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Article

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The gender gap and the COVID-19 pandemic: An analysis of net Brazilian formal job destruction[☆]



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ABSTRACT

This paper sets out to analyze gender behavior in the Brazilian labor market as a result of the economic effects of the COVID-19 pandemic. It focuses on job destruction and creation during the lockdown and implementation of social distancing throughout 2020. To do so, it uses the New General Register of Employed and Unemployed (NCAGED) and applies the Oaxaca-Blinder decomposition to net male and female job destruction at municipal level, in the 18 to 40 age group. In addition, inequality for every month of 2020, in terms of the pre- and post-pandemic context was verified. It was found that the initial months affected all formal workers but had an even greater effect on women. Another relevant contribution of this study is its inequality decomposition, where the findings show that it is largely due to structural effects.

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1. Introduction

Since Doeringer and Piore (1971) treated discrimination in the workforce as a timeless cultural factor, several studies have sought to explain the gender gap and its persistence in different countries (Adda et al., 2017; Goldin, 2014; Le Barbanchon et al., 2021). The present research examines gender behavior in the Brazilian labor market as a response to the economic effects of the COVID-19 pandemic (C19p). More specifically, it analyzes job creation and destruction during the lockdown and implementation of social distancing, covering gender behavior per month during 2020.

Discrimination in the workforce can be internal or external, depending on where workers find themselves (Vietorisz and Harrison, 1973). If they are employed, internal discrimination can be expressed in private employer cost, with the training and risks involved (Human Capital factor – see Manning and Swaffield, 2008). On the other hand, when the worker does not belong to the formal workforce, discrimination can be due to the history and evolution of the system (Reich et al., 1973). While such a

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discussion is not new, it is still valid for today, mainly because the C19p can force employers to make difficult decisions about their employees, which could include job destruction involving gender.

In truth, because this is an old discussion, the employer's risk-taking decision may also have been taken before C19p, thereby showing significant gender discrimination in the Brazilian labor market during the pandemic shock. According to [Adams-Prassl et al. \(2020\)](#), in the United Kingdom (UK) and the United States (US) female workers are more likely than males to lose their jobs, at rates of around 4.8 and 6.5 percentage points (pp), respectively. However, these losses occur independently of job characteristics and show that other factors, such as "traditional" women's activities (mainly housework) could explain the gender gap.

The gender gap after C19p is also notable in the South Korean labor market. According to [Ham \(2021\)](#), more women than men are unemployed or on leave of absence. Married women present higher percentages than single women, while married men experience fewer of these outcomes. In addition, women's care duties again present the principal explanation for these gender differences.

[Reichelt et al. \(2021\)](#) analyze household gender roles after the C19p transitioning to working from home or transitioning to unemployment. Their findings indicate that unemployment or home office activities increase the length of time men spend on domestic activities, thereby making the division of labor more egalitarian. However, when the role is inverted, and women lose their jobs or transition to home office activities, something pushes them to almost total domestic activities.

For [Goldin \(2014\)](#), there can be a balanced carrying out of domestic activities between women and men when firms do not provide incentives to reward individuals with more available hours. In various sectors, there is evidence of productivity gain when part-time work is adopted. She mentions, for example, the Dutch Pharmacy sector, where part-time work enables firms to remain open during lunch break or for 24 hours without paying overtime, despite paying night wages (for more detail see [Künn-Nelen et al., 2013](#)). However, if part-time work is not for everyone, the probability of gender discrimination increases as women's share in this work format increases ([Haines et al., 2018](#)). Furthermore, there is evidence of wage penalties among part-time female workers in Organization for Economic Co-operation and Development (OECD) countries, except Sweden ([Bardasi and Gornick, 2008](#)).

A recent discussion on gender in Brazil presents positive findings on the inclusion of women in the formal labor market ([Bruschini and Lombardi, 2000](#); [Bruschini, 2007](#)), a reduction in the gender wage gap ([Scorzafave and Pazello, 2007](#); [Freitas, 2015](#); [Hausmann and Golgher, 2016](#)), turnover analysis ([da Silva Filho, 2018](#)), and gender vulnerability after C19p ([Pizzinga, 2021](#)).

[Bruschini and Lombardi \(2000\)](#) highlight the inclusion of women in the Brazilian labor market, considering as "good quality" those jobs which require specific or superior technical knowledge and "bad quality" those at the base of the pyramid. Their findings indicate that the rate of inclusion of women in "good" jobs is relatively equal to that of men. On the other hand, the competitive jobs, mainly represented by domestic workers, are characterized by increases in average age and salary, but however, with the stigma of being genuinely female jobs, and therefore without any meaningful comparison with men's share. These positive trends in the inclusion of Brazilian women started in the mid-seventies. In this regard, [Bruschini \(2007\)](#) highlights the challenges, progress, and current issues involving the female share in the Brazilian labor market. Her findings indicate the perpetuation of notions of family care, which implies an extra burden for women who prioritize their careers.

Several recent articles seek to measure these women's additional burdens resulting from the gender wage gap. According to [Scorzafave and Pazello \(2007\)](#), the gender wage gap decreased from 0.48 in 1988 to 0.28 in 1996 and to 0.22 in 2004. Furthermore, for [Hausmann and Golgher \(2016\)](#), in 2012, the Brazilian gender wage gap vanished in some sectors and actually favored women in the education sector. However, the C19p and restrictions in circulation introduced in mid-March 2020 may have affected this increase in progress. According to [Pizzinga \(2021\)](#), women in competitive Brazilian labor are vulnerable to circulation restrictions. This finding is in consonance with the international literature where the C19p has promoted gender transactions in the labor market and increased gender discrimination ([Ham, 2021](#); [Reichelt et al., 2021](#)).

In terms of increased gender discrimination, before considering the wage gap, this research deals with the issue of the survival of jobs. We think that, in a crisis, the first step to be taken in the interests of not undoing existing progress is to understand the dynamics of job maintenance. Accordingly, this article contributes to the literature on the Brazilian labor market, by exploring the creation and destruction of jobs, according to gender, during C19p. As a strategy, the article uses the Oaxaca-Blinder decomposition to analyze the creation or destruction of jobs for males and females.

The New General Register of the Employed and Unemployed (NCAGED) is made available by the Brazilian Labor Bureau (*Secretaria Especial de Previdência e Trabalho* SEPRT). This database shows monthly individual unemployment and employment data by gender, sector, age, schooling, and municipality. However, our research considers a municipality's rates by gender and sector for individuals in the 18 to 40 age group only. According to [Bhat et al. \(2007\)](#), this age group is the most likely for childbearing, and, in addition, this time span seeks to reduce possible noise in the destruction of jobs by age ([Ejarque, 2020](#)).

We linked the results with the 2020 employment and income maintenance policies and found that the country registered job destruction despite the employment and income maintenance policies in force during the initial months of restricted circulation. On decomposing this effect by gender, it is understood that employers showed a greater preference for the maintenance of men's rather than women's jobs. Although there is no empirical test, our findings could be associated with Employer-Sponsored job improvement before C19p (Human Capital effect). Other factors also associated are the fact that women are less likely to change jobs (no Job-Shopping effect) and, also to a lesser degree, cultural factors involving women, where they subordinate themselves to men (Psychological effects)³.

³ For an in-depth analysis of each of these points, see [Manning and Swaffield \(2008\)](#).

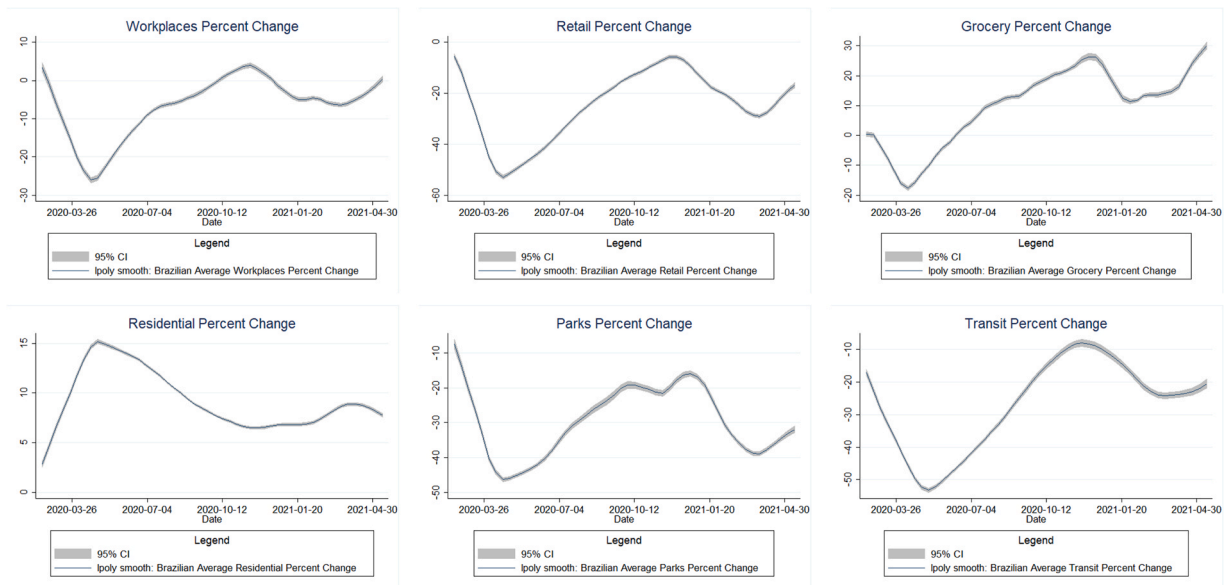


Fig. 1. Average Percentage Change for Brazilian States and Brazilian Polynomial Smooth (February 2020 – May 2021). Source: Drawn up by the authors, based on data from the Google Global Mobility Report.

Besides this Introduction, the study is divided into four sections: the next section presents the Brazilian labor Context prior to C19p and a relative panorama during the months of 2020; that is followed by the third section, a presentation of the Methodology; the fourth section then describes the Results; while the last section contains the study's Final comments.

2. Context

Throughout the months of 2020, Brazilian workers were affected by a sequence of events starting in March when the World Health Organization (WHO) declared an international emergency because of the COVID-19 pandemic (C19p). It, then, indicated four essential steps to be undertaken by governments: [i] be ready; [ii] detect and treat; [iii] reduce transmission; and, [iv] learn and innovate (WHO, 2020).

The Brazilian labor market was most affected by the lockdown measures, which sought to reduce transmission of the virus in the short term but were maintained for a period longer than desired. According to the Brazilian Federal Court of Justice (STF, 2020), responsibility for social distancing measures pertains to state and municipal governments. Thus, there is no significant Federal orientation about lockdown procedures, which renders it difficult to map the role of each municipality. In this regard, according to the Google Global Mobility Report, available from February 2020 to the present (June 2021), the average time spent at workplaces in April 2020 dropped around 30% from the regular movements of previous years. The Federal District of Brasilia was noted for its 76% rate of social distancing (Fig. 1).

Brazilian average time at the workplace returned to normal (0% compared with its movement before C19p) at the beginning of 2021, but the average time spent at other places still remains distorted. What is notable is the time Brazilians spend indoors. On average, they now spend around 7% more time in their residences than before the pandemic. As well as residences and workplaces, there has been a significant variation in the time spent at other places, such as parks, grocery, retail, and transit.

In this regard, the Federal Government adopted certain labor market support measures to combat the effects of C19p. For example, on March 22, Executive Order 927 (MPV 927, 2020) indicated that employers and employees could sign a written agreement to maintain employment and income under public calamity rules (Brasil, 2020b). MPV 927 also dealt with vacation conditions, the hour bank system, telecommuting, qualification, and the postponement of March, April, and May labor obligations to July 2020, with an interest-free installment option.

With the increase in social distancing, on April 1, the Federal Government promulgated a new Executive Order 936 (MPV 936, 2020), which provided for a 25%, 50%, and 70% reduction in working hours and wages, with specific rules according to payroll salary and suspension of the employment contract (Brasil, 2020c). In such cases, the government undertook to pay workers' incomes, according to pre-established limits. However, the agreement did not deal with justified or voluntary dismissals.

On April 3, 2020, Executive Order 944 (MPV 944, 2020) was introduced to protect jobs in companies that had a turnover of between R\$360 thousand and R\$10 million in the 2019 fiscal year (Brasil, 2020d). This MPV created the Job Support Emergency Program (*Programa Emergencial de Suporte a Empregos PESE*). The credit facility was exclusively used to compensate for payroll expenses, and companies could not lay off workers for up to 60 days after receiving the last installment through this program.

Finally, on May 18, 2020, Law 13,999 (Act 13,999, 2020) instituted the National Support Program for Micro and Small Businesses (*Programa Nacional de Apoio às Microempresas e Empresas de Pequeno Porte PRONAMP*). In this program, the credit facility was around 30% of Micro-firms' 2019 revenue or 50% if the firm was established in 2019 (Brasil, 2020a). In addition, the credit facility was not limited to payroll and sought to alleviate the problem of increased market friction for Micro-firms.

These were the main measures introduced in the formal Brazilian labor market, excluding the public sector, with the aim of buffering the effects of C19p throughout 2020. This study does not set out to evaluate the effects of these measures. Instead, in the following sections, our propositions explore the destruction and/or creation of jobs within this context.

3. Methodology

The research design involves two steps. First, it presents the data characteristics, construction of variables, and their descriptive statistics. At this point, a brief defense of the variables used and their objectives is presented. Then, the empirical strategy used to arrive at the results is presented.

3.1. Database

3.1.1. The NCAGED

The New General Register of Employed and Unemployed (*Novo Cadastro Geral de Empregados e Desempregados NCAGED*) is used to evaluate job destruction or creation. This data is taken from the Brazilian Labor Bureau (*Secretaria Especial de Previdência e Trabalho, SEPRT*) which has monthly periodicity, and registers only the current movement of formal jobs. The total labor stock is contained in another SEPRT database, known as the Annual Social Information Report (*Relação Annual de Informações Sociais RAIS*), which uses the last day of December as its base.

This research only uses the movement base (NCAGED) because it sets out to identify formal job creation or destruction for each month in 2020. According to Brasil (1965), employers must present a monthly declaration of their job movements. From 2019, these declarations are made through the Digital Bookkeeping System for Tax, Social Security, and Labor Obligations (Brasil, 2019). Consequently, this database could contain errors and omissions because the base is formed using employers' statements. However, according to the SEPRT, this base currently covers, on average, 97% of total formal Brazilian labor jobs. Also, the NCAGED is the official base used in the formulation of policy presented in the Context section.

In terms of error, some distortions occur when filling in data regarding age and declarations of race. For Osorio (2003), some workers declare themselves white when applying for a job, even though they do not belong to that race, and that position remains when employers actually hire them. In this respect, on comparing RAIS with the National Household Sample Survey (*Pesquisa Nacional por Amostra de Domicílios PNAD*), Paixão et al. (2012), do not reject the null hypothesis that the race effect exists. However, there is a convergence in the distributions of both these bases. Consequently, since NCAGED is the monthly movement that makes up the Brazilian annual total stock of jobs, their distribution seems to be the most appropriate for the objectives of this research.

3.1.2. Job creation and destruction

In this research, job movement disregards terminations due to death, retirement, or unknown type. In addition, it disregards terminations and admissions by transfer and public sector movements. All other movements presented in the NCAGED enter this research (Admission classes considered: first job, re-employment, fixed-term, reinstatement, and employment contract. Termination classes considered: voluntary termination, fixed-term end, termination of the contract, an agreement between Employee and Employer, unfair termination, fair dismissal, and reciprocal guilt).

Two terms can be used when analyzing the Results to avoid any interpretation other than that suggested by the data. The term "Dismissals" is used if the predominant terminations are a result of fair dismissal. On the other hand, if the sum of all other termination classes is predominant, mainly of unfair termination, then the correct term is "Layoffs." Both types belong to the job destruction concept, as fair dismissal may be driven by the context.

Within these concepts, the following equations indicate the process used to measure the job creation or destruction variable. Orellano and Pazello (2006) measure the creation and destruction of jobs from Eqs. (1) and (2), respectively:

$$JC_{g,m,t} = \frac{AD_{g,m,t}}{\frac{WF_{g,m,t} + WF_{g,m,t+1}}{2}} \quad (1)$$

$$JD_{g,m,t} = \frac{TE_{g,m,t}}{\frac{WF_{g,m,t} + WF_{g,m,t+1}}{2}} \quad (2)$$

where AD is admissions, and TE is terminations occurred in month t , for gender g , and municipality m , while WF (workforce) is the total stock at the beginning of the period. The denominator is the average between the beginning and end of the period.

From these measures, the literature uses the net creation or destruction of jobs by subtracting $JC_{g,m,t}$ from $JD_{g,m,t}$, where there is jobs creation if the results are positive and jobs destruction if the results are negative (Orellano and Pazello, 2006; da Silva Filho et al., 2014; da Silva Filho, 2016). However, in the present research, the multiplicative approach is used, calculating the gender rate between $JD_{g,m,t}$ and $JC_{g,m,t}$ as in the following equation:

Table 1

Municipal descriptive statistics, by type of movement and gender, 2020.

Source: Drawn up by the authors, based on NCAGED data.

Type of movement	Female			
	Mean	Std. Dev.	Min.	Max.
Terminations	92.19	992.98	0	81,578
Admissions	94.79	1,005.56	1	72,972
Terminations/Admissions	1.31	3.10	0	339
Type of movement	Male			
	Mean	Std. Dev.	Min.	Max.
Terminations	122.55	1,249.90	0	103,821
Admissions	131.40	1,326.29	1	96,757
Terminations/Admissions	1.41	6.75	0	1,030

$$Y_{g,m,t} = \frac{JD_{g,m,t}}{JC_{g,m,t}} \quad (3)$$

The multiplicative approach offers certain advantages. First, there is no need to compute the total stock from RAIS because the division considers the total stocks unnecessary, thereby making it possible to do a direct relative analysis between the genders. In addition, the analysis comes to around 1 (one). Another change involved is that instead of analyzing establishments as units, the creations and destructions of jobs are analyzed on the basis of the municipal aggregate. Thus, the creation or destruction of municipal jobs is evaluated. If the results are greater than one ($Y_{g,m,t} > 1$), then it is a question of job destruction, and if the results are less than one ($Y_{g,m,t} < 1$), then it is a question of job creation. Considering Eq. (3), Table 1 shows municipal statistics for the January–December 2020 period.

In Table 1, it can be seen that the $Y_{g,m,t}$ rate is greater than 1 (one), which indicates that, on average, there was more destruction than creation of jobs in 2020. However, these values do not remain symmetric between Brazilian municipalities, as average municipal terminations and admissions present the most significant standard errors for both genders.

As regards gender issues, this research only considers individuals in the 18 to 40 age group (statistics presented in Table 1). According to Bhat et al., 2007, this age group belongs to the range with the highest probability of procreation. In addition, Ejarque (2020) indicates that the over 40 age group has different formal job creation and destruction dynamics when compared to younger people. Thus, the age group considered in this research seeks to avoid the job changes involving older workers (over 40 years old), thereby reducing the noise of the unexplained component of the decomposition that is presented in the Decomposition analysis.

Thus, between January and December 2020, there were totals of 4,432,312 terminations for women and of 6,740,573 for men. Also, in the same period, there were 4,532,313 admissions for women and 7,191,831 for men. Table 2 presents statistics for the variables related to observable characteristics contributing to productivity and the sectors for these individuals.

In Table 2, it can be seen to what extent males and females differ in terms of the attributes they can contribute to productivity at work and to their sector of activity. The research design, therefore, aggregates these characteristics by municipality, sex, and monthly averages in the decomposition estimations. This strategy is presented in the following subsection.

3.1.3. Counterfactual Decomposition

The differences between groups, related to labor market results, could be due to experimental factors linked to productivity, such as experience and educational stock. However, according to Blinder (1973), even if these groups have similar productive

Table 2

Descriptive statistics of the characteristics of individuals and composition of sectors, 2020.

Source: Drawn up by the authors, based on NCAGED data.

Variables	Male		Female	
	Mean	Std. Dev.	Mean	Std. Dev.
Schooling Level				
Complete Elementary Schooling	0.09	0.28	0.04	0.21
Complete High School	0.62	0.49	0.65	0.48
Complete University Education	0.06	0.24	0.14	0.34
Age	28.09	6.40	27.78	6.41
Sector				
Industry	0.19	0.39	0.13	0.33
Construction	0.14	0.35	0.02	0.13
Commerce	0.23	0.42	0.29	0.45
Services	0.24	0.43	0.34	0.47
Science and technology	0.03	0.17	0.04	0.19
Education	0.01	0.11	0.04	0.20
Health	0.02	0.14	0.09	0.29

characteristics, one could be more affected than the other because of discrimination or other factors which obstruct chances of permanence, hiring and occupations with higher wage earnings.

The Oaxaca-Blinder procedure usually separates such components from inequality (composition effect and structural effect), and also verifies each explanatory variable’s contribution in this decomposition. This type of analysis is common for wage income (Scorzafave and Pazello, 2007; Etilé and Plessz, 2018; Firpo et al., 2018; Schwaab et al., 2019), but can also be commonly used for movement in the labor market, as in Ham (2021).

The strategy base comes from a linear estimation in Eq. (3). However, as it is intended to verify the inequality for each period t , we have:

$$Y_{g,m,t} = X_{g,m,t}\beta_{g,t} + \varepsilon_{g,m,t} \text{ for } g = H, L, \text{ and } t = 1, \dots, 12, \tag{4}$$

where $Y_{g,m,t}$ is the result for group g , X_g is a vector of observed characteristics of individuals belonging to group g , and β_g is a vector with the respective coefficients.

Because it is an aggregate result for each municipality m , as seen in Eq. (3), the decomposition process considers municipal averages of all variables. It is assumed that the group with the subscript H (high) has favorable results, and that the other group, represented by L (low), has unfavorable results. Therefore, considering the literature (presented in the Introduction section), this research assumes H for males and L for females.

The strategy predicts the estimation of Eq. (4) using the Ordinary Least Squares method. According to Angrist and Pischke (2008), the coefficients found are the same for conditional and unconditional estimation because of the Law of Iterated Expectations. Thus, following Blinder (1973), the unconditional decomposition comes from:

$$\bar{Y}_H - \bar{Y}_L = (\bar{X}_H - \bar{X}_L)\beta_H + (\beta_H - \beta_L)\bar{X}_L, \tag{5}$$

Unlike wage analysis, one can expect the gap between job destruction to be negative for group H . The term $(\bar{X}_H - \bar{X}_L)\beta_H$ represents the compositional effects, which explain the difference related to the observable productive characteristics of each group. The term $(\beta_H - \beta_L)\bar{X}_L$ explains the difference due to unobservable factors (structural effect), such as the differences resulting from discrimination against the female sex, the motherhood penalty, and the fall in productivity due to dedication to traditional (domestic) activities (England et al., 2016; Cooke and Hook, 2018; Firpo et al., 2018; Ham, 2021).

In addition to decomposing the changes or differences in the results, this procedure allows for dividing each component in the contribution of each variable, which is simple to verify when it comes to decomposition in the mean (Firpo et al., 2018).

4. Results

The first step in analyzing the gender gap over the months of 2020 is to see the context in which Terminations were carried out during the implementation of lockdown due to C19p. Table 3 presents these results for January (pre-lockdown implementations), April and June (post-lockdown implementations), and December (when the effect of restrictions had decreased; see Fig. 1).

In January 2020, before the confidence of employers and employees was shaken by C19p, rates of Voluntary Terminations for females and males came to around 30 and 26%, respectively. In April, rates of this type of Termination dropped to approximately

Table 3
Allocation of workers by sex, schooling, and sector, 2020.
Source: Research Results. Note: Percentages greater than 10% are presented in bold.

Movement	Female							
	Jan		Apr		Jun		Dec	
	Obs.	%	Obs.	%	Obs.	%	Obs.	%
Unfair Terminations	205,050	47.00	341,570	70.72	155,691	58.80	155,484	38.32
Fair Dismissals	5,808	1.33	3,726	0.76	3,119	1.18	3,848	0.95
Reciprocal Guilt	351	0.08	1,194	0.25	444	0.17	412	0.10
Voluntary Termination	133,623	30.63	56,303	11.66	67,009	25.31	128,546	31.68
Fixed Term End	77,386	17.74	72,813	15.08	35,106	13.26	110,990	27.35
Termination of Contract	8,741	2.00	4,192	0.87	1,094	0.41	2,674	0.66
Agreement between Employee and Employer	5,310	1.22	3,164	0.66	2,308	0.87	3,827	0.94
Total	436,269	100.00	482,962	100.00	264,771	100.00	405,781	100.00
Movement	Male							
	Jan		Apr		Jun		Dec	
	Obs.	%	Obs.	%	Obs.	%	Obs.	%
Unfair Terminations	321,577	52.85	474,788	69.76	253,020	60.14	279,363	47.14
Fair Dismissals	11,396	1.87	7,636	1.12	6,648	1.58	9,018	1.52
Reciprocal Guilt	681	0.12	1,682	0.25	629	0.15	837	0.14
Voluntary Terminations	159,961	26.29	71,475	10.50	95,010	22.58	159,623	26.94
Fixed Term End	94,263	15.49	113,472	16.67	58,929	14.01	134,048	22.62
Termination of Contract	12,376	2.04	6,723	0.99	2,345	0.56	3,509	0.59
Agreement between Employee and Employer	8,166	1.34	4,847	0.71	4,164	0.99	6,209	1.05
Total	608,420	100.00	680,623	100.00	420,745	100.00	592,607	100.00

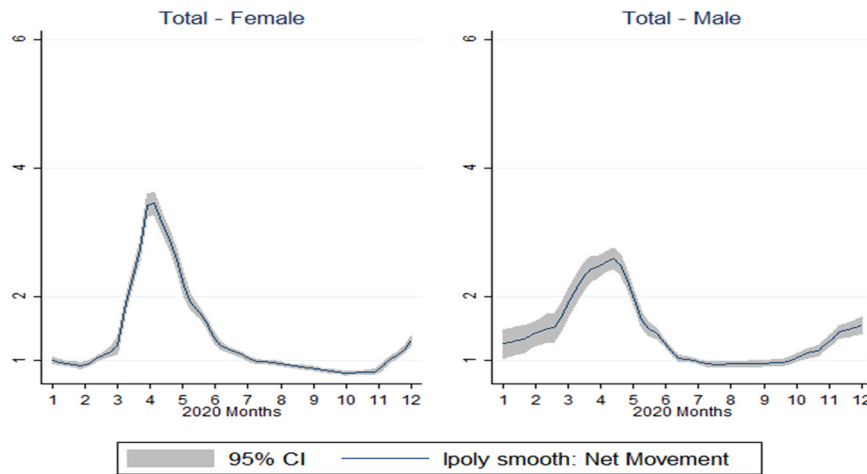


Fig. 2. Net job destruction rate, by gender, January to December 2020. Source: Research Results.

11% for both sexes and only returned to their pre-pandemic level in December. On the other hand, Unfair Terminations went from 47 and 53% (female and male, respectively) in January to almost 70% for both sexes in April, and returned to lower rates in December (38 and 47%). Also noteworthy is the fact: that Fair Dismissals and Reciprocal Guilt remained relatively constant over the months of 2020; that the Fixed Term End type increased in December 2020 for both sexes; and that the Termination of Contract and the Agreements dropped over the period. These movements oblige one to use the “Layoff” term when interpreting the results as the principal cause of Termination seems to be the external factor that affects the supply side of the labor market (companies do not have enough jobs).

The behavior of the net movement in the job market, by gender, over 2020 is presented in Fig. 2.

A comparison of Fig. 2 with Fig. 1 (mobility at places) allows one to associate the implementation of social distancing with the dynamic of job creation or destruction. In this respect, the findings indicate a worse scenario up until July for females when compared to that of males. Then, only between August and November is there a balance in net job creation. In general, the analysis indicates that the beginning of the pandemic was prejudicial to both sexes when there was net destruction of four jobs for females and three for males.

Before analyzing what influenced this difference in results, schooling level and average sector share were compared in order to draw up a brief profile of certain characteristics observed for both males and females who underwent movement in the Brazilian labor market in 2020. Table 4 shows the composition of each group according to type of movement.

Most females and males, for both movement types, had schooling up to Complete High School level. As regards University Education, 14% of females completed this stage, compared to 6% of males. Of the total number of females admitted over the period, 33.5% were in the Services sector, while 1.8% were in the Construction sector. The largest share of total male admissions over the period was also in the Services sector (23.5%). However, there is a much lower share of males in the Education sector (1.2%). In the Health sector, considered the C19p frontline, the period shows an Admission of 10% for females, against only 2% for males. For Layoffs, the compositions according to sex, schooling and sector, were similar to those of Admissions.

Table 4 Allocation of workers by sex, schooling, and sector, 2020. Source: Research Results.

Schooling level	Admissions		Layoffs	
	Female	Male	Female	Male
Complete Elementary School	4.3%	8.5%	4.7%	9.0%
Complete High School	65.0%	62.8%	64.2%	60.9%
Complete University Education	14.1%	6.3%	13.4%	6.3%
Sector				
Industry	12.9%	19.1%	12.3%	18.5%
Construction	1.8%	14.2%	1.6%	13.6%
Commerce	28.6%	22.2%	29.9%	22.8%
Services	33.5%	23.5%	34.6%	24.3%
Science and Technology	3.9%	3.1%	3.7%	2.9%
Education	3.9%	1.2%	4.4%	1.4%
Health	10.0%	2.0%	8.1%	1.7%

Table 5

Net job destruction rate, by sector, 2020.

Source: Research Results.

Sector	Total	January	April	December
Industry	1.84	1.30	5.44	1.94
Construction	1.29	1.00	2.76	2.05
Commerce	1.15	1.13	2.67	1.04
Services	1.25	0.91	4.01	1.08
Science and Technology	0.97	0.78	1.99	1.21
Education	1.55	1.06	3.75	3.63
Health	0.83	0.79	1.30	0.95

In order to make a descriptive comparison of average job destruction rates, [Table 5](#) shows their averages, by sector analyzed, for the whole of 2020 (Total) and selected months.

The findings in [Table 5](#) show that the sectors with most movement shares present a more significant increase in municipal job destruction rates in April than in January. In this set, stand out the Industry (4.14), Services (3.1) and Education (2.69) with the most significant variations in the period. In short, the average rates decreased in December, but some sectors remained above the January levels. Construction and Education sectors stand out, with rates closer to those of April than pre-pandemic (January) rates.

[Table 5](#) provides information about municipal job movement in 2020 aggregated rates but does not allow one to visualize the gender percentage municipal job movement dynamic. So, [Fig. 3](#) presents the results decomposed by gender, months, and sectors.

[Fig. 3](#) presents a peak in April for all sectors, as seen for the total net job destruction rate ([Fig. 2](#)). The exception is for males in the Health sector, which underwent more Admissions than Layoffs throughout the year. Education was the sector which delayed longest in balancing Layoffs and Admissions, and presented a second peak in December. Inequalities between males and females were seen in almost all sectors. Of note are the Science and Technology and Health sectors, whose behaviors were similar for both genders, in that there was virtually no excess of Admissions over Layoffs. The only sector in which females had lower destruction rates was that of Construction, but there is a low female share in that sector.

The decomposition results for the municipal averages are presented in [Table 6](#). Due to the difference in net job destruction rates in the pre-lockdown period, the municipal average for females is lower than that for males. In addition, female Admissions were higher than female Layoffs in February, but that situation was inverted in March when female Layoff rates per Admission became more significant than those of males from April to July.

On observing the lower part of [Table 6](#), it can be seen that it is only the composition effect that is significant between January and March. As the Complete University Education rates of females are more significant than those of males ([Table 4](#)), the results for these first three months of 2020 indicate that observed characteristics were favorable for females. In addition, the share of females in sectors with more Admissions than Layoffs can be considered to explain the lower rates in the pre-lockdown period.

From April onwards, it turned out that the process of job destruction prejudiced both sexes but females carried the greater burden, with a rate around three times higher than in March, when compared to a twice greater rate for males. However, in April specifically, the explained component of the decomposition was not statistically significant, which indicated that the only effect responsible for the difference, on average, was the structural effect (unexplained). The gap due to this effect is 0.69 more jobs destroyed for females when compared to males. Thus, in a situation where the same productive characteristics are observed for males and females, the unobserved factors associated with traditional ways of thinking (domestic tasks, human capital effects, psychology, and others) contributed more to reducing the rate of job destruction for males than for females.

The negative gap persisted until July, although the explained component again favored females from April onwards. Nevertheless, the unexplained component indicated that if the productivity characteristics had been equal, the return characteristics would, on average, have contributed less to reducing the rate between female Layoffs and Admissions.

In August, the differences in results between males and females were no longer significant, and returned to a scenario favoring females in October. However, starting with decomposition in terms of explained (composition effect) and unexplained (structural effect) factors, one can perceive how much the whole period was prejudicial to females, especially in terms of the unobserved component of inequality (except for October and November).

From August until November, females experienced a scenario of net job creation (Admissions greater than Layoffs), which was interrupted in December. Despite a lower rate of female job destruction, it can be seen that this is due to composition effects when examining the unexplained component. For the unexplained component of the decomposition, the gap between males and females would be negative, which indicates that females suffered 0.21 more job destruction than males due to structural factors.

For more detailed results, [Table 7](#) shows how allocated groups and sectors contributed to gender inequality. In addition, the composition and return effects by the variables observed are presented, considering the most critical months of the C19p (April, May, June, and December).

As regards the explained movement shares, as the average share of females with Complete University Education was higher than that of males, it contributed to fewer Layoffs per Admission, with a difference of 0.06 to 0.27 more jobs destroyed for males. Another factor favorable to females was the lower female movement share in the Industry sector which had more Layoffs

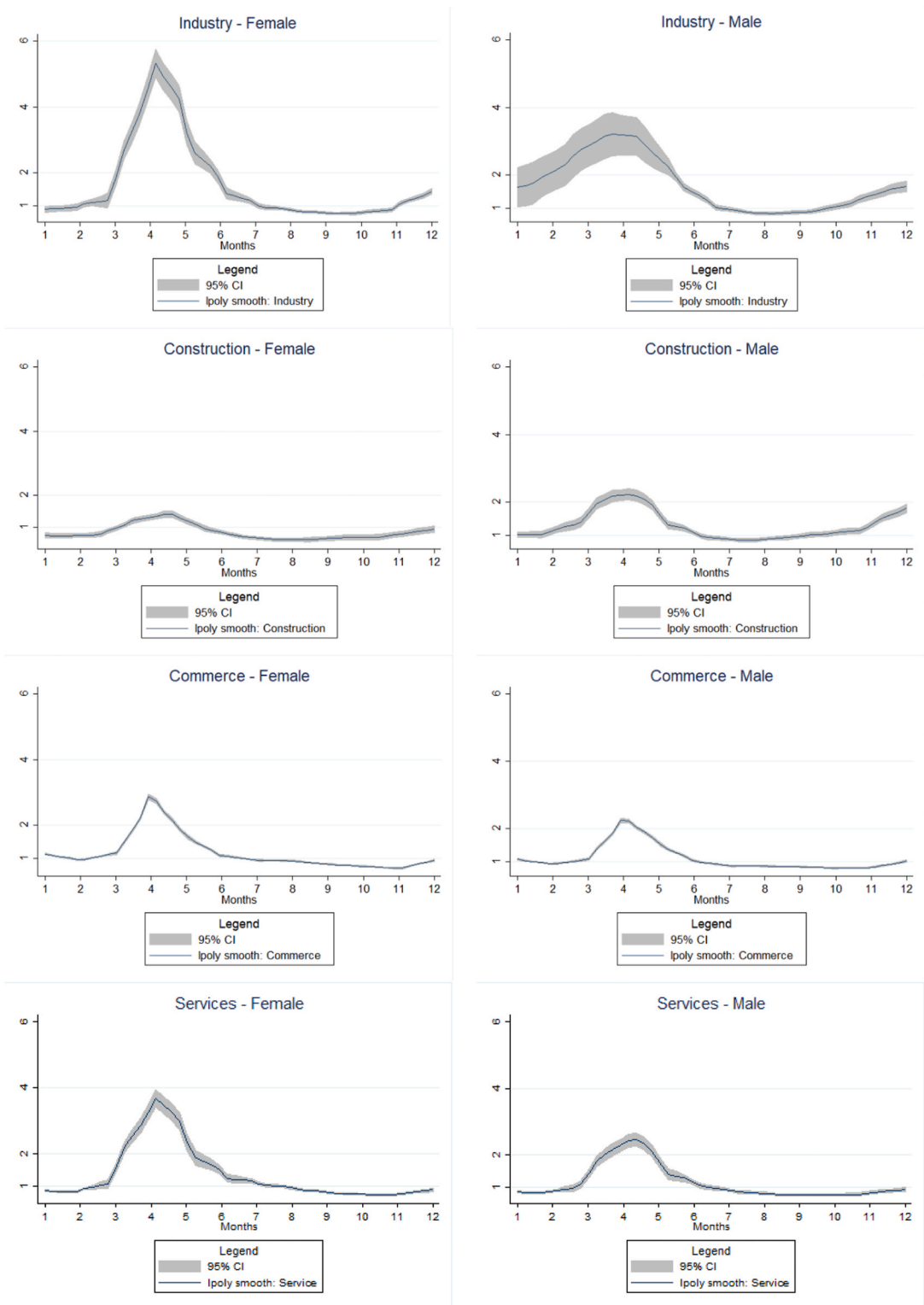


Fig. 3. Net job destruction rate, by gender and sector, January to December 2020. Source: Research Results.

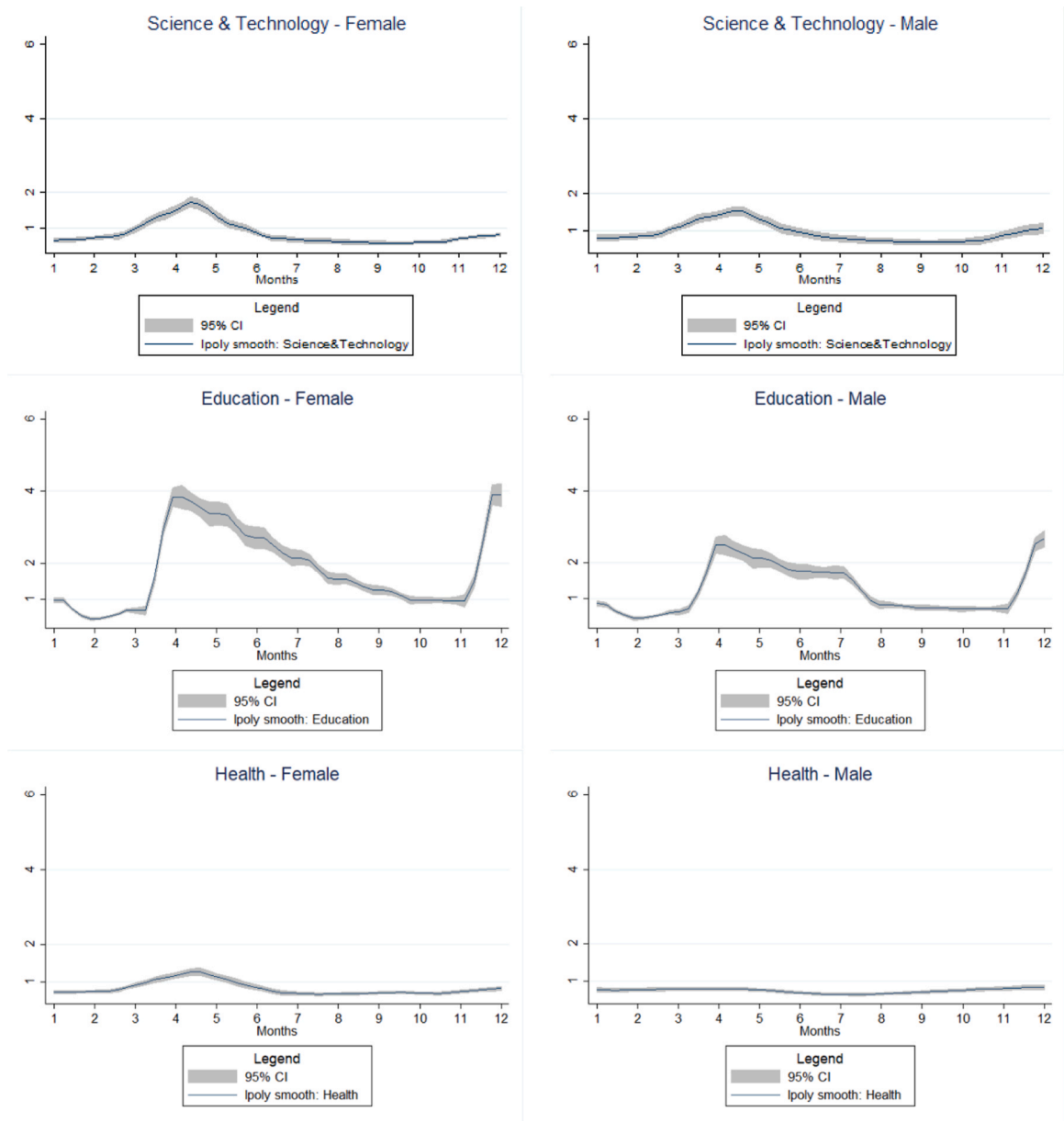


Fig. 3. (continued)

than Admissions throughout 2020. In addition, with the exception of April, Health sector net positive job creation was favorable to females, net rates not being higher than those of males in May and June. This result is also an essential factor because women had more Admissions than Terminations/Layoffs when compared to the results for men in December.

As regards factors unfavorable to females, the effect of the Services sector in April stands out, as it contributed to 0.47 less job destruction for males, thus contributing to increasing the average gender gap for that month. These findings came about because the average female allocation in the Services sector⁴ was higher than that of males. Due to the weight exerted by this factor in the explained component, it can be seen that it contributed to canceling out the favorable factors, thereby making the composition effect non-significant in the final decomposition. These results remain for all selected months, except for December, when the predominance of factors favorable to females (proportion of females with University Education and allocation

⁴ Services sector is the second sector with more Layoffs than Admissions in April (see Table 4).

Table 6
Decomposing gender gaps in net movement, January to December 2020.
Source: Research Results.

	January	February	March	April	May	June	July	August	September	October	November	December
Male	1.1678 (0.033)	1.4662 (0.228)	1.5497 (0.109)	3.2151 (0.173)	1.8721 (0.056)	1.1235 (0.025)	0.9321 (0.020)	0.9502 (0.031)	0.9410 (0.041)	0.9952 (0.034)	1.2732 (0.057)	1.6716 (0.108)
Female	1.0053 (0.024)	0.9045 (0.025)	1.2282 (0.027)	3.7510 (0.140)	2.1915 (0.075)	1.2966 (0.036)	1.0176 (0.021)	0.9448 (0.020)	0.8727 (0.018)	0.8023 (0.019)	0.8293 (0.022)	1.3105 (0.045)
Difference	0.1624 (0.041)	0.5617 (0.229)	0.3215 (0.112)	-0.5360 (0.223)	-0.3194 (0.094)	-0.1731 (0.044)	-0.0855 (0.028)	0.0054 (0.037)	0.0684 (0.045)	0.1929 (0.039)	0.4439 (0.061)	0.3612 (0.117)
Explained	0.1679 (0.040)	0.3651 (0.094)	0.3900 (0.059)	0.1500 (0.162)	0.2339 (0.067)	0.1040 (0.035)	0.0717 (0.024)	0.1590 (0.056)	0.1298 (0.044)	0.1798 (0.037)	0.2979 (0.039)	0.5689 (0.123)
Unexplained	-0.0055 (0.054)	0.1966 (0.157)	-0.0685 (0.092)	-0.6860 (0.344)	-0.5533 (0.127)	-0.2772 (0.062)	-0.1573 (0.035)	-0.1536 (0.044)	-0.0615 (0.036)	0.0132 (0.048)	0.1460 (0.061)	-0.2078 (0.079)
Observations	9025	9200	9091	7677	7790	8066	8473	8615	8777	8900	8741	8433

Note: Robust standard errors in parentheses.

* p < 0.1.

** p < 0.05.

*** p < 0.01.

Table 7

Decomposing gender gaps in net movement by explanatory variables, critical months 2020.

Source: Research Results.

Variables	April		May		June		December	
	Explained	Unexplained	Explained	Unexplained	Explained	Unexplained	Explained	Unexplained
Complete Elementary School	-0.0594** (0.030)	-0.2211** (0.103)	-0.0361* (0.021)	-0.1124* (0.067)	-0.0051 (0.014)	-0.0126 (0.042)	-0.0798 (0.050)	-0.1524 (0.119)
Complete High School	0.0846** (0.040)	-1.4677** (0.744)	0.0485*** (0.015)	-0.4064 (0.317)	0.0094 (0.007)	-0.0931 (0.163)	0.0789** (0.040)	-1.3021* (0.791)
Complete University Education	0.2670*** (0.033)	-0.2034** (0.070)	0.1839*** (0.026)	-0.0226 (0.046)	0.0632*** (0.014)	0.0133 (0.025)	0.1407*** (0.052)	-0.2009* (0.107)
25-29 Age group	-0.0204** (0.008)	0.0411 (0.224)	-0.0120*** (0.005)	-0.1313 (0.082)	-0.0008 (0.002)	-0.0591 (0.050)	-0.0038* (0.002)	0.1181 (0.077)
30-35 Age group	0.0015 (0.004)	-0.3516* (0.190)	-0.0003 (0.005)	-0.1460* (0.089)	0.0028 (0.003)	-0.0971* (0.051)	0.0051* (0.003)	0.0446 (0.092)
35-40 Age group	0.0168** (0.008)	-0.3353* (0.196)	0.0264** (0.007)	-0.1926* (0.099)	0.0159** (0.004)	-0.0624 (0.064)	0.0223* (0.012)	0.0747 (0.133)
Industry	0.2840*** (0.057)	-0.5775 (0.441)	0.0916** (0.024)	-0.5412 (0.201)	0.0369** (0.011)	-0.2216 (0.087)	-0.0701 (0.057)	-0.5403* (0.288)
Construction	0.0899** (0.034)	0.0484* (0.027)	-0.0451 (0.035)	-0.0003 (0.027)	-0.0146 (0.020)	-0.0001 (0.013)	-0.1076 (0.098)	-0.1082* (0.063)
Commerce	-0.0618* (0.123)	0.3457 (0.480)	0.0176 (0.032)	-0.1778 (0.101)	0.0048 (0.012)	-0.0845 (0.045)	0.3403*** (0.062)	-0.7428 (0.191)
Services	-0.4702*** (0.123)	0.6680 (0.480)	-0.0626* (0.032)	-0.0600 (0.101)	-0.0241** (0.012)	-0.0652 (0.045)	0.1611*** (0.062)	-0.3507* (0.191)
Science & Technology	-0.0001 (0.003)	-0.0022 (0.019)	0.0053** (0.002)	-0.0159 (0.012)	-0.0042 (0.003)	-0.0243 (0.022)	0.0009 (0.012)	0.0590 (0.076)
Education	-0.0119 (0.010)	-0.0395** (0.017)	-0.0244*** (0.009)	-0.0188 (0.013)	-0.0081 (0.005)	-0.0008 (0.008)	-0.0241 (0.036)	-0.0763* (0.046)
Health	0.0300 (0.023)	-0.0155 (0.023)	0.0412** (0.018)	-0.0323 (0.021)	0.0279** (0.008)	-0.0224 (0.009)	0.1051*** (0.034)	-0.0786* (0.043)
Total	0.1500 (0.162)	-0.6860** (0.344)	0.2339*** (0.067)	-0.5533*** (0.127)	0.1040** (0.035)	-0.2772*** (0.062)	0.5689*** (0.123)	-0.2078*** (0.079)

Note: Robust standard errors in parentheses.

* p < 0,

** p < 0.05,

*** p < 0.01.

in sectors with fewer Terminations/Layoffs than Admissions) was responsible for producing a positive value, thereby indicating a higher net rate of job destruction for males.

Table 7 also shows the unexplained component of the decomposition. Similar to the Explained effects, the negative effects were unfavorable to women because the calculation considers male rates minus female rates, so if job destruction is greater for females than for males then the signal will be negative and the extent of this result will indicate the size of the gender gap (that is, the distance between the women and men). In this respect, the returns of the 30–34 and 35–40 age groups are notable, contributing to greater female job destruction in April and May than that of males. Although the database does not contain specific family information, the family could be the unobserved factor which influences such differences as this age group is considered childbearing (see Bhat et al., 2007). In this regard, the traditional factors could be responsible for the penalty suffered by women.

In terms of schooling, especially for April, the month with most critical results, it was noted that the school returns were favorable to females with schooling beyond Complete High School but unfavorable to females with just Complete Elementary Schooling. However, on considering the equality in the proportion of individuals of both sexes, Complete High Schooling was not presented as favorable to women in June, as the only characteristic that helped reduce the gender gap in that month was Complete University Education. Even so, these results did not contribute towards reverting unfavorable female relative Layoffs when compared to male rates from April to July (Table 6). In December, the observed characteristics lead to the relative Layoff comparisons being favorable for females. It must be emphasized that December presented net job destruction rates, as the results were greater than 1 (one) for both sexes (Table 6). Thus, without lockdown restrictions, the observable characteristics, with emphasis on schooling, seem essential in reducing the gender gap.

Although there is no empirical test, our findings dialogue with the Manning and Swaffield (2008) results, as the unexplained component could be associated with factors, such as the employer's costs of training workers in the past (Human Capital effect); the fact that women are less likely to change jobs (no Job-Shopping effect); and cultural factors, where women consider themselves inferior to men (Psychological effects).

Despite the limitation of the database available, the literature can help understand what underlies this unexplained gap, which was prejudicial to women, throughout almost the whole of C19p in 2020. Women in the age group analyzed were highly likely to be mothers of young children (Bhat et al., 2007). According to Goldin (2014), this can reduce employer investment in females, as employers' risk of losing their female employee increases at the age range analyzed (18–40). The warning signs come

from the Education sector which presents greater net job destruction (see [Table 5](#) and [Fig. 3](#)), which indicates more children at home and the need for more parents/guardians at home too. This is intensified when competitive jobs (usually those of maids or housekeepers) are affected by the pandemic ([Pizzinga, 2021](#)). Thus, when comparing the political context with the findings of this paper, the C19p shows an association between employer behavior and job destruction and a preference for male workers, as happened between April and July.

Another factor in the present findings, which deserves reflection, is that housework (traditional thinking in some literature) could reduce women's productivity, as the C19p could double a woman's workload ([Reichelt et al., 2021](#)), especially if there are no teachers for children in the Education sector or housekeepers in the services sectors. [Bertrand et al. \(2010\)](#) already showed that women who become mothers are more likely to abandon their careers. However, here the analysis does not present results for voluntary Terminations. Thus, the findings reinforce the hypothesis that gender discrimination becomes more evident with C19p because of employers.

In good times, employers invest in employees but when doing so they choose which employee will be maintained, in order to minimize costs, should the company be affected by a crisis. Because women are involved in traditional jobs (taking care of the home, children, etc.), many employers do not train women in their attempt to minimize costs. Thus, in times of crisis, employers exercise the option of maintaining male rather than female workers, since the cost of destroying jobs for the former is greater. This also fits our results into the Human Capital literature.

Finally, in this study the effects presented in the results are only for formal workers. However, this does not prevent one from dialoguing with other studies dealing with informal Brazilian workers. According to [Ramos \(2002\)](#) and [Araújo and Lombardi \(2013\)](#), who on analyzing the PNAD, found that the informal work rate in Brazil was always (up until 2009) greater than 50% considering the total number of economically active people. For [Araújo and Lombardi \(2013\)](#), female informal work is relatively two percentage points higher when compared to data evaluating males only. Thus, if that coefficient were maintained constant, the gender gap in informal labor could be two percentage points greater for females than for males.

However, little can be said about the destruction of informal employment, given that there is no physical figure of the employer to create or destroy jobs. In a municipal analysis, the movement could present a different face as there is a social weight involved here in addition to the movement analysis. For example, the worker who earned resources by selling goods in front of a school starts to explore some other opportunity for survival, if it exists. From this example, an analysis of a rotation of opportunities seems more sensible than that of job creation or destruction. Therefore, given its changing characteristics, an analysis of informality would be another research theme, which goes beyond the objectives of this study.

5. Final comments

This article contributes to the debate on the gender wage gap by analyzing the context of the crisis imposed by the COVID-19 pandemic (C19p). We understand that in times of crisis, before looking at the wage gap, we must look at job survival. In this way, this article contributes by trying to understand what underlies employers' choices, evaluating the extent of job creation or destruction, by gender in the face of a random exogenous shock. Thus, we assess how gender behavior in the Brazilian labor market responded, on average, in Brazilian municipalities to the economic effects of the C19p. Evidence was found that the initial months of the pandemic were prejudicial to all formal workers, but women carried the greater burden. Thus, another relevant contribution of this study is its inequality decomposition, where the findings show that it is largely due to structural effects.

Females had higher net movement indicating job destruction in almost all months of 2020. This result occurs even when females presented more favorable observable characteristics than males, such as a higher proportion with a university education or low allocation in the most affected sectors (Industry) and a high share in the Health sector. For example, in April as compared to March, net job destruction increased by 2.5% for females against 1.7% for males.

The inequality decomposition showed that as of April the structural effect was relevant in explaining this gap. It is interesting to note that the restrictive measures were imposed in April and that the difference in the rates of net job destruction between males and females was due, in its entirety, to unobserved factors. In almost all other months after isolation measures were in place, the decomposition shows that these effects were significant for the gender wage gap, as they were favorable to males. When the structural effect presents the return of characteristics on the result of interest, that indicates that even if males and females had similar observed characteristics, with advanced schooling and age group, the females would be more disadvantaged.

On considering the employment maintenance policies implemented between April and May 2020 (Executive Orders 936 and 944 and Law 13,999), there is a strong association between our results and employer behavior described by the human capital literature, as the process of job destruction is unfavorable for females.

Despite the limitation of the NCAGED database (concerning the composition of workers' families or time allocation in domestic activities), the decomposition of the job destruction rates showed indications of how such unobserved factors might have contributed to this process due to the restrictive measures imposed by the C19p scenario.

Further research could analyze such issues, considering the decrease in well-being caused by the growing unemployment scenario. With specific reference to NCAGED, it might be relevant to analyze how job destruction happened, by Dismissal type, because this present research looked at the process in its entirety without distinguishing whether these dismissals were voluntary or otherwise. Thus, an analysis of the contract between employee and employer could complement our analysis. In addition, NCAGED covers only formal workers, and there is no information about the gender wage gap in informal workers. However, given the characteristics of Brazilian informal labor, with everything else being maintained constant, the gender gap could be two percentage points higher in informal markets and unfavorable to females as compared to males. However, as the informal market presents different characteristics, that would be a topic for another research paper.

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