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Do labor inspections make a difference? An analysis of establishments in
Brazil

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Brazil**

Dissertação apresentada ao Programa de Pós-Graduação em Economia da Universidade Federal de Juiz de Fora como requisito parcial à obtenção do título de Mestre em Economia

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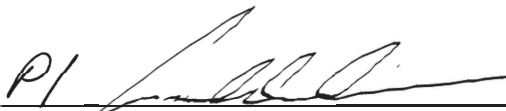
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ABSTRACT

Establishments worldwide experience a trade-off between following the law and incurring higher labor costs or evading regulations and running the risk of being punished. In this context, labor inspection is the main public policy that aims to reduce the gap between laws on paper and compliance by society. This paper studies how inspections affect firms' outcomes in Brazil. We explore the fact that firms are not warned about the inspection act, which makes the timing exogenous. We combine data of firms inspected between 2007 and 2017 with employer-employee administrative data (RAIS). Using a sample with companies inspected only once in the period or never inspected that had between 10 and 500 employees on the baseline (first quarter in the dataset) and event study/difference-in-difference approaches, we find that receiving the inspection negatively affects the establishment. There is a decline in all eight quarters after the inspection in employment, hiring, separation and wages. The average effect is 16.47%, 17.39%, 11.31% and 4.26% respectively. We also document a little change in labor composition due to inspection, more flexible contracts and fewer hours contracted. Moreover, establishments in the construction and services sector are most affected, as are companies with 50 to 100 employees. We argue that the main channel can be through increasing labor costs.

Keywords: Labor; Inspection; Enforcement; Firm dynamics; Firm size

RESUMO

Estabelecimentos em todo o mundo enfrentam um *trade-off* entre seguir a lei e incorrer em custos trabalhistas mais altos ou fugir dos regulamentos e correr o risco de punição. Neste contexto, a inspeção do trabalho é a principal política pública que visa reduzir o hiato entre as leis no papel e o seu cumprimento pela sociedade. Este trabalho estuda como as inspeções afetam os resultados das empresas no Brasil. Exploramos o fato de que estabelecimentos não são avisados sobre o ato de fiscalização, o que torna o momento da ação exógeno. Combinamos os dados das empresas inspecionadas entre 2007 e 2017 com os dados administrativos do empregador-empregado (RAIS). Usando uma amostra com empresas inspecionadas apenas uma vez no período ou nunca inspecionadas que tinham entre 10 e 500 funcionários inicialmente e adotando as abordagens de estudo de evento/diferença-em-diferença, descobrimos que receber a fiscalização afeta negativamente o estabelecimento. Observa-se um declínio nos oito trimestres seguintes a fiscalização no emprego, contratação, separação e salários. O efeito médio é de cerca de 16,47%, 17,39%, 11,31% e 4,26% respectivamente. Também é documentado uma pequena mudança na composição da mão de obra devido à fiscalização, contratos mais flexíveis e menos horas contratadas. Além disso, os estabelecimentos do setor de construção e serviços são os mais afetados, assim como as empresas com 50 a 100 empregados. Argumentamos que o principal canal pode ser via aumento dos custos trabalhistas.

Palavras-chave: Mercado de Trabalho; Fiscalização; Dinâmica de firma; Tamanho da empresa

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1 INTRODUCTION

Brazil has one of the most rigidity labor laws globally. The main goal is to ensure employees' rights and minimum working conditions (CARDOSO; LAGE, 2007; ALMEIDA; CARNEIRO, 2012). However, the employment protection legislation implies costs to the companies¹ that need to decide whether or not to comply. In this sense, just the existence of laws on paper is no guarantee that it will be enforced (RONCONI, 2010). Costly regulations combined with weak monitoring create evasion incentives, especially in developing countries (ALMEIDA; CARNEIRO, 2009). In Brazil, for example, between 2012 and 2017, about 25%² of workers had no formal contract despite being employees. (IBGE, 2013; IBGE, 2017).

The compliance decision is exclusive to the companies, even though the workers are directly affected. Each firm individually chooses whether or how much to follow the laws evaluating the benefits and costs of evading depending on labor costs, the value of fines, and the perceived probability of being inspected (ASHENFELTER; SMITH, 1979). In the firm's problem, the inspection acts - especially when unexpected - as stricter enforcement, which may affect the company's decisions regarding organization and dynamics through the imposition of higher costs. In other words, when the company is inspected, it may be exposed to a new cost structure related to regularization and compliance with regulations. To adapt, it may be necessary, for example, to change the company's activity level or to hire a relatively cheaper labor force. In this view, the main channel through which stricter enforcement will affect labor markets is by increasing labor costs (ALMEIDA; CARNEIRO, 2009).

Focusing on the establishment, we aim to evaluate how the inspection changed the companies' dynamics, looking at the size, wages, hiring, and separation level. Our first contribution is to analyze firm-level data that allows us to identify the direct effects of actions on companies that have received inspections. Most of the studies in the literature use city-level data that do not allow the differentiation between direct effects and possible spillover effects.

Estimating the causal effect is challenging because, possibly, enforcement is not randomly allocated across cities³ (ALMEIDA; CARNEIRO, 2012). As a second contribution of this study, we use a different identification strategy from the literature. We explore the fact that companies selected for inspection are not informed about the action, which makes

¹ Cardoso and Lage (2007) estimate that for a worker to receive a net wage of R\$100, the employer must disburse approximately R\$165.

² According to data from *Pesquisa Nacional por Amostra de Domicílios Contínua (PNADC)*. Proportion calculated as total employees without a formal contract divided by the total number of persons employed as an employee.

³ Enforcement may be stricter in cities with more violations or in cities with more developed institutions (ALMEIDA; CARNEIRO, 2012).

the action's timing unknown and unexpected by the firm. We argue that the anticipation effect is difficult because regularization, for example formalizing irregular workers, is a bureaucratic and not instantaneous process. In other words, even if the company knew in advance that the inspection would take place, it is unlikely that it would be able to regularize itself in time. Corroborating our argument, we did not observe anticipation in the results of the event study.

Our analysis is based on two main firm-level data sources. The first is a novel dataset of inspection that identifies all firms inspected between 2007 and 2017 and all firms notified for some irregularity found during inspection for years 2013 to 2016. This data is provided by Secretaria de inspeção do trabalho (SIT) and were made available through the *Lei de Acesso à Informação*. The second data source was *Relação Anual de Informações Sociais* (RAIS) which contains information from firms in the formal labor market sector.

Using rich information at the establishment level previously described, we adopt event study and difference-in-difference approaches exploiting variation in events' timing. We restricted our analysis to a sample of formal firms that in the baseline period had between 10 and 500 employees and were never inspected in the period from 2007 to 2017 or were inspected only once (8,914,304 observations from 288,896 firms).

We find that inspected firms have a drop in employment, hiring, separation, and wages after inspection. The effect is persistent for at least two years, indicating a short and medium-term impact on companies. In numbers, The effect one quarter after the inspection is about -9.39% in total employees, 11.48% in hiring and 3.05% in separation. The average effects, from difference-in-difference estimate, are even bigger: 16.47%, 17.39% and 11.31%, respectively. Wages are relatively less affected, but there is still a reduction of 1% in the second quarter after inspection and an average post-treatment effect of 4.26%. Our results are robust to alternative specifications and variable definitions. Besides, firms with 50 to 100 employees and in the construction or services sector are more impacted by inspection in the outcomes analyzed.

To shed some light on whether there is a change in the composition during the process of contraction companies, we analyze how employment varies according to some categories. Evidence suggests that more flexible and perhaps cheaper contracts are less affected by inspection, and even positively affected, during the firms' adjustment.

Until the last decade, the literature analyzed the effects of variation on de jure regulations like minimum wage law. Evidence suggests that an increase in minimum wage increases earnings and decreases employment level (CORSEUIL; CARNEIRO, 2001; FAJNZYLBER, 2001; LEMOS; RIGOBON; LANG, 2004; GINDLING; TERRELL, 2004; NEUMARK; WASCHER, 2006; ULYSSEA, 2006). The largest number of worker protection rules can increase unemployment (HECKMAN; PAGÉS, 2004) and reduced employment

(DOWNES; MAMINGI; ANTOINE, 2004; SAAVEDRA; TORERO, 2004; MONDINO; MONTOYA, 2004).

However, more recent studies emphasize the importance of considering the intensity or the way the law is applied (CARDOSO; LAGE, 2005; PIORE; SCHRANK, 2008; KANBUR; RONCONI, 2018). After all, if society does not adapt to changes in regulations, the effects will be small. Recent studies that evaluate the impact of an increase in inspection intensity show a rise in compliance with labor law in Brazil, Argentina and Peru (ALMEIDA; CARNEIRO; NARITA, 2013; RONCONI, 2010; VIOLLAZ, 2018). In South Africa, results indicate a null effect of raise enforcement on compliance with minimum wage law (BHORAT; KANBUR; MAYET, 2012).

Some papers show that inspections, the main instrument of incentive compliance, can affect firm variables by changing the cost structure that the company faces. The idea is that companies choose to violate any regulation due, mainly, to the costs. When inspected, the expected behavior is that these firms will start to follow the regulations that were not previously followed. As a result, they incur the costs they have avoided until then. A hypothesis is that the increase in the cost may affect the company's decisions regarding its dynamics.

Evidence suggests that increase in enforcement can generate a reduction in firm size (ALMEIDA; CARNEIRO, 2009; ALMEIDA; SUSANLI, 2012), an increase in separations (ABRAS et al., 2018), as well as a decrease in formal wage in contrast to a rise in informal wages (ALMEIDA; CARNEIRO, 2012). To hire, there is evidence in both directions (ALMEIDA; CARNEIRO, 2009; ABRAS et al., 2018). There is a possible explanation for some differences in the results. All studies analyze city-level data. Thus, the authors estimate the average effect of increased enforcement in the municipality, while we focus on the impact in inspected firms. So, there is possibly a difference between the direct effect of the inspection and the spillover or peer effect.

These results could have several policy implications. First of all, we highlight that enforcement can negatively impact Brazilian labor market outcomes. We also discuss that the way the law is enforced can matter: punishing directly or changing the likelihood of being caught.

This paper is organized as follows. Section 2 discusses the related literature. Section 3 discusses the institutional framework of labor regulations and inspections. Section 4 describes the construction of our dataset and descriptive statistics. Section 5 discusses our empirical strategy. Section 6 presents the results. Finally, Section 7 discusses the concluding remarks.

2 LITERATURE REVIEW

Government intervention in labor market using laws and public policy has been based on the theory that free labor markets are imperfect and can create inefficiency and unfair employment relationships. Thus, almost every country in the world have established a complex system of laws and institutions intended to protect the interests of workers and help assure a minimum standard of living for its population. (BOTERO et al., 2004; RONCONI, 2012).

The first generation of quantitative research tried to evaluate the relationship between institutions and the labor market using aggregate data to explain the cross-country variation in outcomes given differences in national labor market regulations (BETCHERMAN, 2014). For example, evidence suggests that minimum wage legislation changes are negatively correlated with aggregate employment in Latin America and Caribbean (CORSEUIL; CARNEIRO, 2001; FAJNZYLBER, 2001; LEMOS; RIGOBON; LANG, 2004; NEUMARK; WASCHER, 2006; ULYSSEA, 2006) and positive correlation with wages (FAJNZYLBER, 2001; GINDLING; TERRELL, 2004; LEMOS; RIGOBON; LANG, 2004). Variations in worker protection rules seem to have no or a modest negative correlation with the level of employment and a positive correlation with unemployment (HECKMAN; PAGÉS, 2004). The results were not conclusive, with some studies identifying a negative employment effect of job security rules (SAAVEDRA; TORERO, 2004; MONDINO; MONTROYA, 2004) and others finding no significant effect (BARROS; CORSEUIL, 2004a; DOWNES; MAMINGI; ANTOINE, 2004).

However, strict labor regulations on paper are not guaranteed to be enforced, resulting in unequal competition conditions and less security for workers (CARDOSO; LAGE, 2005; BASU; CHAU; KANBUR, 2010; ALMEIDA; RONCONI, 2016; VIOLLAZ, 2018). In terms of generating incentives to adequacy (through the intention of punishment violators) and aiming to narrow the gap between the de jure and the de facto one, the main public policy is inspection (PIORE; SCHRANK, 2008; KANBUR; RONCONI, 2018).

The theoretical models developed from Becker's (1968) seminal work in crime economics, such as Ashenfelter and Smith (1979) for example, argue that a conventional profit-maximizing firm chooses between respecting regulations or evading laws. When the firm follows the rules there is a cost linked to labor obligations. When evades, there is the cost of a fine in case of being caught but there is also the benefit of a lower labor cost and greater labor flexibility. His main conclusion is that the firms' propensity to evade regulations is inversely related to the probability of being caught multiplied by the expected fine. In this way, increased enforcement would increase compliance because it would increase the likelihood of being inspected and fined (VIOLLAZ, 2018).

Based on the same initial argument, Cardoso and Lage (2007) suggest that non-

compliance with the law is a dominant strategy for firms. If labor costs are high enough, entrepreneurs will assume them only if the punishment (denoted by F) is greater than the cost (denoted by c), $F > c$, and if the probability of being caught and punished is large enough. The decisive variable is the “interaction effect” between the cost of not adapting to the regulations and the probability of sanction.

The first expected effect of an increase in inspections, according to theory, is an increase in compliance with the law. However, it is not simple to test theoretical models’ conclusions for two reasons. First, it is hard to measure compliance and the individual weighting between the risk of punishment and the benefits of breaking the law. Second, it is possible to have simultaneity between inspections and compliance (regions with poor compliance tends to receive more inspections). There are not many empirical studies about the effects of inspections on compliance yet, especially about the Brazilian labor market. Using the instrumental variables method¹ and data at the region/city/province level, the evidence suggests little correlation between increased inspections and labor regulation compliance in Argentina and Peru (RONCONI, 2010; VIOLLAZ, 2018) and no correlation with minimum wage compliance in South Africa (BHORAT; KANBUR; MAYET, 2012).

For Brazil, Almeida, Carneiro and Narita (2013) analyze the correlation between inspections and compliance and if this translates into higher quality jobs (wage level, voluntary and mandatory benefits²). The results suggest that increased enforcement raises a little compliance of benefits but generates a trade-off between the mandatory and the volunteer’s benefits. Unlike the other articles on this topic, the authors argue that the intensity of inspections varies over time in the municipalities and therefore, there would be no endogeneity.

The second effect of an increase in inspections is a rise in labor costs for irregular firms. In the theoretical framework showed before, we argue that firms can choose to evade the law because this behavior generates the benefit of a smaller cost per employee. So, when the firm receives inspection while breaking the law, it is expected that the firm will change its wrong behavior. This modification would increase its costs and affect its dynamic in many aspects such as hires, separations, wages, size, growth, labor’s composition, and others.

¹ Ronconi (2010) uses electoral years as an instrumental variable because it would affect enforcement agencies but has no direct effect on firms’ propensities to comply with labor regulations. Bhorat, Kanbur and Mayet (2012) use the number of non-inspectors as enforcement instruments, that is, the number of workers in the labor inspection sectors who do not participate in inspection effectively. Viollaz (2018) proposes measurement of the “arrival cost” of labor inspector as an instrument to enforcement. The arrival cost is defined as the logarithm of the road traffic per capita per kilometer according to the ratio “territory to regional road network”.

² The voluntary benefits considered are health insurance and food voucher. The mandatory ones are Social Security contribution, formal registration, salary according to the current minimum wage and transport voucher.

In the literature on labor market effects of payroll taxes, the impact on firms is uncertain. Some evidence suggests that a tax increase could decrease the employment level if the firms can not pass new taxes to workers through smaller net wage. Therefore, the employer would need to fire to offset it (VROMAN, 1974; HAMERMESH, 1979; KUGLER; KUGLER, 2009; CERVINI-PLÁ; RAMOS; SILVA, 2014). On the other hand, if it is possible to pass-through tax to salaries, there is no impact on employment (GRUBER; KRUEGER, 1991; KORKEAMÄKI; UUSITALO, 2009; CRUCES; GALIANI; KIDYBA, 2010; DESLAURIERS et al., 2018).

Almeida and Carneiro (2009) analyzing data from Brazil find that the increase in enforcement is negatively related to hiring. In contrast Almeida and Carneiro (2012), Abras et al. (2018) find a positive relation. This result may be due to at least two different mechanisms. The first would be formalizing informal employees in formal firms since inspections would decrease access to flexible labor (informal). The second would be hiring new employees with different characteristics (such as less experienced ones) or even with different contracts to replace old employees to reduce labor costs. This last mechanism is corroborated by the result of a rise firing seen in Abras et al. (2018). However, it is important to note that changes in labor composition depend on other variables such as admission and dismissal costs.

The movement and magnitude of hiring and firing can directly affect the company's size and growth, especially when measured by the number of workers. Almeida and Carneiro (2009) for Brazil and Almeida and Susanlı (2012) analyzing 63 developing countries, suggest a decrease in companies' size when they face higher inspection levels. The high labor cost can be a restrictive factor for companies' growth and even their longevity (especially those incipients).

The wages also can be affected by the increase in costs imposed by inspection. Almeida and Carneiro (2012) find a negative impact of enforcement on formal wages and positive impact on informal wages. The effect depends on wage rigidity (e.g. through minimum wage or contracts) because wages can only be affected if the employer can transfer the worker's increase in costs by reducing the net wage. In the case of wages very close to the minimum value defined by law or inflexibility due to the contract, the transfer is hard and the wages are not affected. If there is a change in the workforce's composition to reduce costs, we expect new employees to be hired by the firm with lower wages, which may decrease wages.

It is not only the dynamics of the firm that can change with variations in inspections. Some studies show that increased enforcement reduces accidents due to compliance with regulations, which helps create safer workplaces for workers without job loss (LEVINE; TOFFEL; JOHNSON, 2012).

The evidence indicates that the increased likelihood of enforcement of labor regula-

tion generates little or no change in compliance but considerable changes in firms' dynamics. However, so far as is known, almost all the papers presented before use city/region level data. We intend to contribute to the literature from an unprecedented analysis with data at the firm level that allows us to identify which and when the firm was inspected and fined.

3 INSTITUTIONAL BACKGROUND

3.1 LABOR REGULATION

The current Brazilian labor code, named as *Consolidação das Leis Trabalhistas (CLT)*, dates back to 1943 (BRASIL, 1943). It was the most important achievement for the regulation of worker relationships in Brazil, followed by the new Brazilian Federal Constitution (BRASIL, 1988) which introduced several changes increasing the degree of worker protection (BARROS; CORSEUIL, 2004b). Although the legislation has changed over the years to adapt to the modernization of society, the main goal remains constant: to regulate labor relations ensuring the rights and duties of all parties involved, whether worker or employer.

Hypothetically, Brazil has one of the most rigid and costly labor laws in the world (ALMEIDA; CARNEIRO, 2012), which in itself does not mean the effectiveness of regulations. According to Cardoso and Lage (2007), due to charges related to Social Security, job security fund (*Fundo de Garantia do Tempo de Serviço - FGTS*) and others, for a worker to receive a net wage of R\$100, the employer must disburse approximately R\$165 in 2007. The workforce's high cost is one of the indirect incentives for informal hiring and even evasion of benefits (ULYSSEA, 2006). In 2012, the informal workforce was 33 % of employment, rising to 45.4% in 2016 during the recession (IBGE, 2013; IBGE, 2017).

With strict rules, the firms weigh the costs and benefits of complying with the legislation and decide whether or not to evade the law or the degree of evasion (ALMEIDA; CARNEIRO, 2007). The expected cost of evading the law is a function of the probability of being caught and the penalties' monetary value. In turn, the probability of being caught depends on the firm's characteristics (such as size and legal status) and the degree of enforcement (ALMEIDA; CARNEIRO, 2012).

Inspections are the main public policy to encourage compliance with laws. The main goal is to ensure the well-being and protection of workers. The department responsible for inspections is the Ministry of Labor/Economy. They are also accountable for creating policies and guidelines for generating employment and income, training and professional development of workers (BRASIL, 2016).

3.2 TO COMPLY WITH THE LABOR LAW OR NOT

The firm's rational decision when faced with the choice between following or breaking the law, according to the theoretical framework presented in the literature, is based on the probability of being caught committing an infraction, the expected fine and the costs linked to both possibilities (ASHENFELTER; SMITH, 1979; CARDOSO;

LAGE, 2007; ALMEIDA; CARNEIRO, 2012). In the Brazilian context, other variables not addressed in the literature may be related to labor inspections and increased compliance with the law.

As already discussed, inspection is one of the most used ways to enforce legislation. With an increase in inspections, the employer may perceive this variation as an increase in the probability of being caught. Companies may have different perceptions about the likelihood of being inspected. For example, between 2013 and 2016, 6,4% of small firms (up to 10 employees) received some inspections while 74% of large firms (more than 100 employees) received inspection. In this case, large companies are more likely to be inspected than small ones.

The employer can also consider the likelihood of being penalized when inspected. That is, if the firm was inspected and was misconducting, what is the probability of it to receive a fine? By law, all infractions have to be penalized, except for the case of double visits to specific categories of firms¹. However, Inspector's corruptive behavior could be captured by the companies (POLINSKY; SHAVELL, 2001). Thus, in addition to the probability of being caught, a key variable is the probability of actually being fined after being caught for committing an infraction.

Although the penalty is credible, that is, those firms that had caught committing an infraction will be fined, there is a possibility that the amount of the fine represents a lower cost than the labor cost linked to the adequacy to the CLT. The amount of fines varies according to the seriousness of the infraction and may also vary according to the number of workers affected and whether is a repeated offense. Companies inspected with irregularities in the payment of wages, holidays or transportation vouchers should be fined R\$ 170.26 for each worker affected. The lack of formal employee registration results in a fine of R\$ 3,000.00 for each informal worker. Infractions related to workers' health and safety are the ones with the highest value, which can generate a fine of up to R\$ 6,708.88 for companies with more than 1000 employees (See more about fines in Appendix A).

Besides, even when the company is fined, if there is a possibility of debt forgiveness, no payment or renegotiation of its value, this information can influence the choice between respecting the law or not. In Brazil, we have Refis (*Programa de Recuperação Fiscal*), a program that aims to regularize tax arrears but does not include labor debts (BRASIL, 2000). Only in 2017 the *Programa de Regularização de Débitos não tributários* was created, allowing for discounts and installment of fine labor debt (BRASIL, 2017). According to data from the Federal Revenue of December 2019, about 419 thousand firms were in debt to the Federal Government for the non-payment of labor fines and 393 thousand owed the State for more than a year.

In the Brazilian context, it is relevant to consider other variables than those

¹ Double visit criteria explained in Section 3.4

commonly presented as decisive in the trade-off of whether or not to comply with labor legislation. For example, the likelihood of being fined when committing a labor infraction and the likelihood of not paying the fine and not receiving any legal penalty for it.

3.3 HOW ARE FIRMS SELECTED FOR INSPECTION?

The Ministry of Labor² is responsible for organizing, maintaining, and executing labor inspections in Brazil (BRASIL, 1988; CARDOSO; LAGE, 2007). It is composed of decentralized units called *Superintendências Regionais do Trabalho e do Emprego* (SRTE) one in each federation unit, subdivided into *subdelegacias*. The Labor Inspection Secretariat (SIT) is responsible for designing strategies for inspection in companies to ensure compliance with labor legislation that will be carried out by labor inspectors at the regional level of the SRTE and city level of the *subdelegacias*.

In theory, an inspection can be triggered either by a random firm audit or a report (CARDOSO; LAGE, 2005; ALMEIDA; CARNEIRO, 2012; ALMEIDA; CARNEIRO; NARITA, 2013). In practice, the number of labor inspectors has been insufficient to meet the demand from reports and make random visits. In 2016, there were about 2.400 inspectors in operation, a reduction of more than 20% from 2011³. This means that the number of auditors for 10,000 formal workers was 0.66 in 2011 and dropped to 0.52 in 2016⁴. In developing countries like South Africa and Mexico, the inspectors per 10,000 workers in 2016 was 0.8 and 0.2, respectively. In the same year, Romania and Croatia were the countries with the best rates, 1.6 and 1.4 (ILO, 2020).

Given the shortage of human resources, inspection planning has been based on three main sources: the goals established at the federal level, the Labor Inspection Department own goals drawn from diagnoses of the local labor market, and complaints received (SIT, 2008; SIT, 2016; OIT, 2010). Thus, in addition to seeking to meet national needs, planning considers the peculiarities of each region, the complaints received, and the demands that may arise from other departments, such as the Public Ministry and the police (ALMEIDA; CARNEIRO; NARITA, 2013).

It is important to know that inspectors are only assigned to inspections. They do not participate in the firm's selection process. Although the selection is not effectively random, the companies do not receive notifications that the inspection will occur, making it unexpected for the establishment (BRASIL, 2002).

It is impossible to inspect all workplaces with irregularities. Thus, the inspections are concentrated in larger firms where the number of workers reached by inspection is

² Since 2019 the Ministry of Labor became part of the Ministry of Economy (BRASIL, 2019)

³ At the height of inspection in Brazil in 1996, 3.464 inspected were in service. Data provided by the Labor Inspection Department.

⁴ The statistics were created based on data on the number of labor auditors from the Labor Inspection Secretariat and data on workers in the formal sector of RAIS.

large. Between 2013 to 2016, about 74% of large firms (with more than 100 employees) were inspected at any time in the period, compared to 6.43%⁵ of the small companies (with up to 10 employees) who were inspected in the same period. However, 48%⁶ of the formal workforce is employed at small and medium-sized companies. The larger the company's size, the more significant the proportion of companies inspected. This shows that larger companies are more likely to be inspected.

Suppose firms observe the behavior of their peers. In that case, we can expect two pre-inspection situations: large companies do not know when the inspection will take place, but expect it to occur at some point (they consider it more likely to be inspected); smaller companies, which also do not know when the inspection will take place, have a perception of a lower probability of being inspected because the proportion of small companies inspected is short. Thus, inspection in small companies tends to be more unexpected (exogenous) than in larger companies. Also, the inspection date is unknown to the company, which creates a surprise element for inspection. When compliance is costly to firms, a key aspect of this approach is that the timing of inspections is unannounced and difficult to anticipate, lest firms comply only when they believe an inspection is likely (MAKOFKSKE, 2019).

3.4 INSPECTION PROCESS

There was a relevant change in the late 1990s in the structure and formulation of labor inspections policies (CARDOSO; LAGE, 2007). With the implementation of the Federal Labor Inspection System (SFIT), a computerized system that operates an information bank based on the data set produced by all inspection actions carried out across the country, in 1996, inspections began to follow a pattern.

A service order (OS) is issued containing the identification and information of the company to be inspected. The labor inspector goes to the company where he will work. He must verify compliance with legal provisions in the scope of labor and employment relations, guide/inform/advise workers and employers, and investigate potential risk situations (OIT, 2010). If there is any irregularity (informal worker, FGTS payment, working hours, workers' health and safety, wages, and others), the inspector must notify the company for violations of the labor code (BRASIL, 2002).

After being notified, the firm has ten days to present evidence in its defense (counted from the date of receipt of notification). If the firm contests, the process is re-examined by a different inspector. In case of confirming the violation, the fine is applied with ten days to pay⁷. It is still possible to present a new appeal that will be analyzed by the responsible

⁵ Data from Labor Inspection Secretariat.

⁶ Data from RAIS

⁷ The amount of fines applied depends on the seriousness of the offense committed and injured

tax auditor and sent to the superior department (*Coordenação Geral de Recursos da SIT*) for a final decision.

In companies with up to 10 employees (except when an infraction is found due to lack of registration), those recently opened and in the event of enacting new laws (90 days after coming into force), the inspection must take place following the double visit criterion (BRASIL, 2002)⁸. This principle aims to guide the employer on irregularities, allowing regularizing without punishment.

The inspector plays a crucial role. In addition to carrying out the inspection, it is also responsible for guiding and advising social partners, and reporting to the competent authorities on labor relations abuses (CARDOSO; LAGE, 2007). Until 2004 inspectors also received bonuses for both individual performance and the general performance of department (CARDOSO; LAGE, 2007). In 2004 all bonuses and prizes were extinguished (BRASIL, 2004). However, seeking to increase incentives for a good performance of inspections. In July 2017, the congress passed a law that allows the bonus for Efficiency and Productivity in the inspector activity (BRASIL, 2017). The bonus amount depends on the total collected with fines, institutional efficiency (percentage of goals achieved in the evaluation period), and the number of active and inactive employees. It is not an individual incentive. It depends on the effectiveness of the actions (number of inspections carried out and the amount collected in fines) of the entire department. In our analysis period, 2007 to 2017, there was no incentives for bonuses.

Even in periods of absence of financial incentives, the actions of the auditors and the joint performance of the Department Labor Inspection (SIT), are evaluated based on quality and effectiveness indicators. Thus, it is possible to identify the execution of previously established goals. There are six central indicators: 1) the number of workers released, who were in slave labor; 2) the regularization rate of the inspected establishments⁹; 3) the number of workers registered under tax action; 4) the amount of FGTS collected and notified under tax action; 5) the coefficient workers reached by health and safety inspection¹⁰; 6) and fatal accident rate investigated¹¹ (SIT, 2008; SIT, 2017).

The most recurrent violations were related to the collection of FGTS and Social Contribution (29.3%), worker health and safety (24%), worker registration (10.82%) and remuneration (6.20%)¹². However, based on the figures presented above, it is not possible to assess the efficiency of inspections. The inspection process is detailed, depends on

workers. They can vary from R\$ 1,000 to R\$ 100,000.

⁸ New law in 2019 included in the criterion of double visit companies with up to 20 employees and companies that committed a minor violation of worker health and safety (BRASIL, 2019). But in 2020 this law was repealed

⁹ Number of items of labor legislation regularized in the inspection divided by the number of items of labor legislation found by the inspection in an irregular situation.

¹⁰ Number of workers reached by inspection on safety and health at work for every 1,000 workers.

¹¹ Number of fatal accidents investigated divided by the number of reported fatal accidents.

¹² Inspection data present in government reports and available at

several factors and agents, so its effects are not trivial. Impact assessments in this context are essential to assess whether the current design of inspections can generate the right incentives for compliance with laws and the impacts generated for companies that suffer from it.

4 DATA

4.1 THE INSPECTION AND LABOR MARKET DATA

We construct a pooled data panel containing quarterly information for each formal firm from 2007 to 2017. First, we use administrative data on the enforcement of labor regulations, collected by *Secretaria de Inspeção do Trabalho* (SIT/ME) available through the *Lei de Acesso à Informação*¹. These data contain identification of each inspected firm and the exact date in the year/month format in which the inspection took place for the years 2007 to 2017. Besides, it also identifies companies notified for irregularities and the exact reason for such notification for the years 2013 to 2016. During the inspection, the inspector must notify any irregularities identified and liable to a fine under the law. Our main measure of enforcement is a dummy variable named "*inspection*" which equals 1 on the date that the firm was inspected and 0 otherwise. We also created a variable dummy named "*notice*" which equals 1 on the date that the firm was inspected and notified of an infringement and 0 otherwise. To the best of our knowledge, this is the first time that firm-level inspection information is used to analyze the effect of enforcement on labor market outcomes.

The second main data source was the *Relação Anual de Informações Sociais RAIS*, a matched employee-employer annual dataset covering the universe of formal employees, also from the Ministry of Economic/Labor. The dataset includes worker-level information (for example, age, schooling, wage, hire and separation date) and firm-level (for example, sector of activity and localization). Using information about hire and separation dates we could transform annual employee data in a quarterly² panel aggregated at the firm level (See more in Appendix B).

We constructed variables in the format of total, logarithm and proportions (using workers active in the quarter as a baseline). Thus, for the following characteristics of workers and the link with the company, we have variables of: hiring, firing, schooling, hours contracted, wages, type of contracts, tenure, occupation, occupational accidents, gender and employee age³. Besides the variables created for quarterly analysis and at the firm level, we also use original RAIS information, such as economic activity, the city where the firm was installed and the identification code (CNPJ).

We merged data from SIT/ME and RAIS using the identifier (CNPJ) and date in

¹ The *Lei de Acesso à Informação*, or the Access to Information Law, is a federal law that allows anyone, whether physical or legal, to request public information from municipal, state and federal levels (BRASIL, 2011)

² We opted for quarterly data for two reasons. The first is the greater variability of the disaggregated data (monthly or quarterly) when compared to the annual. Second, for computational reasons, using monthly data could be highly demanding. Thus, we chose to use the data in the quarterly format.

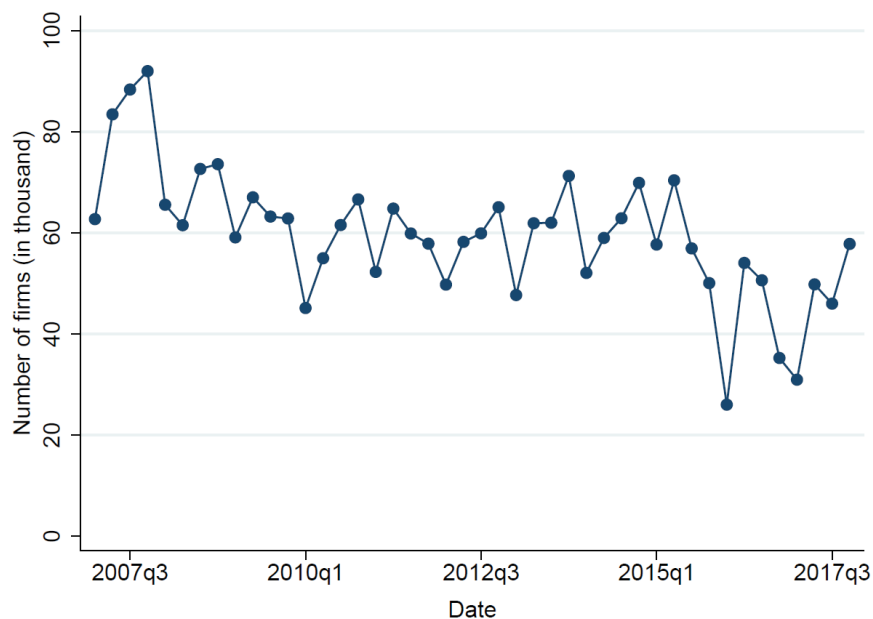
³ See more in Appendix B

format year/quarter present in both. At the end, we had a quarterly panel with information at the firm level about the formal labor market and the enforcement of labor law for the period from 2007 to 2017 (154,635,432 observations).

4.2 DESCRIPTIVE ANALYSIS OF INSPECTION DATA

Before we begin the empirical analysis of the effects of inspections on companies' outcomes, it may be interesting to analyze the data of inspection and notification descriptively. At this stage, we analyze the complete database⁴.

Figure 1 - Evolution in the number of establishment inspected by quarter (2007 to 2017)



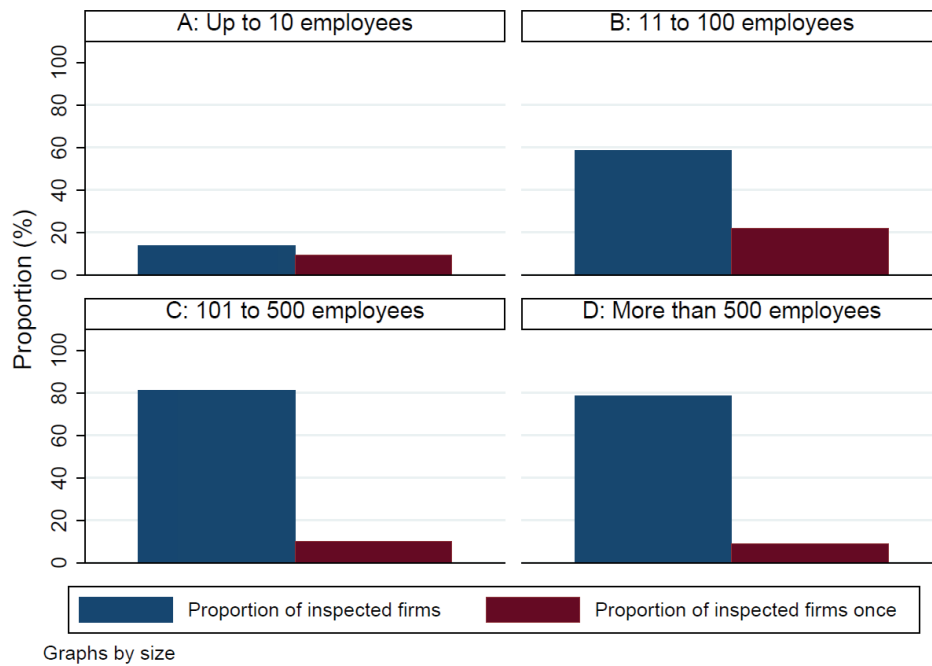
Source: SIT.

Figure 1 shows the evolution of inspections over the quarters between 2007 and 2017. On average, approximately 59,541 companies are inspected per quarter during that period. It is possible to observe a decrease in the number of companies inspected and a certain seasonality at each year's first quarter. As mentioned in Section ??, the number of auditors is insufficient to meet the demand for inspection. And, besides, there is no replacement of servers in office since 2013.

Inspections are heterogeneously distributed in terms of company characteristics (size) and geographically. At the absolute level, the range of companies receiving the most inspections is the minors (Figure 2). But, proportionally, larger companies are more inspected (about 60% of companies with 11 to 100 employees and 80% of companies with more than 100 employees).

⁴ All formal companies that are in the RAIS administrative data in the years 2007 to 2017.

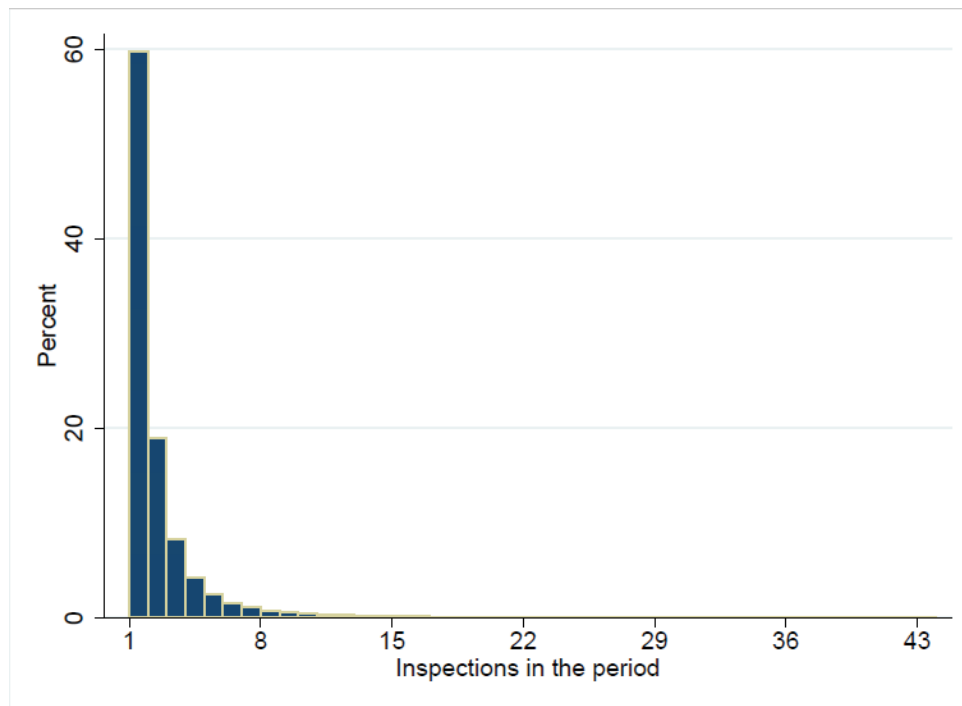
Figure 2 - Share of inspected firms by size



Notes: The graph indicates the share of companies inspected and companies inspected only once between 2007 and 2017 subdivided by 4 size ranges.

Among the establishments with up to 10 employees in the baseline period, approximately 14% were inspected in the period and 9% were inspected only once. For companies with 11 to 100 employees, 58% were inspected and 22% were inspected once. In firms with 101 to 500 employees and more than 500, the behavior is very similar. About 80% were inspected while only 10% were inspected only once (Figure 2). It is possible to see that fiscal actions tend to be less repeated in smaller companies than in medium or large companies.

Figure 3 - Histogram of inspection frequency in companies inspected at least once between 2007 and 2017

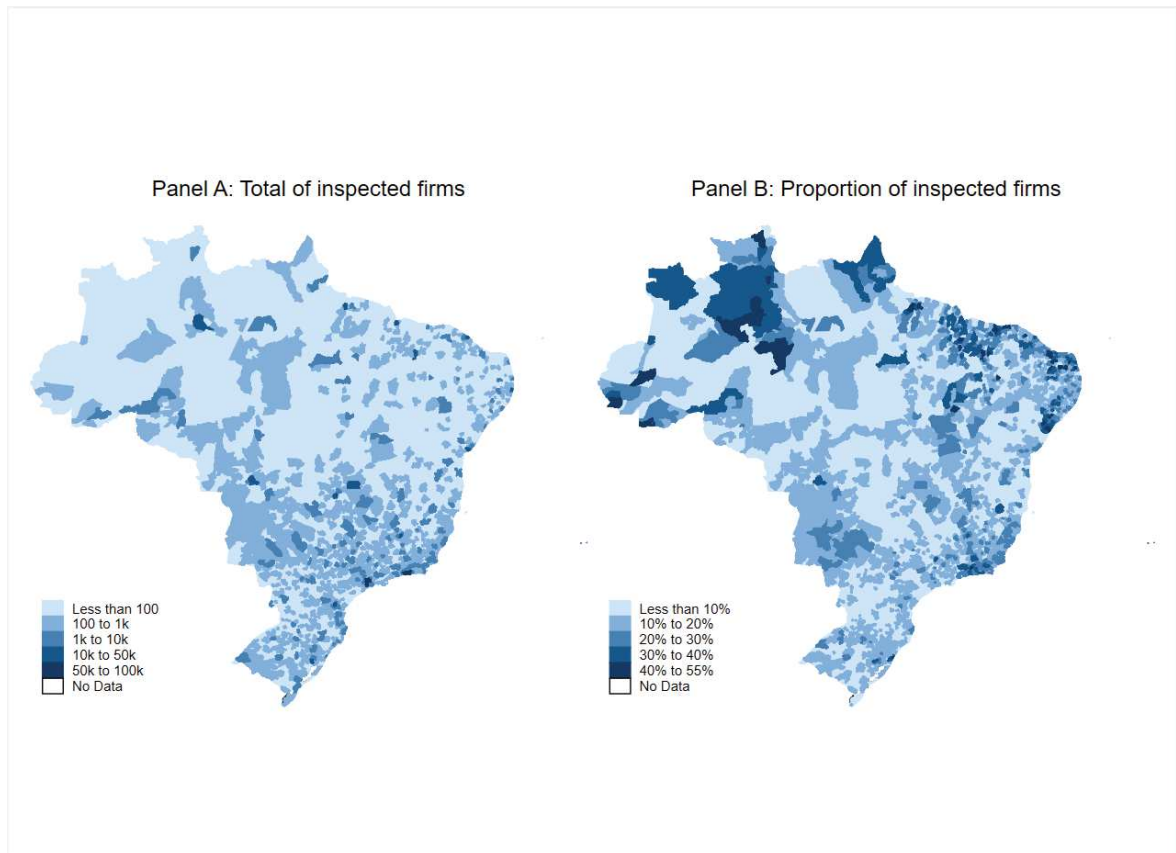


Notes: Histogram of the variable "total inspections", which add all inspections that took place in the establishment between 2007 and 2017. Sample considering only companies that were inspected at least once in the period.

Looking at all the companies inspected, about 60% are inspected only once (Figure 3). In companies that receive more than one inspection, the average interval between actions is approximately 6 quarters (deviation of 6.04). The larger the size of the company, the shorter the interval between inspections. For example, in firms with up to 10 employees, the average interval is 6.57 quarters while in companies with more than 500 employees, the interval is 2.56 quarters

In Figure 4 we have the geographic distribution of inspections. There is a concentration in the southeast region (50%), where there is also the largest number of companies (49%). Proportionally, the region with the most audited companies is the North (almost 24% of firms) followed by the Northeast, Midwest, Southeast and South (22.74%, 16.5%, 15.9% and 13.6%, respectively). The three cities that receive the most inspections are São Paulo, Rio de Janeiro and Belo Horizonte, which are also the locations with the most companies registered in RAIS (proportion of inspected firms was 14%, 25% and 31%, respectively).

Figure 4 - Number and proportion of inspected firms by city



Notes: Panel A indicates the total number of companies inspected by municipality during 2007 and 2017. Panel B indicates the share of formal companies that were inspected during this period. Data from RAIS and SIT.

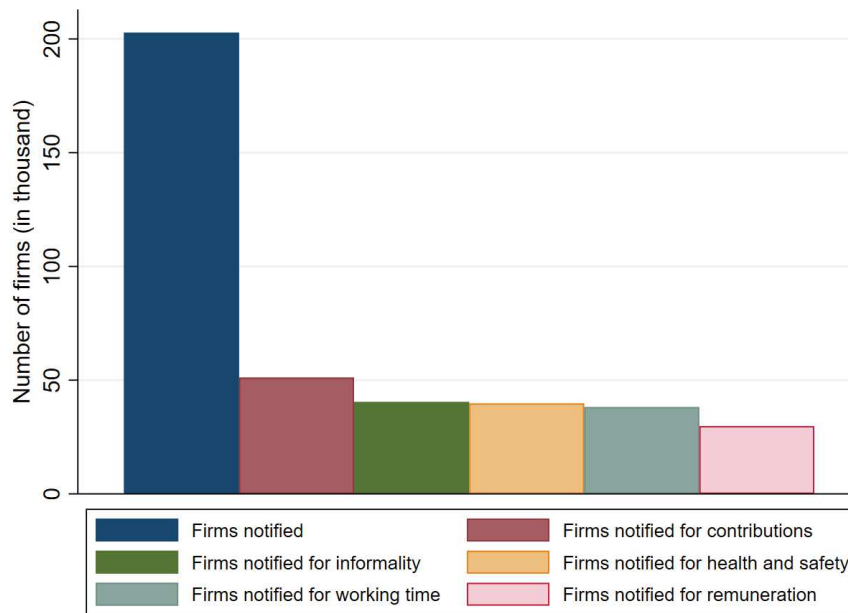
A process that can be derived (or continued) from inspection actions is the notification. If the AFT finds any irregularity, it must draw up an infraction notice and initiate the punishment process. As mentioned in the Section 4, the notification data are only available from 2013 to 2016, so it is only possible (for now) to analyze this period.

Between 2013 and 2016, 532,724 companies were inspected (228,653 of which were the first time in this period). Among those inspected, 202,794 were notified during an inspection for at least one irregularity (38% of inspected firms in the period).

Figure 5 shows that the total number of firms notified in the period and for type of irregularity. The most common irregularities are due to contributions (25%), informality (19.92%), worker health and safety (19.61%), working hours and rest (18,82%), and remuneration (14.69%). Of the 202,794 companies notified, 160,812 were only once (79.3%), while 41,982 were notified more than once (20.7%). Among the 41,982 companies notified more than once, 43% were repeat offenders in the type of irregularity⁵.

⁵ 6,296 was a repeat offender in health and safety; 1,539 in informality; 3,597 in contributions; 2,393 in remuneration; and 4,272 working time/vacation/rest.

Figure 5 Number of firms notified by type of irregularity



Notes: Considering the years 2013 to 2016, the graph indicates the total of firms notified and the total by type of notification.

Table 1 – Descriptive statistics on inspection date - notified firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Firms notified		Contribution		Informality		Health and safety	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Main Variables								
Employees	158.43	704.26	63.28	448.36	59.27	503.71	278.46	1,017.61
Hire	19.78	110.64	6.99	57.55	9.02	85.8	35.7	169.6
Separation	22.23	125.53	8.65	60.95	8.63	89.36	40.21	193.15
Real average wage	1,230.85	1,012.27	1,030.30	659.41	929.74	634.64	1,335.53	994.45
Number of firm	202,794		51,136		10,398		39,771	
Observations	269,123		55,243		42,083		48,545	

Notes: Dataset includes firms notified between 2013 and 2016. Observations are only from the date the notification took place.

As shown in Table 1, the firms when were notified had, on average, 158 employees. The size is very different among firms notified for various reasons. On average, irregularities in social contribution and informal worker seem to be more common in establishments with 63 and 59 employees, respectively. In contrast, companies notified for health and safety have about 278 workers on the date of inspection. One possible explanation is that the infractions are correlated with the size of the companies. Informal issues, contributions and remuneration can be challenging for smaller companies since complete regularization implies costs. On the other hand, larger firms tend to have more control over these regularization issues, but they are not always 100% adequate in terms of security, especially due to many regulations.

4.3 SAMPLE CONSTRUCTION FOR EMPIRICAL ANALYSIS

Initially, we have a quarterly panel of formal firm data for the period from 2007 to 2017. There are 154,635,432 observations, with 6,123,657 from firms never inspected, 731,101 are from companies inspected once and 493,123 are inspected more than once.

Table 2 – Descriptive statistics - all formal firms

	(1)		(2)		(3)		(4)		(5)		(6)	
	Never inspected		Once inspected		Once inspected		Once inspected		More than once inspected		More than once inspected	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Main Variables												
Employees	5.61	126.40	13.11	427.73	13.11	427.73	62.33	878.29	62.33	878.29		
Hire	0.73	13.67	1.65	31.11	1.65	31.11	7.87	79.63	7.87	79.63		
Separation	0.61	12.21	1.51	65.77	1.51	65.77	7.20	71.28	7.20	71.28		
Real average wage	940.38	801.18	981.99	837.18	981.99	837.18	1,129.35	1,020.83	1,129.35	1,020.83		
Number of firm	6,123,657		731,101		731,101		493,123		493,123			
Observations	116,455,140		20,945,708		20,945,708		17,234,584		17,234,584			

Notes: This table reports statistics from the full sample, divided in never inspected, once inspected and inspected more than once. Firms' characteristics we obtain from RAIS. The identification of the audited companies we obtain from SIT. Information from 2007 to 2017. Data frequency is quarterly.

Our first restriction was to exclude the inspected companies more than once in the analysis period. When inspections are more frequent, pre and post-inspection periods could be overlapping. It is not clear when these intervals begin or end. As we saw in Figure 3, about 40% of the establishment were inspected more. This kind of firm is very different from others, as we can saw in Table 2. For example, firms inspected more than once have, on average, 62 employees, while firms never inspected and inspected once have 5 and 13 employees, respectively. With this restriction, we drop 17,234,584 observations from 493,123 establishments.

The second restriction was to keep in the sample firms with 10 to 500 employees in the baseline. The main reason is because firms inspected once and firms never inspected are very similar in this range of size, 29 employees on average in both groups, as we saw in Table 3. In Table 4 we show descriptive statistics for the other two sets. For companies with less than 10 employees and companies with more than 500 employees, the difference between never inspected and inspected once is clear.

Another reason for the exclusion of small companies is that they are, by law, exposed to a double visit inspection scheme (as explained in the Section 3.4). Thus, for this specific group of companies, the outcomes and further analysis may be different from the others.

Table 3 – Descriptive statistics for companies with 10 to 500 employees

	10 to 500 employees					
	(1)	(2)	(3)	(4)	(5)	(6)
	Never inspected		Inspected once		Inspected more than once	
	Mean	SD	Mean	SD	Mean	SD
Main Variables						
Employees	29.34	66.29	29.07	50.28	68.91	133.56
Hire	2.95	11.85	3.45	12.40	9.20	34.93
Separation	2.82	10.89	3.42	11.98	8.67	32.44
Real average wage	1,362.54	1,293.61	1,290.22	1,216.08	1,330.83	1,179.48
Number of firm	188,363		100,260		186,903	
Observations	5,595,508		3,318,796		7,110,076	

Notes: This table reports statistics from the sample of companies with 10 to 500 employees in the baseline, divided in never inspected, once inspected and inspected more than once. Firms' characteristics we obtain from RAIS. The identification of the audited companies we obtain from SIT. Information from 2007 to 2017. Data frequency is quarterly.

Table 4 – Descriptive statistics for companies under 10 and over 500 employees

	Up to 10 employees						More than 500 employees					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Never inspected		Inspected once		Inspected more than once		Never inspected		Inspected once		Inspected more than once	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Main Variables												
Employees	3.26	8.12	6.32	20.47	18.94	108.90	1,833.02	4,831.60	2,478.39	11,634.22	1,732.03	7,354.62
Hire	0.56	3.76	1.13	7.51	3.67	30.97	90.78	523.66	122.54	825.06	147.77	614.23
Separation	0.45	2.79	0.96	5.81	3.10	25.46	67.59	475.56	129.56	1,817.41	138.52	550.95
Real average wage	917.71	756.70	921.90	722.34	963.84	813.34	2,703.50	2,884.02	2,270.75	2,476.9	2,024.99	1,844.04
Number of firm	5,933,361		630,052		300,202		1,933		789		6,018	
Observations	110,791,184		17,599,940		9,895,396		68,448		26,972		229,112	

Notes: Columns (1)-(6) reports statistics from the sample of companies with up to 10 employees in the baseline. Columns (7)-(8) reports statistics from the sample of companies with more than 500 employees in the baseline. Both group of firms are divided in never inspected, once inspected and inspected more than once. Firms' characteristics we obtain from RAIS. The identification of the audited companies we obtain from SIT. Information from 2007 to 2017. Data frequency is quarterly.

In smaller establishments, never inspected companies have, on average, 3 employees and less than one hiring and separation per quarter (column (1) and (3) in Table 4). Meanwhile, firms inspected once have 6 employees and one hiring and separation. The difference is even greater in large companies, 1,833 employees in never inspected in contrast to 2,478 employees in firms inspected once (Column (7) and (9) in Table 4).

It is also possible to note that, for the three size ranges, the companies inspected more than once are quite different from the others, as previously mentioned. In general, they are larger and have a higher turnover (Column (5) in Table 3, Column (5) and (11) in Table 4).

We exclude about 128,486,544 observations or 6,566,135 establishments, 6,563,413 small and 2,722 large firms. In the end, we have a quarterly panel with firms never inspected and inspected once during 2007 and 2017 that in the baseline had among 10 and 500 employees.

Table 5 – Descriptive statistics - final sample

	(1)	(2)	(3)	(4)
	Never inspected		Inspected once	
	Mean	SD	Mean	SD
Main Variables				
Employees	29.34	2.95	29.07	3.45
Hire	2.95	11.85	3.45	12.39
Separation	2.82	10.89	3.42	11.98
Real average wage	1,362.54	1,293.61	1,290.22	1,216.08
Workers' and contract characteristics				
Male	0.57	0.31	0.58	0.31
Basic education	0.40	0.34	0.40	0.33
High school or College	0.58	0.34	0.28	0.34
Real wage up to 1,000	0.54	0.35	0.57	0.35
Real wage above 1,000	0.44	0.35	0.41	0.34
CLT contract	0.92	0.26	0.97	0.16
Apprentice/temporary contract	0.002	0.03	0.004	0.05
44-hours contract	0.80	0.35	0.85	0.31
Less than 44 hours contract	0.18	0.34	0.14	0.30
Establishment's characteristics				
Transformation Industry	0.23	0.42	0.23	0.42
Trade	0.26	0.44	0.31	0.46
Service	0.48	0.50	0.41	0.49
Construction	0.02	0.16	0.03	0.17
Other sectors	0.008	0.09	0.007	0.08
Central-West Region	0.07	0.25	0.08	0.27
North Region	0.03	0.18	0.04	0.19
Northeast Region	0.10	0.30	0.12	0.33
South Region	0.19	0.39	0.20	0.40
Southeast Region	0.61	0.49	0.56	0.50
Number of firm	188,363		100,260	
Observations	5,595,508		3,318,796	

Notes: Summary statistics are computed considering all periods from our main sample (companies inspected once with 10 to 500 employees in the baseline). Firms' characteristics we obtain from RAIS. The identification of the audited companies we obtain from SIT. Information from 2007 to 2017. Data frequency is quarterly.

Table 5 presents summary statistics for both groups - inspected establishments and never inspected firms in the period - using the sample described previously. Supervised firms have, on average, 29 employees, the same amount as the companies in the control group. Hiring and separation are also very close in both groups, about 3 employees hired and dismissed per quarter. The average real wage is similar in inspected establishment (1,290 Brazilian *reais*) to the comparison group (1,362 Brazilian *reais*). The two groups are also similar in workers' and establishments' characteristics. Therefore, we have evidence that the control group is similar to the treatment group in the variables regarded in our analysis.

5 EMPIRICAL STRATEGY

To identify the causal effect of enforcement of labor law on firms' dynamics, we leverage variation in each inspection's timing in an event-study framework. Our identification strategy is based on two central points. In the first, we explore the fact that companies are unaware of and are not advised of inspection actions in the future. Thus, the timing of inspection is possibly exogenous, a surprise element, to the firm. In the second, we explore the contrast between firms treated and firms that have not yet been treated or those that have never been treated¹, after accounting for fixed differences between the establishments and for common time effects.

Specifically, we estimate the following equation:

$$Y_{i,t} = \alpha + Date_t + Firm_i + \beta X_{i,t} + \sum_{k=r_{min}}^{k=r_{max}} \gamma_k \times \mathbf{1}(t_i = t^* + k) + e_{it} \quad (5.1)$$

where $Y_{i,t}$ denotes the outcome of interest (total of workers, hire and separation) for firm i in the date t . $Date_t$ denotes date fixed effects which captures common shocks to firms in date t ; $Firm_i$ denotes firm fixed effects which captures the establishment's characteristics invariant in the period; $X_{i,t}$ is a vector of control variables; $\mathbf{1}(t_i = t^* + k)$ are dummies equal 1 if firm i has been inspected for k periods while t^* is the inspection date; and $e_{i,t}$ denotes the error term.

The coefficients of interests are γ_k , which represents the effect of inspection on date t^* on outcomes, given by the difference between control and treated, k months later inspection (or previously, for $k < 0$). These effects are measured relative the month before the event ($k = -1$), because we expect responses to begin in the month of the inspection, t^* (HOYNES; SCHANZENBACH, 2012).

We impose a restriction to our set of event-time dummies. The endpoints are open brackets (9 or more quarters prior to inspection on the left and 9 or more quarter later on the right) which helps reduce the collinearity between event time and inspection date (HOYNES; SCHANZENBACH; ALMOND, 2016). Because the sample is unbalanced in event time, these endpoint coefficients give unequal weight to firms inspected early or late in the sample. For this reason, we focus the analysis on the event-time coefficients falling

¹ Some papers in the literature that adopt an event study use as counterfactual only units that have not yet been treated (that is, units that will eventually also be treated). For example, Hoynes and Schanzenbach (2012), Kline (2012) and Dobkin et al. (2018). However, as Borusyak and Jaravel (2017) argue, in estimating by two-way fixed effects, the effect can be under-identified because it is impossible to identify the linear component of the path of pre-trends and dynamic treatment effects. The authors' most practical recommendation is the inclusion of untreated units. Therefore, we choose to include in the sample some of never inspected firms.

within an eight-quarter window that are identified of a nearly balanced panel of companies (KLINE, 2012). We normalize $\gamma_{-1} = 0$, so all coefficients γ_k para $k > -1$ are measured relative to γ_{-1} (HOYNES; SCHANZENBACH, 2012). In other words, γ_k capture the dynamic effects of inspection relative to the quarter before the event.

The choice of control variables is not obvious. Most of the variables we observe at firm level could be affected by inspection, which makes them bad controls (ANGRIST; PISCHKE, 2009). We opt to control for interactions of their baseline values (first observation on dataset) with time dummies, instead of directly controlling for their contemporaneous values (CHIMELI; SOARES, 2017). The variables used on baseline are the following: firm size (number of employees), share of male workers, share of workers with wage above 1,000 *reais* and share of workers with high school complete or more.

To assess the average impact after inspection, we estimate the follow equation using difference-in-difference model:

$$Y_{i,t} = \alpha + Date_t + Firm_i + \beta X_{i,t} + \delta Post_Inspection_{it} + e_{it} \quad (5.2)$$

where $Y_{i,t}$ denotes the outcome of interest for firm i in the date t . $Date_t$ denotes date fixed effects and is useful to capture common shocks in t ; $Firm_i$ denotes firm fixed effects and control for all invariant characteristics of firm i ; $X_{i,t}$ is a vector of control variables (interactions of baseline values of variables with fixed time effect, as well as in a event study); $Post_Inspection_{it}$ is a dummy equals 1 if firm i was inspected on date t or on earlier date (t is equal or greater than the inspection date); and $e_{i,t}$ denotes the error term. The coefficient of interest is δ , which capture the average effect of inspections.

For the estimation to really result in the inspection effect on firms, it is necessary to guarantee that the hypothesis of parallel trends, before realizing the inspection, is satisfied. Thus, it is expected that treated and untreated before treatment will show similar trajectories in the analyzed variable.

The models are estimated using weighted least squares. We weight for total of workers in the firm in the baseline (first quarter in the data). The goal is to approximate the average partial effect for the whole population in the potential presence of heterogeneous effects and heteroskedastic error terms (SOLON; HAIDER; WOOLDRIDGE, 2015).

In a traditional difference-in-differences or event study, in the presence of heterogeneous effects over time and among units, the model may have negative weights, as discussed by Goodman-Bacon (2018) and Callaway and Sant'Anna (2020). We try to avoid this problem by using weights² (company size in the baseline period).

² For future work, we want to estimate weighted event studies that rely on matching to identify control units with similar counterfactual trends as suggested by Ben-Michael, Feller and Rothstein (2021).

We use standard errors that are clustered at the firm level to allow for arbitrary dependence of $e_{i,t}$ across t within i (BERTRAND; DUFLO; MULLAINATHAN, 2004).

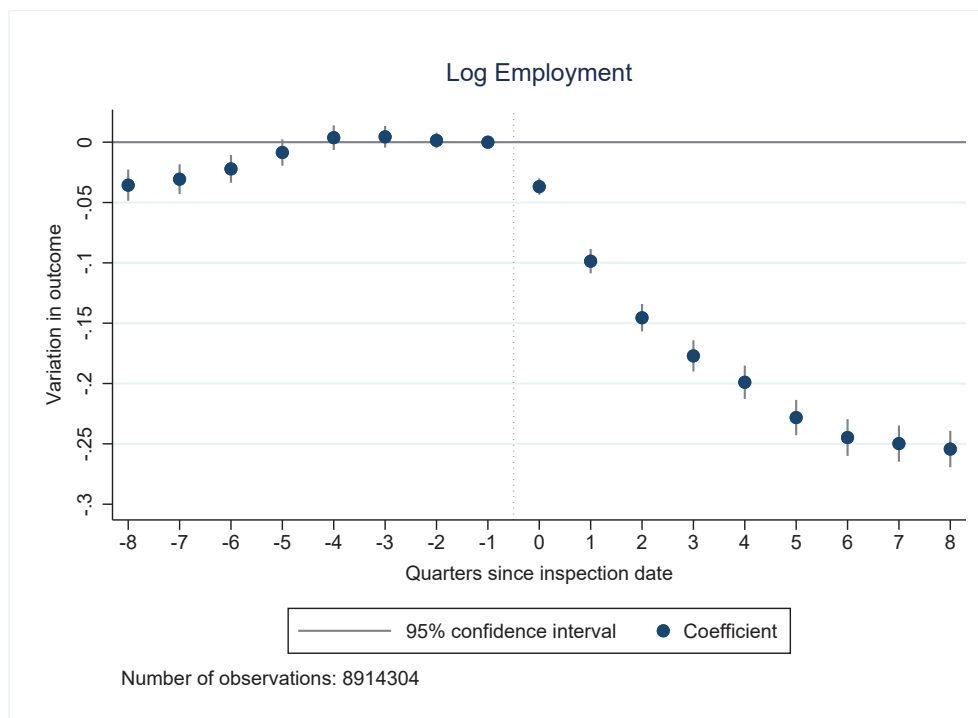
6 RESULTS

In this section, we first examine the responses of employment, hiring, separation and wages to inspection. Second, we investigate whether the increase in labor costs caused by inspection is a possible channel for transmitting the effect on the firms' dynamics. Third, we discuss heterogeneity according to firm size and economic activity.

6.1 EFFECTS ON EMPLOYMENT, HIRING, SEPARATION AND WAGES

Figures 6-9 display the estimations of γ_k for selected labor market variables. For employment, hiring and wage, pre-event coefficients are statistically equal to zero, leading support to parallel trends assumption. That is, treatment and control groups present similar trends in the quarters before inspection. For separation variable, estimating Equation 5.1, the pre-event coefficients are not statistically equal to zero.

Figure 6 - The effects of inspection on employment

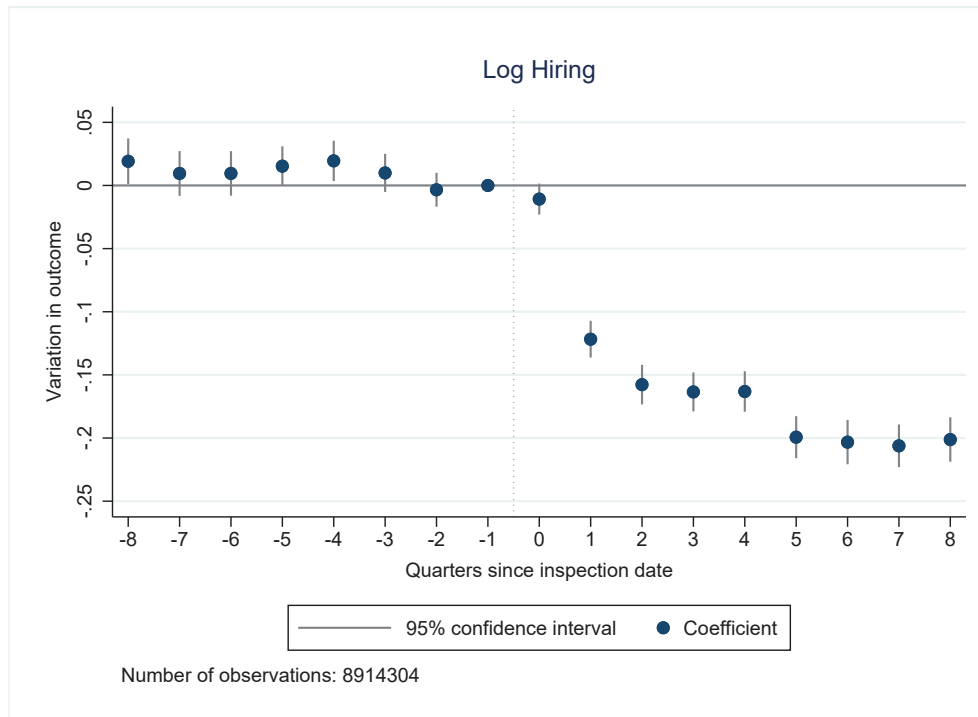


Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample.

Figure 6 shows the point estimates for log employment. We find a sharp and significant decline in employment that intensifies over the following quarters. In the

quarter of inspection, the drop is -0.037 (equivalent to -3.63%)¹. In the eighth quarter after inspection, log employment falls by -0.254 (22.43%). Regarding the average impact of inspection in later periods, Column 1 of Table 6 presents the estimate from Equation 5.2. After inspection, the decline in log employment is equal to -0.180, equivalent to 16.47%.

Figure 7 - The effects of inspection on hiring



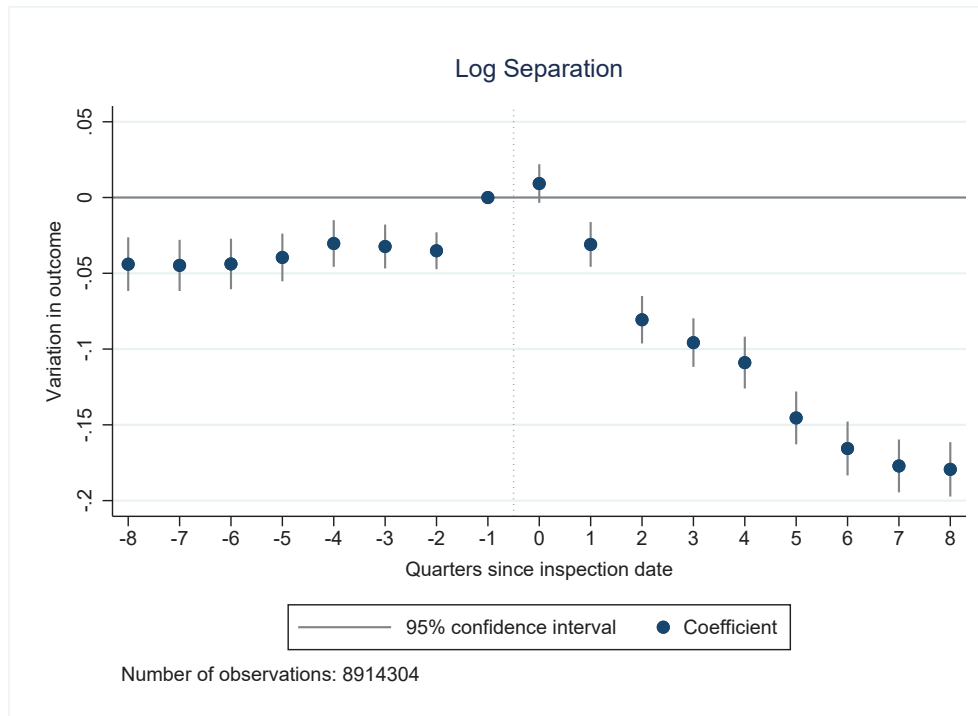
Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample.

We present the event-study estimates for hirings in Figure 7. There is no effect in the inspection date (coefficient γ_0 is statistically equals zero). In the quarter immediately after, there is a sharp decrease in log hirings of -0.122 (11.48%). The pattern is even stronger in the subsequent quarters. The average impact in all periods after the inspection date is shown in Column 2 of Table 6 and indicates that inspected firms have a decline of 17.39% in log hiring when compared to control group.

The estimated effect on separation is documented in Figure 8. As mentioned before, the hypothesis of parallel trends is not satisfied. There is a small and constant, but also significant, difference between treated and control groups in the pre-event period. It may occur due to a poor specification of the model that does not capture all possible trends. This issue will be addressed in the next stages of the research.

¹ We use the approximation $(100 * [\exp(\gamma_k) - 1])$ when interpreting the estimated coefficients as a percentage.

Figure 8 - The effects of inspection on separation



Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample.

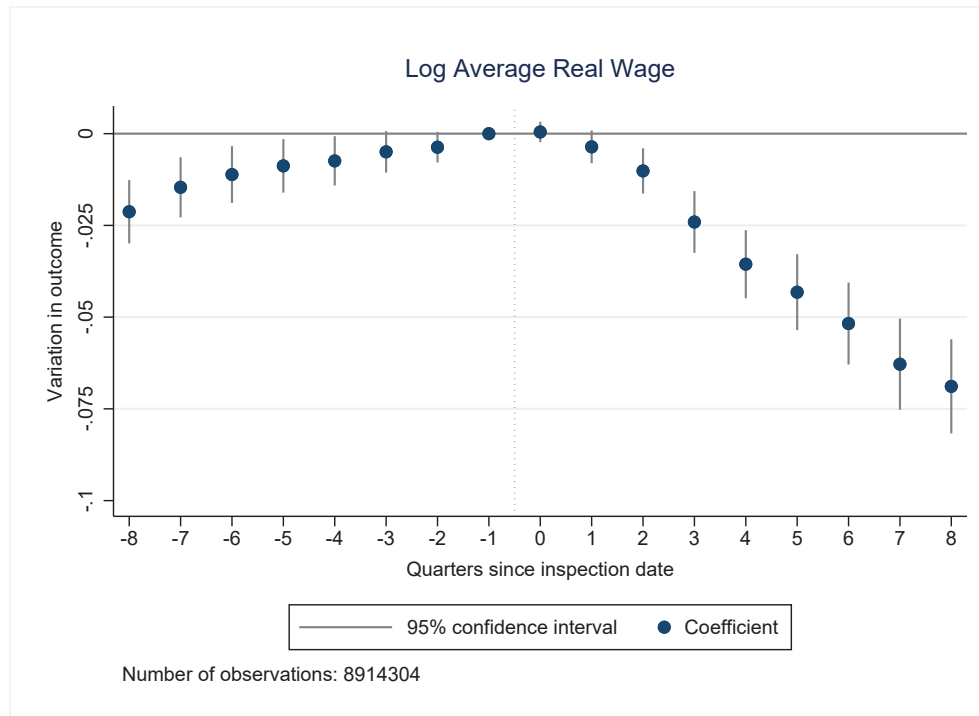
However, we see a clear and significant drop in the quarters after inspection comparing the treated and control groups. In the quarter before inspection, the decrease is -0.031 in log separation (about 3.05%). In the eighth quarter, the coefficient is -0.179 (or 16.39%). Considering the average effect in all post-inspection quarters, the coefficient is -0.120, a decrease of -11.31% (Column 3 of Table 6).

Finally, we analyze the log real average wage. Figure 9 shows a statistically significant small drop from the second quarter after inspection by -0.01 (about 1%). Five quarters after inspection, the fall is about -0.04 in log wage. The average effect is -0.04, a 4.26 percent decrease (Column 4 of Table 6).

To test the robustness of the results, we include state x date effects to control for time-varying shocks specific to states and sector x date effects to control for unobserved time-varying shocks to sectors². Figure 15 and Table 14 in Appendix C show the results from event study and difference-in-difference, respectively. The results are very close with and without the inclusion of specific fixed effects.

² The sector was defined based on 2-digit CNAE and grouped in 5 categories (industry, construction, trade, services and other).

Figure 9 - The effects of inspection on wages



Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample.

Table 6 – The effects of inspection on establishments outcomes

	(1)	(2)	(3)	(4)
	Log Employment	Log Hiring	Log Separation	Log Average Real Wage
Post_Inspection	-0.180*** (0.00567)	-0.191*** (0.00536)	-0.120*** (0.00562)	-0.0435*** (0.00476)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes
Observations	8,914,304	8,914,304	8,914,304	8,914,304
Number of firms	288,896	288,896	288,896	288,896

Note: All estimates include time and firm fixed effects. Robust standard errors in parentheses. *** denotes $p < 0.01$, ** denotes $p < 0.05$ and * denotes $p < 0.1$. All specification include controls and fixed effects. Regressions weighted for firm size on baseline. Statistics from sample containing firms inspected once or never inspected between 2007 and 2017 with 10 to 500 employees in the baseline.

Still testing robustness, we consider alternative variable definitions. In Figure 16(a)-(d) we present estimates to outcome variables in level (total of workers, total of hiring, total of separation and average real wage). The same is seen in columns (1)-(4)

in Table 15. In event study estimates, the employment still decreases after inspection. Reduction of 5 employees in the second quarter subsequent to inspection date and 11 in the eighth quarter. Considering hiring and separation, there is a reduction but of a small magnitude. For wages the effect is not statistically different from zero. Looking at difference-in-differences estimates, we observe a decline in all four variables and only real wage is not significant, respectively -9.99, -2.59, -1.52, and -3.04.

In the last check, we consider an alternative sample with establishment stayers in the dataset in all periods (44 quarters). The results are present in Figure 17 and Table 16 in Appendix C. The impacts are different in magnitude but statistically significant for employment, hiring and wages. For hiring, the effect in the date of inspection is positive and equal to 0.025 (equivalent to 2.53%). However, in the following 4 quarters there is a drop in hiring of about -0.05.

The validity of our identification depends on the hypothesis of the exogenous timing of the inspection. Fortunately, as we saw in Figures 6-9, there is no anticipation of inspection. That is, before inspection occurs, there is no difference between the treated and never treated companies (no pre-trends). Hence, even if firms could predict or advance inspections, most regulations such as contributions and remuneration, for example, are not easily or quickly regularized. There is a bureaucracy involved that can make manipulation or anticipation unfeasible.

In summary, we show robust evidence that there is a reduction in employment, hiring, separation and wages after inspection. So, how do we explain these results? First of all, we have to remember which theoretical background we are inserted in.

We consider a firm in a context with strict regulation and imperfect monitoring. Each firm can either choose to comply with the regulation or evade the law (totally or partially). The benefits of evasion relate to a lower labor cost and, when firms hire informal workers, they will also benefit from the flexibility in the labor force. On the other hand, evasion costs are related to the probability of being caught and punished (ASHENFELTER; SMITH, 1979; ALMEIDA; CARNEIRO, 2009). Brazil has one of the most expensive labor laws, which is the main reason why companies choose to evade regulations (CARDOSO; LAGE, 2007).

When the company chooses to hire workers informally, in addition to the lower labor costs, there is also the benefit of flexibility. In this case, Almeida and Carneiro (2012) argue how enforcement can affect labor market variables (considering the formal and informal markets). Increased enforcement increases the likelihood of being caught and punished. Thus, it is riskier to keep the workforce informal. There is a decrease in the demand for informal workers while the demand for formal workers increases. So, it is expected then that there will be an increase in formal employment and hiring. As for wages, the movement depends on the supply of labor and its rigidity. If workers

value the formal position's benefits more, there will be an increase in formal labor supply, which tends to decrease wages in the formal sector. Empirical evidence corroborates the theoretical arguments discussed by the authors.

From the perspective of less access to flexible labor, the hiring of informal workers is implicitly seen as the main irregularity committed. In fact, this is an important irregularity and maybe the one that most influences the trade off between following or not following the legislation. However, several other regulations imply high costs for companies and can be violated even when the workforce is formalized. We can treat the hiring of informal workers as a total evasion of the regulations (since the employee is not supported in any aspect by the labor legislation). The other types of evasions can be considered partial (for example, irregularity in contributions with FGTS, overtime, vacations, health and safety) and which will not necessarily (or not directly) affect access to informal labor.

In this sense, we can consider any type of evasion (whether total or partial) as an escape from costs or an attempt to reduce costs. Increased enforcement can increase companies' costs and thus affect their decisions since the main goal is to enforce compliance with all mandated benefits. It is also possible to divide two dimensions of this mechanism. The first would be the immediate effect on companies with irregularities. Thus, the inspection would imply higher labor costs and costs of fines, with the potential to affect the company's conditions and decisions in the short term. What is expected is an adjustment by companies in terms of cost reduction, decreasing employment (size), decreasing hiring and increasing layoffs.

The second dimension is the change through the perception of how credible the inspections are. In other words, it would be an anticipated change in the behavior of firms in the face of possible inspection in the future. From this perspective, both companies with and without irregularities can be affected. For example, a possible behavior as argued by Almeida and Carneiro (2009) is the contraction of companies (size) to be less targeted by inspections³. The adjustment occurs in both dimensions due to exposure or imminent exposure to a new and more expensive cost structure.

What we try to do in the Section 6.2, perhaps naively, is to analyze if there is a change or an adjustment of the companies that indicates that they are adapting. We evaluate the composition of employment according to some characteristics of workers and contracts. Bear in mind that this is not an analysis of the mechanism itself. We seek to assess whether there has been any change that indicates a preference for "cheaper labor" after inspection.

A fact that is important to note is that the mechanisms are not mutually exclusive, as they are indeed very likely to work together. Evidence of this is that there is no

³ In Figure 2 we show that 60% of firms with 11 to 100 employees and almost 80% of firms with more than 100 employees were inspected between 2007 and 2017.

consensus in the literature on the behavior of some variables. For example, Almeida and Carneiro (2009) find a negative effect of the increase in enforcement on the company's size (measured mainly by employment), on hiring and firing. Almeida and Carneiro (2012), among other evidences, suggest that there is an increase in employment in both the formal and informal sectors and an increase in hiring. Abras et al. (2018) found evidence of increased adherence and separation rates (comparable to hiring and firing, respectively). All three works use Brazilian municipality-level data. The only difference is that Abras et al. (2018) exclusively analyze data from the formal sector from RAIS.

Our results are close to Almeida and Carneiro (2009), suggesting that an increase in enforcement restricts the firms' size and decreases turnover (decrease in hiring and separations). The reduction in formal wages resulting from greatest enforcement corroborates with the findings in Almeida and Carneiro (2012).

A limitation of our work is to analyze only data from formal companies. Thus, the movement between the formal and informal sectors is not mapped. However, in contrast, the difference from some of results in the literature could be evidence that there are at least two distinct effects of enforcement. The first one is the direct effect, or in other words, the effect of inspection in firms inspected. The second one is possible spillovers effects, that is, the effect of the inspection on companies that are not directly inspected, but that in some way changed their perception of the probability of punishment and thereby changed their behavior/decisions.

We are exclusively estimating the direct effects of the inspection, while the other authors, who use city-data level, estimate the sum of all possible effects (direct and spillovers). This difference is curious because it suggests that the way the company is "affected" can change its response and/or adaptation.

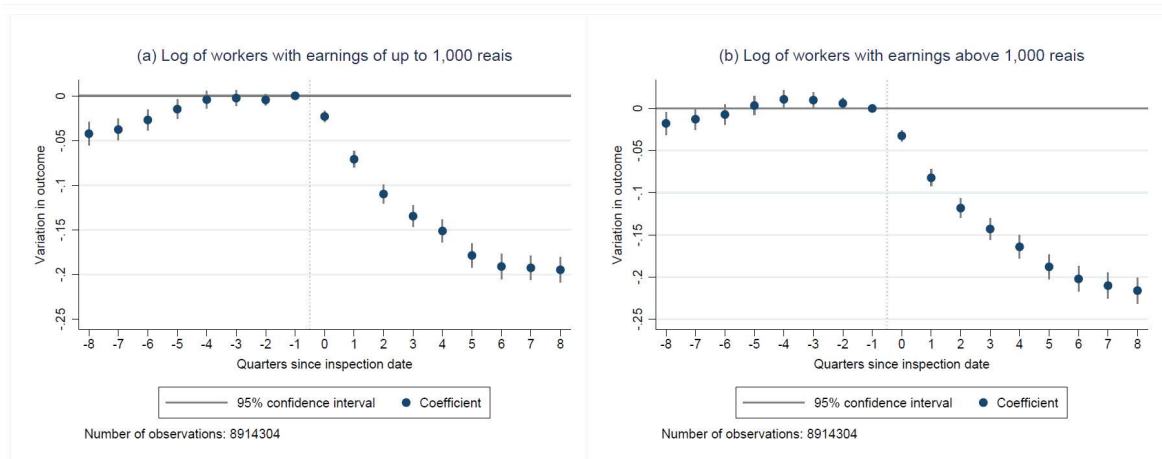
6.2 EFFECTS ON LABOR FORCE COMPOSITION

As we cited before, companies may alter their employees' composition in response to shocks in costs imposed by inspection. To investigate whether there is a change in the composition of employment, we analyze 5 characteristics of workers/contract: earnings, hours contracted, type of contracts, schooling, and gender.

Because our data is at the firm-level, we analyze variables representing the total of employees in each category⁴. In this way, it is possible to observe whether the decrease in employment, seen in Figure 6, is equal among characteristics of contracts and workers or there is some evidence of change in composition.

⁴ For example, the total of men and the total of women.

Figure 10 - Effects of inspection on employment by earnings range



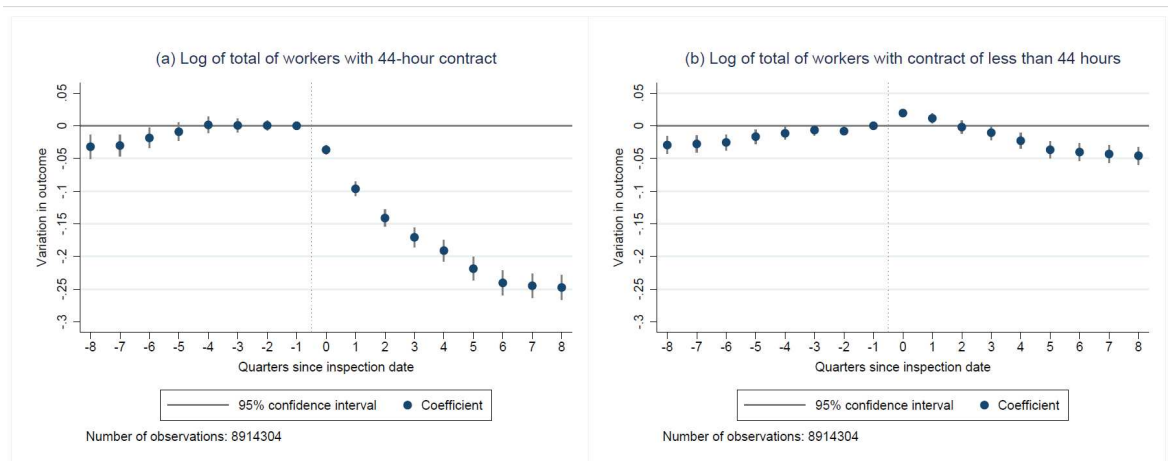
Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample.

First, we analyze employment according to two wage ranges. Figure 10 shows that employment reduces almost equally among workers with earnings below and above 1,000 *reais*. The estimates of average effects (Table 17 in Appendix C) corroborates that the result is very close in both employment categories (-0.131 against -0.165, respectively). But when we look at the proportion of workers by earnings range (Figure 18 in Appendix C), there is an increase in share of workers with earnings of up to 500 *reais* while there is a decrease in share with earnings of 500 to 1,500 *reais*. There is no change in the share of workers with earnings above 1,500 *reais*.

In other words, there is a small change in the bottom of the wage distribution, with an increase in the share of workers receiving low wages and a decrease in workers receiving intermediate wages. This could explain the reduction in log average real wage seen in Figure 9. It seems that the adjustment in earnings, even if it happens, is not the main modification in companies after receiving the inspection.

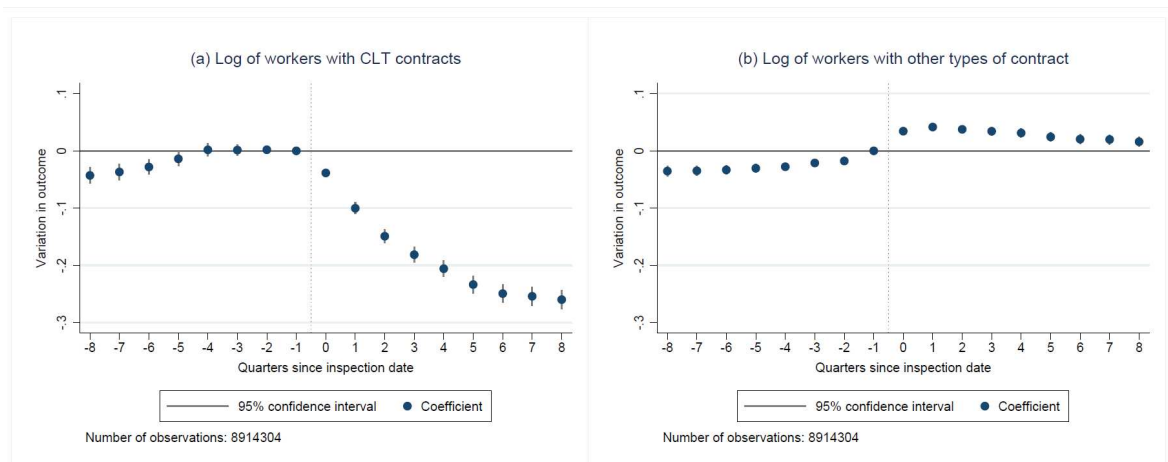
To analyze employment according to contracts' characteristics, we focus on hours contracted and contract type. Figure 11 presents evidence that the drop in employment is mostly driven by reducing standard contracts (44 hours per week). In contrast, there is a little but significant increase in contracts of less than 44 hours per week but only on inspection date and one quarter after. The average coefficient (Table 18 in Appendix C) suggests negative effects post-inspection for both groups, but the impact in 44-hour contract is biggest than in contracts of less than 44-hours (-0.173 and -0.0180, respectively). It is important to remember that regular contracts (44 hours) are predominant in establishments, 85% of all contracts in inspected firms and 80% in never inspected companies (Table 5).

Figure 11 - Effects of inspection on employment according to hours contracted



Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample.

Figure 12 - Effects of inspection on employment by type of contract



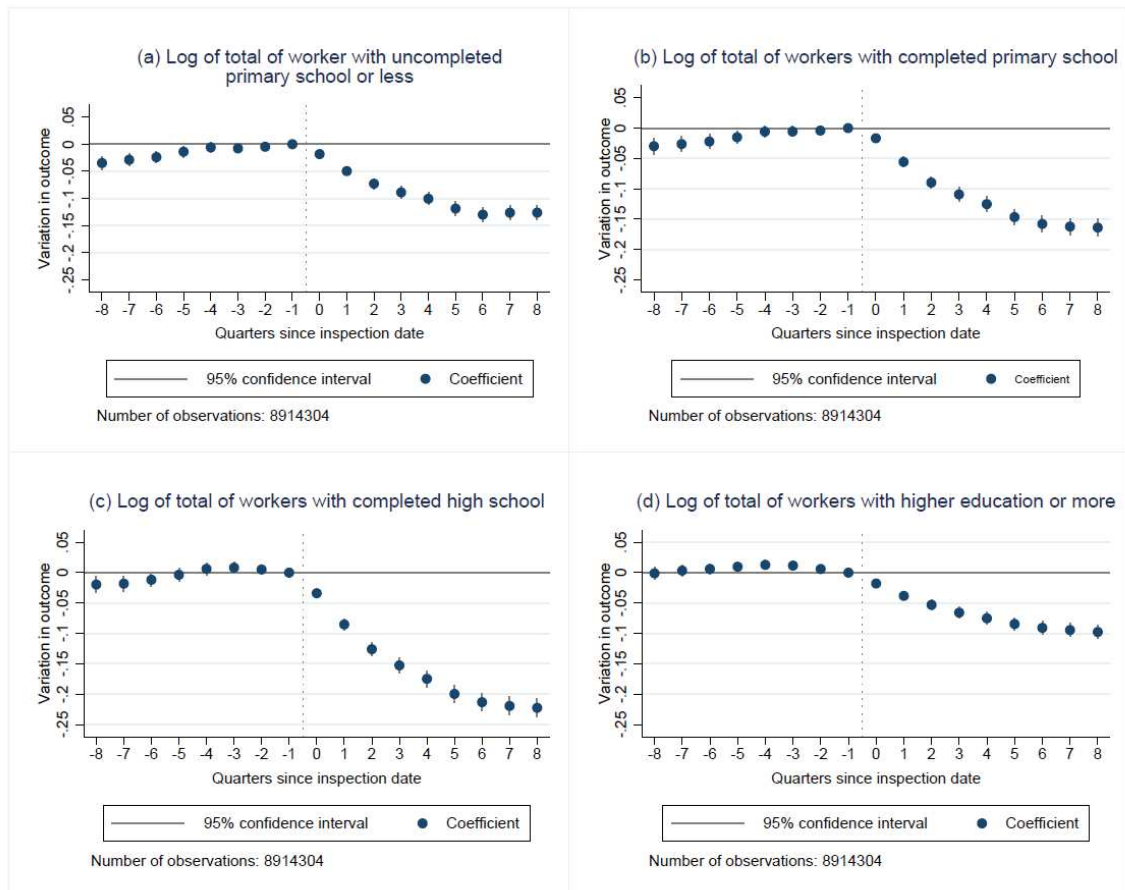
Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample.

Looking at the type of contracts, we subdivided them into CLT contract⁵ and other types of contracts, which includes more flexible contracts (such as temporary and *Jovem Aprendiz* contracts). In Figure 12 we see in Panel (a) a sharp decrease in CLT while increasing in other types of contracts in Panel (b). Considering all post-treatment periods,

⁵ That is, employees contracted under CLT regime, which should mean all guaranteed labor rights.

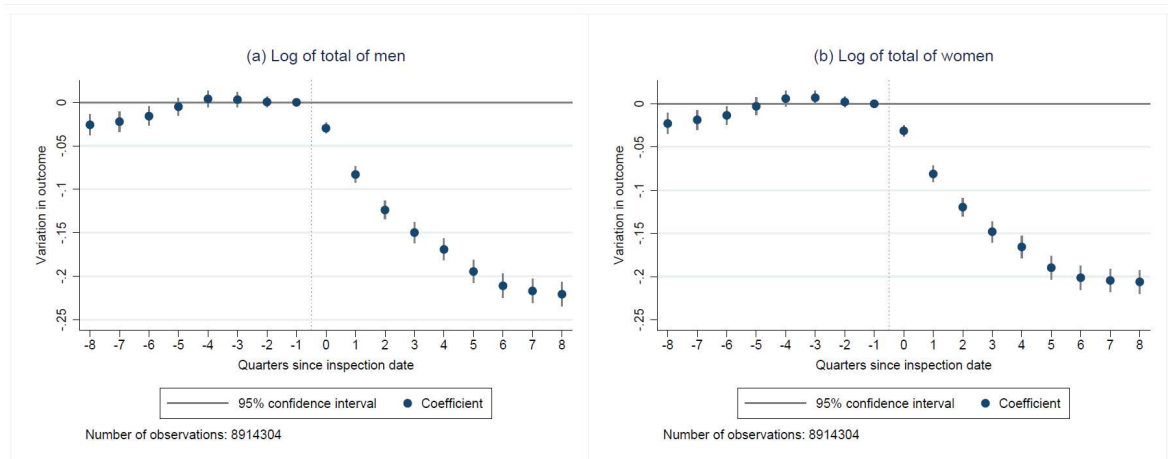
Table 19 (Appendix C), the effect is negative in CLT contract (-0.177) and positive to other contracts (0.0466). This suggests a replacement between more expensive contracts for cheaper contracts for firms. However, other types of contracts are scarce in companies. They do not make up 1% of all contracts.

Figure 13 - Effects of inspection on employment by schooling



Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample.

Figure 14 - Effects of inspection on employment by gender



Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample.

We then investigate how employment is affected according to workers' characteristics. In Figure 13 we see that the impact on employment is not the same across educational levels. The reduction is smaller among less educated workers and employees with higher education. On the other hand, workers with completed primary and high schools are the most affected. Regarding gender (Figure 14), the effect is the same for men and women.

The evidence presented above suggests a small change in employment composition when we analyze by pay ranges and contract characteristics (hours contracted and types of contracts). Our main hypothesis is that this change occurs due to the increase in labor costs caused by inspection. However, it is not possible to state that this is the only or main cause of the observed movement. For a robust analysis of the mechanism, it would be necessary to know the companies' costs. But, we do not have access to such information from the database used (RAIS).

6.3 HETEROGENEITY

Turning to heterogeneous effects based on firms' characteristics, we investigate whether some establishment groups are affected differently by inspection actions.

First, considering firm size, Table 7 reports the estimates of outcome variables to three sizes of groups: 10 to 50 employees, 51 to 100 employees and more than 100 employees⁶. There is evidence of heterogeneous impacts. Establishments with 50 to 100 employees are more affected in employment, hiring and firing. Only for wages that the

⁶ Figures 19, 20 and 21 in Appendix C reports event study coefficients.

Table 7 – Heterogeneous effects by size

	(1)	(2)	(3)	(4)
	Log Employment	Log Hiring	Log Separation	Log Average Real Wage
Panel A: 10 to 50 employees				
Post_Inspection	-0.0722*** (0.00291)	-0.0980*** (0.00241)	-0.0205*** (0.00223)	-0.0139*** (0.00302)
Observations	8,101,460	8,101,460	8,101,460	8,101,460
Number of firms	260,478	260,478	260,478	260,478
Panel B: 50 to 100 employees				
Post_Inspection	-0.162*** (0.0124)	-0.182*** (0.0106)	-0.0706*** (0.0100)	-0.00411*** (0.0131)
Observations	485,500	485,500	485,500	485,500
Number of firms	17,341	17,341	17,341	17,341
Panel C: More than 100 employees				
Post_Inspection	-0.134*** (0.0518)	-0.0751 (0.0961)	-0.167 (0.113)	-0.0947*** (0.0215)
Observations	421,800	421,800	421,800	421,800
Number of firms	13,726	13,726	13,726	13,726
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes

Note: All estimates include time and firm fixed effects. Robust standard errors in parentheses. *** denotes $p < 0.01$, ** denotes $p < 0.05$ and * denotes $p < 0.1$. All specification include controls and fixed effects. Regressions weighted for firm size on baseline. Statistics from sample containing firms inspected once or never inspected between 2007 and 2017 with 10 to 500 employees in the baseline.

most affected companies are the ones with more than 100 employees. This suggests that firms of different sizes react differently to inspections.

Second, we look at possible differences between sectors (converting industry, construction, trade, services and other)⁷. According to estimates in Table 8, construction is the sector more affected in employment, hiring and separation (reduction about 22.89%, 32.43% and 13.84% respectively). Service is the second most affected sector. In 2012, the construction and services sectors were among the 3 with the highest proportion of workers without a formal contract, only behind the agriculture sector (IBGE, 2013). This result is consistent with the hypothesis that establishments with more irregularities are more affected by inspections.

⁷ Figures 22, 23, 24, 25 and 26 in Appendix C reports event study coefficients.

Table 8 – Heterogeneous effects by economic activity

	(1)	(2)	(3)	(4)
	Log Employment	Log Hiring	Log Separation	Log Average Real Wage
Panel A: Industry				
Post_Inspection	-0.116*** (0.0106)	-0.147*** (0.00923)	-0.0348*** (0.00882)	0.00169 (0.0114)
Observations	2,047,260	2,047,260	2,047,260	2,047,260
Number of firms	70,780	70,780	70,780	70,780
Panel B: Construction				
Post_Inspection	-0.260*** (0.0339)	-0.392*** (0.0345)	-0.149*** (0.0339)	-0.0103 (0.0413)
Observations	247,540	247,540	247,540	247,540
Number of firms	13,408	13,408	13,408	13,408
Panel C: Trade				
Post_Inspection	-0.0752*** (0.00733)	-0.0994*** (0.00598)	-0.0123** (0.00583)	0.00776 (0.00720)
Observations	2,499,972	2,499,972	2,499,972	2,499,972
Number of firms	88,978	88,978	88,978	88,978
Panel D: Services				
Post_Inspection	-0.163*** (0.00860)	-0.168*** (0.00858)	-0.120*** (0.00919)	-0.0397 (0.00643)
Observations	4,055,000	4,055,000	4,055,000	4,055,000
Number of firms	132,516	132,516	132,516	132,516
Panel E: Others activity				
Post_Inspection	-0.0587 (0.0508)	-0.138*** (0.0535)	-0.104* (0.0595)	-0.00954 (0.0764)
Observations	64,532	64,532	64,532	64,532
Number of firms	2,306	2,306	2,306	2,306
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes

Note: All estimates include time and firm fixed effects. Robust standard errors in parentheses. *** denotes $p < 0.01$, ** denotes $p < 0.05$ and * denotes $p < 0.1$. All specification include controls and fixed effects. Regressions weighted for firm size on baseline. Statistics from sample containing firms inspected once or never inspected between 2007 and 2017 with 10 to 500 employees in the baseline.

7 CONCLUSIONS

Although inspection is widely used as an instrument that aims to increase compliance with labor laws, there are still some gaps in understanding how firms' decisions are affected by this policy. Exploiting the fact that firms are not informed about the inspection action in Brazilian context, we use a novel data at the establishment-level and adopt an event study/difference-in-difference approach to investigate how inspection impacts firms' outcomes.

When compared to firms never inspected or not yet inspected, we find that inspected companies experience considerable and negative post-inspection impacts on size, hiring, separation, and a small magnitude on wages. One quarter post-inspection, the effect is about -9.39% in total number of employees, 11.48% in hiring and 3.05% on separation. The average effect for these outcomes is a decrease of -16.47%, 17.39% and 11.31%, respectively. The smaller effect is on wage, a reduction of 4.26%. Looking at heterogeneities, we find that the companies most affected are those with 50 to 100 employees and those in the construction and services sector.

There are at least two mechanisms through which inspections affect companies. The first is due to a possible increase in companies' costs, either with labor or with penalties. On the other hand, the second may occur due to the difficulty of access by employing informal labor. Both channels are discussed by Almeida and Carneiro (2009) and Almeida and Carneiro (2012).

As a second step, we focus on understanding if there is any evidence of changes in the adjustment of labor or composition in response to the possible increase in costs linked to inspection. To do this, we analyze how employment alters according to the characteristics of contracts and workers. Our results suggest a preference for more flexible and probably cheaper contracts such as temporary and with fewer hours contracted.

We contributed to the literature by analyzing the research problem from information at the firm level, which allowed us to apply an identification strategy different from those commonly seen in the correlated literature. Our evidence is in line with that presented by Almeida and Carneiro (2009), but it differs from some results present by Almeida and Carneiro (2012) and Abras et al. (2018).

We believe that this divergence may occur due to two reasons. Firstly, the level of analysis, all three works use aggregated information at the city-level while we use firm-level data, as we cited before. Secondly, the sector analyzed, we were only able to focus on formal sector while Almeida and Carneiro (2009) and Almeida and Carneiro (2012) study all economy.

Our results are limited to the effect of the inspection on the companies that received it, which we call direct effects, while the other authors estimate the average treatment

effect (ATE). Thus, we indicate that there may be a difference in magnitude and direction between the direct effect of the inspection and the spillovers or peer effects.

Actions that encourage compliance are important to provide minimum conditions for workers. However, policymakers must consider the effects of inspections on companies since they impact firms' decisions in both the short and long term (because companies are affected for at least two years after inspection).

The main limitation of this work is that it has not yet been possible to carry out an analysis of the mechanisms. We hope to do this by accessing data with companies' cost, revenue and profit information. Besides, our results are restricted to our sample, that is, companies with 10 to 500 employees who were inspected only once between 2007 and 2017. There is still a long way to understand what incentives are generated in each part of the inspection process.

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APPENDIX A – Labor Fines

Table 9 – Administrative fines - fixed value

Topic	Amount	Note
13 ^o wage	R\$ 170,26	Per employee. Double on recidivism
Late payment of wages	R\$ 170,26	Per employee
Vacation	R\$ 170,26	Per employee. Double on recidivism
Non-payment of severance payments	R\$ 170,26	Per employee
Transportation vouchers	R\$ 170,26	Per employee. Double on recidivism
Unregistered employee	R\$ 3.000,00 ^a	Per employee. Double on recidivism
	R\$ 800,00 ^b	Per employee. Double on recidivism
Lack of recording of employee's work card	R\$ 402,53	-
Failure to update the Employee Registration Book	R\$ 600,00	Per employee
Underage employee	R\$ 402,53	Per irregular underage worker up to a maximum of R\$ 2.012,66 when a primary offender. This maximum was doubled in recidivism

^a Medium and large firm

^b Micro and small firm

Table 10 – Administrative fines - variable value (depends on the size of the company)

Topic	Minimum value	Maximum value	Note
Working hours	R\$ 40,25	R\$ 4.025,33	Double on recidivism
Union contribution	R\$ 8,05	R\$ 8.050,66	
FGTS	R\$ 2,13	R\$ 106,41	Per employee. Double on recidivism or fraud
Inspections	R\$ 201,27	R\$ 2.012,66	-
Error, omission, lack or false statement - RAIS	R\$ 425,64	R\$ 42.564	Double on recidivism
Minimum wage	R\$ 40,25	R\$ 1.610,13	Double on recidivism
Unemployment insurance	R\$ 425,26	R\$ 42.564,00	Double on recidivism
Health and safety at work	R\$ 402,53	R\$ 6.708,88	Maximum value in case of recidivism

APPENDIX B – Data

Among other things, the employer reports information about the date of hiring and the date of dismissal (if applicable) of each employee. The first step was to create monthly variables using old variables of dates as a base (like hiring and firing). For example, we created a variable named "*worker_January*" which equals 1 if the employee was in that firm on January. Another example, we create a variable named "*education1_January*" which equals 1 if the employee was in that firm on January and he has educational level equivalent to illiterate or incomplete elementary school. The same was done for other variables, which will be described below, and for all months. In the second step, we group worker information to represent the firm. For the same examples before, we had variable "*sum_worker_January*" count total of employees in the firm on January and a variable "*sum_education1_January*" counting total of employees illiterate or with incomplete elementary school in the firm on January too. The third step was to turn the data into a monthly panel and join the data from 2007 to 2017. Finally, we group the data at the firm-quarter level.

Below we have the description of all variables present in the database:

Table 11 – Variables definition - part 1

Variable	Definition
ID	Firm identifier
Year	-
Quarter	Number represent the quarter
Date	Date in year/quarter format
Activity code (CNAE)	Code of the activity performed by the company following the IBGE classification
City code	City code following the IBGE classification
Firm size	Firm size by number of workers (RAIS categorical variable)
Employment_31dec	Total of workers on December 31
Hours	Average hours contracted by firm
Real wage	Average real wage in the firm
Worker	Average number of workers in the firm in the quarter
Hire	Total of workers hired in the firm in the quarter
Separation	Total of workers fired in the firm in the quarter
Schooling 1	Average number of workers illiterate or with incomplete elementary education in the firm in the quarter
Schooling 2	Average number of workers with complete primary education in the firm in the quarter
Schooling 3	Average number of workers with complete high school in the firm in the quarter
Schooling 4	Average number of workers with undergraduate complete or more in the firm in the quarter
Hour 44	Average number of workers with contracts of 44 hours/week in the firm in the quarter
Hour less 44	Average number of workers with contracts of less than 44 hours/week in the firm in the quarter
Contract 1	Average number of workers with undetermined CLT contract in the firm in the quarter
Contract 2	Average number of workers with determined CLT contract in the firm in the quarter
Contract 3	Average number of workers with apprentice contract in the firm in the quarter
Contract 4	Average number of workers with temporary or detached contract in the firm in the quarter
Contract 5	Average number of workers with non-CLT contract in the firm in the quarter
Contract 6	Average number of workers with director contract in the firm in the quarter

Table 12 – Variables definition - part 2

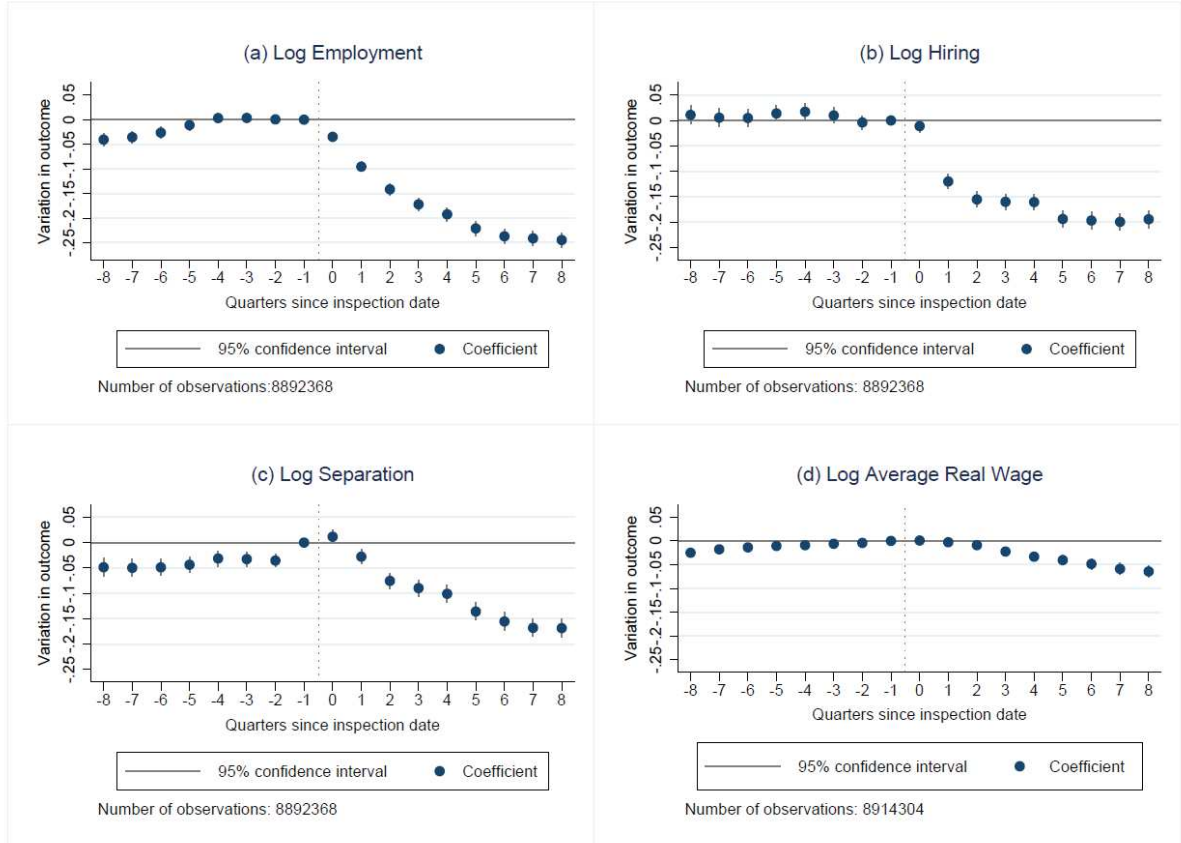
Variable	Definition
Wage 1	Average number of workers with real wages of up to R\$ 500 in the firm in the quarter
Wage 2	Average number of workers with real wages of R\$ 500 to R\$ 1,000 in the firm in the quarter
Wage 3	Average number of workers with real wages of R\$ 1,000 to R\$ 2,500 in the firm in the quarter
Wage 4	Average number of workers with real wages of more than R\$ 2,500 in the firm in the quarter
Men	Average number of male workers in the firm in the quarter
Women	Average number of female workers in the firm in the quarter
Age 21	Average number of workers under 21 years old in the firm in the quarter
Age 22 to 30	Average number of workers 22 to 30 years old in the firm in the quarter
Age 31 to 50	Average number of workers 31 to 50 years old in the firm in the quarter
Age 50 more	Average number of workers over 50 years old in the firm in the quarter
Group CBO 1	Average number of workers employed in the large group CBO 1 in the firm in the quarter
Group CBO 2	Average number of workers employed in the large group CBO 2 in the firm in the quarter
Group CBO 3	Average number of workers employed in the large group CBO 3 in the firm in the quarter
Group CBO 4	Average number of workers employed in the large group CBO 4 in the firm in the quarter
Group CBO 5	Average number of workers employed in the large group CBO 5 in the firm in the quarter
Group CBO 6	Average number of workers employed in the large group CBO 6 in the firm in the quarter
Group CBO 7	Average number of workers employed in the large group CBO 7 in the firm in the quarter
Group CBO 8	Average number of workers employed in the large group CBO 8 in the firm in the quarter
Group CBO 9	Average number of workers employed in the large group CBO 9 in the firm in the quarter
Tenure 1	Average number of workers with up to 1 year of employment in the firm
Tenure 2	Average number of workers with 1 to 2 years of employment in the firm
Tenure 3	Average number of workers with 2 to 5 years of employment in the firm
Tenure 4	Average number of workers with 5 to 10 years of employment in the firm
Tenure 5	Average number of workers with employment time of more than 10 years in the firm
Accident leave	Total of workers on leave due to occupational accident in the firm in the quarter
Separation for accident	Total of workers fired due to occupational accident in the firm in the quarter
Maternity leave	Total of workers on leave due to maternity in the firm in the quarter
Sick leave	Total of workers on leave due to non-occupational sick in the firm in the quarter

Table 13 – Variables definition - part 2

Variable	Definition
Inspection	Dummy equals 1 if firm was inspected in the quarter
Notification	Dummy equals 1 if firm was notified in the quarter
Health	Dummy equals 1 if firm was notified by workers health and safety in the quarter
Informality	Dummy equals 1 if firm was notified by informal worker in the quarter
Contributions	Dummy equals 1 if firm was notified by irregular contributions in the quarter
Working time	Dummy equals 1 if firm was notified by irregularities in hours of work, rest or vacation in the quarter
Remuneration	Dummy equals 1 if firm was notified by irregular remuneration in the quarter
Other	Dummy equals 1 if firm was notified for other reasons in the quarter

APPENDIX C – Additional results

Figure 15 - Effects of inspection on firms outcome - include specific fixed effects



Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time, firm, sector and region fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample.

Table 14 – Effects of inspection on firms outcome - include specific fixed effects

	(1)	(2)	(3)	(4)
	Log Employment	Log Hiring	Log Separation	Log Average Real Wage
Post_Inspection	-0.167*** (0.00560)	-0.181*** (0.00532)	-0.106*** (0.00556)	-0.0363*** (0.00471)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes
State x date FE	Yes	Yes	Yes	Yes
Sector x date FE	Yes	Yes	Yes	Yes
Observations	8,914,304	8,914,304	8,914,304	8,914,304
Number of firms	288,896	288,896	288,896	288,896

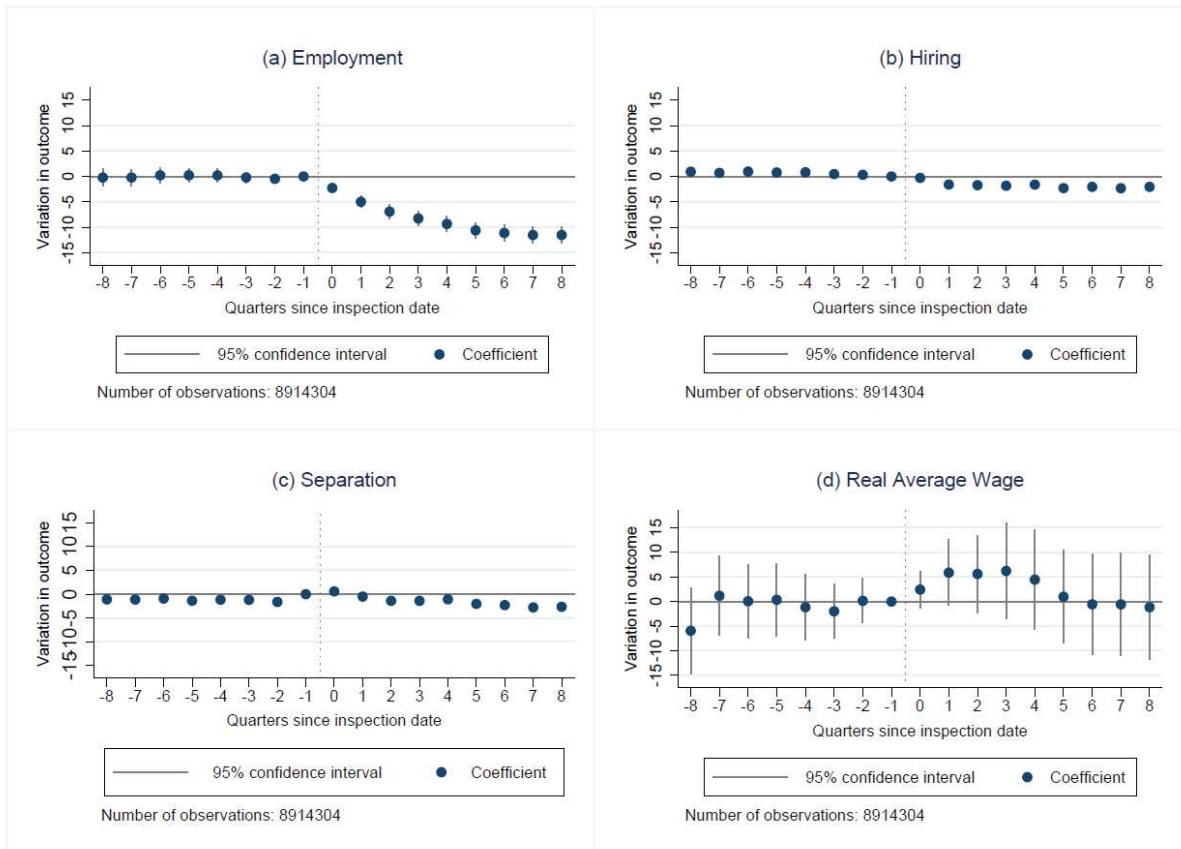
Note: All estimates include time and firm fixed effects. Robust standard errors in parentheses. *** denotes $p < 0.01$, ** denotes $p < 0.05$ and * denotes $p < 0.1$. All specification include controls and fixed effects. Regressions weighted for firm size on baseline. Statistics from sample containing firms inspected once or never inspected between 2007 and 2017 with 10 to 500 employees in the baseline.

Table 15 – Effects of inspection on firms outcome - other variable measures

	(1)	(2)	(3)	(4)
	Employment	Hiring	Separation	Average Real Wage
Post_Inspection	-9.993*** (0.897)	-2.596*** (0.191)	-1.517*** (0.196)	-3.041 (4.740)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes
Observations	8,914,304	8,914,304	8,914,304	8,914,304
Number of firms	288,896	288,896	288,896	288,896

Note: All estimates include time and firm fixed effects. Robust standard errors in parentheses. *** denotes $p < 0.01$, ** denotes $p < 0.05$ and * denotes $p < 0.1$. All specification include controls and fixed effects. Regressions weighted for firm size on baseline. Statistics from sample containing firms inspected once or never inspected between 2007 and 2017 with 10 to 500 employees in the baseline.

Figure 16 - Effects of inspection on firms outcome - other variable measures



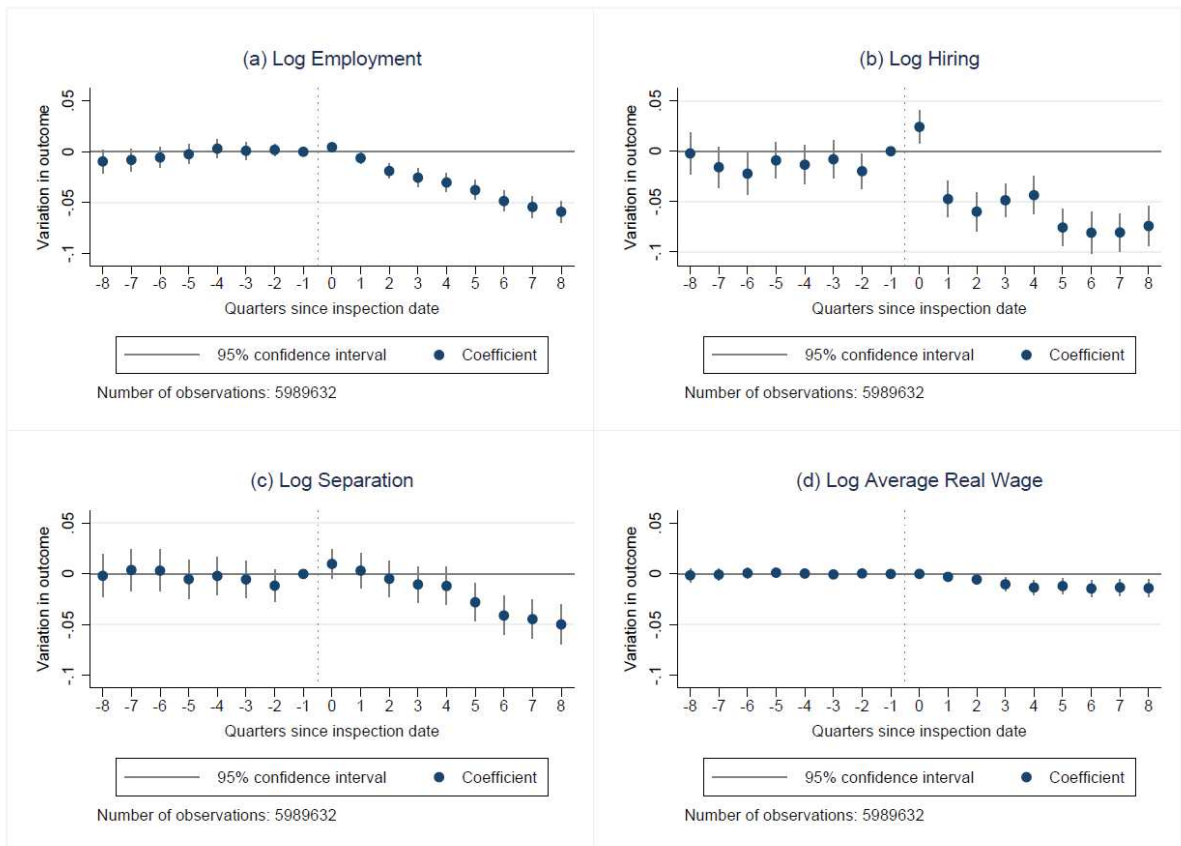
Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample. Variables without logarithmic transformation.

Table 16 – Effects of inspection on firms outcome - firms stayers

	(1)	(2)	(3)	(4)
	Log Employment	Log Hiring	Log Separation	Log Average Real Wage
Post_Inspection	-0.0543*** (0.00566)	-0.0879*** (0.00604)	-0.0615*** (0.00656)	-0.0216*** (0.00487)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes
Observations	5,989,632	5,989,632	5,989,632	5,989,632
Number of firms	136,128	136,128	136,128	136,128

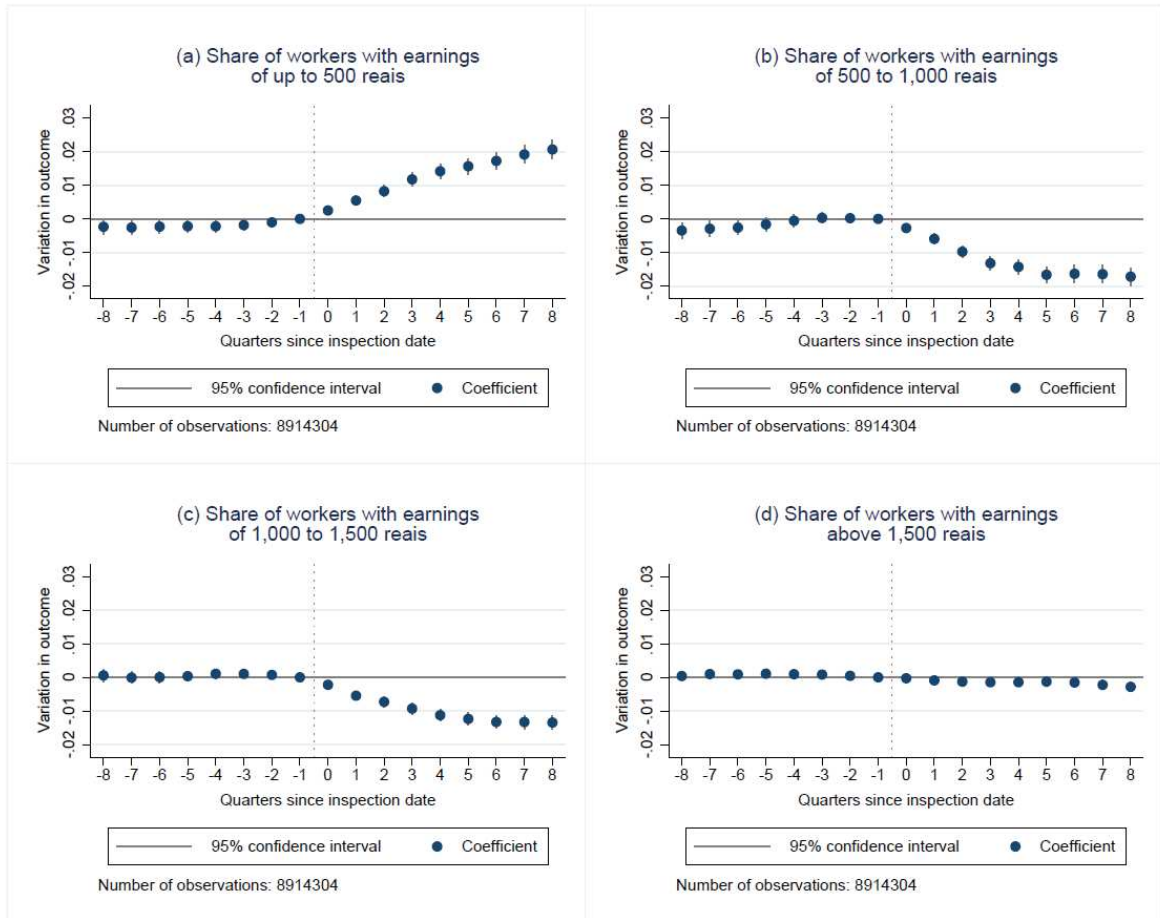
Note: All estimates include time and firm fixed effects. Robust standard errors in parentheses. *** denotes $p < 0.01$, ** denotes $p < 0.05$ and * denotes $p < 0.1$. All specification include controls and fixed effects. Regressions weighted for firm size on baseline. Statistics from sample containing firms stayers inspected once or never inspected between 2007 and 2017 with 10 to 500 employees in the baseline.

Figure 17 - Effects of inspection on firms outcome - firms stayers



Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample with only firms stayers in all periods.

Figure 18 - Effects of inspection on employment by earnings range



Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using the main sample

Table 17 – Effects of inspection on employment by earnings range

	(1)	(2)
	Earnings up to 1,000 <i>reais</i>	Earnings above 1,000 <i>reais</i>
Post_Inspection	-0.131*** (0.00536)	-0.165*** (0.00626)
Controls	Yes	Yes
Firm FE	Yes	Yes
Date FE	Yes	Yes
Observations	8,914,304	8,914,304
Number of firms	288,896	288,896

Note: All estimates include time and firm fixed effects. Robust standard errors in parentheses. *** denotes $p < 0.01$, ** denotes $p < 0.05$ and * denotes $p < 0.1$. All specification include controls and fixed effects. Regressions weighted for firm size on baseline. Statistics from sample containing firms inspected once or never inspected between 2007 and 2017 with 10 to 500 employees in the baseline.

Table 18 – Effects of inspection on employment according to hours contracted

	(1)	(2)
	44-hour	Less than 44 hours
Post_Inspection	-0.173*** (0.00936)	-0.0180*** (0.00651)
Controls	Yes	Yes
Firm FE	Yes	Yes
Date FE	Yes	Yes
Observations	8,914,304	8,914,304
Number of firms	288,896	288,896

Note: All estimates include time and firm fixed effects. Robust standard errors in parentheses. *** denotes $p < 0.01$, ** denotes $p < 0.05$ and * denotes $p < 0.1$. All specification include controls and fixed effects. Regressions weighted for firm size on baseline. Statistics from sample containing firms inspected once or never inspected between 2007 and 2017 with 10 to 500 employees in the baseline.

Table 19 – Effects of inspection on employment by type of contract

	(1)	(2)	(3)
	CLT contract	non-CLT contract	Other contracts
Post_Inspection	-0.177*** (0.00689)	-0.0126*** (0.00476)	0.0466*** (0.00370)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Date FE	Yes	Yes	Yes
Observations	8,914,304	8,914,304	8,914,304
Number of firms	288,896	288,896	288,896

Note: All estimates include time and firm fixed effects. Robust standard errors in parentheses. *** denotes $p < 0.01$, ** denotes $p < 0.05$ and * denotes $p < 0.1$. All specification include controls and fixed effects. Regressions weighted for firm size on baseline. Statistics from sample containing firms inspected once or never inspected between 2007 and 2017 with 10 to 500 employees in the baseline.

Table 20 – Effects of inspection on employment by schooling

	(1)	(2)	(3)	(4)
	Uncompleted primary school	Completed primary school	Completed high school	Higher education
Post_Inspection	-0.0842*** (0.00540)	-0.109*** (0.00567)	-0.162*** (0.00610)	-0.0794*** (0.00471)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes
Observations	8,914,304	8,914,304	8,914,304	8,914,304
Number of firms	288,896	288,896	288,896	288,896

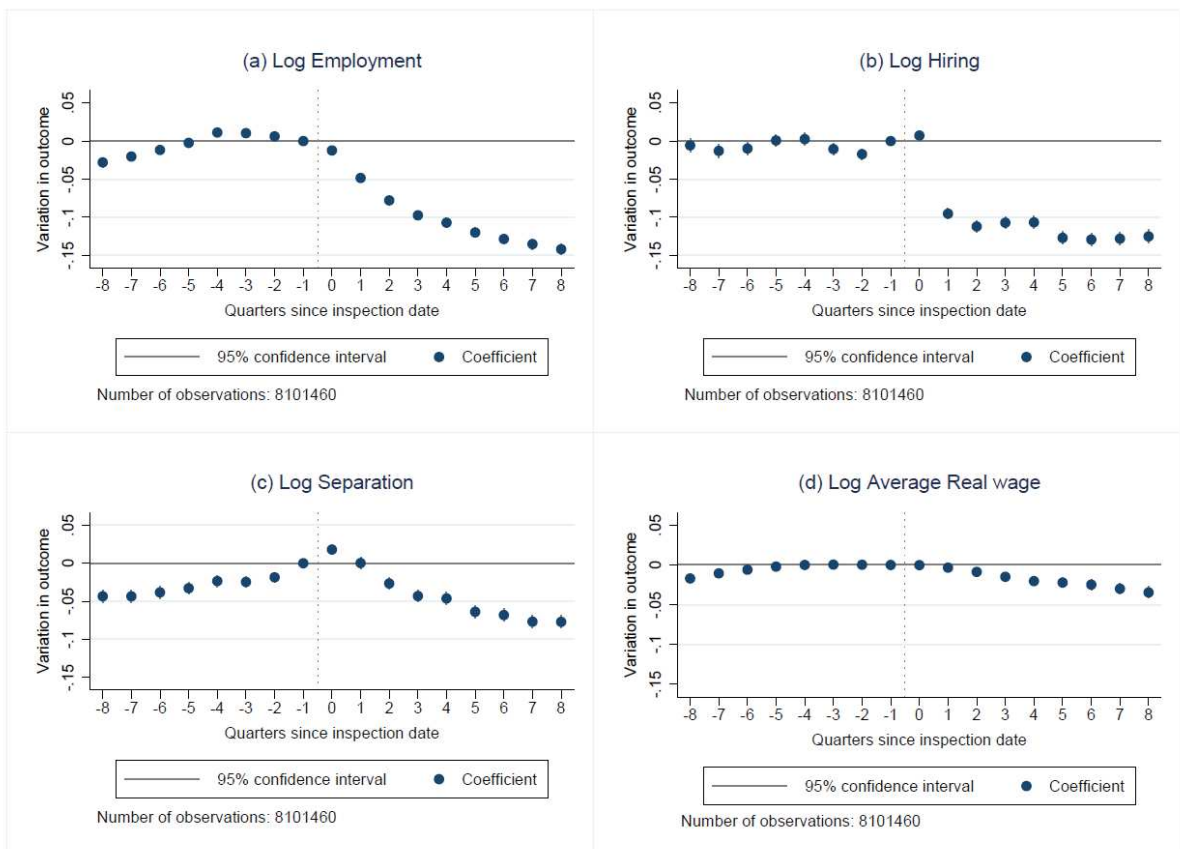
Note: All estimates include time and firm fixed effects. Robust standard errors in parentheses. *** denotes $p < 0.01$, ** denotes $p < 0.05$ and * denotes $p < 0.1$. All specification include controls and fixed effects. Regressions weighted for firm size on baseline. Statistics from sample containing firms inspected once or never inspected between 2007 and 2017 with 10 to 500 employees in the baseline.

Table 21 – Effects of inspection on employment by gender

	(1)	(2)
	Men	Women
Post_Inspection	-0.160*** (0.00525)	-0.149*** (0.00526)
Controls	Yes	Yes
Firm FE	Yes	Yes
Date FE	Yes	Yes
Observations	8,914,304	8,914,304
Number of firms	288,896	288,896

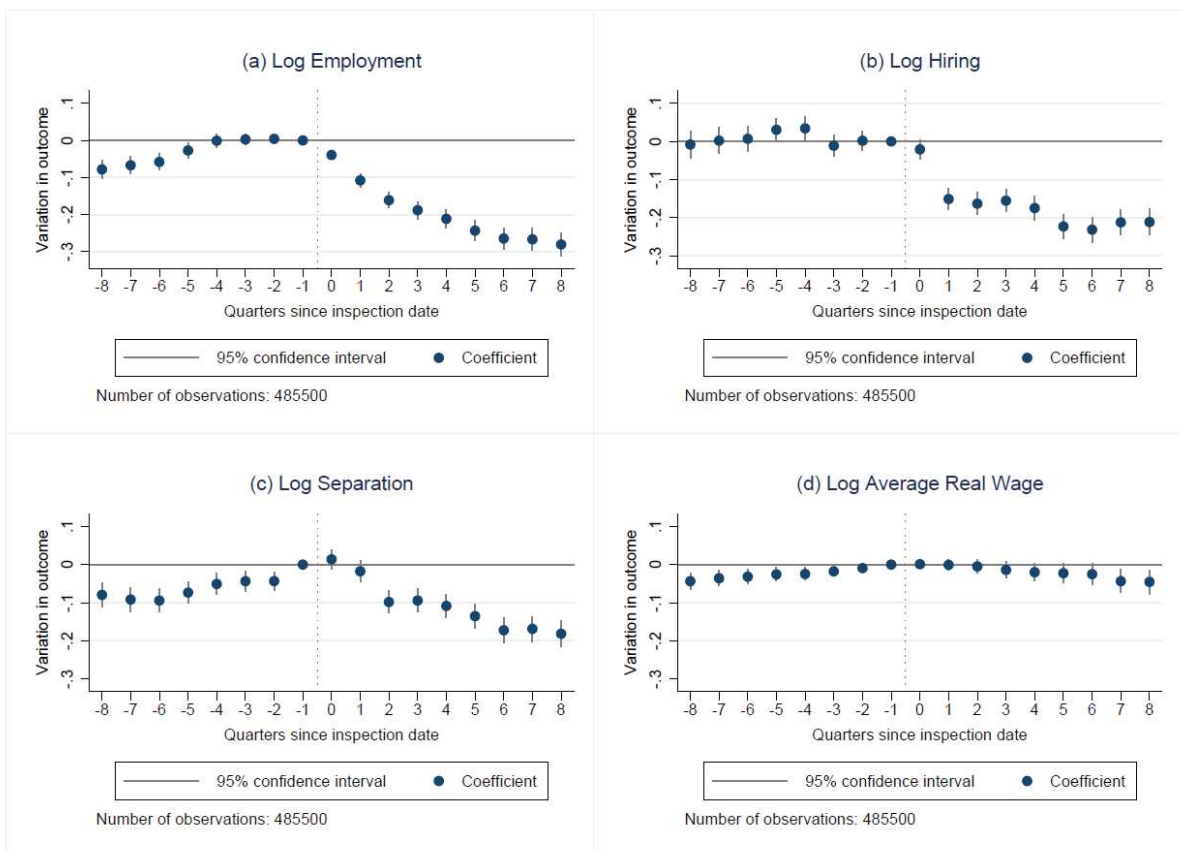
Note: All estimates include time and firm fixed effects. Robust standard errors in parentheses. *** denotes $p < 0.01$, ** denotes $p < 0.05$ and * denotes $p < 0.1$. All specification include controls and fixed effects. Regressions weighted for firm size on baseline. Statistics from sample containing firms inspected once or never inspected between 2007 and 2017 with 10 to 500 employees in the baseline.

Figure 19 - Heterogeneous effects of inspection on firms outcomes by size - 10 to 50 employees



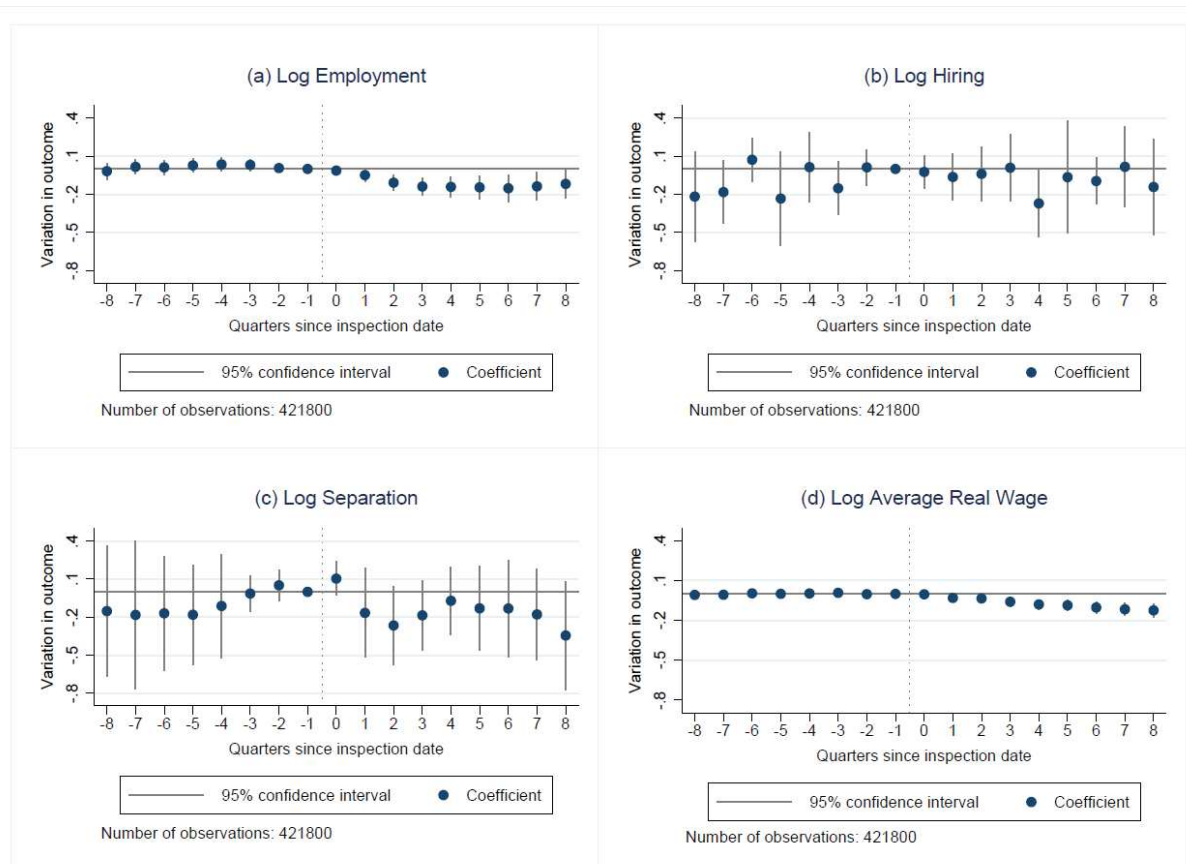
Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using firms with 10 to 50 employees from the main sample.

Figure 20 - Heterogeneous effects of inspection on firms outcomes by size - 50 to 100 employees



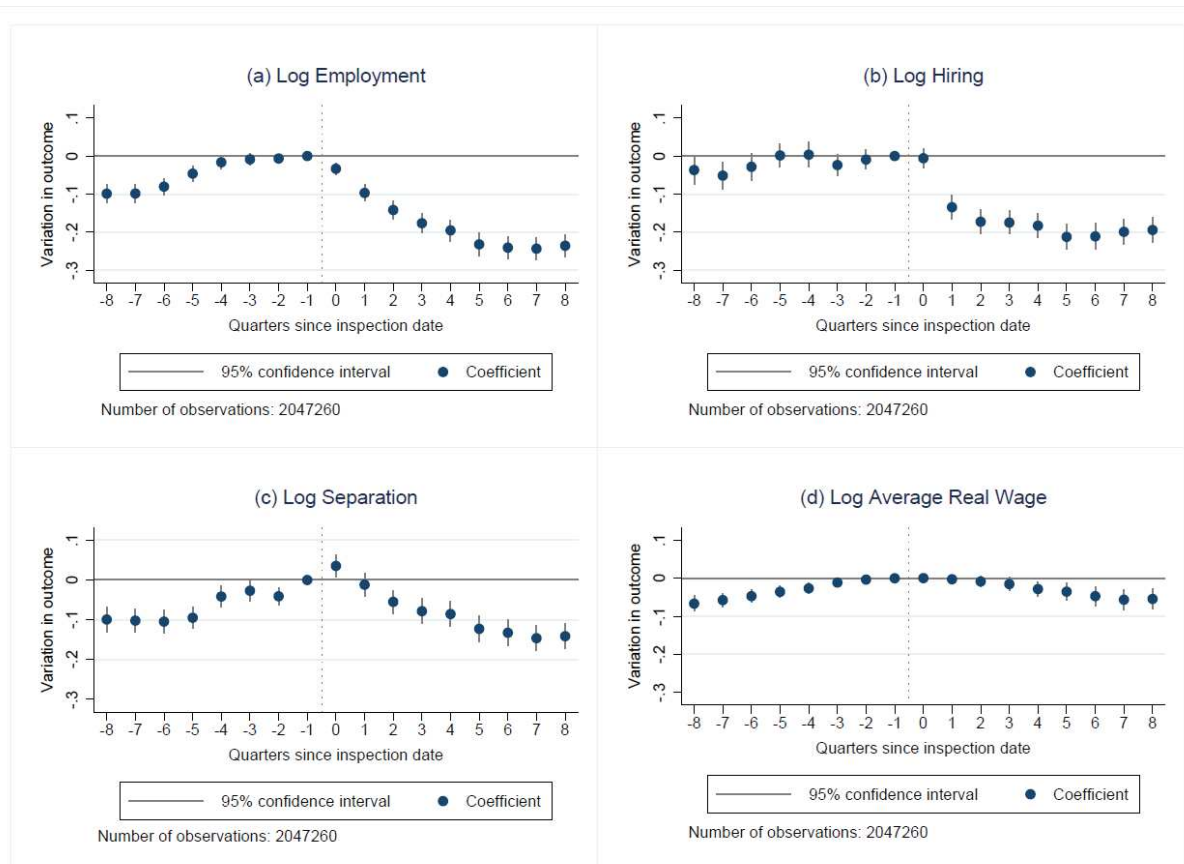
Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using firms with 50 to 100 employees from the main sample.

Figure 21 - Heterogeneous effects of inspection on firms outcomes by size - more than 100 employees



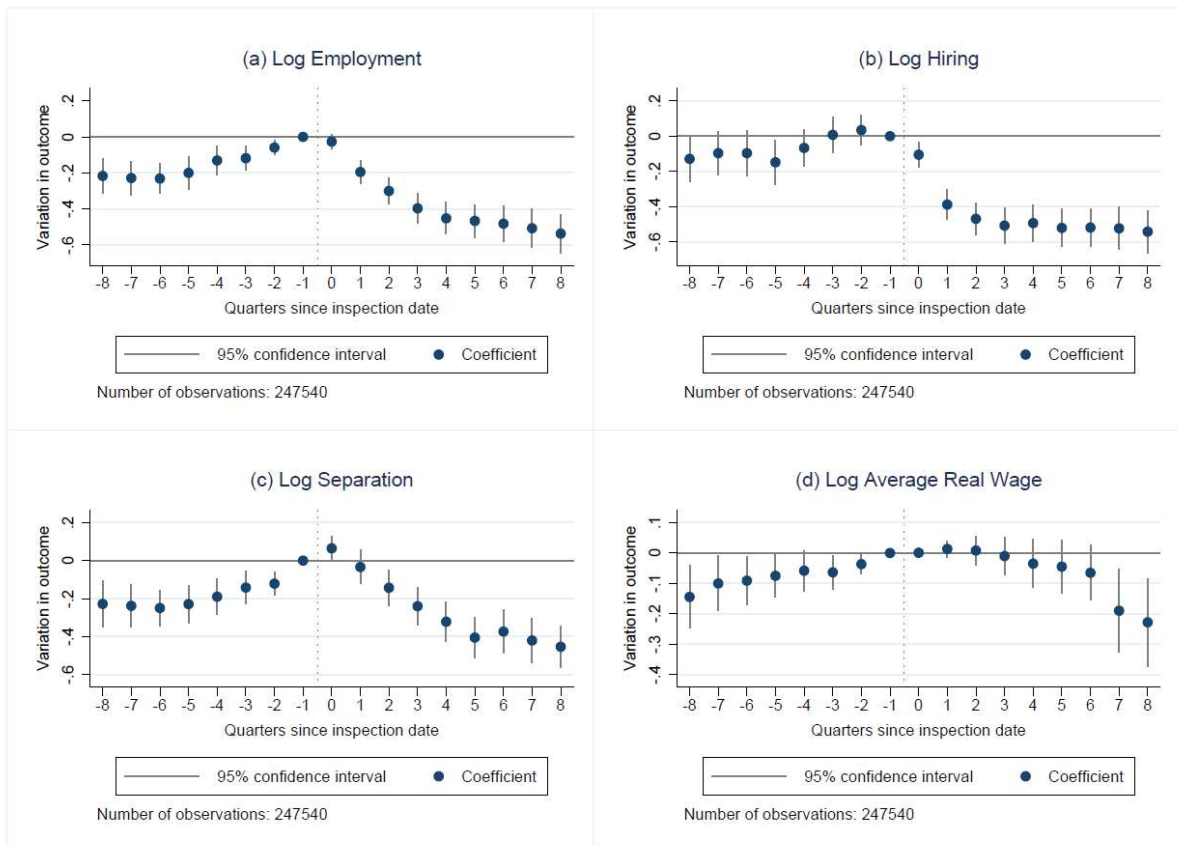
Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using firms with more than 100 employees from the main sample.

Figure 22 - Heterogeneous effects of inspection on firms outcomes by economic activity - Industry



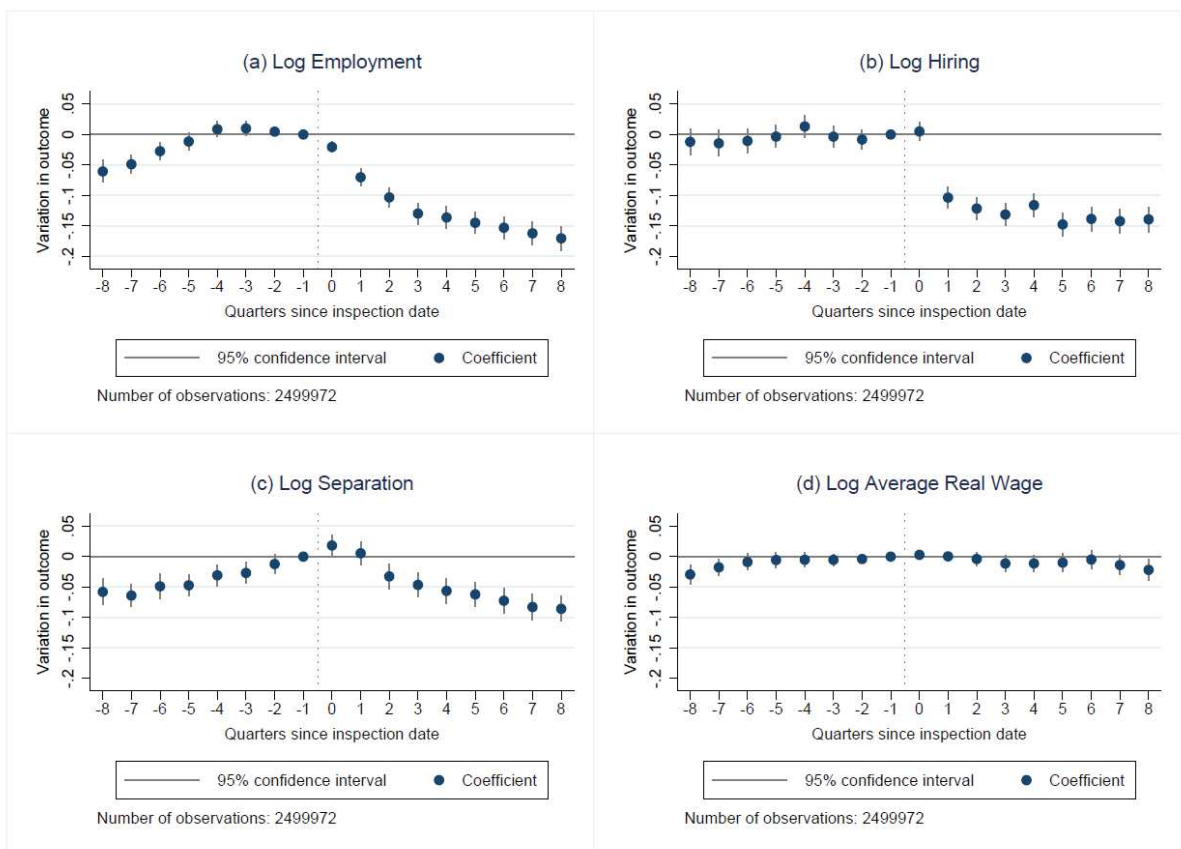
Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using industrial sector companies from the main sample.

Figure 23 - Heterogeneous effects of inspection on firms outcomes by economic activity - Construction



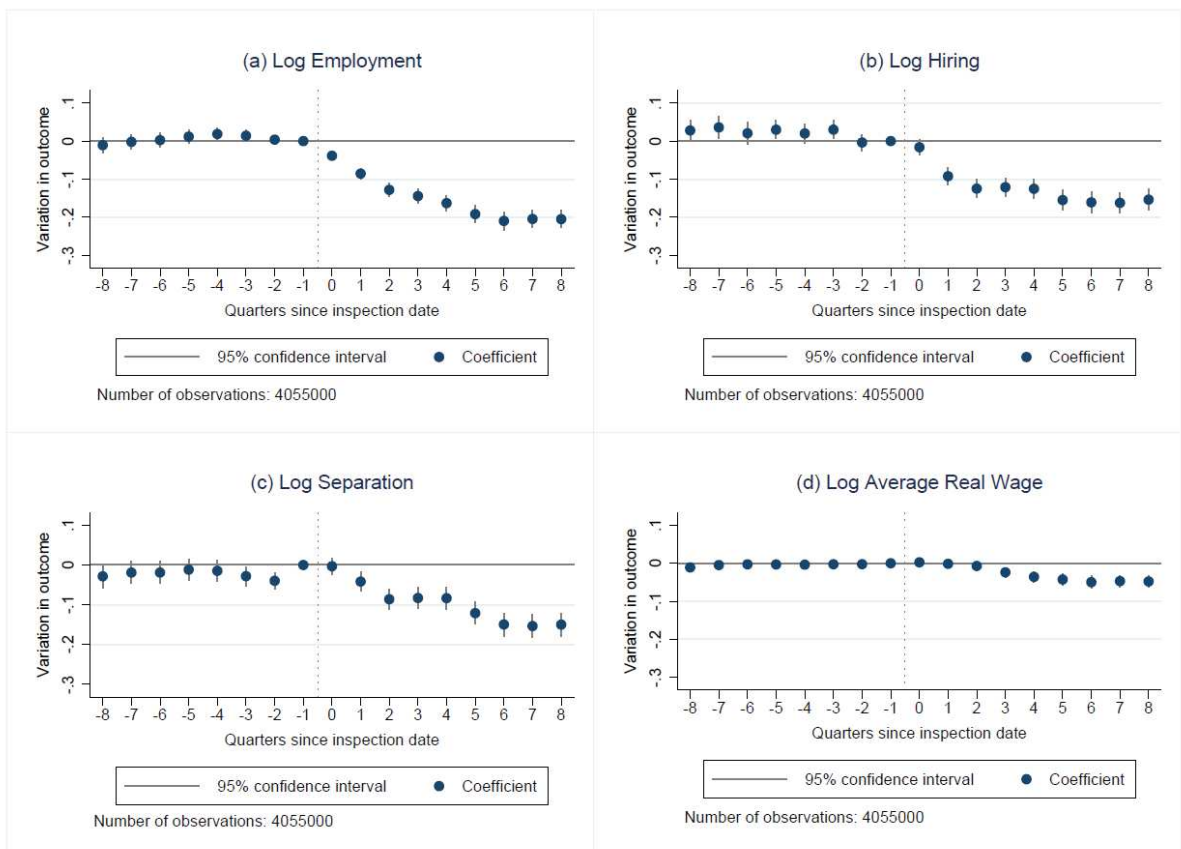
Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using industrial sector companies from the main sample. Estimates using construction companies from the main sample.

Figure 24 - Heterogeneous effects of inspection on firms outcomes by economic activity - Trade



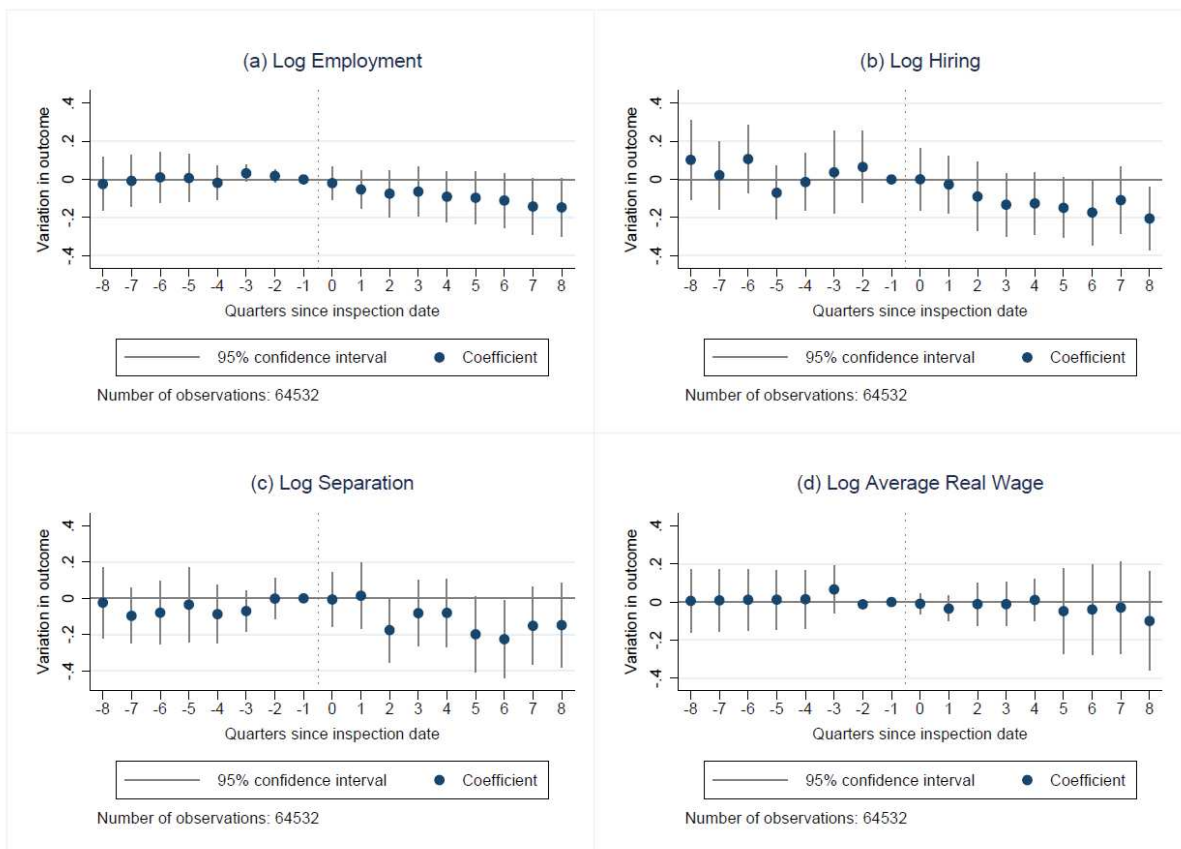
Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using industrial sector companies from the main sample. Estimates using trade companies from the main sample.

Figure 25 - Heterogeneous effects of inspection on firms outcomes by economic activity - Services



Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using industrial sector companies from the main sample. Estimates using service companies from the main sample.

Figure 26 - Heterogeneous effects of inspection on firms outcomes by economic activity - Other activities



Notes: The figure plots the estimated γ_k coefficients from a regression of the form given in Equation 5.1. The bands around the point estimates are 95 percent confidence intervals. Specification includes controls, time and firm fixed effects. Regressions weighted for firm size on baseline. The omitted category is the quarter before inspection. Estimates using industrial sector companies from the main sample. Estimates using companies from other sectors in the main sample.