3876
Years of schooling: 8 to 10 years*	0.2289	0.4202	0.1679	0.3738
Years of schooling: 11 or more*	0.5626	0.4962	0.5981	0.4903
First semester of the year*	0.6790	0.4670	0.5692	0.4952
Salvador*	0.1068	0.3090	0.1102	0.3132
Belo Horizonte*	0.2759	0.4471	0.2076	0.4056
Rio de Janeiro*	0.1055	0.3073	0.2004	0.4003
São Paulo*	0.2524	0.4345	0.2355	0.4243
Porto Alegre*	0.1596	0.3663	0.1652	0.3714
Age: 25 to 30 years*	0.2295	0.4206	0.1907	0.3928
Age: 31 to 40 years*	0.2276	0.4194	0.2872	0.4525
Age: 41 to 50 years*	0.1297	0.3361	0.2460	0.4307
Age: 51 to 60 years*	0.0407	0.1976	0.1231	0.3286
Household head*	0.2982	0.4576	0.4765	0.4995
NumberofHouseholdmembers	4.0000	1.6669	3.6436	1.4960
Log hourly wage	2.6446	0.4892	3.0309	0.7318
Observations	1.573		58.921	

Source: Monthly Employment Survey (2008, 2009). Note: \* For binary variables means are interpreted as percent values.

### *3.2 Econometric analysis: Application of the bivariate probit model, linear regression with correcting for selection bias and wage decomposition*

After the brief description of the sample, the first objective of the study is to estimate the joint probability of participation in the labour market and wage determinants. The results of the bivariate probit estimation are described in Table 2 below. It is recalled that the model is composed of several explanatory variables related to personal and regional characteristics. The first important aspect to be stressed in the estimated result concerns the positive sign and statistically significant at the 1 percent level of the correlation coefficient  $\rho$  (0,8367) that is supported by the significance of likelihood ratio test, and such reinforce evidence confirms the application of this model over the use of separate models.

From the signs estimated for each parameter and its level of significance, it was possible to observe that men, older individuals, white and heads of household are more likely to be employed. The variable for the first semester of the year was negative in both regressions (indicating that the labour market is more dynamic and, therefore, tends to hire more workers in the second semester of the year) as well as the number of household members (indicating that the available time for the labour market is reduced the greater the number of household members). The positive signs of regional variables reinforce the hypothesis that the more developed regions are (São Paulo, Rio de Janeiro, Porto Alegre, Belo Horizonte) the greater the chances of employability.

Still in Table 2, a more detailed analysis can be made by observing that the negative signs of the estimated levels of schooling. These signs reinforce the importance of investment in human capital, showing that the lower the levels of schooling are, the lower the chances of getting a job. Moreover, it is essential to clarify that this signal shows only the higher or lower chances of being employed, not taking into consideration what type of activity the worker is inserted or who earned the same salary.

Table 2: Bivariate probit model of the individual's status in the labour market

Variables	$y_1 = 1$ if the individual is employed (initial status)		$y_2 = 1$ if the individual is employed (final status)	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Male	0.2843*** (0.0134)	0.0487*** (0.0023)	0.3220*** (0.0118)	0.0781*** (0.0028)
White	0.0893*** (0.0143)	0.0153*** (0.0025)	0.0329*** (0.0127)	0.0080*** (0.0031)
Age: 25 to 30 years	0.4446*** (0.0183)	0.1090*** (0.0045)	0.3891*** (0.0172)	0.1138*** (0.0050)
Age: 31 to 40 years	0.6875*** (0.0185)	0.1502*** (0.0043)	0.5891*** (0.0169)	0.1599*** (0.0047)
Age: 41 to 50 years	0.8466*** (0.0209)	0.1709*** (0.0043)	0.6305*** (0.0183)	0.1684*** (0.0049)
Age: 51 to 60 years	0.9236*** (0.0277)	0.1793*** (0.0046)	0.4185*** (0.0214)	0.1211*** (0.0060)
Years of schooling: 1 to 3 years	0.0022 (0.0600)	0.0004 (0.0121)	0.0376 (0.0481)	0.0113 (0.0145)
Years of schooling: 4 to 7 years	0.0382 (0.0519)	0.0075 (0.0104)	0.1034** (0.0418)	0.0304** (0.0126)
Years of schooling: 8 to 10 years	-0.0135 (0.0520)	-0.0027 (0.0105)	0.1260*** (0.0421)	0.0368*** (0.0127)
Years of schooling: 11 or more	0.2559*** (0.0510)	0.0451*** (0.0102)	0.4644*** (0.0412)	0.1200*** (0.0124)
Household head	0.1786*** (0.0152)	0.0306*** (0.0026)	0.2089*** (0.0131)	0.0507*** (0.0032)
Number of Household members	-0.0295*** (0.0041)	-0.0051*** (0.0007)	-0.0328*** (0.0036)	-0.0080*** (0.0009)
First semester of the year	-0.0885*** (0.0129)	-0.0152*** (0.0022)	-0.0617*** (0.0114)	-0.0150*** (0.0028)
Salvador	-0.0899*** (0.0254)	-0.0189*** (0.0053)	0.1756*** (0.0221)	0.0538*** (0.0068)
Belo Horizonte	0.2804*** (0.0241)	0.0486*** (0.0044)	0.4755*** (0.0201)	0.1316*** (0.0058)
Rio de Janeiro	0.1752*** (0.0247)	0.0322*** (0.0046)	0.5678*** (0.0215)	0.1518*** (0.0060)
São Paulo	0.1080*** (0.0235)	0.0205*** (0.0046)	0.4296*** (0.0201)	0.1209*** (0.0059)
Porto Alegre	0.2959*** (0.0270)	0.0509*** (0.0048)	0.4937*** (0.0226)	0.1358*** (0.0063)
Intercept	0.3509*** (0.0586)		-0.2721*** (0.0483)	
Correlation Coefficient ( $\rho$ )	0.8367*** (0.0036)			
Wald test for $\rho = 0$	Chi-Square = 9,872.86*** [p-value = 0.0000]			
Observations	73,940			

Source: Monthly Employment Survey (2008, 2009).\*\*\*, \*\*, \* significant at the 1%, 5% and 10% level, respectively. Notes: 1. Robust standard deviation in parentheses. 2. Marginal effects calculated on the means of explanatory variables with standard deviation estimated by delta method.

In order to analyse the wage determinants, we took into account the correction procedure for the two sources of selection bias, as shown by Tunali (1986) and Heckman (1979).

Table 3 presents the results of four linear regressions. Columns (1) and (3) refers to equations estimated by Ordinary Least Squares (OLS) without taking into account the positive self-selection in the sample, while in the columns (2) and (4) we performed two linear regressions estimated by OLS, including  $\lambda_1$  and  $\lambda_2$  as additional explanatory variables, used to

correct the bias selection<sup>5</sup>. The two first columns refer to individuals who were not employed by the time of the first interview (initial status, baseline) but that managed to get a job during the follow-up period (by the time of the second time of the interview – final status). The last two columns are related to the determinants of wage workers who remained employed throughout the review period.

Table 3: Results of linear regression analysis of log hourly wage

Variables	Non employed (initial status) and employed (final status)		Employed (initial status) and employed (final status)	
	(1) Non-corrected	(2) Corrected	(3) Non-corrected	(4) Corrected
Male	0.1221*** (0.0215)	0.1032*** (0.0310)	0.2291*** (0.0048)	0.1727*** (0.0079)
White	0.0998*** (0.0259)	0.0691** (0.0287)	0.2474*** (0.0053)	0.2455*** (0.0059)
Age	0.0321*** (0.0081)	0.0262** (0.0126)	0.0561*** (0.0015)	0.0379*** (0.0025)
Age squared	-0.0004*** (0.0001)	-0.0004** (0.0002)	-0.0005*** (0.0000)	-0.0002*** (0.0000)
Years of schooling: 1 to 3 years	-0.0573 (0.0747)	-0.0575 (0.0792)	0.0160 (0.0163)	0.0048 (0.0165)
Years of schooling: 4 to 7 years	-0.0011 (0.0661)	0.0084 (0.0719)	0.1138*** (0.0141)	0.0898*** (0.0146)
Years of schooling: 8 to 10 years	0.0381 (0.0657)	0.0800 (0.0799)	0.2860*** (0.0144)	0.2542*** (0.0154)
Years of schooling: 11 or more	0.2607*** (0.0665)	0.3005*** (0.0920)	0.8227*** (0.0144)	0.7395*** (0.0171)
First semester of the year	0.0448** (0.0226)	0.0646*** (0.0241)	-0.0076 (0.0048)	-0.0005 (0.0051)
Salvador	0.0365 (0.0465)	0.1424 (0.0884)	0.1761*** (0.0110)	0.1261*** (0.0142)
Belo Horizonte	0.1840*** (0.0389)	0.2274*** (0.0718)	0.2950*** (0.0095)	0.2050*** (0.0130)
Rio de Janeiro	0.1530*** (0.0453)	0.2774** (0.1198)	0.2621*** (0.0097)	0.1486*** (0.0171)
São Paulo	0.1937*** (0.0386)	0.3020*** (0.0979)	0.3488*** (0.0095)	0.2565*** (0.0152)
Porto Alegre	0.1692*** (0.0436)	0.2129*** (0.0744)	0.2657*** (0.0103)	0.1706*** (0.0147)
$\lambda_1$		-0.1996* (0.1041)		-0.0032 (0.0984)
$\lambda_2$		0.0075 (0.0978)		-0.5042*** (0.0550)
Intercept	1.6386*** (0.1417)	1.0740* (0.5502)	0.5824*** (0.0315)	1.2256*** (0.0740)
Adjusted R-square	0.1380	0.1390	0.3430	0.3440
Observations	1,535	1,535	58,144	58,144

Source: Monthly Employment Survey (2008, 2009).\*\*\*, \*\*, \* significant at the 1%, 5% and 10% level, respectively. Notes: 1. Robust standard deviation in parentheses. 2. For corrected regressions the standard deviation was obtained by bootstrap with 1,000 replications.

<sup>5</sup> Formally, according to equation (5) and (6):  $\lambda_1 = \begin{cases} \lambda_{21} & \text{if } y_{1i} = 0; y_{2i} = 1 \\ \lambda_{31} & \text{if } y_{1i} = 1; y_{2i} = 1 \end{cases}$  and  $\lambda_2 = \begin{cases} \lambda_{22} & \text{if } y_{1i} = 0; y_{2i} = 1 \\ \lambda_{32} & \text{if } y_{1i} = 1; y_{2i} = 1 \end{cases}$

The results show the existence of a possible discrimination in the job, favorable to male and white workers, and the importance of variables related to the human capital (age and level of schooling). Interestingly, the wages show a non-linear correlation with the variable experience (age) which increase with the level of schooling of workers, especially for those employed during the entire period analyzed. Finally, in regression (2), the parameter related to  $\lambda_1$  was statistically significant, and in regression (4), this is only verified to  $\lambda_2$ . In turn, comparing corrected equations with the non-corrected equations, we observed many changes in the magnitude of the coefficients estimated, thus justifying the use of the approach adopted by Tunali (1986) in this study.

To further investigate differences in wages generated by labour market transitions, we tried to provide inferences regarding the labour costs brought by the time the worker became unemployed. Thus, we analyse the decomposition of wage differentials<sup>6</sup> according to their condition in the labour market, isolating the portion of the wage gap explained by the difference between workers who were exposed to unemployment and those who remained employed over time of analysis.

The differential of the logarithm of hourly wage rate of between employed workers who have recently experienced an unemployment spell (group 1) and those who remain employed during the entire period – initial and final status (stayers workers, group 2) - were 100.7. Of this amount, only about 15.5% percent is attributed to the influence of productive characteristics - workers' endowment, such as age, experience, schooling, among others - and the remaining 85.5 percent represents the unexplained residual which is due to differences in the estimated coefficients for both groups (1 and 2) and is often referred to as discrimination effect, as we can see in table 4. According to Weichselbaumer and Winter-Ebmer (2005), many factors might be responsible for the unexplained residual and the decomposition cannot tell us an ideal specification for an analysis of the wage gap. In this context, we consider that the fact the worker had a recent experience of unemployment is an important differentiating factor to be addressed.

Naturally, other factors such as employment duration and firm's internal environment also contribute to determine the worker's salary. However, it is believed that these factors, although important, should not be responsible for a proportion of this magnitude in favor of the group of workers who remain employed over time of analysis, whereas other aspects such as productivity, innovation and effort, would be equally or more significant in an increasingly competitive world. In these terms, Bloom and Van Reenen (2010) made a survey report of practices adopted by the companies and which are considered essential in the process of surviving in a competitive market. The authors emphasize the importance that firms are giving to their innovative management methods, practices optimized for HRM (Human Resource Management) which always aiming at increasing the effort, efficiency and productivity of their workers that, as a rule, are almost always associated with the incentives promoted by the company.

First of all, still in Table 4, it's important to consider that a positive sign indicates a relative advantage to group 2. Thus, we can highlight that the major disadvantage for employed workers who have recently experienced an unemployment spell (group 1) is observed mainly in the age variable (59.5 percent difference in total wage gap; 24.4 percent of which are due to endowments and 35.1 percent are due to unexplained residuals). In addition to this variable, the other two variables that showed the disadvantage of workers in group 1 were related to gender

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<sup>6</sup>For more details see Blinder (1973) and Oaxaca (1973).

and race, both variables of discriminatory nature. For other variables, the positive signs of the estimated coefficients indicate that the newly employed workers have advantages in terms of wages compared to those who remained employed throughout the period. One possible explanation for this result is based on the fact that newly employed workers have higher level of schooling than those who remained employed all the time. This is because many of these workers are employed for a long time and in the same company, and that when they were hired, possibly the level of requirement from employers was not the same which is now demanded for newly hired workers, given that the degree of competitiveness of firms has significantly increased. As said by Bloom and Van Reenen (2010), the level of competition in the market and, therefore, the level of the human capital required increases every year.

Table 4: Summary of the decomposition of wage differentials between employed workers who have recently experienced an unemployment spell (group 1) *versus* workers who remain employed during the entire period (group 2)

Variables	Total Wage Gap	Due to endowments	Due to unexplained residuals
Male	4.6	1.5	3.1
White	9.7	2.0	7.7
Age	59.5	24.4	35.1
Age squared	4.3	-10.7	15.0
Years of schooling: 1 to 3 years	0.2	0.0	0.2
Years of schooling: 4 to 7 years	1.5	0.2	1.3
Years of schooling: 8 to 10 years	2.5	-1.5	4.0
Years of schooling: 11 or more	27.3	2.4	24.9
First semester of the year	-4.4	0.0	-4.4
Salvador	-0.1	0.1	-0.2
Belo Horizonte	-2.0	-1.4	-0.6
Rio de Janeiro	0.0	1.4	-1.4
São Paulo	-1.7	-0.5	-1.2
Porto Alegre	-0.6	0.1	-0.7
	(A)	(B)	(C)
Total	100.7	18.0	82.7
Shift in intercept of regressions (D)	15.2		
Due to endowments: $B/(B+C+D)$	15.5%		
Due to unexplained residual: $(C+D)/(B+C+D)$	84.5%		

Source: Monthly Employment Survey (2008, 2009). Notes: 1. Group 1 is the reference category. 2. Only corrected wage regressions were considered.

We have finally estimated a last specification to find out whether the negative effects of non-employment transitions on subsequent wages for different samples using the time duration of unemployment are a determining variable. Table 5 refers, briefly, to the results from the decomposition of wage differentials of two equations. The first part of the table refers to the first equation, i.e., the comparison of the logarithm of hourly wage rate between the group of newly hired workers who have recently experienced an unemployment spell (group 1) and those who remain employed during the entire period (group 2) which is shown on the first column, while the second part refers to the comparison between the group of newly hired employed workers who have recently experienced an unemployment duration up to 12 months (group 3) and the

group of workers who remain employed during the entire period (group 2) which is shown on the second column.

Our findings, in both the first and the second estimated equations, reinforce that unemployment, and its duration, generates a cost to employees represented in a subsequent wage loss (e.g., Blanchard and Diamond, 1994; Cremieux et al., 1995; Knight and Li, 2006). As said by Blanchard and Diamond (1994), the wages offered by firms to workers depends on the length of time the worker remained unemployed, decreasing as the duration of unemployment. The author argues that if the wage level becomes too low, the worker will choose to remain unemployed rather than accept a job offer. More recently, Knight and Li (2006) reinforce that the longer the worker remains unemployed, the greater the cost of unemployment reflected in his/her subsequent wage. The results in Table 5 support these arguments in both the first and the second decomposition since that the wage differential is favorable to stayers (those workers who registered 0 month in unemployment, group 2). There might be a possible reason for this outcome. The portion of wage differentiation explained by discrimination effect, in both cases, is much higher than observed in the endowment effect (82.3 percent against 17.7 percent in the first decomposition, and 86.3 percent against 13.7 percent in the second decomposition, respectively). In line with Arranz et al. (2010), it seems that as spells of non-employment get longer, subsequent wage losses tend to increase compared to workers who remain employed over time of analysis.

Table 5: Summary of the decomposition of wage differentials

	(1)	(2)
	Employed during the entire period (group 2) x Newly hired employed (group 1)	Employed during the entire period (group 2) x Newly hired employed up to 12 months of previous unemployment (group 3)
Endowment effect (A)	16.2	20.2
Coefficients effect (B)	101.3	64.5
Shift in intercept of regressions (C)	-26.0	63.2
Due to endowments: $A/(A+B+C)$	17.7%	13.7%
Due to unexplained residual : $B/(A+B+C)$	82.3%	86.3%

Source: Monthly Employment Survey (2008, 2009). Notes: 1. Group 1 is the reference group in the analysis (1) while group 3 is the reference group in the analysis (2). 2. 835 observations were used for group 1, and 58,144 observations for group 2 and 700 observations for group 3.

#### 4. Conclusions

This paper has analysed the non-employment duration and subsequent wage losses in the Brazilian labour market using the approach adopted by Tunali (1986) by applying a bivariate probit model related to the individual's status in the labour market. Moreover, we added an analysis of wage differential decomposition, correcting the potential problems of selection bias.

The economic literature about this matter (Blanchard and Diamond, 1994; Cremieux et al., 1995) has shown that unemployment experience generates a very large cost both in the process of recruiting/hiring and in the wage determination. Kollman (1994), for example, states that during the recruitment process, firms make use of all possible information that may be relevant in order to hire a worker, among which may be the possible recently experienced unemployment spell. The results gathered in this paper corroborate the evidence usually addressed in the literature (e.g. Keltzer, 1998; Burda and Mertens, 2001; Arulampalam 2001; Arranz et al., 2010), indicating that non-employment duration affects the chances of reemployment and also reflects in the subsequent wage. As said before, making use of different econometric methodologies made possible two important observations:

- There is a distinct difference between the personal characteristics of workers who have recently experienced an unemployment spell and those who remain employed during the entire period (group 2). This difference is due primarily to the growing participation of women, young individual and workers with higher levels of schooling.

- There is clear evidence of a wage differential in favour of stayers (workers who remain employed during the entire period), regardless of human capital investment made by the worker.

Therefore, the newly hired workers tend to receive lower wage than those who were already employed. The rationale for this wage differential is unobserved variables in this study of a discriminatory character, among which, exposure period of unemployment. The reason for this wage differential is found out in the unobserved productive attributes, including the experience of recent unemployment spell.

Finally, our empirical analysis does not allow us to explore this issue in depth. Thus, we could not distinguish whether the wage losses linked to Brazilian labour market transitions are due to obsolescence of human capital or employers using individuals' recent unemployment experience as a screening device. Despite being restricted to the Brazilian labour market and aware of the limits of the data available, it is believed that this result reinforces the importance of measures aimed at combating unemployment experiences and its duration, since, besides the economic and social losses, unemployment spell generates a negative sign in the reemployment process of workers in the labour market, which becomes more severe the more competitive the job market becomes.

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