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How does Commuting Time Affect the Gender Gap in Labor Supply? Evidence from Firms that Relocate

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Dissertação de Mestrado apresentada ao Programa de Pós-Graduação em Ciências Econômicas (área de concentração: Teoria Econômica), como parte dos requisitos necessários para a obtenção do Título de Mestre em Economia.

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Resumo

Os diferenciais compensatórios para a distância de deslocamento afetam as diferenças de gênero no mercado de trabalho? Neste artigo, aproveitamos de uma estrutura quase-experimental para investigar como indicadores de mercado de trabalho, tais como recebimentos anuais e situação empregatícia, respondem à mudanças na distância de deslocamento do trabalho para casa, induzidas por firmas que mudaram de endereço no ano de 2015, sobre o universo de trabalhadores brasileiros no período 2013-2018. Descobrimos que o aumento na distância de deslocamento, devido à mudança da firma, reduz a renda de trabalhadores do sexo feminino em 21,3 pontos percentuais em relação às suas contrapartes masculinas na linha de base. Também mostramos que a probabilidade de uma trabalhadora deixar o emprego após um aumento na distância de deslocamento é, na média, aproximadamente 1% maior que suas contrapartes masculinas.

Palavras-chaves: Disparidade Salarial de Gênero. Deslocamento para o Trabalho. Brasil.

Abstract

Can compensating differentials for commute distance affects the gender gaps in labor market? In this paper, we take advantage of a quasi-natural experiment framework by investigating how labor market outcomes, such as annual earnings and employment status respond to changes in commute distance induced by firms that relocated in 2015 on the universe of workers in Brazil over the 2013-2018 period. We find that the increase in commuting distance due to a firm relocation reduces the annual labor income of female workers by 21.3 percentage points relative to their male counterparts in baseline. It is also shown that the probability of a female worker leave the job after an increase in commute distance is, on average, about 1% higher than her male counterpart.

Keywords: Gender Gaps. Commuting. Brazil.

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Sumário

1 Introduction

The last decades have supported improvements in the labor market such as the increase of female labor participation and the reduction in the gender pay gap. In spite of these advances, a considerable gender labor-force participation gap remains. The United States has witnessed both a sharp increase in the female labor-force participation rate (from 31.8 percent in 1947 to 57.2 percent in 2013), and a robust convergence in the gender wage gap, which has declined significantly over the 1980-2010 period (Blau and Kahn, 2017). In Brazil, female participation in the labor market increased from 52.5% to 61%, for women between 15-59 years, during the period 1992-2012, while male participation in the labor market, 15-59, decreased by 5.9 percentage points (from 88.9% to 83.0%) (Barbosa, 2014). Overall, Brazil has experienced a reduction in the gender wage gap: in 1995, Brazilian women earned, on average, 53% of Brazilian male income, and this figure exceeded 70% for the first time in 2014 (Pinheiro et al., 2016).

Recent studies have examined the extent to which the costs of labor market participation are higher for women, for the reason that women's role as primary providers of childcare and domestic chores could limit their labor market engagement (Kleven et al., 2019; Maurer-Fazio et al., 2011). As a consequence of women's heavier caring responsibilities in the household, they are likely to be more willing to seek jobs with better non-wage amenities, such as more flexible work arrangements, and the opportunity to work from home, which has an important role in explaining the remaining gender wage gap (Bertrand, 2018; Wiswall and Zafar, 2018; Mas and Pallais, 2017). An important strand of the literature highlights how women's greater distaste for longer commuting time may act as another source of non-wage amenity that could contribute to the gender wage gap by limiting their job opportunities (see Petrongolo and Ronchi (2020) for a review).

In this paper, we study the relationship between the gender differences in willingness to commute and the gender gap in labor supply by taking advantage of employee micro-data of the Brazilian formal labor market, for the period 2013-2018. More accurately, our dataset combines administrative data of linked employer-employee records on employment contracts and earnings, and individual level data from the Brazilian taxpayer registry, which allows us to access the residential address history for each individual in our sample.

Our empirical strategy aims to estimate dynamic effects of changes in the commuting distance caused by workplace relocation, which are employer-induced, by comparing the earnings behaviour of female workers, before and after job relocation, with a matched control group of male workers who face the same changes in job location. That is, for every woman used to study the earnings trajectory, a man working in the same company is used

to study the male earnings trajectory. The workplace and the residence location, that are commonly chosen by the worker, define the worker's commuting distance. Nonetheless, the workplace relocation, which is usually determined by the employer and therefore uncontrolled by the worker, can be explored as a source of an exogenous change in commuting distance, as exploited in Gutiérrez-i Puigarnau and van Ommeren (2010), who study the effect of commuting distance on labour supply patterns.

Our paper contributes to the empirical literature on the effect of commute time on the gender labor supply gap. Within this strand of literature, our study is closely related to those of Gutierrez (2018), Le Barbanchon et al. (2021), Liu and Su (2020), and Farré et al. (2020). Using pooled data from the American Community survey, Gutierrez (2018) studies to what extent gender differences in commuting patterns explain the observed intra-household disparities in relation to earnings and wages. Le Barbanchon et al. (2021) document that unemployed women have a lor reservation wage and a shorter maximum acceptable commute time than their male counterparts using French administrative data on job applications. They show, controlling for previous jobs, that newly hired women are more likely to trade off earnings for a shorter commute time. Liu and Su (2020) show, using micro-data from the American Community survey, that differential commuting choices account for approximately 21% of the gender wage gap on average. They find that women have stronger disutility for commuting, so that, on average, women are willing to give up a greater percentage of wages in exchange for a 10-minute shorter one-way commute, compared with men. By using evidence from US cities, Farré et al. (2020) investigate the contribution of increasing travel times to the persistent gender gap in labor market participation. They conclude that the increasing trend in travel times observed in the US during the last few decades may have contributed to gender disparities in labor market outcomes, such as participation.

Our contribution to the existing literature is twofold. First, provide a causal estimate of the effect of commuting on the gender gap in labor supply in a large developing country, which is characterized by high levels of inequality by using Brazilian registry data on the population of formal employees of large firms that relocated in the year 2015. Second, employ a large, rich, and novel dataset that allows us to estimate a large distribution of treatment effects on a wide array of individual characteristics. To the extent of our knowledge, this is the first paper that studies the causal effects of commute time on gender gaps in labor market outcomes in the Brazilian context [1].

The rest of the paper is organized as follows. Section 2 describes the data. Section 3 describes the sample selection and descriptive statistics. Empirical strategy is presented

[1] Silveira Neto et al. (2015) used microdata from the Brazilian Demographic Census of 2010 in order to investigate the determinants of gender differences on commuting time in São Paulo Metropolitan Region. Their results indicates that relative to males, females are more likely to have shorter commutes regardless of household structure, and the effect may have be more pronounced for married women.

in Section 4. Results are presented and examined in Section 5. Section 6 presents the conclusions.

2 Data Sources

We rely on a database developed from two distinct sources containing micro-data of linked employer-employee records and Internal Revenue Service registers, during the period of 2014-2019: the *Relação Anual de Informações Sociais* (RAIS), made available by the Brazilian Ministry of Labor and Employment, and data provided by the Brazilian Internal Revenue Service Agency (IRS), commonly referred to as *Receita Federal do Brasil* (RFB, henceforth).

2.1 RAIS Dataset

The RAIS dataset is an administrative dataset that consists of linked employer-employee records which are collected by the Ministry of Labor. Annually, all firms must report all workers formally employed at any point during the previous year. It covers the universe of formal firms and workers in Brazil, and contains detailed information such as worker ID, type of labor contract, including the start/end date, contracted hours, tenure, hiring and separation months, reason for separation, occupation, sector of activity, job location, earnings, education, gender, race, and age of every employee in all firms. Each worker in RAIS dataset is uniquely identified by both a unique tax code identifier (CPF) and its full name.

2.2 RFB Registry Dataset

The RFB database consists of the *Cadastro de Pessoas Físicas* (CPF). It is an individual-level dataset covering the population of Brazilian individuals ($\approx$ 255 million people) which contains information such as birth date, year of death, municipality of birth, residential full address history, and data about income tax filling, including dependents, and partner identification, in a given year. The RFB identifies individuals by a unique tax code identifier (CPF).

2.3 Record Linkage

We exploit the fact that each individual is uniquely identified by the tax code identifier (CPF) both in the RAIS and RFB datasets. The merge between these two datasets is 100% accurate and allows us to construct a panel dataset that contains detailed information about the records of each employee in a given year including the commute

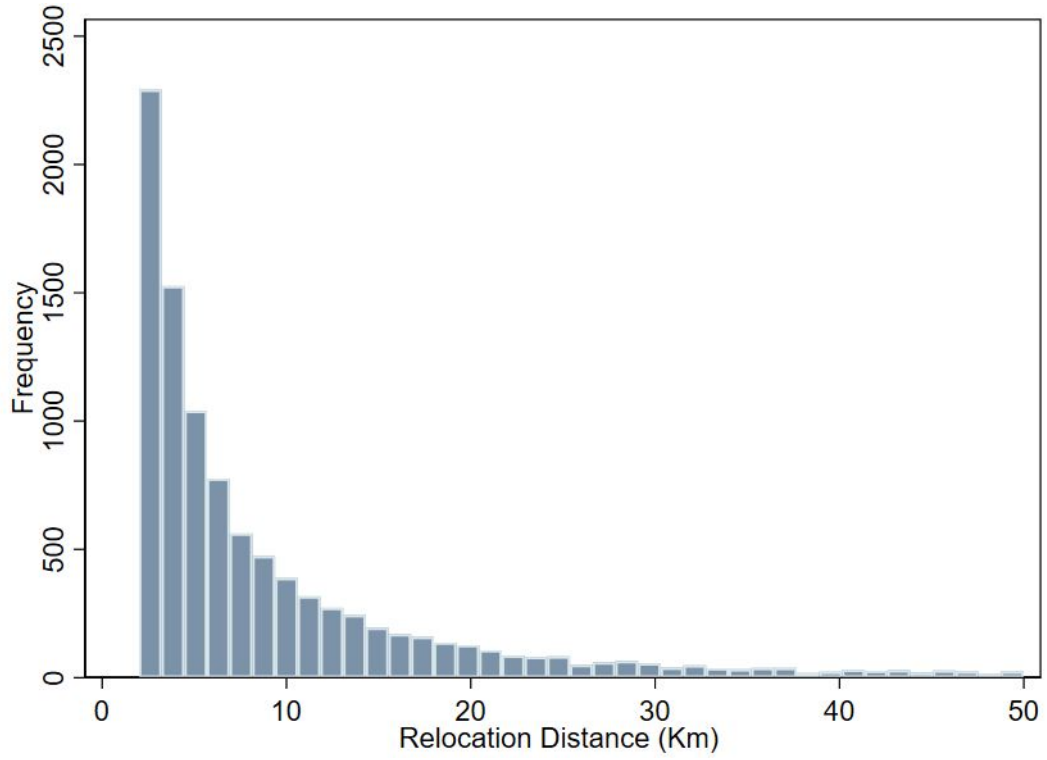
distance, which was obtained by calculating the distance beten the firm address in RAIS and the worker residence address in RFB Dataset[1].

[1] These addresses re geocoded using the Bing™ Maps REST Services Application Programming Interface (API) that provides a Representational State Transfer (REST) interface to perform address geocoding.

3 Sample Selection and Descriptive Statistics

Initially, identified the firms that relocated in 2015 and selected those that faced a relocation within the 2- 50 Km range[1]. The Figure 1 presents the distribution of large firms that relocated in 2015 by distance in kilometers for all those firms that faced a relocation. The average relocation distance in this sample is 9.32 kilometers. Out of the 9,551 firms that relocated, 7,645 (80.04 %) remained in the same municipality.

Figura 1 – Distribution of large firms that relocated in 2015 by distance (Km)



Our individual-level data on employment cover the 2013-2018 period. select as our treatment group, to implement our event study strategy, all female full-time workers (i.e. those employed for at least 30 hours per week), in the 18-60 age range, who had been employed on 1 January 2015 by a non-agricultural firm in the private sector with 10 or more workers that relocated in the year 2015, and experienced an increase in the commute distance caused by the firm relocation. This allows us to estimate the treatment effects for up to four years after relocation. The group of potential control workers comprises all male individuals that also were employed, on 1 January 2015, and also faced an increase in the commute time caused by a firm that relocated on the same period of the treatment group. Then we matched each treated worker with a control worker that belongs to the

[1] follow Mulalic et al. (2014) and excluded observations for which the distance exceeds 100 km or the change in distance exceeds 50 Km as they re assumed to be outliers.

same birth cohort, earnings category (by R$300/month bins), has the same job tenure (quartiles), firm size (quartiles), and state (27). When a treated worker is matched with multiple controls, one control is randomly selected. Out of 63,781 female workers that faced the firm relocation, 32,961 are successfully matched to a control unit. In our final sample, the average distance on firm relocation is 9.04 km (8.83 s.d.).

Table 1 presents summary statistics of variables of interest, before the firm relocation (January, 2015) for treatment and control groups. The control and treatment groups are balanced in terms of job and demographic characteristics. The standardized difference beten the two groups is below the value of 0.20[2] suggested by Imbens and Rubin (2015) for all variables except education.

Tabela 1 – Summary statistics, treated and matched control workers

	Treatment	Control	Std Diff
DEMOGRAPHIC CHARACTERISTICS			
Age	34.58	34.57	0.00
Years of Education	11.97	10.99	-0.35
Race - Black	4.78%	5.42%	0.03
Race - Brown	34.94%	35.20%	0.00
Race - White	52.81%	50.41%	-0.05
JOB CHARACTERISTICS			
Monthly Income (R$)	1,692.00	1,702.00	0.01
Tenure on Jan 1st (Months)	161.40	160.80	0.00
Firm size (Number of employees)	1,008.00	963.20	-0.02
Number of Observations	32,961	32,961	

Note: This table reports the average characteristics of treated and matched control workers, respectively, and the standardized difference between the two groups.

Table 2 shows summary statistics of commuting distance before the firm relocation (in December 2014), the commuting distance in 2015 (after the firm relocation) as well as the changes of commuting distance over time. From 2 it can be noted that female workers face shorter commuting distances than male workers, which is consistent with evidence from international studies. On average, changes in commuting distance are between 6.40 km (7.71 s.d.) in the treatment group and 6.34 km (7.29 s.d.) in the control group.

[2] Cohen (1988) suggested that an effect size index of 0.20 can be used to represent small effect size.

Tabela 2 – Summary Statistics, Means and Standard Deviations of Commuting Distance

	Treated	**Control**
Commuting distance, 2014 (km)	12.49	13.77
	(16.84)	(17.88)
Commuting distance, 2015 (km)	18.89	20.11
	(18.49)	(19.05)
Change in commuting distance (km)	6.40	6.34
	(7.71)	(7.29)
N. of Observations	32,961	32,961

Note: Standard deviations are in parentheses.

4 Empirical Strategy

The main goal of our approach is estimating wage responses to changes in commuting distance of large firms that relocated (defined, in this paper, as firms with at least 10 employees). use employer-induced workplace relocation as a source of exogenous change in commuting distance [1]. In order to reduce the possibility that the workplace change event was known before the worker started to work at this firm, select employees who have been employed at least one month in the previous year before relocation.

Our first specification explores an event study setting to estimating the dynamics gender difference responses given changes in commuting distance due to Brazilian firms that relocated in 2015. focus on wage responses and the probability to leave the job as the main labor outcomes of the analysis[2].

We then estimate the following equation on the sample of treated and (matched) control workers:

$$Y_{it} = \alpha + \beta Gender_i + \sum_{t=0}^{T} \delta_t (Gender_i \times Time_t) + \sum_{t=0}^{T} \lambda_t (Time_t) + \epsilon_{it} \tag{4.1}$$

where Y_{it} the outcome for individual i in year t, $Gender_i$ is a dummy indicating that the individual belongs to the treatment group and takes the value of one if the worker is a woman and zero otherwise, $Time_t$'s, are dummies identifying years since the firm relocation and, finally, ϵ_{it} is an error term. $Time_t$'s are dummies identifying years since the change in the commuting distance caused by the firm's relocation. Thus, $t = 1$ for the first year after the firm's relocation, $t = 2$ for the following year, and so on. Analogously, $t = 0$ for the firm's relocation year, $t = -1$ for the previous year, and so on. The coefficients $\{\delta_t\}$ for $t < 0$ correspond to estimate anticipation effects, and for $t \geq 0$ to estimate dynamic treatment effects t periods relative to the baseline omitted period, $t = 0$. The time-varying shocks are absorbed by the $Time_t$'s fixed effects.

In order to summarize the average treatment effect over all periods, estimate the following difference-in-difference equation:

$$Y_{it} = \alpha + \beta Gender_i + \delta (Treat_i \times Post_t) + \gamma Post_t + \epsilon_{it} \tag{4.2}$$

[1] As argued by Mulalic et al. (2014), the change in the employees' commuting distance can be assumed to be due to an exogenous treatment (conditional on the average change in the commuting distance for workers in the same firm).

[2] measure the labor outcomes on an annual basis.

where the dummy $Post_t$ identifies the whole period after firm's relocation, and all other variables are defined as in 4.1.

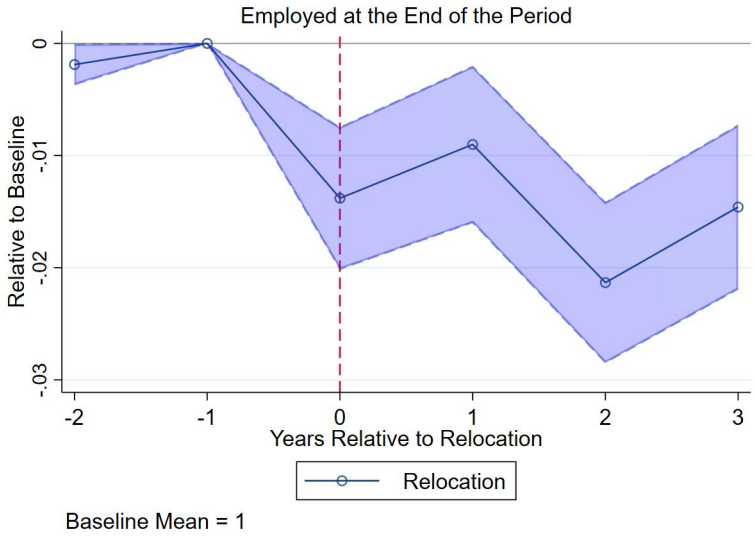
5 Results

This section presents the econometric results of the estimated effects based on the specifications presented in the previous section. The treatment group comprises female workers that experienced an increase in the commute distance caused by the firm relocation in 2015, while the control group is defined via matching among male workers that also experienced an increase in the commute distance caused by the firm relocation in the same year. The outcomes of interest are the probability of being employed at the end of a year and percentual changes in annual labor income.

5.1 Effects on Employment Status

Figure 2 presents the impact of a increase in commuting distance, due to a firm relocation, on the probability of being employed at the end of the year, as estimated from equation 4.1. This graph depicts the difference in the outcome between treatment and control groups before and after the firm relocation. The treatment effects are rescaled by the baseline mean of outcome at time t = -1. As depicted in Figure 2, after the firm relocation, the probability of being employed decline by 1.5% for female workers, in the control group, relative to the matched control group. These gaps still remains, as two years after firm relocation, treated workers still experience 1.5% lower employment rates.

Figura 2 – Effects of an increase in commuting distance on Employment Status.



Note: This figure show the effect of an increase in commuting distance on the probability of being employed at the end of the year, as estimated from the equation 4.1 with 95% confidence intervals. All coefficients are rescaled by the average value of the outcome in the treated group at t = -1, that is also reported. Years relative to firm relocation are defined relative to 2015, i.e., t = 1 for 2016, t = 2 for 2017,and so on.

In Table 3, we obtain, from equation 4.2, the average effect on employment status, over the three years after the firm relocation. An increase on commuting distance, on average, decreased the probability of a woman in our treatment group by 1.00 percentage point, relative to the matched control group.

Tabela 3 – Effect of commuting distance increase on Employment Status

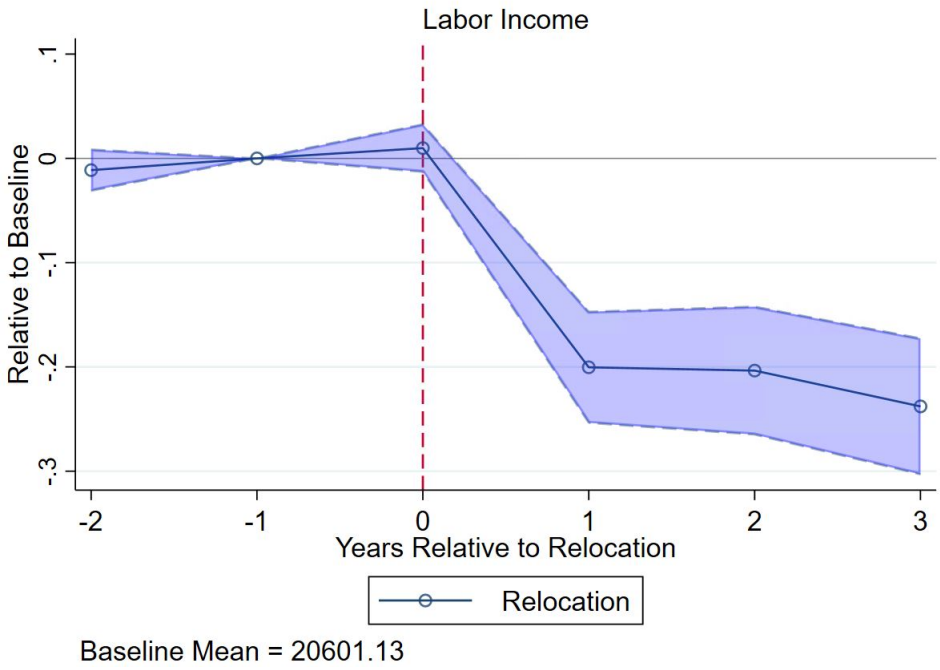
Dependent Variable:	**Employment**
$Treat_i \times Post_t$	-0.010***
	(0.003)
Mean Outcome, treated at $t = -1$	1.00
Effect relative to the mean	-1.00%
N. of Observations	131,844

Note: This table shows the effect of firm relocation on Employment Status, as estimated from difference-in-differences equation 4.2. The explanatory variable of interest is a dummy $Treat_i$ that is equal to 1 for female workers in treatment group, interacted with a dummy $Post_t$ equal to 1 for the period after firm relocation. Standard errors clustered at the individual level are displayed in parentheses (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$).

5.2 Effects on Annual Labor Income

Figure 3 shows, as estimated from equation 4.1, the dynamic effects of changes in the commuting distance caused by workplace relocation. As can be observed, the increase in commuting distance drives sharp decrease in Annual Labor Income, for female workers in treatment group, relative to the male workers in the matched control group. After workplace relocation, labor income declines by 20 % for female workers, relative to the matched control group. This gap still remains after the following years, as three years after the workplace relocation treated workers still faces 21% lower labor income.

Figura 3 – Effects of an increase in commuting distance on Annual Labor Income.



Note: This figure show the effect of an increase in commuting distance on the probability of being employed at the end of the year, as estimated from the equation 4.1 with 95% confidence intervals. All coefficients are rescaled by the average value of the outcome in the treated group at t = -1, that is also reported. Years relative to firm relocation are defined relative to 2015, i.e., t = 1 for 2016, t = 2 for 2017,and so on. Income variables are measured in Brazilian Reais.

In Table 4, we estimate the average effect of an increase in commuting distance over the three years after the workplace relocation. On average, firm relocation decreases annual labor income by 21.3 percentage points relative to the baseline.

Tabela 4 – Effect of commuting distance increase on Annual Labor Income

Dependent Variable:	**Labor Income**
$Treat_i \times Post_t$	-0.213***
	(0.025)
Mean Outcome, treated at $t = -1$	20,601.13
Effect relative to the mean	- 4,388.04
N. of Observations	131,844

Note: This table shows the effect of firm relocation on Employment Status, as estimated from difference-in-differences equation 4.2. The explanatory variable of interest is a dummy $Treat_i$ that is equal to 1 for female workers in treatment group, interacted with a dummy $Post_t$ equal to 1 for the period after firm relocation. Standard errors clustered at the individual level are displayed in parentheses (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$).

5.3 Caveats and Discussion

This section presents simple but important results: when an increase in commuting distance happens, female labor outcomes, such as annual labor income and the probability of being employed, are more affected than their male counterparts.

Some caveats to these results are worth noting. Firstly, we do not address the mechanisms through by these results are driven. Although Brazil is a developing country with a high level of inequalities and mechanisms such as higher costs of female labor participation due to women's heavier caring responsibilities in the household may play an important role in this context, we can not discard other mechanisms such as a female distaste for commuting or even complementary explanations like the perception of safety during the commute time.[1]

We hope that future research will expand our understanding of how changes impact on female labor gap can be better understood and enhanced.

[1] Moura (2013) finds that longer commuting times are positively associated with an increase in the probability of being victim of robbery in Brazil.

6 Concluding Remarks

In this paper we investigate of how gender gaps in labor market outcomes, such as annual labor income and employment status are affected by an increase in commuting time caused by a firm relocation in the Brazilian context. It is shown that the probability of a female worker leave the job after an increase in commute distance is, on average, about 1% higher than for her male counterpart. We estimate the effects of greater commute distance on annual earnings and find that, on average, the increase in commute distance decreases annual labor income of the female workers by 21.3 percentage points relative to their male counterparts in baseline.

Although our finds point to an increase in gender labor outcomes due to the firm relocation and the higher commute distance, we do not address the mechanisms that are driving the results and caution that more research is needed to disentangle the components of this impact so that it is going to be possible to provide a better understanding about this issue.

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