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Article

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Public versus private wage differential in Brazilian public firms

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Abstract

This work explores that Brazilian public firms were allowed to hire workers either as statutory (civil servants) as well as under private market labor regime (CLT). We use RAIS that matches employer-employee data for all formal firms in Brazil from 2014 to 2016 to control for fixed effects at the individual and firm levels and the Oaxaca-Blinder decomposition to quantify the size of the wage differential explained by the labor regime versus individual characteristics. We find that CLT civil servants earn in average R\$ 310.00 per month less than similar statutory positions, a difference of 13% comparing the average wage of each group. Only for high skilled workers we found a salary R\$ 95.98 larger for CLT employees. Last, our decomposition strategy reveals that the largest share of the gap is not explained by endowments differences.

Keywords: Wage; Differential; Civil; Servants; Public; Versus; Private; Employers; Brazilian; Public; Firms

JEL Classification: C23; H50; J31.

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1. Introduction

The debate about public spending is a hot topic among politicians, media and Brazilian society nowadays. Whereas the government revenue (taxes and contributions) decreased in the last years due the economic recession, the public spending keeps increasing over time. Furthermore it is almost consensual the inefficiency of the government providing goods and services. In general it seems that public entities have a huge amount of civil servants but these are less productive even receiving wages higher than related positions in private companies. For instance, The World Bank organized a publication in November of 2017¹ pointing out the increase of civil servants wage mass from 11.6% in 2006 to 13.1% of Brazilian GDP in 2015, larger than we observe in European and developed countries such as France (13%), Portugal (11%), United States (9%) and even compared to Chile (6.4%). On the other hand the ratio of public employees over population in Brazil (5.6%) is larger than the average of Latin America (4.4%) however it is lower than

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¹ *Mundial* (2017), Um ajuste justo: Análise da eficiência e equidade do gasto público no Brasil. Grupo Banco Mundial, vol. 1.

the average of OCDE countries (10%). Last the share of public jobs in Brazil is around 18%, lower than the observed in countries with similar GDP per capita.

This paper explores the wage differential between statutory and CLT civil servants in Public Administration. Brazil has two labor regulations applied to civil servants, (i) the Statutory Regime and (ii) CLT – *Consolidação das Leis do Trabalho*: On the other hand most of private sector employees are under CLT regulation without any possibility to be hired under conditions similar to statutory rules. Nowadays both regimes exist in the Public Administration due a constitutional amendment approved in 1998² that allowed Public Entities to hire workers using CLT labor rules. This change was revoked in 2007³ but there is still a significant amount of CLT workers in the Public Service occupying positions similar that ones occupied by statutory civil servants.

There is a broad literature exploring wage differentials using Brazilian data. One of the approaches presented by Barbosa-Filho and Souza (2012) compares civil servants and similar occupations in private companies. The paper decomposes the civil servants wage prize of 71.6% observed in 2011. The price effect differential is an estimation of the salary that would be received by a civil servant if he was in the private sector whereas the composition effect differential estimates the impact of personal skills and qualifications of each employee. Using PNAD (“Pesquisa Nacional por Amostra de Domicílio”) the authors conclude that the positive differential is mostly driven by the composition effect which explains a wage gap of 41.7% while the price effect is responsible for the remaining 29.9%. Belluzzo et al. (2005) use PNAD (2001) to estimate the wage differential between public and private sector earnings by Quantile Regressions, the same approach of Foguel et al. (2000) using PNAD (1995). The authors point out that the positive differential observed to lower earnings disappears in higher quantiles of income distribution, different from Barbosa and Souza (2012). The issue of sample selection bias is discussed in Barbosa et al. (2013) and Souza and Medeiros (2013). Both works use an endogenous Switching Regression Model to analyze which variables determine the choice for a job in the public sector and the issues of not considering it in the estimation. Last Emilio et al. (2012) explore fixed-effects regressions based on a panel dataset from March 2002 to December 2004. Using the Pesquisa Mensal de Emprego (Monthly Employment Survey) compiled by IBGE, the work focus on the transition of individuals between jobs available in the public and private sectors in Brazil. The authors used three samples to evaluate the wage differential between workers: (i) transitions between Statutory and CLT (4.6% in favor of the Statutory employees), (ii) transitions between CLT Public Employees and CLT Private Companies Employees (wage prize of 3.9% to CLT Public Employees) and (iii) transitions between Private and Public Employees regardless the contract type (wage differential of 3.7% in favor of Public Employees).

Moreover, many studies in the literature report wage differentials favorable to civil servants for countries other than Brazil such as Smith (1976, 1977) in the U.S., Gunderson (1979) and Shapiro and Stelcner (1989) for Canada, Tansel (2005) in Turkey, Lassibilee (1998) in Spain, Glinskaya and Lokshin (2007) in India. There may be some possible explanations for this wage premium such as redistribution (Alesina, Baqir and Easterley, 2000; Mattos and França, 2011) or larger unionization in the public service in comparison to the private sector (Freeman, 1986, 1988; and Robison and Tomes, 1984).

In this work, we investigate the civil servant wage gap using matched employer-employee data from Brazil’s *Relação Anual de Informações Sociais* (RAIS) collected between 2014 and 2016. Our strategy allows controlling for fixed effects for individuals and firms. We build five categories of occupations: high skilled, low skilled, teachers/educational, technicians and others. Our model suggests a negative prize to CLT civil servants to almost all occupations. The exception is a small positive differential in favor of CLT high skilled workers. Last, our differential decomposition strategy indicates that the largest part of the gap is driven by unexplained factors (coefficients effect).

This paper is divided into six sections. Section 2 presents an analysis of the data and variables used in the econometric models. Section 3 and section 4 presents the methodology and identification strategy used to evaluate the wage differential between statutory and CLT civil servants. Section 5 describes the regression results and finally, section 6 summarizes the decomposition results and our conclusions.

² Constitutional Amendment number 19 - link

³ Supreme Court Decision about Ação Direta de Inconstitucionalidade 2135ön August 2nd, 2007- link

Table 1
RAIS Survey Descriptive Statistics.

Year	Companies	Employees	Average Nominal Wage ^I	Public Entities	Share of Public Entities	Public Sector Employees	Share of Public Employees	Average Nominal Wage ^{II}
2005	2.724.172	33.238.617	949,50	31.063	1,14%	7.073.486	21.3%	1.533,31
2006	2.833.567	35.155.249	1.027,80	31.503	1,11%	7.467.673	21.2%	1.684,28
2007	2.935.448	37.607.430	1.049,79	32.278	1,10%	7.705.479	20.5%	1.812,17
2008	3.085.470	39.441.566	1.169,08	33.201	1,08%	8.177.401	20,7%	1.980,48
2009	3.223.514	41.207.546	1.289,56	33.438	1,04%	8.375.317	20.3%	2.182,69
2010	3.403.448	44.068.355	1.425,32	34.166	1,00%	8.551.516	19.4%	2.454,66
2011	3.590.616	46.310.631	1.615,59	34.394	0,96%	8.676.013	18.7%	2.718,91
2012	3.695.735	47.458.712	1.737,95	31.112	0,84%	8.835.577	18,6%	3.040,44
2013	3.836.771	48.948.433	1.862,33	35.501	0,93%	8.966.902	18.3%	3.287,44
2014	3.949.979	49.571.510	2.045,66	35.549	0,90%	9.185.032	18,5%	3.575,40
2015	3.971.108	48.060.807	2.234,68	35.569	0,90%	9.026.061	18,8%	3.918,43
2016	3.921.448	46.060.198	2.452,01	35.023	0,89%	8.978.942	19.5%	4.199,19

Source: Ministry of Labor. Prepared by the Authors

2. Sources and references

We explore the panel data structure of RAIS to evaluate civil servants wage gap. Once informal workers (whose that are not registered formally by a company) do not appear in such database the statistics based on RAIS will capture only the formal labor market.⁴ Negri et al. (2001) compares RAIS and PNAD using samples of 1998. The main conclusion is that there is convergence to some variables such age and gender. Both show the same earnings dispersion around the mean however the wage averages found are different. The most relevant difference was found comparing the correlation between education and salary, which the author points out methodological differences as a probably explanation. Last the paper reinforce that RAIS is a reliable source of information to analyze the formal labor market once it allows time series and panel investigations and it covers a significant share of Brazilian territory, which allows exploring questions about wealth distribution and inequality.

To the purpose of this work, informality in is not a significant concern due legal constraints of public entities to hire workers since the regulation applied to public firms requires that all civil servants must be hired formally. Hence RAIS have an advantage in comparison to PNAD once the first one handles population data instead a sample of that. Moreover RAIS allow us tracking the same individual over time.⁵

In Table 1 we compare the share of Public Entities⁶ and civil servants in RAIS. The government provides almost twenty percent of the formal jobs however it represents less than one percent of the companies. One possible explanation is the size of Brazilian public companies in comparison to private ones. As reference the government spending is about twenty percent of Brazilian gross domestic product according IBGE⁷. Last the data shows that civil servants have larger earnings (*Average Nominal WageII*) in comparison to private workers in the whole period.

Once we will explore the civil servants wage gap, we exclude all private companies and their workers of the sample. After that, we have used as individual identification the CPF (*Cadastro de Pessoa Física*) of each employee to build a Panel and track the salary evolution of each individual over time. The Brazilian legislation allows that in some cases civil servants work in more than one public job simultaneously. These ones receive a monthly salary to each occupation despite the fact of working only for one of them. These individuals represent only a tiny share of the sample and can be

⁴ In a country as Brazil where a relevant share of the population live and work in the rural area and suburban districts we will probably see significant differences to the average wage since PNAD consider these informal workers.

⁵ The Ministry of Labor provides the annual RAIS Survey to public access in its website. These file do not contains any kind of employee identification. To the purpose of this work we required to Fundação Getúlio Vargas the identified database access to organize a panel. All results are shown by groups of occupation in order to preserve the confidentiality of the data.

⁶ Public Entities are all institutions which the Government has total ownership or the majority of the shares such as Autarchies, Public Companies, Public and Private Controlled Companies, Public Foundations and Associations, Law Courts, Parliamentary Chamber, Ministries and other Government Departments.

⁷ In 2017 Brazilian nominal GDP was around BRL 6.5 trillion and the Government Consumption BRL 1.3 trillion of this amount.

Table 2
Summary of Variables.

Variable	Detail
Wage	Monthly salary in Brazilian Real received on December of each year. In the models we deflated this variable by the Consumer Price Index (IPCA) to evaluate the salary growth in real terms.
Education	Classification of educational eleven categories: Uneducated, Incomplete Pre School, Complete Pre School, Incomplete Primary School, Complete Primary School, Incomplete High School, Complete High School, Incomplete College, Complete College, Master Degree and PhD. To the purpose of this work we group these categories in six: Uneducated, Primary School, High School, College, Master Degree and PhD.
Age	Employees' age in years
Tenure	Employees' months of experience in a company
Working Hours	Contractual Working Hours defined to a Week

Source: Ministry of Labor. Prepared by the Authors

interpreted as outliers in RAIS. We decided to keep in the sample only workers with one occupation in order to have more similar samples.⁸

Moreover, due computational limitations, we had to define a shorter period of time to our database.

We consider the most recent year we had with individual identification (2016) and we moved backwards up to our computational limit. After some adjustments⁹ we have limited the time period from 2014 to 2016 and we have selected the variables listed in Table 2 to our analysis:

Table 3 summarizes descriptive statistics of the database after adjustments. To statutory civil servants there is a predominance of women while there are more men in CLT positions. Statutory civil servants are older than CLT in average (we see a larger amount of workers over 35 years old). About education the most of statutory employees have college degree whereas the high school degree is the main education level of CLT workers. The average salary of CLT employees is larger than the observed to statutory civil servants. At last, comparing the number of observations of each group we see that the statutory regime is predominant in public entities. In the period CLT employees represented only 20 percent of the civil servants.

The standard database has more than 2.500 different jobs divided in 49 groups following the CBO classification (Classificação Brasileira de Ocupações). Individuals with no occupation declared in the database were considered missing values in this work. We build 5 different groups out of those 49 based on the similarity of occupations. We basically consider as criteria formal skill jobs and educational levels differences to analyze the wage gap between statutory and CLT civil servants. The high skilled group concentrates Directors and Managers while the low skilled group is composed by occupations with lower schooling requirement. Teachers and researchers are the group with the largest average educational levels whereas those with technical formation were labeled as technicians. Last we have created a category called 'excluded' for occupations that do not have a comparison group as counterfactual (Military, Police Force and Fire Department), i.e., all civil servants are hired as statutory. In the Appendix we show the average salary to each occupation and the five groups division proposed by this work.

Table 4 summarizes the means of each group. Technicians are the most representative group of the sample. Teachers and Researchers present the largest participation of women and the highest Average Salary and Education Level. Low Skilled is the oldest group in average and it is also the group with the highest Working Hours level. Last, the High Skilled civil servants presented the highest level of tenure in months of experience.

Table 5 shows the average of each variable by group and labor regime. CLT workers present higher wages than Statutory to all occupation groups except to High Skilled. Statutory civil servants are older and they have in average more months of experience than CLT employees. To all groups CLT civil servants presented a higher level of weekly working hours. About schooling statutory civil servants are less educated in average to all occupation groups except to the High Skilled workers.

⁸ The wage differential to these civil servants would be explained by the extra compensation of the second job and not by individual characteristics or their labor regime. So if we keep them in the sample we would probably have an upward bias to this group of civil servants.

⁹ In summary we excluded private companies and employees and all other variables presented in RAIS that are not listed in Table 2. We used gender and race to build Descriptive Statistics but once these characteristics are fixed over time it is not possible using them to fixed-effects model.

Table 3
Descriptive Statistics - Selected Cases.

	2014 Statutory	CLT	2015 Statutory	CLT	2016 Statutory	CLT
Sex						
Female	56.8%	43.3%	56.9%	43.0%	56.9%	42.8%
Male	43.2%	56.7%	43.1%	57.0%	43.1%	57.2%
Race						
Native	0.0%	0.2%	0.0%	0.2%	0.0%	0.2%
White	0.0%	62.6%	0.0%	61.8%	0.0%	61.7%
Afro-Descendant	0.0%	4.6%	0.0%	4.7%	0.0%	4.7%
Asian	0.0%	1.5%	0.0%	1.6%	0.0%	1.4%
Brown	0.0%	21.5%	0.0%	21.8%	0.0%	22.1%
Non Informed	100.0%	9.6%	100.0%	10.1%	100.0%	9.8%
Year						
10-24 years old	3.2%	5.9%	2.4%	4.7%	1.7%	3.5%
25-34 years old	21.0%	25.7%	19.0%	24.1%	16.7%	21.9%
35-44 years old	30.0%	26.5%	29.7%	27.1%	29.6%	28.0%
45-54 years old	30.0%	26.7%	30.6%	26.4%	31.2%	26.3%
Over 55 years old	15.8%	15.2%	18.3%	17.6%	20.8%	20.2%
Education						
Uneducated	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Primary School	16.0%	14.5%	15.4%	14.1%	15.2%	13.8%
High School	38.2%	45.9%	38.1%	45.5%	37.5%	44.9%
College	44.2%	38.1%	44.6%	38.9%	45.3%	39.4%
Master Degree	1.1%	1.1%	1.2%	1.1%	1.3%	1.4%
PhD	0.4%	0.3%	0.5%	0.3%	0.6%	0.4%
Working Hours						
0-10 weekly hours	0.6%	0.9%	0.6%	0.9%	0.6%	0.9%
10-20 weekly hours	0.8%	0.2%	0.8%	0.2%	0.8%	0.2%
20-30 weekly hours	9.9%	2.8%	10.1%	2.9%	9.5%	2.9%
30-40 weekly hours	18.7%	21.9%	18.7%	22.3%	19.2%	22.7%
Over 40 weekly hours	70.0%	74.1%	69.8%	73.7%	70.0%	73.3%
Tenure (in months)	155.67	116.55	166.92	127.09	177.46	136.37
Average Salary (in R\$)	3,934.52	4,388.95	4,381.42	4,872.37	4,739.21	5,370.56

Source: Ministry of Labor. Prepared by the Authors

Table 4
Descriptive Statistics Summary by Group.

Group	N	% of Women	Average Salary	Age	Working Hours	Education	Tenure
High Skilled	1,448,562	54.8%	6261.29	45.08	35.95	7.70	171.53
Low Skilled	1,310,801	17.9%	2267.71	46.19	40.63	5.62	156.20
Technicians	12,454,886	59.8%	3535.85	44.34	37.57	7.11	158.02
Teachers & Researchers	4,197,869	67.2%	7003.63	44.61	34.13	8.90	159.34

Source: Ministry of Labor. Prepared by the Authors

3. Methodology and identification strategy

The identification strategy applied to measure wage differentials must deal with two main issues: (i) the heterogeneity of workers in the sample and (ii) a potential self-selection bias since the choice by a statutory or CLT position probably is not random.¹⁰

¹⁰ As pointed out by Roy (1951) it is possible that workers decide to a sector for which they are more productive.

Table 5
Descriptive Statistics by occupation and labor regime.

Group	Average Salary	
	Statutory	CLT
High Skilled	6,296.54	5,893.42
Low Skilled	2,096.33	2,627.56
Technicians	3,314.34	4268.09
Techers & Researchers	6,597.81	9,676.97

Group	Age	
	Statutory	CLT
High Skilled	45.21	43.70
Low Skilled	47.24	43.98
Technicians	44.87	42.55
Techers & Researchers	44.68	44.13

Group	Working Hours	
	Statutory	CLT
High Skilled	35.52	40.43
Low Skilled	40.02	41.90
Technicians	37.23	38.67
Techers & Researchers	33.84	36.10

Group	Education	
	Statutory	CLT
High Skilled	7.70	7.66
Low Skilled	5.55	5.76
Technicians	7.06	7.28
Techers & Researchers	8.88	8.99

Group	Tenure	
	Statutory	CLT
High Skilled	176.24	122.41
Low Skilled	174.17	118.47
Technicians	167.35	127.17
Techers & Researchers	161.30	146.45

Source: Ministry of Labor. Prepared by the Authors

Assuming Roy's model, if we use cross-sectional data the wage differential measured by Ordinary Least Squares (OLS) will be inconsistent since we would not address the heterogeneity of civil servants observable and unobservable characteristics. As we have seen at [Table 5](#) some variables such schooling and tenure present significant differences between CLT and statutory civil servants of similar positions. Thus we can find biased estimators when comparing the average earnings of each sector. Even if we control by variables such gender and age we would not correct the bias caused by unobservable characteristics such as culture, ability and intrinsic preferences.

The endogeneity derived from the sectoral choice is dealt by some authors using Heckman two-stage procedure to address the selection bias. To use Heckman procedure in our sample we should estimate the choice equation between statutory and CLT positions (first stage) by a probit model and hence finding correction terms to be used in the wage gap regression (second stage). The validity of this approach requires variables that are relevant to determine the choice in the first stage but they are also orthogonal to the errors of the second stage. In our dataset it is hard to assume any variable satisfying both conditions. Our identification strategy explores the panel data structure of RAIS for which we observe several inter-sectoral transitions (from CLT to Statutory and vice-versa). This fact allows us to evaluate the wage

differential of a switch from one sector to the other for the same individual. Even if unobservable characteristics impact sectoral choice, when we assume that these attributes are constant over time, our approach applied to a longitudinal dataset do not incur in the same inconsistency problems of studies based on cross-sectional data.

Civil servants who switch from one sector to other are probably different from that ones who did not change. Hence the results found do not discard completely the existence of some selection bias. On the other hand, the self-selection issue in a panel dataset generates inconsistent estimators only if individual unobservable attributes are not constant over time. In this work we assume that workers who switch from one sector to other are very different from that ones who stay in the same sector since the first group presents this mobility attribute. We also assume mobility and other unobservable characteristics constant over time. Based on these assumptions we can overcome the potential problem of endogeneity regarding the decision with respect to work regime decision and the fixed-effect estimator will be consistent.¹¹

We present in the Subsection 3.1 the specification of the Fixed-Effects model applied to the panel data structure of RAIS. As we mentioned above, the identification strategy is based on the switch of civil servants from one sector to the other (CLT and Statutory positions). To check the inter-sectoral transition, we show in Subsection 3.2 a Transition Matrix by group and labor regime. Despite small number of changes in some occupations, we were able to estimate the wage differentials using fixed-effects.¹²

3.1. Fixed-effects model

The panel structure of RAIS allows controlling for individual heterogeneity and it provides more informative data, less collinearity and much more degrees of freedom. On the other hand, there are some limitations in this approach such design and data collection problems (coverage, frequency of interviewing and others), measurement errors (unclear questions, memory errors and inappropriate informants), selectivity problems (self-selectivity, nonresponse and attrition) and short time-series dimension.

Holding civil servants characteristics constant over time give us the possibility to analyze the labor regime (CLT or Statutory) impact on wages. The main weakness of RAIS is some measurement errors in variables as education since some employers do not update this information on regular basis. Last, once we focus on civil servants we are assuming that informality has no significant impact due the government legal constraints to hire workers formally.

We follow Baltagi (2008) fixed-effects model specification to evaluate the wage differential between CLT and statutory civil servants:

$$y_{it} = \alpha + X'_{it}\beta + \delta_1 CLT_{it} + \delta_2 Low_Skilled_{it} + \delta_3 Teacher_Researchers_{it} + \delta_4 Technicians_{it} + \delta_5 High_Skilled_{it} + \delta_6 Low_Skilled_{it} * CLT_{it} + \delta_7 Teacher_Researchers_{it} * CLT_{it} + \delta_8 Technicians_{it} * CLT_{it} + \delta_9 High_Skilled_{it} * CLT_{it} + u_{it} \quad (1)$$

$$u_{it} = \mu_i + \lambda_t \nu + v_{it} \quad (2)$$

$$i = 1, \dots, N; t = 2014, 2015, 2016$$

with i denoting the individuals and t denoting the period of our sample. The i subscript represents the cross-section dimension whereas t denotes the time-series dimension. α is a fixed-effect parameter, β is $\mathbf{K} \times 1$ and X_{it} is the it th observation on \mathbf{K} explanatory variables.

Furthermore we add dummy variables to control the wage differential by labor regime and occupation. Our base group is statutory civil servants and the dummy CLT assumes one if the individual labor regime is CLT and zero otherwise. To analyze the occupation effect we consider two types of dummy variables, the first represents the five

¹¹ This approach is the same presented in Botelho and Ponczek (2011) to overcome the selection bias evaluating wage differential between formal and informal sector. The authors show the consistency of fixed-effects estimators if we assume that unobservable attributes variation are not jointly correlated with earnings and sectoral choice variation. In the Appendix we present the following comparison. We estimate FE and OLS models for both switchers (from CLT to statutory and vice-versa) and stayers (those that do not switch career) as a robustness check. The general finding is that civil servants who moves from one sector to another seem to present wages more sensitive to all the control variables.

¹² Using a dataset of more than 7.0 million observations is one factor that helps the estimation even in a scenario of few Inter-sectoral transitions.

Table 6
Occupation Groups Transition Matrix.

		Excluded		High Skilled		Low Skilled		Teachers & Researchers		Technicians		Total
		Statutory	CLT	Statutory	CLT	Statutory	CLT	Statutory	CLT	Statutory	CLT	
Excluded	Statutory	98,66	0,04	0,21	0,00	0,02	0,03	0,17	0,01	0,78	0,07	100,00
	CLT	0,16	93,10	0,02	0,74	0,02	1,40	0,04	0,57	0,14	3,82	100,00
High Skilled	Statutory	0,45	0,00	92,68	0,03	0,35	0,00	2,01	0,02	4,44	0,03	100,00
	CLT	0,06	0,52	9,98	80,88	0,02	0,37	0,57	2,80	0,39	4,43	100,00
Low Skilled	Statutory	0,07	0,00	0,26	0,00	97,69	0,15	0,07	0,00	1,74	0,01	100,00
	CLT	0,03	0,71	0,02	0,12	1,03	95,78	0,02	0,03	0,10	2,16	100,00
Teachers & Researchers	Statutory	0,12	0,00	1,77	0,00	0,02	0,00	95,66	0,11	2,30	0,02	100,00
	CLT	0,01	0,05	0,04	0,56	0,01	0,04	1,60	96,35	0,13	1,21	100,00
Technicians	Statutory	0,08	0,00	0,45	0,00	0,15	0,00	0,91	0,01	98,24	0,15	100,00
	CLT	0,02	0,27	0,02	0,43	0,01	0,25	0,04	0,42	1,11	97,42	100,00
Total		8,40	0,97	6,29	0,57	4,15	1,96	16,89	2,59	44,74	13,43	100,00

Source: Ministry of Labor. Prepared by the Authors

groups shown on [table 13](#) and the second represents the interaction between occupation and labor regime (dummy CLT). As benchmark to the occupation effect we have chosen the *Excluded* group. Note that dummies are omitted in Eq. 1 to avoid perfect collinearity.¹³

The term μ_i denotes the unobservable individual fixed effect of each civil servant, λ_t denotes the unobservable time effect to the years 2014, 2015 and 2016 and v_{it} the remainder stochastic disturbance term. We have assumed μ_i and λ_t as fixed parameters to be estimated and the remainder stochastic disturbance term $v_{it} \sim \text{IID}(0, \sigma^2)$. Hence Eq. 2 represents a two-way fixed effects error component model. The X_{ijt} are assumed independent of the v_{it} for all i and t . Under these specifications our inference is conditional on civil servants of our database in the period from 2014 to 2016.

3.2. Panel data transition matrix

If all civil servants stay in the same occupation and labor regime over time, a Pooled OLS Regression would reach results very similar to a Fixed-Effects Regression.

[Table 6](#) shows the matrix organized using RAIS from 2014 to 2016. All groups presented changes in the period, considering a sample of 7,140,610 public employees.

High Skilled CLT civil servants present the largest transition rate since only 80.88% of these workers did not switch between sectors and/or occupation, 9.98% of them migrated to a statutory position in the same group and the remainder moved to other occupations.

The lowest migration was found to statutory civil servants of the Excluded Group. The data shows that 98.66% of these workers stayed in the same position from 2014 to 2016. That makes sense once this group is formed by Military and Police Force and transitions from these occupations to others are unusual. Between occupations the largest transition was observed from High Skilled group to Technicians group once 4.44% of statutory civil servants and 4.43% of CLT employees in that group became Technicians in the period analyzed in our sample.

Last the transition matrix show larger migration from CLT to Statutory sector than otherwise. For example 1.60% of Teachers and Researchers switch from CLT to Statutory while only 0.11% made the opposite change. These facts reinforce the idea that probably there is a better financial perspective to statutory positions in comparison to CLT which stimulates CLT civil servants to look for an opportunity to switch to the statutory regime.

¹³ These dummies are omitted in the Equation 1 to avoid perfect collinearity.

4. Oaxaca-Blinder decomposition of mean wages differentials

This section is based on Jann et al. (2008) which describes the mean wages differentials decomposition presented in Oaxaca (1973) and Blinder (1973). The Oaxaca-Blinder decomposition splits the wage differential between (i) an amount explained by specific group characteristics called endowments (education, work, experience, age and others) and (ii) a residual or 'unexplained' part that cannot be accounted by individual characteristics differences.

Assuming two groups (A and B), a outcome variable (Y) and a set of predictors, the methodology analyze how much of the mean outcome difference is accounted by group differences in the predictors. In this paper we consider the groups of CLT and Statutory civil servants, the real wage (as of December of each year deflated by the Consumer Price Index - IPCA to 2014 level) as outcome variable and education, experience, age, working hours and occupation dummies as predictors.

Oaxaca-Blinder decomposition assumes a basic linear model:

$$Y_l = X_l^j \beta_1 + s_l, E(s_l) = 0 \quad l \in (A, B) \quad (3)$$

where X is the predictors and a constant vector, β as the slope parameters and intercept vector, and the error vector s .

The expression to the mean outcome difference is given by:

$$R = E(Y_a) - E(Y_b) \quad (4)$$

where (Y) denotes the outcome variable expected value.

Hence the mean outcome difference is given by the difference between group-specific means linear prediction that is:

$$R = E(Y_a) - E(Y_b) = E(X_a)^j \beta_a - E(X_b)^j \beta_b \quad (5)$$

because

$$E(Y_l) = E(X_l^j \beta_1 + s_l) = E(X_l^j \beta_1) + E(s_l) = E(X_l)^j \beta_1 \quad (6)$$

where $E(\beta_l) = \beta_l$ and $E(s_l) = 0$ by assumption.

Eq. 5 can be rearranged to split the contribution of predictors' differences from the overall outcome difference as follows:

$$R = \{E(X_a) - E(X_b)\}^j \beta_b + E(X_b)^j (\beta_a - \beta_b) + \{E(X_a) - E(X_b)\}^j (\beta_a - \beta_b) \quad (7)$$

After the rearrangement, the Eq. 7 shows the outcome difference divided into:

$$R = E + C + I$$

The first part,

$$E = \{E(X_a) - E(X_b)\}^j \beta_b \quad (8)$$

represents the endowments effect; that is the differential explained by group predictors differences.

The second part,

$$C = E(X_b)^j (\beta_a - \beta_b) \quad (9)$$

show the contribution of group coefficients differences and their intercept. And the third part,

$$I = \{E(X_a) - E(X_b)\}^j (\beta_a - \beta_b) \quad (10)$$

is the interaction between endowments and coefficients.

Last the decomposition shown in Eq. 7 was made from the perspective of group B. Hence E measures the expected change in group B's mean wage if they had group A's endowments. Moreover the coefficients effect C is weighted by group B's endowments and it represents the expected change in group B's mean wage if they had group A's coefficients. The differential can also be expressed from the perspective of group A, yielding the reverse threefold decomposition:

$$R = \{E(X_a) - E(X_b)\}^j \beta_a + E(X_a)^j (\beta_a - \beta_b) + \{E(X_a) - E(X_b)\}^j (\beta_a - \beta_b) \quad (11)$$

Table 7
Model Comparison.

Variable	FE Model I	POLS I	POLS II
<i>education</i>	23.91***	841.60***	843.02***
<i>age</i> <i>age2</i>	88.85*** – 1.02***	38.42*** – 0.081***	39.00*** – 0.083***
<i>working hours</i>	10.39***	81.56***	81.64***
<i>experience</i>	0.55***	9.67***	9.70***
<i>dummy_clt</i>	–32.66*	505.22***	507.24***
<i>dummy_low_skilled</i>	137.52***	–1942.85***	–1944.94***
<i>dummy_low_skilled*clt</i>	20.46	293.00***	292.55***
<i>dummy_teachers_researchers</i>	251.33***	78.52***	72.60***
<i>dummy_teachers_researchers*clt</i>	–52.60***	2186.79***	2186.20***
<i>dummy_technicians</i>	174.08***	–1731.22***	–1734.12***
<i>dummy_technicians*clt</i>	–64.44***	523.51***	522.31***
<i>dummy_high_skilled</i>	329.64***	492.97***	490.41***
<i>dummy_high_skilled*clt</i>	128.65***	–683.42***	–688.98***
<i>year</i>			
2015	Yes	–	Yes
2016	Yes	–	Yes
<i>_cons</i>	–	–7389.38***	–7316.68***
N	21.421.830	21.421.830	21.421.830
r2	0.968	0.240	0.240
r2_a	0.952	0.240	0.240

Source: Prepared by the Authors

legend: * p < 0.05; ** p < 0.01; *** p < 0.001.

Table 8
Wage Differential By Occupation - FE Model I.

	Low Skilled	Teachers and Researchers	Technicians	High Skilled
CLT Effect	–32.66*	–32.66*	–32.66*	–32.66*
Interaction Effect	20.46	–52.60***	–64.44***	128.65***
Total Effect	–12.20	–85.27	–97.11	95.98

Source: Ministry of Labor. Prepared by the Authors

*p < 0.05; ** p < 0.01; ***p < 0.001.

5. Regression results

We compare Fixed-Effects Model and a Pooled OLS regression In order to evaluate the civil servants wage differential. In the Fixed-Effects approach we control by individual and time effects from 2014 to 2016 besides a set of predictors (education, age, experience and occupation dummies) while in the Pooled OLS we basically apply Ordinary Least Squares in the Panel Database controlling by all of observable variables (gender, ethnicity, etc).

Table 7 shows the results of Fixed-Effects and Pooled regressions. As mentioned in the section 3 all results assume the occupation group *excluded* as reference, i.e., the coefficients will show a positive or negative prize in comparison to this reference group.

The FE MODEL I is our baseline scenario controlling year and occupation fixed-effects. On the other hand the POLS I show the results without controlling these fixed effects. Last the Model POLS II includes controlling dummies to each year in the Pooled OLS regression.

The labor regime effect is compounded by (i) the wage differential measured by the *dummy clt* and (ii) the interaction between the *dummy clt* and occupation dummies. Table 8 and Table 9 resume by occupation group the CLT Labor Regime Total Effect to Fixed Effect Model I and Pooled OLS Model I.

These values represent a monthly wage prize measured given that all variables are in level. As mentioned in Table 2 wages were deflated by the consumer price index (ÍPCA) to the levels of 2014.

Table 9
Wage Differential By Occupation - POLS Model I.

	Low Skilled	Teachers and Researchers	Technicians	High Skilled
CLT Effect	505.22***	505.22***	505.22***	505.22***
Interaction Effect	293.00***	2186.79***	523.51***	-683.42***
Total Effect	798.22	2692.02	1028.74	-178.19

Source: Ministry of Labor. Prepared by the Authors

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Note that for the FE Model I, only the High Skilled CLT civil servants present a positive monthly wage prize of R\$ 95.98. We found negative wage differentials to Technicians (R\$ 97.11), Teachers and Researchers (R\$ 85.27) and Low Skilled (R\$ 12.20) CLT workers. For Low Skilled Workers, it is important mentioning that the Interaction Effect is not statistically significant which means a negative impact driven only by the *dummy clt*, i.e., a monthly earnings decrease of R\$32.66. Last, although statistically significant, all the effects found are really small representing a change in wage close to 1 p.p., except for technicians for which the statutory premium is close to 2.5p.p. when comparing average earnings of each group.

In the POLS Model I only High Skilled CLT civil servants present a negative wage differential (R\$ 178.19). We found positive prizes to Technicians (R\$ 1028.74), Teachers and Researchers (R\$ 2629.02) and Low Skilled (R\$ 798.22) CLT workers. In this approach all dummies are statistically significant.

Comparing Fixed-Effects and Pooled OLS Regressions we found significant differences not only on the magnitude but also on the estimated sign of wage differentials. This is an evidence that there are probably non-observable time and individual effects impacting wages over time that are captured only controlling by Fixed-Effects. The POLS model suggests a positive wage premium for low skilled (+33 p.p.), technicians (+27 p.p.), teachers and researchers (+38 p.p.) but a negative premium for high skilled jobs (-2 p.p.). Last, the inclusion of time controlling dummies (POLS II) do not change significantly the results.

6. Oaxaca-blinder decomposition results

6.1. Fixed effects model

Table 10 presents the decomposition results for the FE Model I.¹⁴ There is a monthly wage prize of R\$ 309.93 in favor of statutory civil servants (dummy CLT = 0) and the largest part of that is explained by the Coefficients Effect (R\$ 283.34). The Endowments differences between groups explains only R\$ 3.09 of the wage differential and the interaction between Coefficients and Endowments represents R\$ 23.49 of the total difference.

Focusing on the contribution of each variable to the Endowments Effect, note that the coefficient of Working Hours is negative which means that CLT civil servants work more hours than Statutory ones. All other variables are estimated to have positive impact¹⁵ which indicates that statutory civil servants present larger averages of schooling, tenure and age variables. Since the coefficient of all occupation dummies are positive, the final impact depends on the relative participation of each occupation in CLT and Statutory groups. For example High Skilled and Teachers & Researchers positive endowments effect indicates that there are a larger proportion of these occupations among statutory civil servants and the opposite occur to Low Skilled and Technicians workers.

Education, Age and Tenure coefficients affect positively statutory civil servants earnings. On the other hand Working Hours has a negative effect to them. Hence Statutory civil servants have larger coefficients than CLT workers to all variables except to Working Hours. Regarding occupation dummies, Low Skilled, Teachers & Researchers and Technicians civil servants earn a positive prize as Statutory whereas the dummy High Skilled indicates a premium to CLT workers.

¹⁴ The predictions to each group are made considering only the explanatory variables without a constant term. Because of that the Average Salaries to Statutory and CLT workers are lower than we observe in the real data to each population.

¹⁵ The impact of age is the sum of age and age2. The last one captures the concavity on remuneration

Table 10
Oaxaca-Blinder Decomposition to FE Model I.

Blinder-Oaxaca Decomposition						
1: Statutory (dummy CLT = 0)						
2: CLT (dummy CLT = 1)						
	obs = 21,421,830					
Differential	Coef.	Std. Err.	z	P>z	[95% Conf.Interval]	
Avg. Salary Statutory (Prediction 1)	2679.83	64.75	41.39	0.000	2552.92	2806.74
Avg. Salary CLT (Prediction 2)	2369.91	98.19	24.14	0.000	2177.45	2562.36
Difference	309.93	117.62	2.63	0.009	79.39	540.46
Decomposition	Total	Std. Err.	z	P>z	[95% Conf.Interval]	
Endowments	3.09	5.29	0.58	0.562	-7.29	13.46
Coefficients	283.34	152.15	1.86	0.063	-14.88	581.57
Interaction	23.49	6.35	3.70	0.000	11.05	35.94
Total	309.93	152.38	2.03	0.042	11.27	608.59
Endowments $[E(X_1)-E(X_2)]'\beta_2$	Total	Std. Err.	z	P>z	[95% Conf.Interval]	
education	0.52	0.13	4.10	0.000	0.27	0.77
age	136.33	4.04	33.75	0.000	128.41	144.25
age2	-126.34	2.46	-51.46	0.000	-131.16	-121.53
working hours	-28.39	0.83	-34.34	0.000	-30.01	-26.77
tenure	3.40	1.44	2.36	0.018	0.57	6.23
dummy_high_skilled	24.19	0.54	44.95	0.000	23.13	25.24
dummy_low_skilled	-7.50	0.53	-14.06	0.000	-8.55	-6.46
dummy_teachers_researchers	12.45	0.94	13.25	0.000	10.61	14.29
dummy_technicians	-11.57	1.19	-9.68	0.000	-13.91	-9.23
Coefficients $[E(X_2)]'(\beta_1-\beta_2)$	Total	Std. Err.	z	P>z	[95% Conf.Interval]	
education	144.02	13.43	10.72	0.000	117.70	170.35
age	-355.68	141.23	-2.52	0.012	-632.49	-78.86
age2	410.84	51.72	7.94	0.000	309.46	512.22
working hours	-101.35	15.38	-6.59	0.000	-131.49	-71.21
tenure	69.54	5.59	12.43	0.000	58.57	80.50
dummy_high_skilled	-4.55	0.44	-10.37	0.000	-5.41	-3.69
dummy_low_skilled	4.01	1.63	2.46	0.014	0.82	7.20
dummy_teachers_researchers	18.82	1.94	9.71	0.000	15.02	22.62
dummy_technicians	97.68	8.59	11.38	0.000	80.86	114.51
Interaction $[E(X_1)-E(X_2)]'(\beta_1-\beta_2)$	Total	Std. Err.	z	P>z	[95% Conf.Interval]	
education	1.52	0.14	10.64	0.000	1.24	1.81
age	-12.10	4.80	-2.52	0.012	-21.52	-2.68
age2	22.56	2.84	7.94	0.000	16.99	28.13
working hours	5.85	0.89	6.59	0.000	4.11	7.60
tenure	22.02	1.77	12.43	0.000	18.55	25.49
dummy_high_skilled	-7.04	0.68	-10.37	0.000	-8.37	-5.71
dummy_low_skilled	-1.95	0.79	-2.46	0.014	-3.51	-0.40
dummy_teachers_researchers	11.46	1.18	9.71	0.000	9.15	13.77
dummy_technicians	-18.83	1.66	-11.37	0.000	-22.07	-15.58

Source: Prepared by the Authors

6.2. Pooled ordinary least squares model

The Oaxaca-Blinder decomposition using POLS Model I shows a positive prize (R\$ 490.88) to CLT civil servants. This is the opposite result of the same decomposition method made to FE Model I which reinforces the relevance of controlling by individual and year unobservable characteristics.

The positive wage gap of CLT civil servants is basically explained by the Coefficients Effect, which represents a prize of R\$ 505.22 to this group. CLT workers have larger Education, Age and Tenure coefficients. A High Skilled civil servant civil servants receives a monthly premium of R\$ 40.47 as Statutory while there is a positive prize to Low Skilled (R\$ 52.30), Teachers & Researchers (R\$ 95.63) and Technicians (R\$ 13.21) CLT workers.

Table 11
Oaxaca-Blinder Decomposition to POLS Model I.

Blinder-Oaxaca Decomposition						
1: Statutory (dummy_clt = 0)						
2: CLT (dummy_clt = 1)						
				obs	=	21,421,830
Differential	Coef.	Robust Std. Error	z	P > z	95% Conf. Interval	
Avg. Salary Statutory (Prediction 1)	3976.48	1.13	3516.34	0.000	3974.26	3978.69
Avg. Salary (Prediction 2)	4467.37	2.47	1807.44	0.000	4462.52	4472.21
Difference	-490.88	2.71	-180.6	0.000	-496.21	-485.56
Endowments $E[(X_1) - E(X_2)]' \beta^*$						
education	65.45	0.79	82.77	0.00	63.90	67.00
age	55.77	1.15	48.09	0.00	53.49	58.04
age ²	-8.77	1.02	-8.54	0.00	-10.79	-6.76
working hours	-183.09	0.41	-446	0.00	-183.89	-182.28
tenure	387.71	0.79	490.59	0.00	386.16	389.26
dummy_low_skilled	95.20	0.33	281.97	0.00	94.54	95.86
dummy_teachers_researchers	6.28	0.29	21.25	0.00	5.70	6.86
dummy_technicians	229.57	0.53	429.16	0.00	228.52	230.62
dummy_high_skilled	22.99	0.26	87.19	0.00	22.48	23.51
Total	14.33	12.31	1.16	0.245	-9.80	38.47
Coefficients $E(X_1)'(\beta_1 - \beta^*) + E(X_2)'(\beta^* - \beta_2)$						
education	-2287.49	10.85	-210.82	0.00	-2308.76	-2266.22
age	-3444.54	63.54	-54.2	0.00	-3569.09	-3319.98
age ²	1887.23	35.68	52.89	0.00	1817.29	1957.16
working hours	3501.71	14.47	241.91	0.00	3473.34	3530.08
tenure	-627.44	4.00	-156.48	0.00	-635.30	-619.58
dummy_low_skilled	-52.30	1.21	-43.14	0.00	-54.68	-49.93
dummy_teachers_researchers	-95.63	2.18	-43.73	0.00	-99.91	-91.34
dummy_technicians	-13.21	8.35	-1.58	0.11	-29.59	3.16
dummy_high_skilled	40.47	0.63	63.78	0.00	39.23	41.72
_cons	-70.82	35.79	-1.98	0.04	-140.97	-0.66
Total	-505.22	12.65	-39.92	0.00	-530.03	-480.41

Source: Prepared by the Authors

The positive endowments effect of R\$ 14.33 to Statutory civil servants indicates that they are in average more qualified than CLT public employees. Education, Age and Tenure are positive and Working Hours is negative in the composition of this amount (Table 11).

6.3. Models comparison

Previous sections show that there are significant differences between the Oaxaca-Blinder Decomposition applied to Fixed-Effects and POLS Models. The total variation between results is R\$ 800.82 (since the FE Model I shows a prize of R\$ 309.93 to Statutory civil servants while POLS Model I presents a premium of R\$ 490.89 to CLT public employees).

Table 12 compares the decomposition total effect for each model by occupation group. For Low Skilled and Teachers and Researchers civil servants group, we have that each empirical strategy presents opposite signs while for Technicians and High Skilled group we find similar and positive differentials (Panel A versus Panel B).

Assuming the FE Model as benchmark, the largest positive difference was found for Statutory Teachers and Researchers (R\$ 132.08= R\$42.73-(-R\$89.35)) civil servants. Statutory Low Skilled (R\$ 48.35), Technicians (R\$ 149.07) and High Skilled Workers (R\$ 50.86) presented a lower occupation prize in comparison to POLS results.

7. Conclusion

This work explores the wage gap between civil servants in Brazil comparing fixed-effects and OLS models. The Fixed-Effects result, controlling for individual non observable attributes and fixed time influences, shows a positive

Table 12
Oaxaca-Blinder Decomposition Comparison.

Panel A: FE MODEL I					
Decomposition	Low Skilled	Teachers and Researchers	Technicians	High Skilled	Total
Endowments	−7.50 (0.53)	12.45 (0.94)	−11.57 (1.19)	24.19 (0.54)	3.09 (5.29)
Coefficients	4.01 (1.63)	18.82 (1.94)	97.68 (8.59)	−4.55 (0.44)	283.34 (152.15)
Interaction	−1.95 (0.79)	11.46 (1.18)	−18.83 (1.66)	−7.04 (0.68)	23.49 (6.35)
Total	−5.45	42.73	67.29	12.60	309.93
Panel B: POLS MODEL I					
Decomposition	Low Skilled	Teachers and Researchers	Technicians	High Skilled	Total
Endowments	95.20 (0.33)	6.28 (0.29)	229.57 (0.53)	22.99 (0.26)	14.33 (12.31)
Coefficients	−52.30 (1.21)	−95.63 (2.18)	−13.21 (8.35)	40.47 (0.63)	−505.22 (35.79)
Total	42.90	−89.35	216.36	63.46	−490.89
Panel C: DIFFERENCE					
Decomposition	Low Skilled	Teachers and Researchers	Technicians	High Skilled	Total
Endowments	−102.70	6.17	−241.14	1.20	−11.24
Coefficients	56.31	114.45	110.89	−45.02	788.56
Interaction	−1.95	11.46	−18.83	−7.04	23.49
Total	−48.35	132.08	−149.07	−50.86	800.82

Source: Prepared by the Authors

*standard deviations in parenthesis.

monthly wage prize of R\$ 309.93 to statutory civil servants, which means a 13% prize considering the average wage of each group. This result is lower than, but close to, the 19% presented in [Barbosa and Barbosa Filho \(2012\)](#), 17% shown in [Souza e Medeiros \(2013\)](#) and 16% in [Marconi et al. \(2004\)](#), however Marconi (2004) does not find a significant difference for those earnings at 5% level.

The Oaxaca-Blinder decomposition indicates that the positive differential over time is driven mainly by unexplained factors (90% for the coefficients effect) since the specific characteristics of each group (endowments effect) explains only a very small part of the total differential. Our result contrasts with the decomposition made in [Vaz and Hoffmann \(2007\)](#) that found endowments explaining about 63% of the wage gap between public and private employees in 2005.

Moving the analysis to occupation type, a unique contribution of this study, we find that the largest wage prize for the statutory employees is earned by Technicians (R\$ 97.11) followed by Teachers and Researchers (R\$ 85.27) and Low Skilled statutory civil servants (R\$ 12.20). Only High Skilled statutory workers presented a negative prize (R\$ 95.98) in comparison to similar CLT positions ([Holanda, 2009](#)).

This work focus on identifying and decomposing monthly wage differentials between statutory and CLT workers in public administered/owned firms. We could not discuss what explains such wage prize in favor of the statutory civil servants and that seems relevant given our finding that endowments differences explain only a small share of the total gap. This work reinforces that individual and time unobservable factors are critical to evaluate wage differentials over the years. Naïve OLS and decomposition strategies might lead to misleading findings.

Appendix

Table A1
Average Salary by CBO Group (in nominal terms).

CBOGroup	Description	Group	2014		2015		2016	
			Statutory	CLT	Statutory	CLT	Statutory	CLT
11	Public Entity Director	High Skilled	R\$ 6037.13	R\$ 2806.52	R\$ 6407.07	R\$ 4351.82	R\$ 6916.34	R\$ 4907.66
12	Company Director		R\$ 3862.95	R\$ 7972.71	R\$ 4268.84	R\$ 8900.87	R\$ 4669.36	R\$ 8687.15
13	Services Co. Manager	n = 1,448,562	R\$ 4325.80	R\$ 4836.82	R\$ 5036.53	R\$ 5369.67	R\$ 5437.43	R\$ 5746.97
14	Managers (General)		R\$ 5876.12	R\$ 6349.11	R\$ 6071.52	R\$ 6803.53	R\$ 6869.60	R\$ 7909.37
61	Farmer (Producer)	Low Skilled	R\$ 1115.07	R\$ 1143.98	R\$ 1244.16	R\$ 1017.68	R\$ 1403.73	R\$ 1597.37
63	Fishing		R\$ 1387.65	R\$ 1150.51	R\$ 1492.27	R\$ 1315.41	R\$ 1677.79	R\$ 1414.63
64	Agribusiness Tech.	n = 1,310,801	R\$ 1762.56	R\$ 2281.97	R\$ 1919.98	R\$ 2469.92	R\$ 2094.06	R\$ 2643.91
71	Building		R\$ 1670.92	R\$ 2401.58	R\$ 1821.92	R\$ 2584.68	R\$ 2048.38	R\$ 2829.11
72	Metallurgy		R\$ 2461.47	R\$ 2926.43	R\$ 2687.42	R\$ 3174.99	R\$ 2863.68	R\$ 3480.27
78	Multitask Ind.		R\$ 2107.46	R\$ 2199.61	R\$ 2288.07	R\$ 2504.27	R\$ 2550.85	R\$ 2734.51
79	Craftwork		R\$ 1019.94	R\$ 1234.91	R\$ 1183.35	R\$ 1562.18	R\$ 1291.60	R\$ 1292.86
95	Facilities		R\$ 2404.65	R\$ 3423.31	R\$ 2636.48	R\$ 3671.82	R\$ 2919.12	R\$ 4193.26
99	Maintenance		R\$ 1209.72	R\$ 1341.61	R\$ 1306.35	R\$ 1475.47	R\$ 1505.22	R\$ 1611.86
20	Researchers	Teachers and	R\$ 12,315.30	R\$ 11,125.98	R\$ 13,523.81	R\$ 13,379.75	R\$ 14,366.75	R\$ 15,036.52
21	Applied Sciences	Researchers	R\$ 8993.02	R\$ 13,695.25	R\$ 9697.86	R\$ 15,181.52	R\$ 10,520.31	R\$ 16,657.71
22	Biology		R\$ 6289.77	R\$ 7309.52	R\$ 6883.94	R\$ 8011.09	R\$ 7396.00	R\$ 8869.31
23	Education	n = 4,197,869	R\$ 4150.28	R\$ 3531.83	R\$ 4654.96	R\$ 3846.74	R\$ 5136.39	R\$ 4313.25
24	Law		R\$ 17,169.84	R\$ 11,015.64	R\$ 19,598.39	R\$ 12,284.75	R\$ 20,551.55	R\$ 13,715.17
25	Human Science		R\$ 9588.33	R\$ 8662.58	R\$ 10,373.74	R\$ 9557.79	R\$ 10,975.93	R\$ 10,411.62
26	Art and Communication	Technicians	R\$ 4820.14	R\$ 6570.16	R\$ 5431.72	R\$ 7454.41	R\$ 5825.11	R\$ 8568.36
27	Cooking		R\$ 1319.02	R\$ 1860.81	R\$ 1357.07	R\$ 2120.91	R\$ 1494.32	R\$ 2304.14
30	Technicians (General)	n = 12,454,886	R\$ 3922.56	R\$ 9635.52	R\$ 4307.40	R\$ 10,930.57	R\$ 4692.05	R\$ 11,801.05
31	Applied Sciences Tech.		R\$ 3611.73	R\$ 7811.69	R\$ 4040.96	R\$ 8532.73	R\$ 4454.11	R\$ 9292.61
32	Biology Tech.		R\$ 2891.51	R\$ 2821.36	R\$ 3352.27	R\$ 3094.46	R\$ 3653.30	R\$ 3461.79
33	High School Teachers		R\$ 2654.46	R\$ 2156.17	R\$ 2921.16	R\$ 2405.84	R\$ 3241.19	R\$ 2664.16
34	Logistic Tech.		R\$ 3890.16	R\$ 6454.50	R\$ 4268.60	R\$ 7278.79	R\$ 4412.34	R\$ 7808.23
35	Human Sciences Tech.		R\$ 6009.72	R\$ 4412.92	R\$ 6615.22	R\$ 5033.04	R\$ 7014.85	R\$ 5813.68
37	Sports and Culture Tech.		R\$ 2133.76	R\$ 2809.34	R\$ 2264.88	R\$ 3068.23	R\$ 2402.77	R\$ 3995.54
39	Technicians (Others)		R\$ 4511.21	R\$ 5911.96	R\$ 5000.84	R\$ 6389.18	R\$ 5332.33	R\$ 6899.61
41	Bookkeeper		R\$ 3586.28	R\$ 4673.31	R\$ 3967.00	R\$ 5158.86	R\$ 4300.12	R\$ 5653.32
42	Public Service Clerk		R\$ 2193.03	R\$ 2213.69	R\$ 2431.14	R\$ 2395.77	R\$ 2166.88	R\$ 2620.11
51	Service Provider		R\$ 1911.45	R\$ 1683.51	R\$ 2144.17	R\$ 1865.16	R\$ 2345.16	R\$ 2044.63
62	Farmer (Employee)		R\$ 1873.20	R\$ 2666.64	R\$ 2032.04	R\$ 2889.34	R\$ 2250.55	R\$ 2971.78
84	Food and Beverage		R\$ 1523.61	R\$ 1492.59	R\$ 1650.48	R\$ 1634.98	R\$ 2031.60	R\$ 1777.35
86	Manufactory Ops.		R\$ 2293.83	R\$ 4470.65	R\$ 2460.31	R\$ 4872.26	R\$ 2820.34	R\$ 5391.01
91	Mechanic Repair		R\$ 2280.49	R\$ 3438.24	R\$ 2483.27	R\$ 3731.21	R\$ 2743.92	R\$ 4032.43
0	Missing Values	Excluded	R\$ 4858.53	R\$ 4467.46	R\$ 5332.71	R\$ 2228.29	R\$ 5704.11	R\$ 3529.49
1	Military		R\$ 4267.66	R\$ 2685.28	R\$ 4973.64	R\$ 2713.59	R\$ 5474.64	R\$ 3488.51
2	Police Force	n = 2,009,712	R\$ 4372.93	R\$ 9226.70	R\$ 5148.33	R\$ 5203.79	R\$ 5507.09	R\$ 5064.40
3	Fire Dpt.		R\$ 5646.13	R\$ 2046.28	R\$ 6535.56	R\$ 2596.17	R\$ 6852.11	R\$ 2388.39
52	Sellers		R\$ 1515.79	R\$ 1430.68	R\$ 1701.95	R\$ 1532.47	R\$ 2092.46	R\$ 1645.48
73	Electronics Ind.		R\$ 3735.30	R\$ 5148.20	R\$ 4063.96	R\$ 5602.83	R\$ 4593.51	R\$ 5989.74
74	Measurements Ind.		R\$ 2059.64	R\$ 2083.08	R\$ 2238.92	R\$ 2533.82	R\$ 2229.73	R\$ 2442.70
75	Ceramics		R\$ 2286.83	R\$ 1355.75	R\$ 2366.72	R\$ 1525.96	R\$ 2632.37	R\$ 1659.36
76	Textile Ind.		R\$ 2466.00	R\$ 1688.33	R\$ 2742.87	R\$ 1556.19	R\$ 2970.53	R\$ 1693.74
77	Furniture Ind.		R\$ 2469.14	R\$ 1594.33	R\$ 2656.21	R\$ 1714.53	R\$ 2834.46	R\$ 1813.82
81	Process Mgmt.		R\$ 3169.62	R\$ 14,272.64	R\$ 3416.10	R\$ 16,261.71	R\$ 3888.32	R\$ 16,636.22
82	Steel Industry		R\$ 1568.20	R\$ 1659.54	R\$ 1677.61	R\$ 1814.55	R\$ 1714.18	R\$ 1937.77
83	Paper Industry		R\$ 3319.95	R\$ 1553.51	R\$ 3378.05	R\$ 1655.54	R\$ 3499.08	R\$ 1764.47

Source: Ministry of Labor. Prepared by the Authors

Table A2
Robustness Check – Using Fixed Effect Model.

Variables	Movers	Non Movers	FE Model
<i>education</i>	51.19*** (-4.014)	23.72*** (-0.741)	23.92*** (-0.731)
<i>age</i>	115.1*** (-10.12)	88.86*** (-1.567)	88.85*** (-1.547)
<i>age2</i>	-1.368*** (-0.1)	-1.025*** (-0.0125)	-1.024*** (-0.0124)
<i>working hours</i>	16.16*** (-0.713)	10.27*** (-0.135)	10.40*** (-0.133)
<i>experience</i>	3.285*** (-0.118)	0.488*** (-0.0215)	0.556*** (-0.0212)
<i>dummy_clt</i>	-351.8*** (-33.53)	-	-32.67** (-13.53)
<i>dummy_low_skilled</i>	-356.7*** (-33.75)	192.2*** (-11.6)	137.5*** (-10.92)
<i>dummy_low_skilled*clt</i>	366.0*** (-38.01)	-36.35** (-17.65)	20.46 (-16.01)
<i>dummy_teachers_researchers</i>	-108.0*** (-28.29)	298.8*** (-8.605)	251.3*** (-8.219)
<i>dummy_teachers_researchers*clt</i>	320.1*** (-35.49)	-138.1*** (-16.78)	-52.60*** (-14.95)
<i>dummy_technicians</i>	-376.0*** (-23.88)	229.0*** (-8.334)	174.1*** (-7.934)
<i>dummy_technicians_clt</i>	322.9*** (-34.4)	-136.7*** (-13.82)	-64.44*** (-12.99)
<i>dummy_high_skilled</i>	-122.7*** (-31.47)	368.2*** (-8.645)	329.6*** (-8.264)
<i>dummy_high_skilled_clt</i>	288.6*** (-35.72)	165.4*** (-16.5)	128.7*** (-14.77)
Observations	173,808	21,248,022	21,421,830
R-squared	0.814	0.968	0.968
Standard errors in parentheses	*** p < 0.01, ** p < 0.05, * p < 0.1		

Source: Prepared by the Authors

Table A3
Robustness Check – Using OLS Model.

Variables	Movers	Non Movers	POLS I
<i>education</i>	229.6*** (-2.407)	841.9*** (-0.581)	841.6*** (-0.577)
<i>age</i>	-16.60***	40.89***	38.42***
<i>age2</i>	(-2.332)0.257*** (-0.0263)	(-0.601)-0.107*** (-0.00664)	(-0.597)-0.0818*** (-0.0066)
<i>working hours</i>	12.46*** (-0.535)	82.06*** (-0.136)	81.56*** (-0.135)
<i>experience</i>	2.080*** (-0.0458)	9.659*** (-0.0101)	9.671*** (-0.0101)
<i>dummy_clt</i>	-751.7*** (-44.78)	521.9*** (-9.716)	505.2*** (-9.664)
<i>dummy_low_skilled</i>	-300.5*** (-31.45)	-1,948*** (-5.6)	-1,943*** (-5.574)
<i>dummy_low_skilled_clt</i>	705.7*** (-52.09)	287.9*** (-12.46)	293.0*** (-12.38)
<i>dummy_teachers_researchers</i>	409.9*** (-28.26)	86.56*** (-4.089)	78.52*** (-4.074)

Table A3 (Continued)

Variables	Movers	Non Movers	POLS I
<i>dummy_teachers_researchers_clt</i>	822.0*** (−48.05)	2291*** (−11.45)	2187*** (−11.36)
<i>dummy_techicians</i>	−608.9*** (−25.56)	−1,730*** (−3.516)	−1,731*** (−3.504)
<i>dummy_techicians_clt</i>	659.3*** (−45.82)	534.7*** (−10.09)	523.5*** (−10.04)
<i>dummy_high_skilled</i>	−801.1*** (−27.62)	536.2*** (−4.904)	493.0*** (−4.874)
<i>dummy_high_skilled_clt</i>	797.8*** (−48.39)	−478.1*** (−16.01)	−683.4*** (−15.57)
Constant	79.83 (−54.4)	−7,462*** (−14.64)	−7,389*** (−14.54)
Observations	173,808	21,248,022	21,421,830
R-squared	0.17	0.241	0.24
Standard errors in parentheses	*** p < 0.01, ** p < 0.05, * p < 0.1		

Source: Prepared by the Author

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