Employer-Employee Collusion and Payments "Under the Table": Evidence from Brazil*

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Abstract

In this paper we study formal workers receiving part of their salary *off the books*, which we refer to as "payments under the table". We conducted a large survey among Brazilian formal workers to understand the extent and mechanics of this type of informality. We find that payments under the table are widespread, sizeable, and proportionally larger for higher income workers. Back of the envelope calculations suggest that payments under the table generate a revenue lost from income tax of around 6.8% of total revenues collected by the income tax. Arrangements involving these payments are typically suggested by the employer, with payments being typically made with cash or virtual payments, and are more widespread in industries with higher shares of informal workers. In addition, we study wage reporting dynamics around the ceiling of employee social security contributions, which can create incentives to collude between employers and employees to underreport wages. We find several patterns of earnings reporting that are consistent with employer and employees engaging in payments under the table. Finally, we incorporate novel data on labor lawsuits related to payments under the table to analyze the consequences of the breakdown of collusive underreporting.

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1 Introduction

Informality is a common feature of labor markets in developing countries. These informal work arrangements have been of interest to economists and policymakers alike, since they reduce tax collection, complicate the allocation of welfare expenditure, and exclude workers from the social security system. In addition, informality is often associated with lower productivity and earnings, leading to concerns regarding the potential misallocation of resources in the presence of a large informal sector.

The literature on informality has mainly focused on two types of informal employment: an "extensive" margin and an "intensive" margin. The traditional "extensive margin" defines informal workers as those who work in businesses that are not registered with the tax authorities and do not comply with labor market regulations (e.g. Rauch 1991). The "intensive margin" additionally considers informal workers, those not registered with the tax authorities even though they work at a registered establishment (e.g. Ulyssea 2018). These margins are often condensed in a definition of informal workers as those who do not contribute to social security (Bonnet et al. 2019). Underlying this definition, there is an assumption that formal workers employed in formal firms do not have any informal ties to their employer.

In this paper, we study an additional margin of informality that has received much less attention: formal workers in formal firms that receive part of their wages "off the books", which we refer to as "payments under the table" (PUT). Recent research has found evidence of underreporting of wages (e.g., Kumler et al. 2020, Bíró et al. 2022), which is often attributed to collusion between employers and employees to avoid taxes. Unreported wages potentially bear important revenue implications since unreported earnings are untaxed. Furthermore, collusive underreporting of wages also bears potentially important distributional implications, depending on how the spread and intensity of PUT vary across the earnings distribution. Finally, this type of informality potentially also bears important regulatory implications since collusive underreporting could respond to incentives set in various government regulations. How-

ever, little is known about this type of informality since it is not typically covered in usual data sources used to study informality such as labor force household surveys.

We begin by presenting the results of a novel large-scale survey we conducted in Brazil to document the prevalence and mechanics of payments "under the table". We find that PUT are widespread: 26% of formal employees admit to receiving a fraction of their salary off-the-books. In addition, among PUT receivers, the fraction of non-reported salary is substantial: the average PUT receiver reports receiving 22% of their labor earnings as PUT. Importantly, the fraction of earnings received as PUT is increasing in total labor earnings, which implies a regressive aspect of this type of collusive underreporting.[1]

We shed light on the mechanics of this type of informality. PUT receivers report cash and virtual payments as the most common method of disbursement of PUT. Moreover, PUT practice is more prevalent in small and medium firms, although still sizeable in large firms, and the share of PUT receivers by industry correlates with the share of informal employees. Importantly, we find that variables associated with bargaining and collusion –such as being an establishment manager– are good predictors of engaging in collusive underreporting.

With the results from our survey, we conduct a simulation exercise to assess the revenue implications of this type of collusive underreporting compared to "classic" informality.[2] We calculate the gains in revenue for income taxes and social security contributions if PUT were eliminated entirely with full compliance with earnings reporting, and compare this to the gains in revenue from formalizing all informal employees.[3] We find that revenue gains from income taxes are substantially greater from eliminating PUT compared to eliminating classic informality, which is driven by the

[1] This suggests that measures of wage inequality using administrative data in Brazil (e.g. Haanwinckel 2020, Engbom and Moser 2021) constitute an underestimation of the true degree of wage inequality.

[2] By "classic" informality we refer to employees who do not contribute to the social security system.

[3] For this exercise, we assume no deductions, no employment responses, and that the formalization of informal workers leaves their earnings unchanged except for workers earning less than the minimum wage, for whom we assume formalization would imply them earning the minimum wage.

fact that PUT are more widespread among high earners, while the revenue gains from social security contributions are smaller. Overall, PUT are almost 60% as costly as classic informality in terms of revenue lost.

To complement our survey evidence, we leverage administrative data to investigate the causes and consequences of PUT. First, we use employer-employee records for the universe of formal workers in Brazil to study a kink in the schedule of social security contributions that could induce incentives for collusive underreporting. Specifically, we study the earnings ceiling that determines the maximum pension for employees: employee's contributions are capped at that level, but employer payroll taxes are not. Thus, reporting higher earnings does not affect the employee's contributions or subsequent pension benefits, but the employer still has to pay payroll taxes on earnings above the ceiling. This, in turn, could create incentives to collude by reporting earnings up to the ceiling and disbursing any additional earnings in the form of PUT to avoid paying payroll taxes on earnings above the ceiling.[4]

We find several patterns of earnings reporting around the ceiling that are consistent with PUT, particularly in light of the survey evidence discussed above.[5] First, we document substantial bunching at earnings reported at the ceiling. This is the case for all years in the sample, even as the ceiling shifts over time to keep up with inflation. We also find that bunchers are likely to be managers and work in small firms, consistent with the survey evidence. In addition, the shares of bunchers are higher in industries with higher levels of classic informality, which is also consistent with the survey evidence. When zooming at within-worker variations in reported earnings over time, we find that bunchers are likely to only update reported earnings to match changes in the ceiling, despite the fact that the earnings of workers at other points in the distribution

[4]Note that the ceiling for the maximum pension does not coincide with any other relevant earnings threshold that could induce labor supply responses from workers (such as *notches* in the income tax schedule).

[5]For this exercise, we focus on workers above the age of 55, since they are the ones who are more likely to have incentives to report higher earnings to improve their pension benefits. Pension benefits in Brazil are determined by a replacement rate over the 80% years of highest earnings. Thus, given typical profiles of earnings, workers who are older are more likely to have incentives to report higher earnings for the purposes of improving their pension benefits.

show no such patterns. We interpret these findings as indicative of employers and employees engaging in PUT.

We then analyze how the breakdown of this type of collusive underreporting affects subsequent wage-reporting behavior. Specifically, we analyze the effects of a firm being sued by a worker due to alleged payments under the table on the subsequent reported wages, both of incumbent workers in the sued firm and of workers in non-sued firms that have an owner in common with the sued firm. To this end, we incorporate rich administrative data on the universe of lawsuits related to payments under the table, which we merge to our administrative labor market data using worker and firm identifiers. We then conduct several event-study analyses to study the effect of a firm being sued on the wages of its incumbent workers and the wages of workers in non-sued firms connected by ownership.

We find that firms significantly increase the reported wages of incumbent workers after a lawsuit for past under-the-table payments. This increase also occurs in non-sued firms with owners in common with a sued firm. Specifically, incumbent workers in sued firms report wages about 1.5% higher after the lawsuit, and this effect is driven primarily by workers in small firms and those with managerial positions. When analyzing the effect on connected firms, we find an increase in reported wages of incumbent workers in small connected firms of over 1%. Overall, these findings indicate that the breakdown of collusive underreporting of wages can lead employers to limit their future engagement in payments under the table, both in the firms in which they were sued and in other firms they own.

Our paper contributes to two main branches of the literature. First, we contribute to the literature that studies informality in labor markets in developing countries. There is a vast amount of research studying the spread and consequences of informality (Williams and Lansky 2013, Bitran 2014, see La Porta and Shleifer 2014 and Ulyssea 2020 for reviews on the literature). We contribute to this literature by documenting and characterising an additional margin of informal employment that has received much

less attention so far. We move beyond the binary formal-informal employees framework and show that informal employment should be thought at the wage level, rather than worker level. There are few papers with suggestive evidence of PUT. Kumler et al. (2020) compare area-by-industry-by-firm size reported wages in household surveys with administrative data, and interpret the gap as PUT.[6] Bíró et al. (2022) uses a reform to payroll taxes to document that part of the bunching at the minimum wage is driven by PUT. While suggestive, these papers do not provide a full analysis on how PUT are distributed across income groups, the share of wages that goes unreported, and the mechanics of how PUT take place in practice. We contribute by filling this gap.

We also contribute to the literature on how regulations and labor costs affect informality. This literature has focused both on firm informality (Ulyssea 2010, Monteiro and Assunção 2012, Hsu Rocha and de Farias 2021) and workers' informality (Gerard and Gonzaga 2021, Lauletta 2021). Most of these papers focus on the lower part of the income or productivity distribution, studying how reductions in costs can affect the formalization decision of firms and workers. Our paper contributes to this literature by showing that regulations in the top of the income distribution can also spur informal labor relations. This difference bears important implications for understanding how informal labor relations can have a regressive aspect, and sheds light on which type of informality has more significant distributional and revenue consequences.

Our paper also contributes to the literature studying collusive behavior regarding earnings reporting between employers and employees. Most research on developed countries have traditionally assumed that third-party reported source of income do not exhibit evasion (Bazzoli et al. 2021, Kleven et al. 2011). However, recent evidence suggest that there is collusive tax evasion between the parts involved. Doerr and Necker (2021) shows collusive tax evasion in the provision on services using a field experiment in Germany. Moreover, Bjørneby et al. (2021) uses on-site random audits to document collusive wage under-reporting in Norway. They show that after the audit, firms in-

[6]Note that this assumes that respondents answer their true wages (i.e. inclusive of PUT) in household surveys. Our survey indicates that this is only true for about 60% of workers.

creased their subsequent wage reporting on behalf of their employees by 18% relative to the control group. We shed light on the collusion story by characterizing which are the type of employees, employers and firms which are able to engage in this type of evasion. In addition, we do back of the envelope calculations to get a sense of the PUT's size for the first time in the literature.

The paper is structured as follows: in the next section we provide a brief description of the Brazilian labor market. Section 3 explains the data we use in this paper. Section 4 contains the big picture of PUT, where we show the main results in terms of extent and mechanics. In Section 5 we exploit the change in incentives generated by the ceiling to the Social Security Contributions. In Section 6 we present results on the effects of lawsuit on reporting wages of incumbent workers and we characterize the dynamics of the collusion break down. Section 7 concludes.

2 Context

Brazil is the largest country in Latin America, with 212 million inhabitants. In 2020, the GDP per capita in PPP was 14,000 US$, an average value for the Latin American region. Furthermore, despite progress in the beginning of the 20th century, Brazil remains one of the most unequal countries in the world: the Gini Index was 53.4 in 2020.

Similar to most developing countries, informal labor relations are a large component of the Brazilian labor market. Individuals that do not have any kind of link to social security represent 31.3% of the Brazilian employees.[7]

In Brazil, the identification of formal and informal employees is straightforward and salient to workers, employers and authorities. Every formal employee must have a document called *Carteira de Trabalho*, in which all her job contracts must be documented. In the traditional measures of informality, an individual is called an informal

[7] Among Self-Employed individuals, who comprise 20% of Brazilian Labor force, this share is even higher. Calculations made with PNAD-C in the first trimester of 2022.

worker if she works without a *signed Carteira de Trabalho*. This provides a salient measure that employees are aware of when asked about the formality of their work status. Furthermore, there are no large penalties to the employee if she works with an unsigned *Carteira de Trabalho*, thus there is no evidence of individuals under-reporting their informality status because of fear of being sanctioned.

Formal labor ties are associated with a series of benefits and costs for the employee and employer. Employees that have a *signed Carteira de Trabalho* are entitled to severance payments, pensions for disabilities, maternity leaves (restricted to women) and unemployment insurance. They also have to contribute to social security system (the contribution schedule is detailed in Section 5) and abide the Brazilian Labor law that, among other things, govern numbers of hours worked, paid vacation days and work conditions. In turn, employers are have to comply with minimum wages, union wage floors and contributions to social security system for each employee. Employers' contributions also vary according to workers' wages.

In Table 1 we provide some descriptive statistics of the Brazilian Labor Market and the differences between formal Employees and Informal Employees. Informal employees are less educated, younger and their average monthly wage is around 50% of the average wage of employees with signed *Carteira Assinada*.

Table 1: Descriptive Statistics of Brazilian Labor Market

	(1)	(2)	(3)	(4)
	All Labor Force	All Employees	Formal Employees	Informal Employees
Sh. Female	0.449	0.479	0.466	0.530
Avg. Age	36.77	35.87	36.19	34.62
Sh. with less than H.S.	0.355	0.313	0.267	0.493
Sh. with High School	0.357	0.372	0.383	0.329
Sh. with Some College	0.288	0.315	0.351	0.177
Sh. Non-white	0.549	0.552	0.534	0.621
Avg. Monthly Wage 2019 BRL	2201.0	2192.2	2427.9	1283.0
Informal	0.313	0.207	0	1
Employee	0.702	1	1	1
Observations	196194	132181	106630	25551

Notes: This table was built using first quarter of PNAD-C in 2019. The sample comprises individuals between 18 and 55 years old. Informality is defined for workers as those who are employed without a signed *Carteira de Trabalho*. For self-employed, employers and other workers in the sample of the first column, informality is defined as if they are contributing to the social security.

3 Data

In this paper we use both data from our own survey, from Brazilian government's household survey and administrative records. In this section we describe these data sources and how each of them is used in our analysis.

3.1 Original Survey

Using the platform Lucid MarketPlace [8] we conducted the first large scale survey on PUT in March 2022. We surveyed about 12,000 workers in Brazil.[9] Lucid filtered the sample so we only keep currently full-time employed and over 18 years of age. Additionally, the company filtered self-employed workers, so we ended up having only employees. Within the survey, we also ask for employment status to screen participants out in the very few cases in which Lucid made mistakes. On top of the previous filters, we also screen informal employees out. We proceeded in the same way than the official Brazilian household survey does. We ask whether the employee holds ***carteira de trabalho assinada*** or not. This is a very salient question because formal employees in Brazil get access to social security benefits through this card. After the screening, we ended up with about 9,000 formal employees. Compared to the PNAD-C, our survey over-represents educated people and high-income earners. A balance table comparing our survey with PNAD-C can be found in the Appendix B. We re-weight our sample when it is required.

3.2 Pesquisa Nacional por Amostra Domiciliar - Continua (PNAD-C)

We also use PNAD-C, which is a national household survey that is conducted by the Brazilian Institute of Geography and Statistics (IBGE). The survey is collected quarterly since 2012. PNAD-C contains individual-level data on demographics and labor mar-

[8] See Coppock and McClellan (2019) for a study on its external validity
[9] Respondents were compensated for their pariticpation in the survey.

ket information such as wages and hours worked for employees in both formal and informal sectors. In this project we want to compare and link the results from our survey to PNAD-C. Given that our survey was collected in March 2022, we use PNAD-C corresponding to the first quarter of 2022.

3.3 Relação Anual de Informações Sociais (RAIS)

The RAIS is a matched employer-employee data set that covers the universe of workers in the Brazilian formal labor market and is collected by the Ministry of Labor. Firms must submit annual information on all formal job contracts that they established in the previous year to the federal government, which uses this information to calculate a series of worker and firm benefits. Firms' compliance in reporting this information is high, as failing to report complete records leads to large penalties. RAIS only tracks hired workers and does not show firm owners.

Workers in RAIS are identified by their name and CPF,[10] which allows us to follow them across time and match the information in RAIS to other identified data sets. Among other variables, we observe December wages, contracted hours, type of contract (temporary or regular), age, gender, schooling, separation and hiring dates, sector and occupation.

3.4 Ownership Data

In addition to the employer-employee data, we also observe who owns the firms. Although RAIS does not record who are firm owners, we recover this information from two data sets, the CNPJ and the CNE. We follow Hsu Rocha and Dias (2021) to construct a matched owner-employer-employee data set that recovers race, gender and education of both workers and the firm owners of the firm they are working at. The construction of this data set is detailed in Appendix A.

[10] CPF is the *Cadastro de Pessoa Fisica* and is an equivalent to the Social Security Number

The matched owner-employer-employee data allow us to explore which type of employers/owners are more likely to engage in PUT, but also to understand if there are matched owner-employee characteristics such as match in gender or in race that determine PUT. With this, we also rule out the possibility that the workers observed in RAIS engaging in PUT are actually the owners employing themselves.[11]

4 Payments Under the Table: The Big Picture

4.1 Extent of PUT

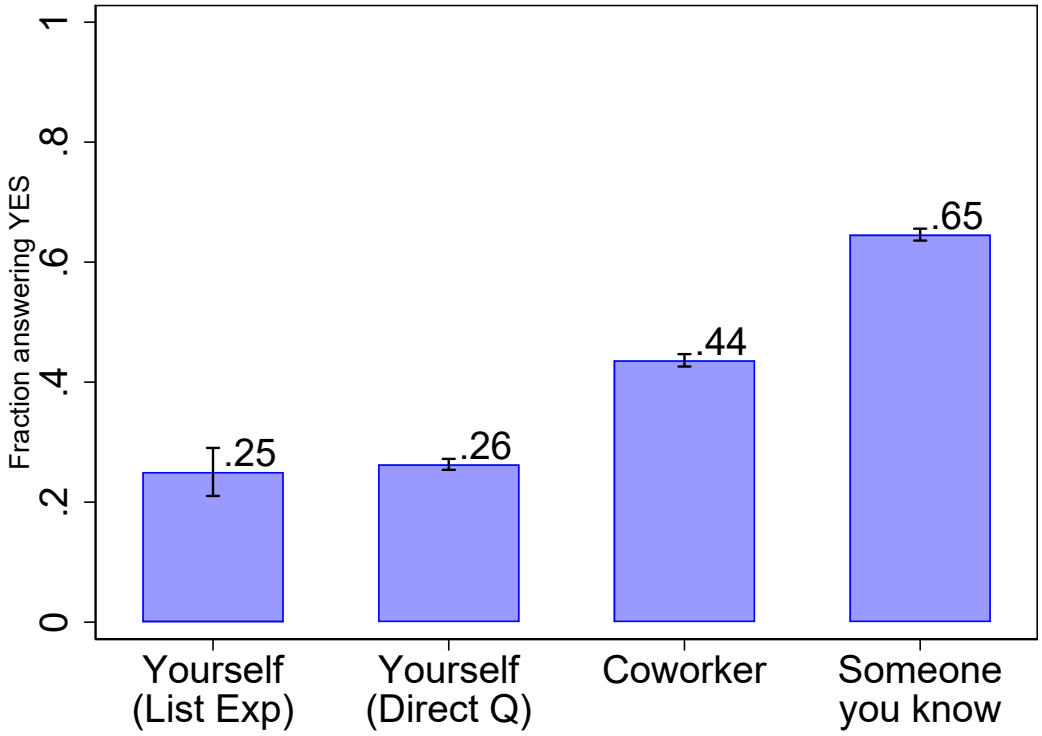
There are several features that determine how widespread PUT are. The first one is the proportion of formal employees who are engaged in this type of informality. To elicit this number we asked several questions, from the most impersonal one to the most personal:

- *Do you know **any** formal worker receiving PUT?*
- ***In your current job**, does anyone receive PUT?*
- *In your current job, do **you** receive PUT?*

As a robustness check, we followed current survey designs for sensitive questions (Castañeda et al. 2020, Coffman et al. 2017), and we started the survey with a List Experiment. We find that more than a quarter of formal workers in Brazil admit to receive payments under the table. Interestingly, the List experiment suggests almost identical results to the direct question. This means that employees are not reluctant to share that they are engage in PUT. We interpret this as evidence of a very extended and normalized practice in the Brazilian labor market.

[11] We do find that employees for whom we have evidence of engagement in PUT are more likely to be the owners of the company. Therefore, we decided to drop all employees who are also owners of the firm where they work at to be sure that there are at least two people involved in setting employee's wage.

Figure 1: Proportion of Formal Employees Engaged in PUT

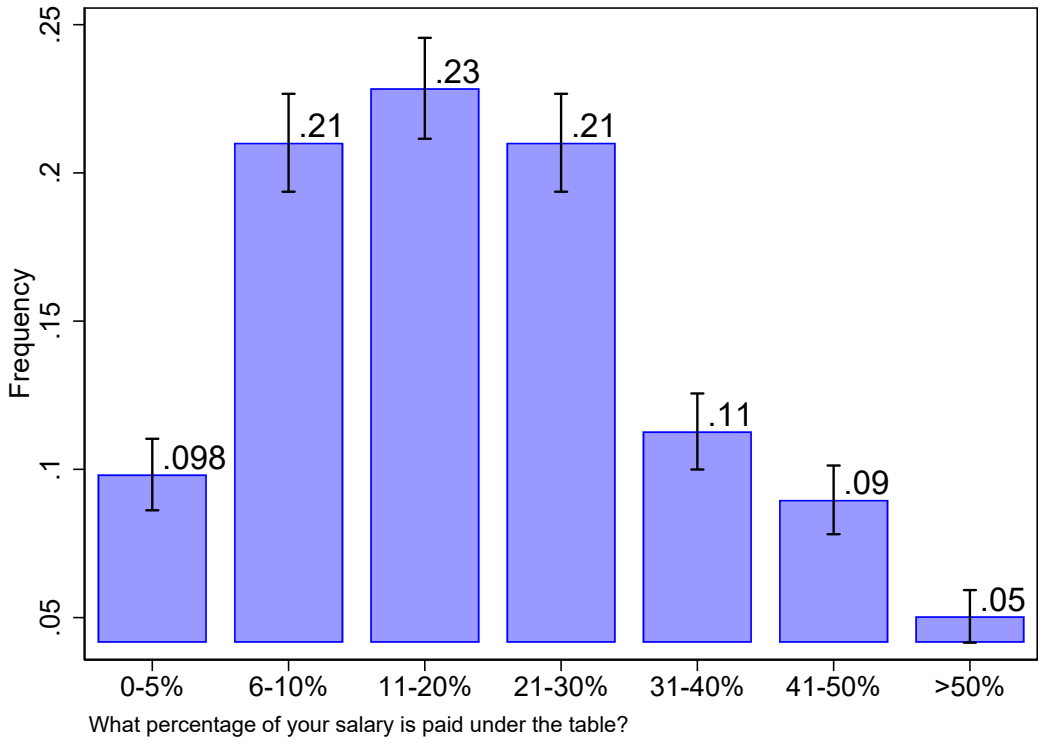


Notes: This figure shows the proportion of respondents in each category. "Yourself (List Exp)" is the proportion of workers that receive PUT derived from the list experiment. "Yourself (Direct Q)" is the proportion of respondents that report receiving at least some part of their salary as PUT. "Coworker" is the proportion of respondents that report that they know at least one coworker at their current establishment that receives part of their salary as PUT. "Someone you know" is the proportion of respondents that report that they know at least one person that receives part of their salary as PUT. Vertical bars represent 95% confidence intervals.

In Appendix B we also show the results by sector and we show that PUT are still sizable in the public sector and mixed companies.

A second dimension that defines the importance of PUT is what fraction of the salary is paid under the table. For those employees who admitted to receive PUT, we directly asked them what proportion of the salary is paid in this way. While there are some variability, more than 60% of PUT receivers admit to receiving between 6 and 30% of the salary as PUT. An average PUT receiver under report 22% of the salary.

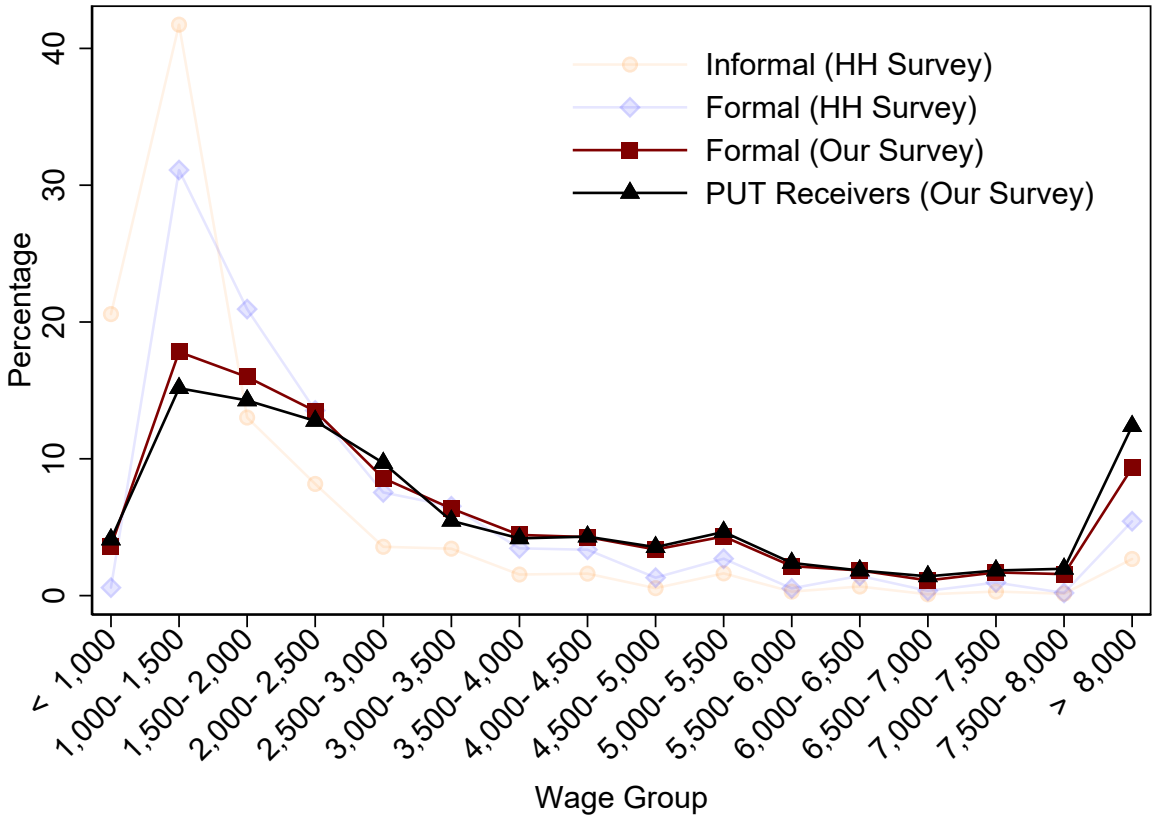
Figure 2: Fraction of the Salary Paid Under the Table
(Only PUT receivers)



Notes: This figure shows the proportion of PUT receivers in the sample that report receiving each percentage range in the X-axis as PUT. Vertical bars represent 95% confidence intervals.

Finally, for tax purposes, it is important to identify how the extensive (proportion of employees receiving PUT) and the intensive margin (fraction paid under the table) are distributed across income. We find that PUT receivers are pretty much along the whole formal employees' income distribution. If anything, PUT receivers seem to be slightly richer.

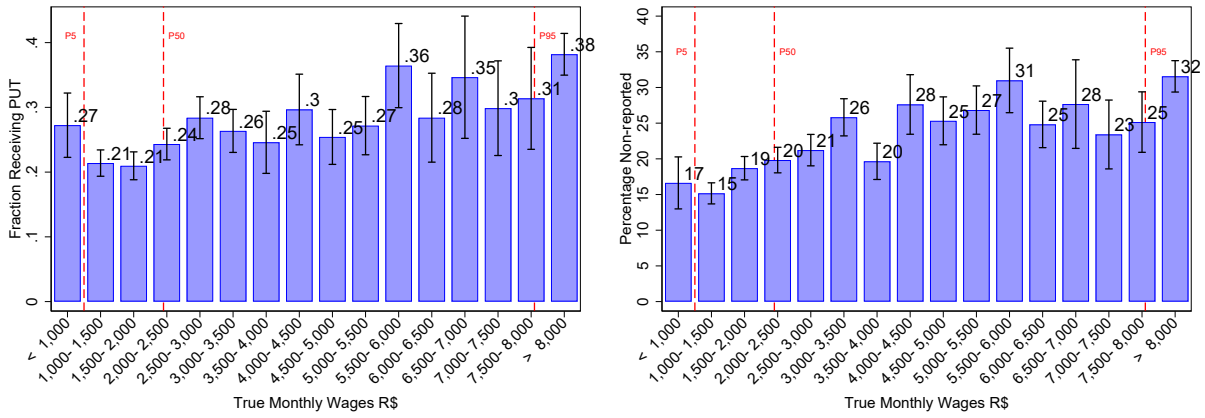
Figure 3: Income Distribution
(PUT receivers v.s. Formal Employees)



Notes: this figure shows the percentage of respondents in each earnings bin. Red indicates all formal workers in our survey. Black indicates PUT receivers in our survey. Orange indicates informal workers in the PNAD-C survey. Blue indicates formal workers in the PNAD-C survey.

Surprisingly, conditional on being a PUT receiver, high-income earners evade a much larger proportion or their wages relative to low-income earners. At the very bottom of the income distribution, PUT receivers evade between 16 and 20% of their wages. At the very top, however, they evade between 25 and 30% of their salaries.

Figure 4: Distribution of Payments under the Table



(a) Extensive Margin (a) Intensive Margin

Notes: panel (a) shows the fraction of formal workers receiving PUT for each wage group. Panel (b) shows the average percentage of the wage that is disbursed as PUT for each wage bin. The x-axis corrects the reported income to account for under-reporting based on a follow-up question in which we asked whether they answered their salary thinking about their total or reported income. Vertical bars represent 95% confidence intervals

In an effort to gain perspective on the importance of PUT, we conducted a simulation exercise in which we recovered the revenues that the government would collect if all PUT were eliminated with full compliance with earnings reporting. In particular, we focused on revenues coming from income tax and social security contributions (both from the employer and the employee). We conducted the same exercise for "classic" informality.[12] This exercise presents challenges and requires several assumptions, but we believe it is important to provide a benchmark of the fiscal costs of this type of informality and how this can change the way tax evasion has been thought in the literature. In Appendix D we explain all the assumptions we made in order to come up with credible estimates. It is worth noting that we do not simulate the government expenses on social security associated with PUT formalization. As it was mentioned before, many social security benefits are linked to the amount reported so they would also increase (the same logic applies to classic informality). In this sense, while the

[12]Those employees who do make any contributions to the social security system.

only component of our calculations that should be thought as pure revenue lost is the income tax, evasion of social security contributions gives a sense of a reduction in state capacity to provide social benefits.

We find that the revenues lost due to classic informality represents 0.7% of Brazilian GDP in 2021. Adding the revenues lost due to PUT, this number jumps to 1.1%. Moreover, together they represent around 7.1% of total revenues. It is important to point out that VAT collects almost half of total revenues. Therefore, when we zoom into the revenues that income taxes and social security contributions collect we find that joint evasion due to classic informality and PUT represents almost 20%.

Table 2: Evasion in Perspective

	Informality	**PUT**
Income Tax Evasion (% of Rev by IIT)	4.2%	6.8%
SSC Evasion (% of Rev by SSC)	14.1%	6.5%
Total Evasion (% Total Revenues)	2.7%	1.7%

Notes: This table reports the estimated gains in revenue estimated from eliminating classic informality (column 1) and eliminating payments under the table (column 2). The rows split the revenue gains in income taxes and social security contributions.

When we split by type of tax, we find that PUT implies more revenue lost than classic informality. On the other hand, for SSC, classic informality is more important than PUT. This is consistent with how tax rates and tax brackets are designed. The income tax rate for low-income earners is zero, so formalizing employees will imply very little revenue collection. On the other hand, SSC are capped, so the marginal contribution rate is zero for high-income earners. This means that formalizing the payments under the table for high-income earners will not bring more revenue collection through SSC. Then, we can compute the ratio $Evasion_{PUT}/Evasion_{Inf}$, which takes value 1 when the money evaded by the two types of informality is the same.

Table 3: $Evasion_{PUT}$ / $Evasion_{Inf}$

	All Workers	Private Workers
Income Tax	1.63	2.58
Employee's Contributions	0.35	0.39
Employer's Contributions	0.46	0.52
Total	0.59	0.68

Notes: This table reports the estimated ratio of evasion due to payments under the table relative to evasion due to informality for each type of tax. Column 1 presents estimates for all workers and column 2 presents estimates for private-sector workers. Row 1 presents ratios of evasion of income tax, row 2 presents ratios of evasion of employee contributions to social security, row 3 presents ratios of evasion of employer contributions, and row 4 presents the total.

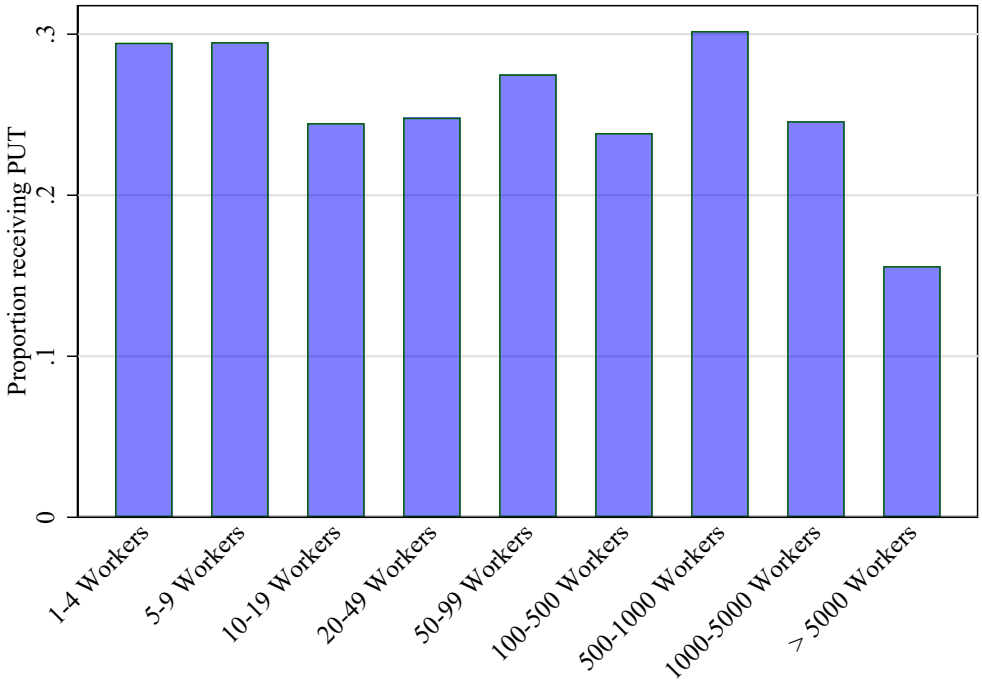
4.2 Mechanics

Employees' wages are third-party reported source of income. In particular, employees report wages to the tax authority when they fill their income taxes, and employers report wages paid to the tax authority. This means that they have to collude to report the same wage, otherwise it is straightforward for the tax authority to catch inconsistencies. Kleven et al. (2016) provides several arguments to point out how hard is that the employer has ex-ante incentives to engage in this type of arrangement (specially in big firms). As we showed in the previous section, PUT are widespread. This opens the door to understand what is wrong with models like Kleven et al. (2016). For example, while it may be true that PUT may not be the standard contract for all workers within a firm, it may be the case that owners have room to negotiate informal arrangements with certain employees. Therefore, we present evidence on how PUT work in practice. This novel evidence is helpful to understand which type of employees and firms are more likely to engage in PUT and to shed light on the collusion story.

Consistent with Bíró et al. (2022) and Bjørneby et al. (2021) we find that PUT are more likely to take place in small and medium size establishments, while it is much more unlikely in big corporations ($>$ 5,000 employees). However, we still find that

relatively large firms have a sizeable proportion of PUT receivers.

Figure 5: Proportion receiving PUT by firm size

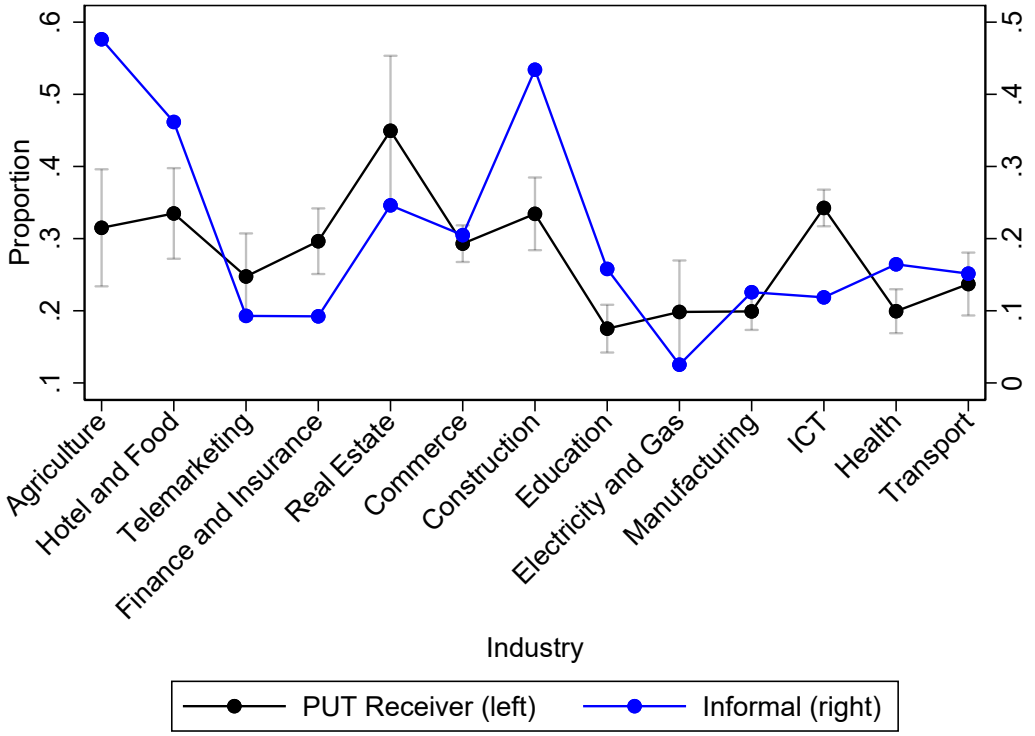


Notes: this figure shows the proportion of survey respondents that report receiving PUT for each firm size.

Using both our survey and PNAD, we find that industries with higher proportion of classic informality also have higher proportion of PUT receivers.[13] This may be explained by industries' underlying features that make illegal activities more likely to happen. Consistent with this story, we find that more than 50% of employees receiving PUT are paid in cash. Industries like Hotel & Foods or constructions are likely to be cash intensive.

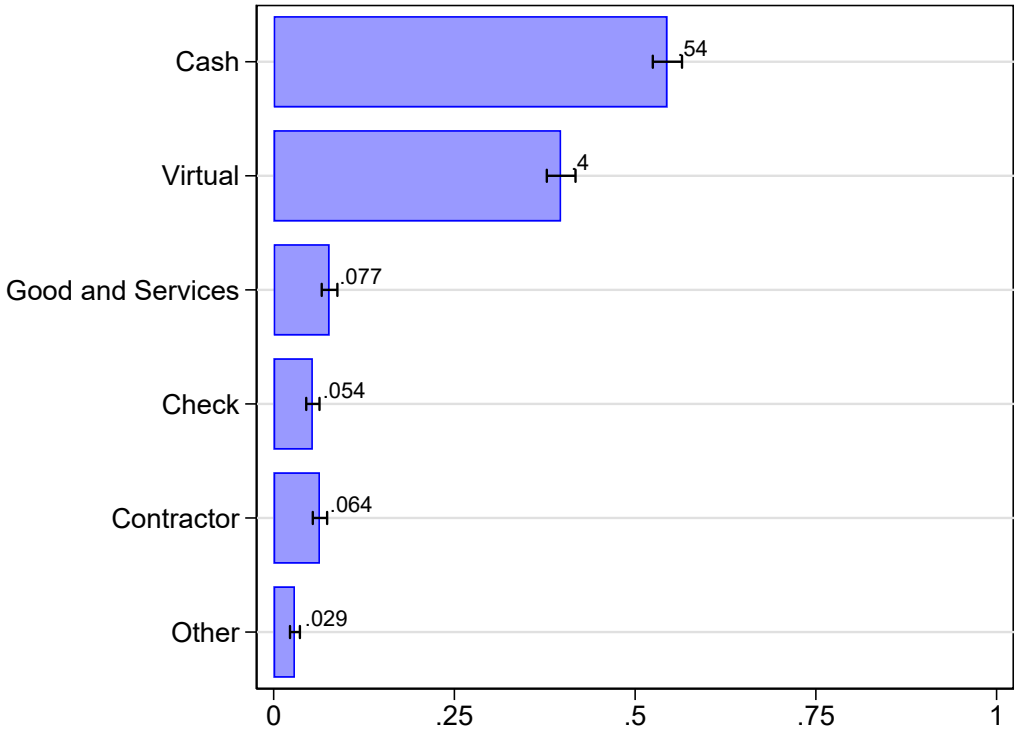
[13] Brief note on industry definition adjustment

Figure 6: PUT and Classic Informality by Industry



Notes: this figure shows the proportion of respondents that report engaging in each type of informality within each industry. Black denotes the proportion that reports receiving payments under the table (left axis). Blue denotes the proportion of workers that report being informal (right axis). Vertical bars represent 95% confidence intervals.

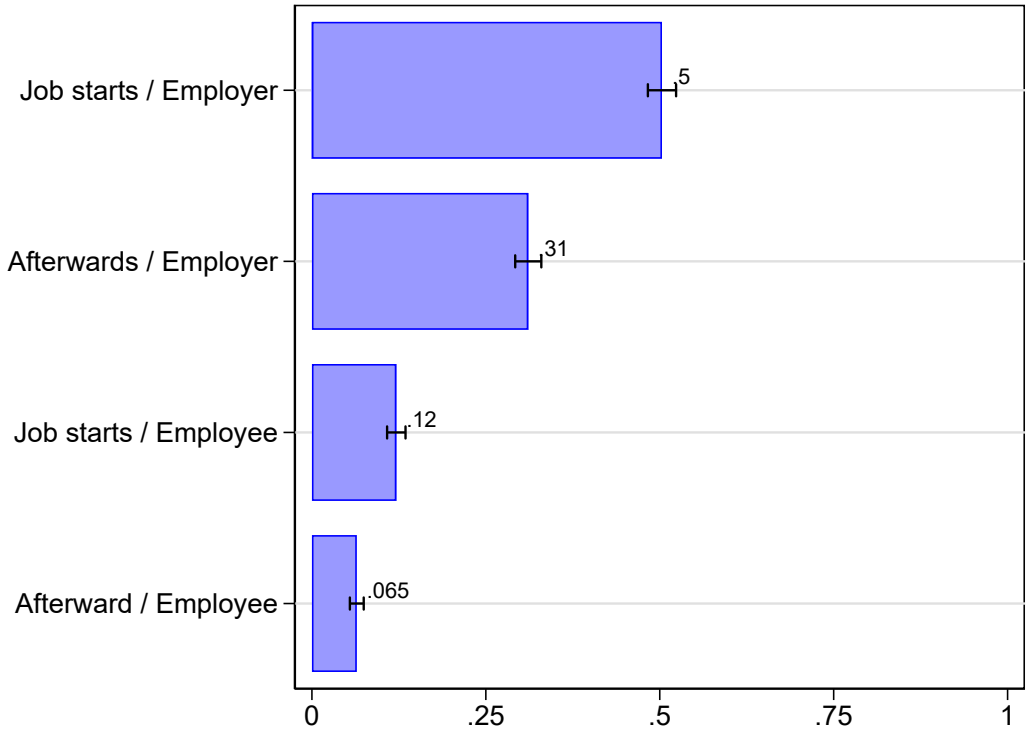
Figure 7: Payment Method



Notes: this figure shows the proportion of workers that report receiving PUT under each payment method. Horizontal bars represent 95% confidence intervals.

We find that in about 80% of the cases, PUT were suggested by the employer and 62% at the beginning of the labor relationship.

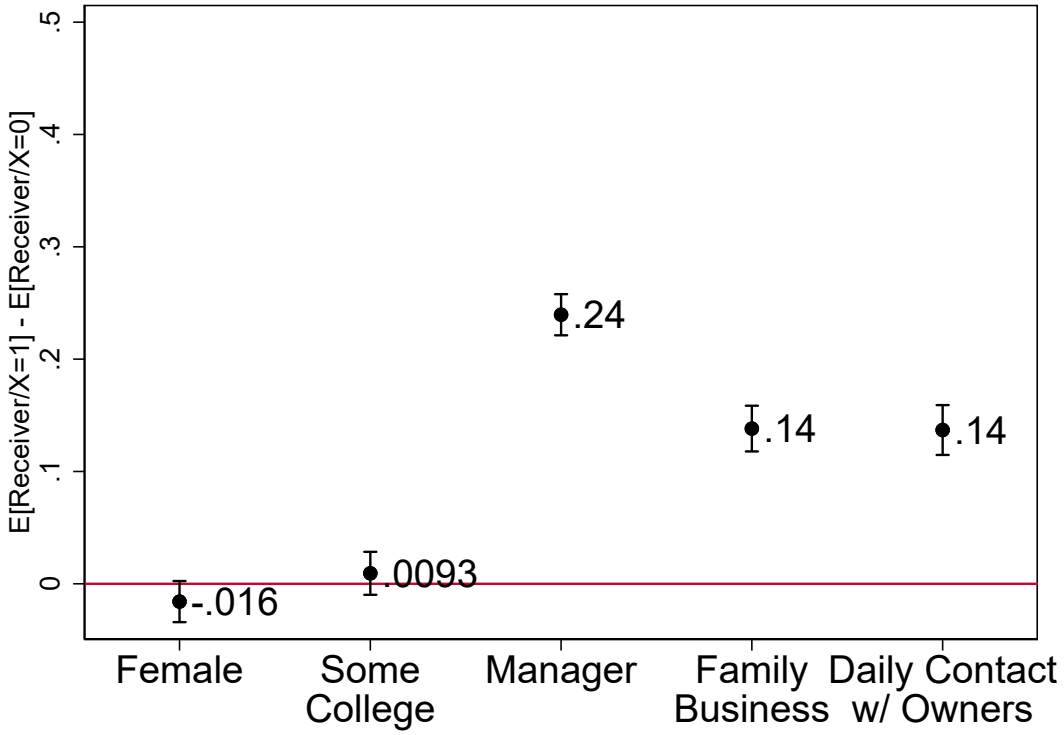
Figure 8: When and who proposed PUT



Notes: this figure reports the proportion of respondents that report each category related to when the practice of PUT starts in the job and whether the employer or the employee suggest it. "Job starts / Employer" denotes that the PUT arrangement is suggested by the employer when the job starts. "Afterwards / Employer" denotes that the PUT arrangement is suggested by the employer after the job starts. "Job starts / Employee" denotes that the PUT arrangement is suggested by the employee when the job starts. "Afterward / Employee" denotes that the PUT arrangement is suggested by the employee after the job starts.

Finally, we explore variables related to bargaining power and collusion to see how they affect the probability of engaging in PUT. Contrary to the literature on gender differences to bargain wages (Roussille 2020) we do not women are differently engaged in PUT than men. The same result holds for education. Educated and non-educated employees are equally likely to receive PUT. On the other hand, working in a family business, having daily conversation with owners and, especially, being a manager are strong predictors of receiving PUT.

Figure 9: Bargaining and Collusion



Notes: this figure shows OLS estimates from simple linear regressions of the probability of being a PUT receiver on each indicator. Female is a dummy variable equal to 1 if the respondent is female and 0 otherwise. Some college is a dummy variable equal to 1 if the respondent reports having completed some college degree and 0 otherwise. Manager is a dummy variable equal to 1 if the respondent reports being a manager at their job and 0 otherwise. Family business is a dummy variable equal to 1 if the respondent reports working at a family-owned business and 0 otherwise. Daily contact w/ owners is a dummy variable equal to 1 if the respondent reports having contact with the owners on a daily basis and 0 otherwise. Vertical bars represent 95% confidence intervals.

In the following section we present evidence of PUT from administrative data coming from regulations affecting incentives to report wages. We conduct several heterogeneity analyses, which show evidence consistent with the results presented in this section.

5 Interaction with Regulations: Social Security Contributions

In the previous section, we presented the first large scale survey on PUT to document its extension and mechanics. However, we are aware of survey data limitations. It is well known that people misunderstand questions and make mistakes when answering. Additionally, it is hard to have a large sample size that allows to do precise heterogeneity analysis. Finally, the survey presents a static picture of PUT. We cannot document how changes in incentives affect wage reporting using only our survey, which is a key feature of collusive arrangements. Therefore, we exploit a regulation that is present in many countries: the ceiling to employee's social security contributions. In a typically retributive system, ceilings limit the contributions and, therefore, the benefits associated to the contributions. However, most papers in the literature treat contributions as a tax when thinking about reported wages and labor supply (Alvaredo et al. 2017). An interesting exemption is Liebman et al. (2009) which explores extensive and intensive margin responses to the tax-benefit link in the U.S. social security system and find responses for workers closer to retirement. These responses are consistent with the fact that many countries' regulations provide to earnings at the end the career more importance in pension formulas.

5.1 Institutional Framework

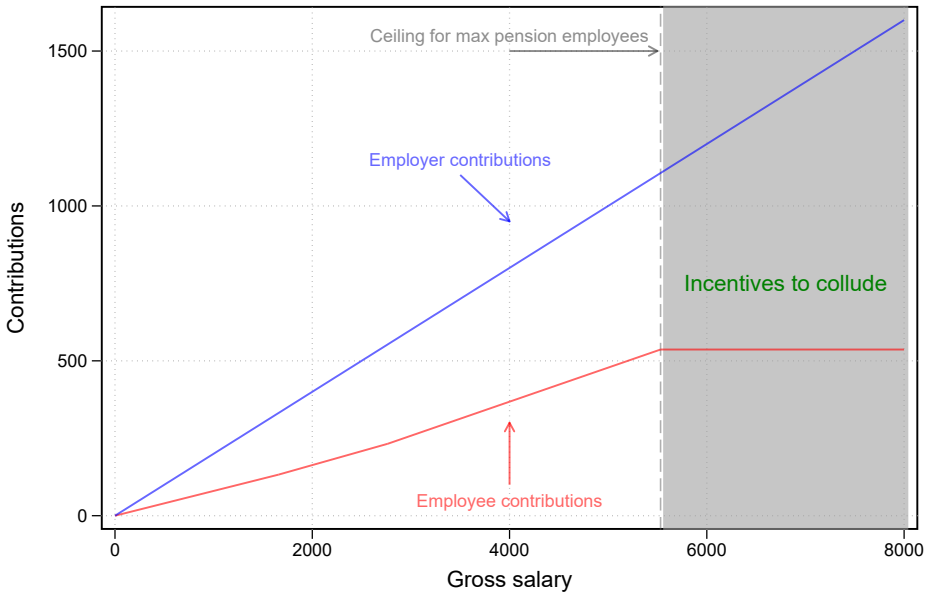
Employee's contributions in Brazil have a cap, which is updated annually[14] and the maximum pension is also capped. The monthly pension is calculated based on the following formula:

$$P = \delta \frac{1}{k} \sum_{i=1}^{k} \max \{w_i, \bar{w}\} \tag{1}$$

[14] Typically following inflation but it is not always the case.

Where δ is a coefficient that depends on the number of contributory years and $\bar{w}$ is the ceiling. Both w_i and $\bar{w}$ are translated into present values using a pre-specified formula. The k salaries are selected to be the highest 80% of salaries earned during the contributory period. As workers' earnings profile is increasing in tenure, workers closer to retirement are more likely to affect their pensions with their current salaries. On top of this, there is vast documentation on behavioral biases for retirement savings (Laibson et al. 1998, Bernheim et al. 2000, Goda et al. 2019). Therefore, we expect that workers closer to retirement have higher incentives to report wages in order to increase their pensions. However, this incentive disappears as soon as the employee reports beyond the threshold. While it is true that the contribution rate jumps down to zero, it is also true that pension cannot increase. On the other hand, employers' contributions are not capped and are about 20% of the gross wage. As a result, when employees get closer to retirement and want to report a higher proportion of their wages, they can collude to the employer to not report earnings beyond the ceiling.

Figure 10: Employer's and Employee's Contribution in Brazil (2017)



Notes: this figure shows the schedule of social security contributions as a function of the gross salary for employees (in red) and employers (in blue). The shaded area indicates the earnings region for which there are incentives to collude, since employees earnings are capped for pension calculations but employer contributions are not capped.

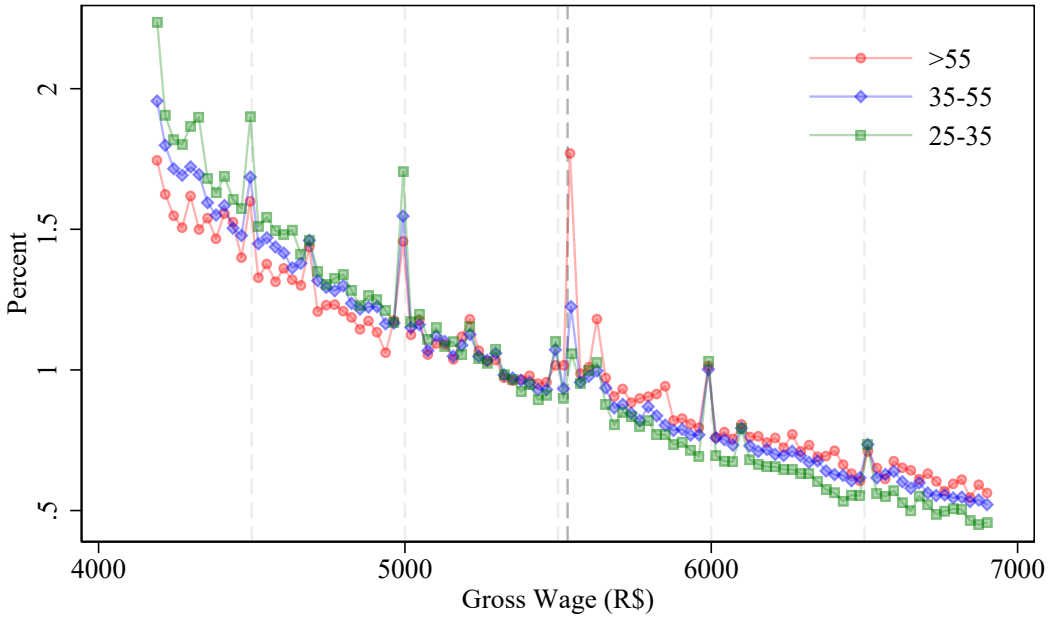
5.2 Results: Incentives responses

Using the matched employer-employee we document substantial bunching at the ceiling for employees closer to retirement age. While there is not a sharp discontinuity in age, the evidence is very clear in terms of who are responding to the incentives.[15] Additionally, the ceiling is updated annually so we can track the consistency of our results until 1994 (when our data starts).[16]

[15] Note that any other bunching is driven by rounds numbers.

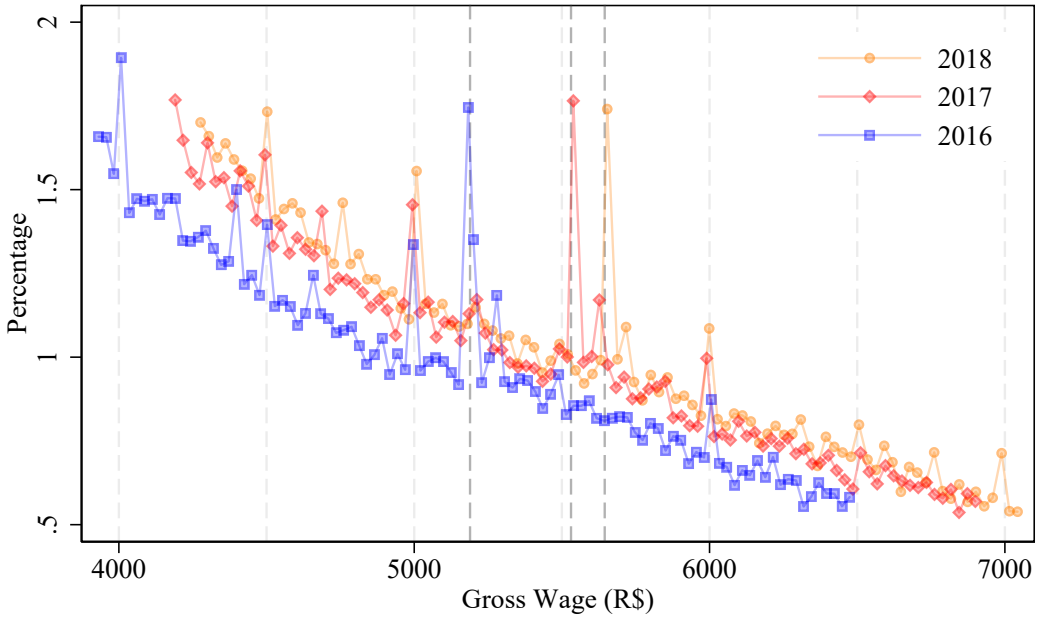
[16] In periods of high inflation, the ceiling is updated twice a year.

Figure 11: Wage Distribution in 2017 by age group



Notes: this figure shows the percentage of observations within each bin around the ceiling for employee contributions in the year 2017. Green indicates workers between 25 and 35 years of age. Blue indicates workers between 35 and 55 years of age. Red indicates workers over 55 years of age.

Figure 12: Wage Distribution across years (>55 yrs old)



Obs 2018 = 190100
Obs 2017 = 181918
Obs 2016 = 185112
Bins = 100
Ceiling 2018: R$ 5,645 - Ceiling 2017: R$ 5,531 - Ceiling 2016: R$ 5,189

Notes: this figure shows the percentage of observations within each bin around the ceiling for employee contributions for workers above 55 years of age for three separate years. Yellow indicates the year 2018, red indicates the year 2017, and blue indicates the year 2016.

5.3 Results: Heterogeneity

In this section we explore who are the employees that self-select to bunch at the ceiling of SSC. When incentives to bunch are low (e.g. for workers between 25 and 35 yrs old - see Figure (11)), we should expect employees reporting wages at the ceiling to be pretty similar than those reporting a little less or more[17]. However, when incentives to bunch are strong (employees closer to retirement) then bunchers' characteristics can shed light on who are those employees that are able to increase their reported wages. Moreover, heterogeneity analysis helps to rule out some alternative explanations. The most obvious is the one about a pure labor supply story, rather than under-reporting.

[17] $\mathbb{E}[X_i|w_i \to_+ w_b] = \mathbb{E}[X_i|w_i \to_- w_b] = \mathbb{E}[X_i|w_b]$, where X_i is any demographic.

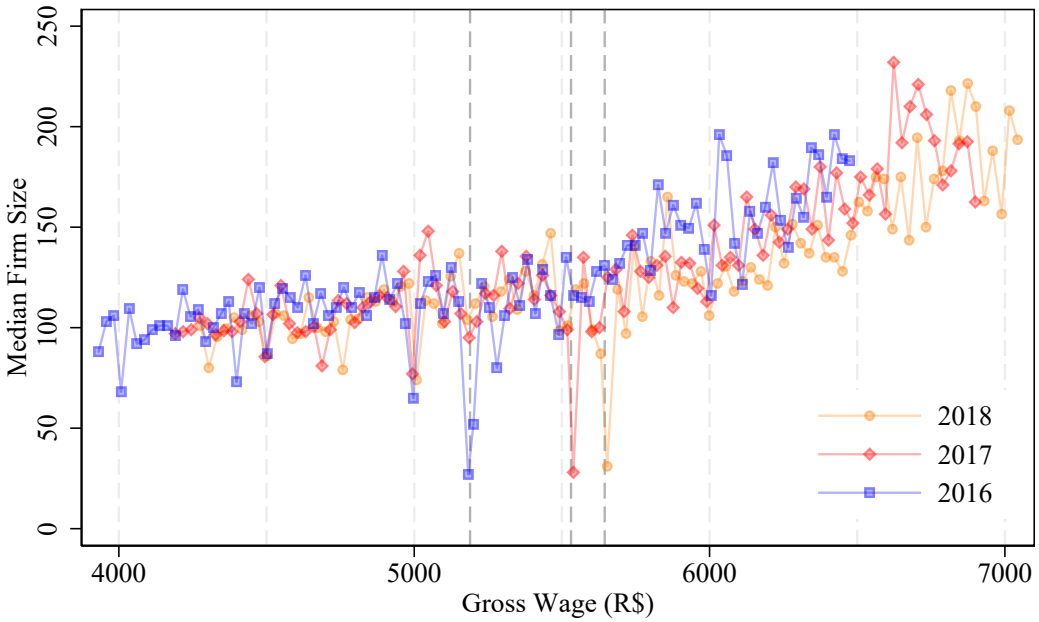
In fact, bunching estimators have been developed to recover labor supply elasticities (Saez 2010). Micro-estimates of labor supply elasticities are typically very low (Peterman 2016) and, therefore, many theories have tried to understand the gap between micro and macro estimates (Chetty 2012, Chetty et al. 2013). As it was mentioned in section 2, hours worked are highly rigid for Brazilian employees.[18] This makes intensive margin labor responses very unlikely. Alternatively, extensive margin responses (workers who decide to join the labor force when they are close to retirement) are particularly unlikely to happen. The reason is that we are studying the top of the Brazilian income distribution. Moving from unemployment or an informal job to a high paid formal job in order to increase pension benefits seems unlikely.

We argue that most of the action is coming from employees who were underreporting wages.[19] Therefore, when their incentive to report wages increase, they will need to negotiate with the employer to do so. This means that bunchers should have similar characteristics of PUT receivers in our survey, with the caveat that we are focusing at the top of the income distribution. Moreover, this regulation implies that it is the employee who goes to renegotiate higher reported wage, so it should be more likely to happen in those cases where the employee has more bargaining power. The following figure shows that bunchers are more likely to work in smaller establishment than comparable workers in term of wages. We clearly observe that better-paid workers tend to work in larger firms, except for the bunchers. This is consistent with the literature (Bíró et al. 2022, Bjørneby et al. 2021) and the survey evidence.

[18] Both the median and the top value of hours worked are 44 per week.

[19] In same cases it could be even the case they were hired *off the books*, so it will look like an extensive margin response.

Figure 13: Median Firm Size across Wage Distribution (>55 yrs)

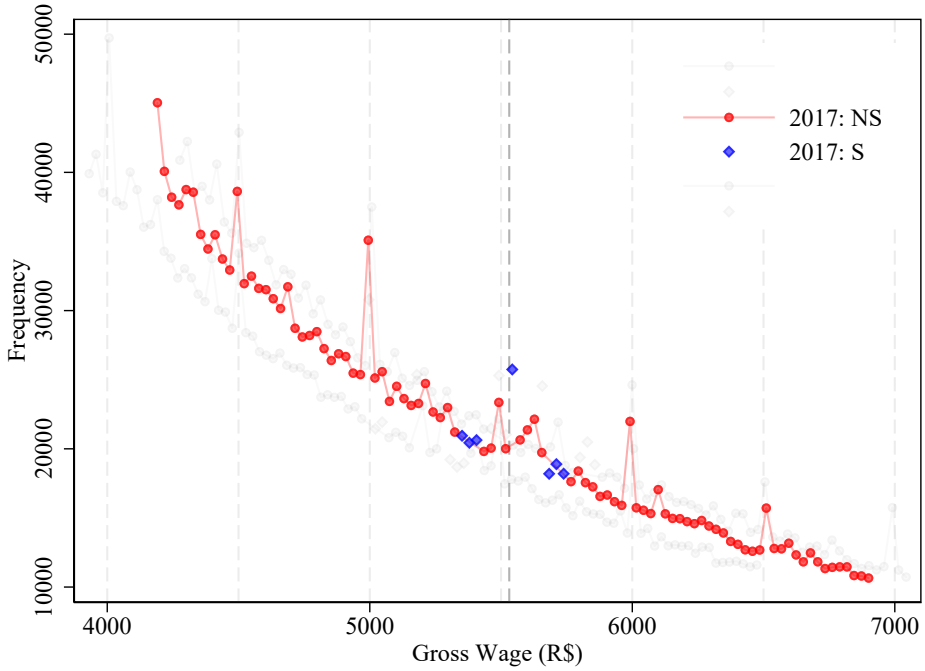


Notes: this figure shows the median firm size for each wage bin for the years 2016 (in blue), 2017 (in red), and 2018 (in yellow).

To take advantage of the annual ceiling updates, we construct a data set pooling bunchers and non-bunchers from 1999 to 2018. To do so, we keep all employees in the ceiling wage bin and in three wage bins to the left and to the right of the ceiling [20]. The following figure illustrates the strategy for 2017.

[20] We do not take the immediately three to the left and right, but we skip five to both sizes in order to minimize measurement error in wage imputation (see Saez (2010)).

Figure 14: Sample Selection

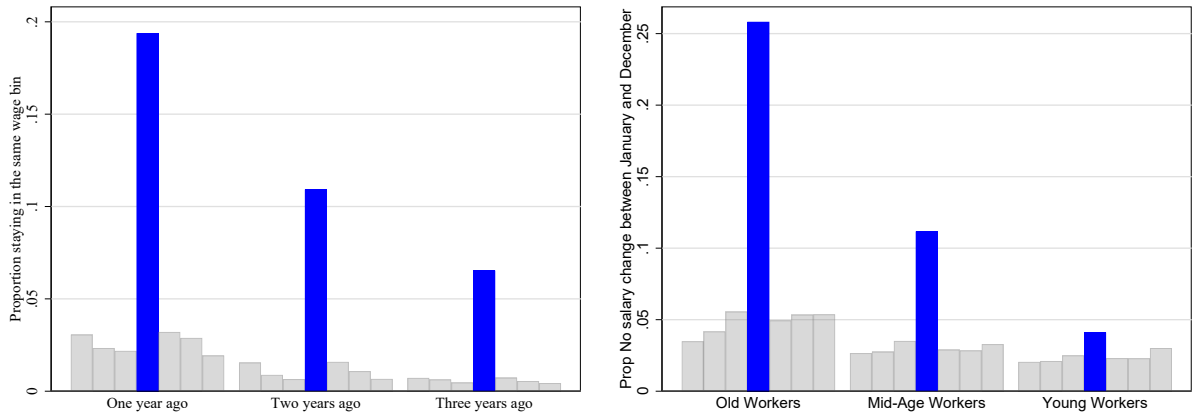


Notes: this figure shows the frequency of observations in each wage bin around the ceiling for the year 2017. Selected bins for the buncher analysis are highlighted in blue. Non-selected bins are shown in red.

Note that we are keeping all age groups, since we will also compare how the heterogeneity analysis differ for group with more and less incentives to report wages. Additionally, in Appendix C we provide robustness checks for this strategy, where we shift the seven wage bins to any other part of the income distribution (where incentives are not affected for anyone).

In the following figure, we show results on how the dynamics of within-year wage updates differs for bunchers and non-bunchers.

Figure 15: Wage Dynamics: Bunchers v.s. Non-Bunchers



(a) Across Years - Old Workers (b) Within Year

Notes: this figure shows the dynamics of wage updating for bunchers and non bunchers. Panel (a) shows the proportion of workers in each wage bin that stayed in the same wage bin they were one, two, and three years ago. Panel (b) shows the proportion of workers that show no change in salaries between January and December in each year. The sample includes only workers over 55 years of age.

Panel (a) shows the proportion of employees who remain in the same wage bin as one, two, and three years ago. The blue bars refers to the bunchers and we are keeping only employees older than 55yrs old. We can see that the probability that a buncher was a buncher in the previous year is around 20%, while it is less than 5% for non-bunchers (for any wage bin). This suggests that bunchers are much more likely to be updating their wages to target the new ceiling. Panel (b) shows the probability that employees remain in the same wage bin within the calendar years.[21] We see that bunchers are much less likely than non-bunchers to face a wage change within the year and this effect is decreasing in the incetives to report wages (by age group).

Finally, we run a Linear Probability Model (LPM) to understand the predictors of the probability of being a buncher at the ceiling for employee SSC. Formally we

[21] We use the difference between January and December wages. We have information on monthly wages from 2015. It is worth noting that keeping the same reported wage within the year should be very unlikely for two reasons. First, in countries with moderate inflation there tend to be wage negotiations during the year. Second, the *thirteen salary* is paid in December, which must be reported to the tax authority because contributions are paid on it (but it does not affect the ceiling).

estimate the following regression model by OLS:

$$b_i = \beta_0 + \beta_1 X_{1,i} + \beta_2 X_{2,i} + \beta_3 X_{3,i} + \beta_4 X_{4,i} + \alpha_s + \mu_t + \varepsilon_i \tag{2}$$

Where b_i is a dummy variable indicating whether you are in the bunchers' wage bin or not. X_1 is a set of covariates related to employees' characteristics (gender, education, race, etc.). On ther other hand, X_2 is a set of covariates related to employeers' characteristics. $X_{3,i}$ incorporates firm and establishment characteristics (industry, establishment size, etc.). $X_{4,i}$ contains matching and bargaining variables (same race, manager, same gender, past coworkers, etc.).

First, it is important to point out that if selection to be a buncher is low, then it should be very hard to explain the probability of earning in the bunchers' wage bin or a little bit above or below it. Consistently, we recover an adjusted R^2 of 0.11 for employers older than 55 years old, while it is almost zero for young employees.

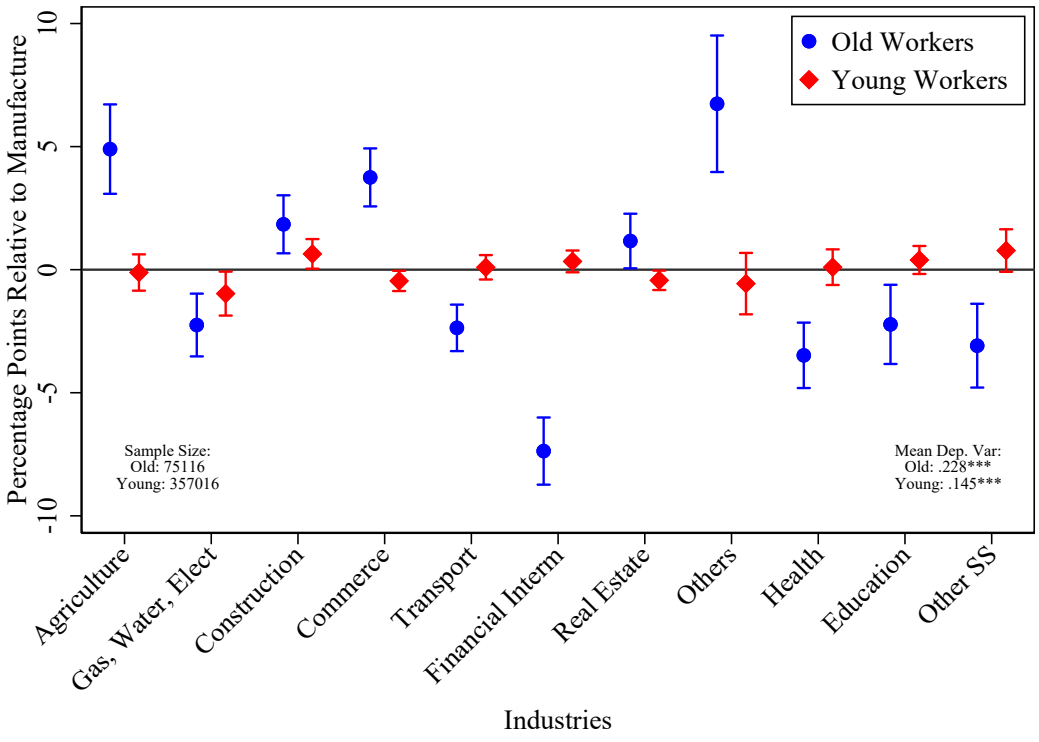
We do not find that basic employee's demographics are relevant to explain being a buncher. Consistent with the survey evidence, more educated workers are equally likely to be engaged in PUT than less educated workers. We do not find that employee's race matters on its own. We do find that female workers are more likely to be bunchers, but it is important to point out that women can retire earlier than men in Brazil. This means that conditional on age, female are closer to retirement than men. Therefore, we interpret this effect as driven by effective retirement age rather than gender. In terms of employers' characteristics, we find that less educated owners are more likely to have employees bunching in the ceiling. Unfortunately, our survey recovered information on employees, so it is hard to compare both source of evidence on this point. Consistent with Figure (13), we recover that working in a establishment with more than 773 employees[22] reduces the probability of being a buncher in 21.5 pp. relative to working in a small establishment (less than 7 employees) for workers older than 55 yrs old. When comparing the probability of being a buncher for old and young

[22] Percentile 90 for firms in the sample selection for the LPM.

workers, we see than in large establishments the gap closes significantly (while not completely), consistent with the survey evidence.

The following graph shows the industry fixed effect coming from the LPM. The baseline is manufacturing and we can see that agriculture, construction, commerce, real estate and others increase the probability of being buncher relative to manufacturing.[23] This is consistent with Figure (6), in which all the industries mentioned before are significantly above manufacturing. On the other hand, education, electricity, water and gas, health and transport slightly reduce the probability of being a buncher. These industries are also among the ones with less proportion of PUT receivers based on Figure (6). The only relevant inconsistency is financial intermediaries.

Figure 16: Industry Fixed Effects



Notes: this figure shows OLS estimates of the industry fixed effects from equation 2. Coefficients for workers over 55 years of age are presented in blue, coefficients for workers under 35 are presented in red. Vertical bars represent 95% confidence intervals.

[23]The sector "others" includes mainly hotel, food, and domestic workers.

Finally, we find that matching race between employer and employee increases the probability of being a buncher in 1pp, which implies a 4% increase relative to the unconditional probability of being a buncher for workers older than 55yrs old. We also find that being a manager is a key predictor of being a buncher (it increases the probability by 18pp). As in the survey evidence, holding a managerial position is a key predictor of being engaged in PUT. In Appendix C we present a table with the coefficients mentioned above.

6 Lawsuits: the breakdown of collusion

Payments under the table are a very particular type of tax evasion: they require collusion between employers and employees. They both must agree to engage in this illegal activity at the risk of one of the parties deciding to break such collusion. Specifically, in Brazilian legislation, PUT entails a violation of tax and labor law. In the first case, the first article of Law N 4,729 defines a fiscal evasion crime as "computing inaccurate or omitting income or operation of any nature in documents or books required by tax laws, with the intention of exoneration from paying taxes due to the Public Treasury".[24] Moreover, it defines the penalty, which can go from 6 months to 2 years of prison, and a financial penalty between 2 to 5 times the tax value. Therefore, collusion exposes both parties to the risk of being caught by the tax authority. On the other hand, the PUT violates article 464 of the Law N 5,452 (*Consolidacao das Lei do Trabalho*).[25] In this case, the tax authority is not an active part of the lawsuit, but rather it is the employee suing the employer to get compensation for the social security contributions that the employer has not paid on her behalf during the labor relationship. If an employee's incentives to collude changed for whatever reason (to increase their pension -as in the bunching analysis in section 5- or because they have been unfairly fired), she can opt for suing the employer and break the collusion.

[24] Complete document and updates Law 4,279
[25] Complete document and updates Law 5,452

We collected the universe of labor lawsuits in Brazil initiated between 2014 and 2019 due to PUT. The federal tribunal records the reasons for the lawsuit and PUT (*pagos por fora*) is one of them. The following quote is our translation from the document presented by the employee's lawyer to the judge in the first step of the lawsuit:

> "To clarify, the claimant was hired as a permanent employee, being agreed to be paid the fixed amount of 2,030 referring to the minimum wage, and the payment of the excess amount in the average of 1,500 paid under the table."

This novel data contains workers' and firms' identifiers, lawyers and judges involved in the lawsuit, values claimed and paid, whether the parties reached an agreement or not, and other useful variables. We merge it with the administrative employer-employee records to understand how workers who sue their firms for PUT are different from their coworkers, which are the sued firms, and what the consequences of being sued for PUT are. Table 4 table describes the raw data on lawsuits comparing workers that sued their employers to their coworkers that did not sue.

6.1 Descriptive Evidence

We search for all employees who have sued at most five firms (in the same lawsuit) in the last year they appear in the administrative matched employer-employee in one of the firms that were sued. This allows us to compare workers who sued with their coworkers within the firm who was sued. Additionally, we look for all firms that were sued the year before the lawsuit.[26] This allows us to compare firms that are sued due to PUT with those that are not. All of these comparisons will be driven not only by the PUT characteristics but also by selection into reporting. Thus, results should be

[26] For firms that are sued multiple times, we keep the first time they have been sued.

Table 4: Suers versus Coworkers

	Employees Suing	Coworkers
Reported Wage Dec (with zeros)	1336.32	1713.53
	(2464.45)	(3424.92)
Reported Wage Dec (no zeros)	2182.74	2801.36
	(2077.12)	(3903.84)
Proportion Manager	0.05	0.02
	(0.22)	(0.15)
Proportion of Non-White	0.31	0.43
	(0.46)	(0.50)
Proportion of Female	0.22	0.34
	(0.42)	(0.47)
Proportion with less than Highschool	0.34	0.37
	(0.47)	(0.48)
Proportion with Highschool	0.55	0.49
	(0.50)	(0.50)
Proportion with more than Highschool	0.11	0.14
	(0.31)	(0.35)
Proportion with Hourly Wage	0.09	0.12
	(0.29)	(0.32)
Proportion fired by employer	0.74	0.45
	(0.44)	(0.50)
N	63,211	8,946,839

Notes: This table compares summary statistics from employees who have sued their employers and their coworkers. Reported Wage Dec (with zeros) is the total wage reported in December, including workers with no reported earnings as having zero wage. Reported Wage Dec (no zeros) is the total wage reported in December, excluding workers with zero wage. Manager is a dummy variable equal to 1 if the worker is an establishment manager. Non-white is a dummy variable equal to 1 if the worker is non-white . Female is a dummy variable equal to 1 if the worker is female. Less than high school is a dummy variable equal to 1 if the worker has not completed a high school education. High school is a dummy variable equal to 1 if the worker has completed high school. More than high school is a dummy variable equal to 1 if the worker has completed any kind of tertiary education. Hourly wage is a dummy variable equal to 1 if the worker is paid by the hour and zero otherwise. Fired by employer is a dummy variable equal to 1 if the worker was fired by their employer.

interpreted with caution. Table (4) sheds some useful light on this. First, it shows that workers who sued are more likely to be managers than their coworkers, which is consistent with our survey evidence.[27] Moreover, suers are more likely to be white and male, which is not consistent with the survey evidence and may be explained by selection into reporting. Men, managers and white employees often have higher earnings than women, non-white, and non-manager employees. However, they report lower wages, consistent with the under-reporting of labor earnings.

Another interesting aspect is shown in the last row of Table (4). In our data, we can observe whether the employees are laid-off at some point of the given year (appearing as non-active contracts in December). Conditional on being laid-off, we can observe the reason for such laid-off that can go from quitting with or without a fair reason to retirement or death. The last row, then, shows the probability that a laid-off worker has been fired by the employer without a fair cause. We see that suers are significantly more likely to have been fired, bringing attention to some potential causes for the collusion to break down.

Table 5 show summary statistics comparing sued firm to non-sued firms in 2013 and 2018. Importantly, sued firms are significantly larger than non-sued firms, in addition to paying significantly higher wages on average. Their workers are more likely to have completed high school or above, and are significantly less likely to be female. In addition, 97% of sued firms are private sector firms.

[27] And we validated this using gender violence cases to show that in that case, suers and coworkers are almost equally likely to be managers.

Table 5: Sued versus Other Firms

	Lawsuit	2013	2018
Number Workers	163.92	17.68	15.95
Number Active Workers	108.49	11.64	11.49
Average Wage	2020.12	1460.41	1993.80
Highschool or More	0.70	0.65	0.74
Proportion Female	0.35	0.47	0.47
Proportion White	0.71	0.78	0.74
Private Sector	0.97	0.84	0.85
N	43,021	866,817	863,435

Notes: This table shows summary statistics comparing eventually-sued-firms to never-sued firms in 2013 and 2018. Column 1 corresponds to sued firms. Column 2 corresponds to never-sued firms in 2013. Column 3 corresponds to non-sued firms in 2018. Number workers is the total number of workers in the firm. Number Active Workers is the total number of active workers in the firm. Average wage is the average wage paid by the firm. High school or More is a dummy variable equal to 1 if the worker has high school complete or any higher degree. Proportion Female is the share of employees within the firm that are female. Proportion White is the share of employees within the firm that are white. Private sector is a dummy variable equal to 1 if the firm belongs to the private sector.

6.2 Identification Strategy

In this part of the paper, we aim to understand the role of labor lawsuits in limiting. Specifically, we analyze whether employers reduce their engagement in PUT after being sued for having done so in the past. To do so, we use a *matching difference-in-differences*, similar to Britto et al. (2022), to study the effects of being sued on the re-

ported wages of incumbent workers (who did not sue) both in the firms that were sued for PUT and in *connected* non-sued firms. It is important to highlight that the nature of the data involves a significant amount of selection. Lawsuits represent important negative shock to firms, which could imply a higher probability of closing or reducing personnel. Thus, we decide to focus on incumbent workers, defined as those who stay working in the firm three years before and three years after the lawsuit. The pure control group contains workers in similar firms that also remain employed during these six years, but their firms are not sued. An immediate concern is that workers who are able to keep their jobs at firms that were sued could potentially be different than those that were not subjected to the shock. Although we cannot rule out this concern completely, we are able to conduct several analyses to alleviate this concern. First, we can control for workers characteristics, such as educational attainment, gender, and ethnicity. Second, and more importantly, our strategy relies on the assumption that workers in the treated and control group would have followed similar trends in the absence of the lawsuit shock. Thus, we do not rely on same *level* of reported wages between treatment and control. In other words, if workers in sued firms have different pre-treatment characteristics than workers in the non-sued firms, such differences should generate a gap in the level of reported wages prior to the treatment as well. In such a case, the coefficients on the post-treatment evolution are measuring the additional effect of the treatment on the gap between the two groups, beyond the pre-existing gap. The identification strategy can be represented by the following equation:

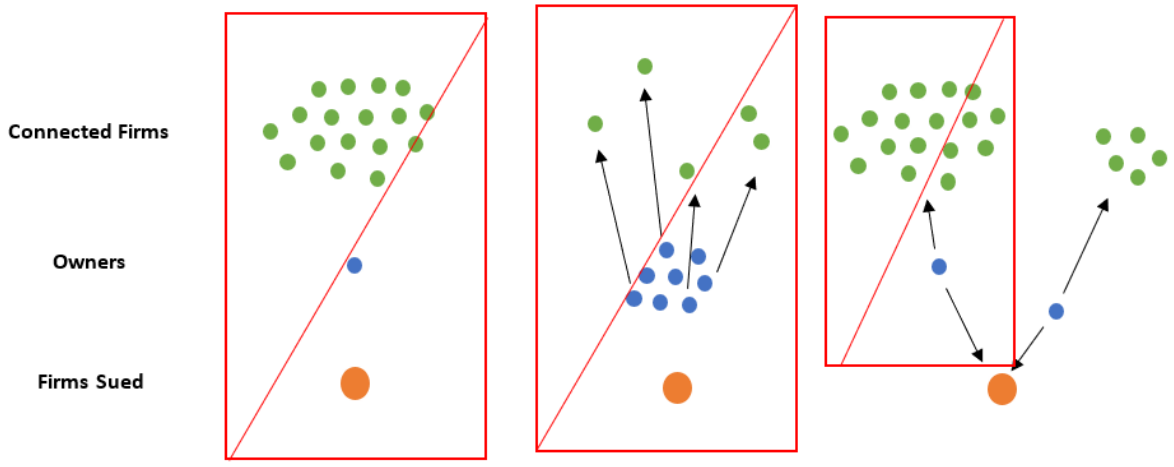
$$ln(w_{i,j,d}) = \gamma_d + \delta_j + \sum_{k \neq -1} \beta_k \mathbf{1}\{k = d\} \mathbf{1}\{Treated = 1\} + \varepsilon_{i,j,d} \tag{3}$$

Where $w_{i,j,d}$ is the wage in December of worker i in establishment j at the time d (which is normalized by the distance to the lawsuit year). The γ_d's are time fixed effects (which are estimated using variation from the pure control group) and δ_j's are establishment fixed effects. β_k's are the coefficient of interests which measure the difference in reported wages between the treatment and control group in each time period, normalized by the difference in $d = -1$. Finally, standard errors are clustered at

the establishment level. To see details on how we created the pure control group, see Appendix (E).

Finally, we also explore the effects on incumbent workers in *connected* firms. We define the network of firms that are connected through ownership information. For example, if individual A owns firm 1 and firm 2, and firm 1 is sued for PUT, we study the behavior of reported wages of incumbent workers in firm 2. Given that lawsuits are a highly salient shock, we conjecture that the effects could potentially propagate throughout the network. For instance, employers may become more reluctant to engage on PUT not only in the firm sued, but also in the others also owned by them. To do so, we limit the network to those sued firms that are owned by less than 10 owners and those owners who own less than 25 firms. We do so in order to be able to capture those networks in which it is plausible for the owners to be actually involved in setting or negotiating wages within the firm, rather than being just owners in paper and not participate in the wage-setting process. Figure 17 shows the type of cases with decided to consider. It is worth noting, however, that our results are not sensitive to the exact restriction in the number of owners or firms owned by each owner.

Figure 17: Firms Network through Ownership
(Sample Selection)



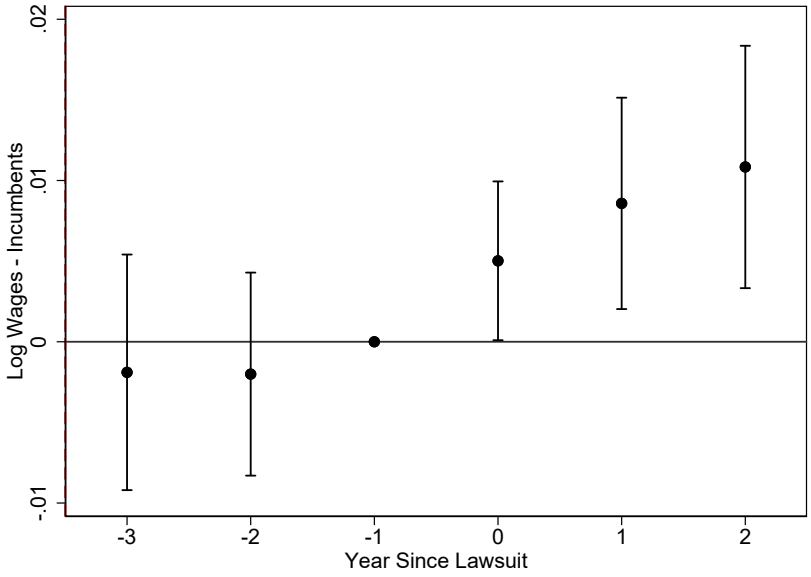
6.3 Results

We begin by analyzing how wages of incumbent workers in sued firms evolve upon a lawsuit due to payments under the table. Given the evidence on how the practice of PUT is more prevalent in small firms that we presented in the previous sections, we also present our event-study plots separately for small firms (less than 30 employees) and large firms (30 or more). Panel (a) of figure 18 presents OLS estimates for the event-study coefficients from equation 3. We find that sued firms increase reported wages of incumbent workers by about 1% in the years after the lawsuit.

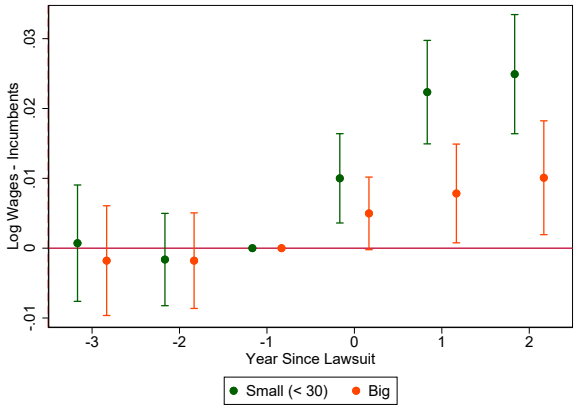
Motivated by our evidence indicating that the practice of PUT is more prevalent in small firms that we covered in previous sections, we estimate the effect separately for large and small firms. Panel (b) reports the event-study coefficients from this exercise. We find a significantly larger increase in smaller firms, on the order of almost 2.5%, which is consistent with our survey and bunching evidence. Then, motivated by our previous evidence on how workers in managerial positions are more likely to engage in PUT, we estimate the effect separately for establishment managers and non-managers. Panel (c) reports the results from this exercise. Although statistical power is lower, we find a significantly larger increase in reported wages among incumbent managers, which is also consistent with our survey and bunching evidence.

Figure 18: Event study plot - Average wages of incumbent Workers

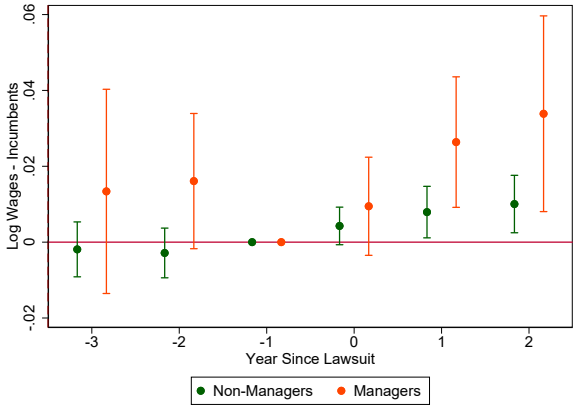
(a) Overall effect



(b) Separated by firm size



(c) Separated by managerial position



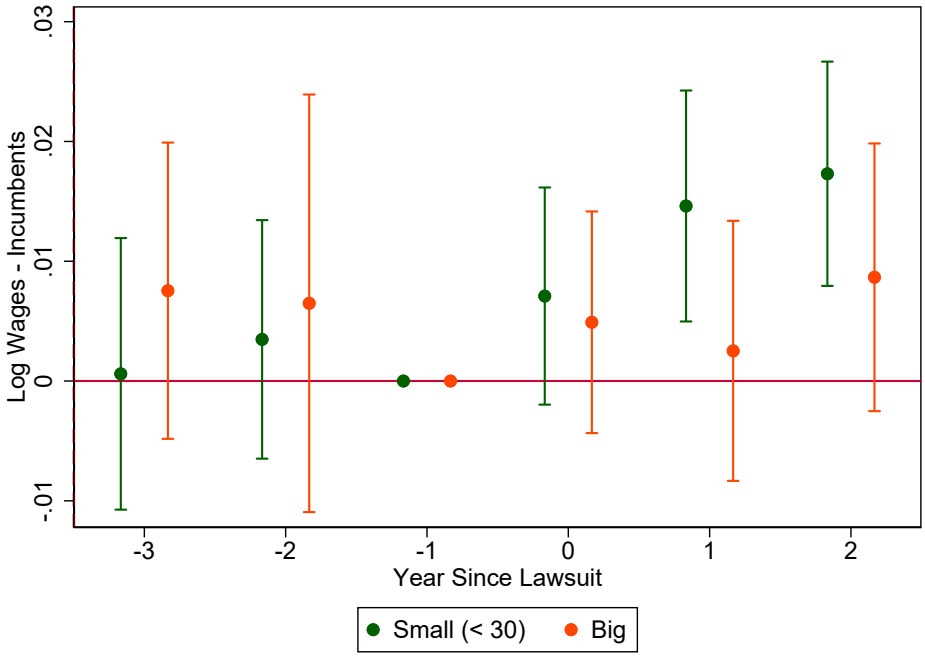
Notes: This figure reports several OLS estimates of event-study coefficients from equation 3, for incumbent workers in sued firms. Panel (a) reports estimates for the overall effect. Panel (b) reports two sets of event-study estimates, one for workers in small firms (in green) and one for large firms (in orange). Small firm is defined as a firm that has less than 30 employees. Panel (c) reports two sets of event-study estimates, one for establishment managers (in orange) and one for non-managers (in green). In all specifications, the dependent variable is the natural logarithm of incumbent workers. Vertical bars represent 95% confidence intervals from standard errors clustered at the establishment level.

It is worth to consider the magnitudes of the effects. From our survey we know that, on average, 26% of formal workers admit to receiving payments under the table

and, on average, the PUT part accounts for about 21% of the salary. In a conservative back-of-the-envelope calculation, if sued firms are paying half of their employees under the table and, on average, the PUT part accounts for about 30% of the salary; we should not expect effects larger than 15%. In addition, this maximum effect would manifest only if every firm reacted to the lawsuit and decided to report all the money under-reported. In this scenario, documenting a 3% increase in reported wages seems a relatively large effect.

We then analyze the effect of a firm being sued on the wages of non-sued *connected* firms. Figure 19 reports OLS estimates of the event-study coefficients for the effect on wages for incumbent workers in connected firms from equation 3, separately for small and large firms. We find that wages of incumbent workers in small connected firms significantly increase after the lawsuit, by about 1.8 percent. This indicates that lawsuits due to PUT in one firm can affect the reporting decisions of affected owners in other firms they own.

Figure 19: Average Log Wages - Incumbent Workers in Connected Firms (by firm size)



Notes: This figure reports several OLS estimates of event-study coefficients from equation 3, for incumbent workers in connected firms. Green corresponds to workers in small firms and orange corresponds to large firms. Small firm is defined as a firm that has less than 30 employees. The dependent variable is the natural logarithm of incumbent workers. Vertical bars represent 95% confidence intervals from standard errors clustered at the establishment level.

We conclude by making a few observations on the coefficients' interpretation. As we mentioned before, lawsuits constitute a significant shock to firms, and trying to disentangle whether the increase in reported wages is due to pre-existing PUT is challenging. For instance, one could argue that firms reducing personnel because of the lawsuit are now capable of paying higher wages to those who remain employed within the firm. Alternatively, if firms are negatively affected and they reduce personnel, they may also reduce payroll for incumbent workers. The heterogeneity analysis for managers and the evidence for connected firms, which are not directly affected by the lawsuit, points to our interpretation of PUT. However, we intend to add more data into the analysis. In particular, we are in the process of acquiring more labor lawsuits non-related to PUT but with similar monetary costs for the firms. That will allow us to

create a control group that was also subjected to a lawsuit but for different reason that PUT.

7 Conclusion

This paper studies employees receiving part of their wages "off-the-books", which we refer to as "payments under the table". We conducted a novel survey to document the prevalence and mechanics of this type of informality, finding that it is widespread, sizeable, and proportionally higher among high-wage workers. These arrangements are typically suggested by the employer, with unreported payments being typically disbursed through cash or virtual payments, and more prevalent in industries that show high levels of classic informality. A simulation exercise suggests that this type of collusive underreporting is almost as costly in terms of revenue lost as classic informality.

We then turn to administrative data, using employer-employee records to analyze wage reporting dynamics at the ceiling of employee social security contributions, which can induce incentives to engage in payments off-the-books. We document several patterns of earnings reporting at the ceiling that are consistent with PUT, such as substantial bunching for earnings at the ceiling, while workers who report earnings at the ceiling are more likely to only update earnings to match movements in the ceiling. In addition, the same predictors for engaging in PUT from the survey evidence are good predictors for bunching at the ceiling.

Finally, we study the consequences of the breakdown of this type of collusive underreporting. Specifically, we study how being sued by a worker for past payments under the table affects subsequent reported wages. We find that sued firms increase the reported wages of their incumbent workers, particularly among small firms and workers in managerial positions. In addition, the effect is not limited to sued firms: reported wages also increase in non-sued firms that have an owner in common with a sued firm. This evidence indicates that the breakdown of collusive evasion can lead

employers to limit their subsequent engagement with payments under the table, both in sued firms and in other non-sued firms they own.

Our study presents, to our knowledge, the first attempt to produce a comprehensive picture of the practice of employees receiving part of their salaries off-the-books. Most of the existing literature on informality has focused on firm- and worker-level informality, with only some papers providing evidence of the existence of unreported payments to some degree, none of which provide comprehensive evidence on the extent and mechanics of this type of informality. Our findings draw parallels to existing research in the sense that informal payments are more prevalent in industries where informal hiring is more prevalent. However, the distributional implications are starkly different: while informal employment is more common among low-wage workers, we find that engaging in payments off-the-books is equally likely across the earnings distribution and that high-earners conceal a higher share of their earnings. This bears important policy implications, since there is a margin of informality that can be reduced to increase revenues without affecting the employment prospects of low-earning informal employees. In addition, the reporting dynamics we document for wages around the ceiling suggest that collusive underreporting can significantly interact with typical regulations, and that careful attention should be paid to the design of tax schedules due to their potential effects on the concealing of earnings. Finally, our evidence regarding lawsuits and the propagation of their effects suggest that strong legal institutions can limit the spread of collusive tax evasion.

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A Ownership Data

***Cadastro Nacional de Pessoa Juridica* (CNPJ)**: consists of a registry of all formal establishments in the country. This includes for profit businesses, public sector establishments and non-profit organizations [28]. For every firm in the CNPJ we have their unique firm identifier, the firm's name, date of entry, date of closure (if closed), industry defined at the 7 digit CNAE level and address. Ownership information in the publicly available CNPJ dataset is only recorded for firms that have more than one legal owner. We have identified information on the owners' name and 6 out of 11 digits from the owners' CPF[29] and date of entry in the partnership.

***Cadastro Nacional de Empresas* (CNE)**: is a data set that used to be organized by the Ministry of Industry and Commerce (MDIC) and put together state-level business registries. It was collected until 2017 and its access is restricted and was obtained through direct contact with MDIC. Every business establishment in Brazil must have a registration in both federal and state business entities. These state-level entities are called *Juntas Comerciais* and collect information that is similar to what is reported to the Federal Tax Authority. The CNE complements the CNPJ data set by providing us the name, and full CPF of firms with only one owner.

We prioritize the CNPJ information over the CNE when both of them are available as it is a more unified data set. As a collection of different state-level institutions, the CNE data can differ in quality (number of missing names or CPFs) according to each state. With the CNE and CNPJ together, we are able to track ownership information of 95.6% of workers that appear in RAIS. However, CNE and CNPJ records only give

[28] In Brazil, these organizations are legally considered public entities that should disclose ownership, address and information on activity. Nevertheless, this was not easily tracked by researchers. Before 2018, one would have to ask for individual information of each organization to the *Receita Federal* (Brazilian Tax Authority) making it virtually impossible to obtain information on the universe of firms. After a long judiciary process, in 2018 the *Receita Federal* started to release files containing the information of all formal firms. Those files are open to the public at the tax authority website and are what we use in our analysis.

[29] They are always the 6 digits in the middle, as the data comes in a format ***.XXX.XXX-** where we observe the Xs but not the asterisks.

us the name and the social security number of the owners. It does not provide other owners characteristics we are interested at, namely race.

Information about firm owners' race, gender education: To recover the race, gender and education of firm owners, we go back to RAIS, and match worker level information from 2003 to 2018 to our ownership records. This allows us to recover race, age, gender and schooling information for all entrepreneurs who had at least one formal job contract as an employee in the 16 years of our labor market data[30]. As mentioned above, the CNPJ data only has 6 out of 11 digits of the CPF. To match those owners to RAIS, we use matching algorithms that first do an exact match on the 6 middle digits of the CPF and then use text (i.e, fuzzy) matching for the name of the workers. We are cautious in our matching, and we believe that this might generate some type-II errors where we do not find the owner in RAIS as a worker, but we avoid matching workers by mistake. This also gives a reason why the CNE data is useful. CNE identifies owners by their full CPF, so we can match them easier with RAIS.

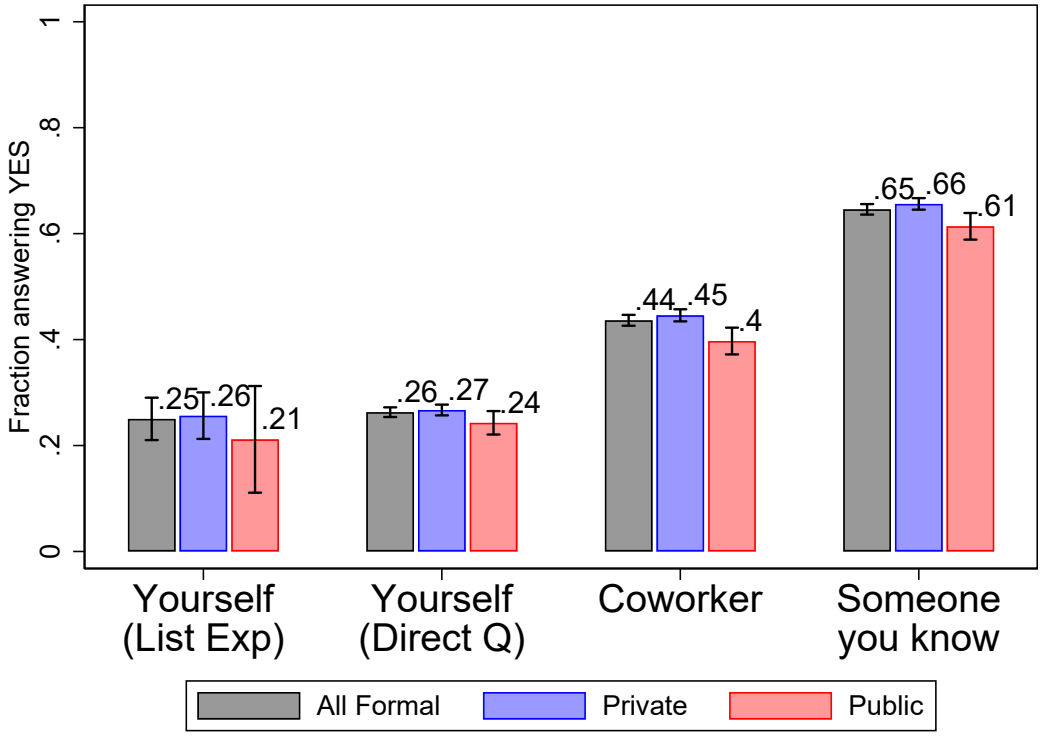
In some cases, a firms' corporate structure includes owners that are individuals and owners that are other companies. In these cases, we consider the race of the individual partners. Firms that are solely owned by other firms are excluded from the sample. Publicly traded firms are also excluded from the sample [31].

[30] As with worker level results, we also take the modal race from all contracts available and input that as the race of the entrepreneurs.

[31] Differently from the U.S. and other developed countries, Brazil has a very small number of firms publicly traded (around 350 every year).

B Own Survey Data

Figure 20: Proportion of Formal Employees Engaged in PUT by Sector



This plot shows

C Bunching Evidence

Figure 21: Industry Fixed Effects (PLACEBO)

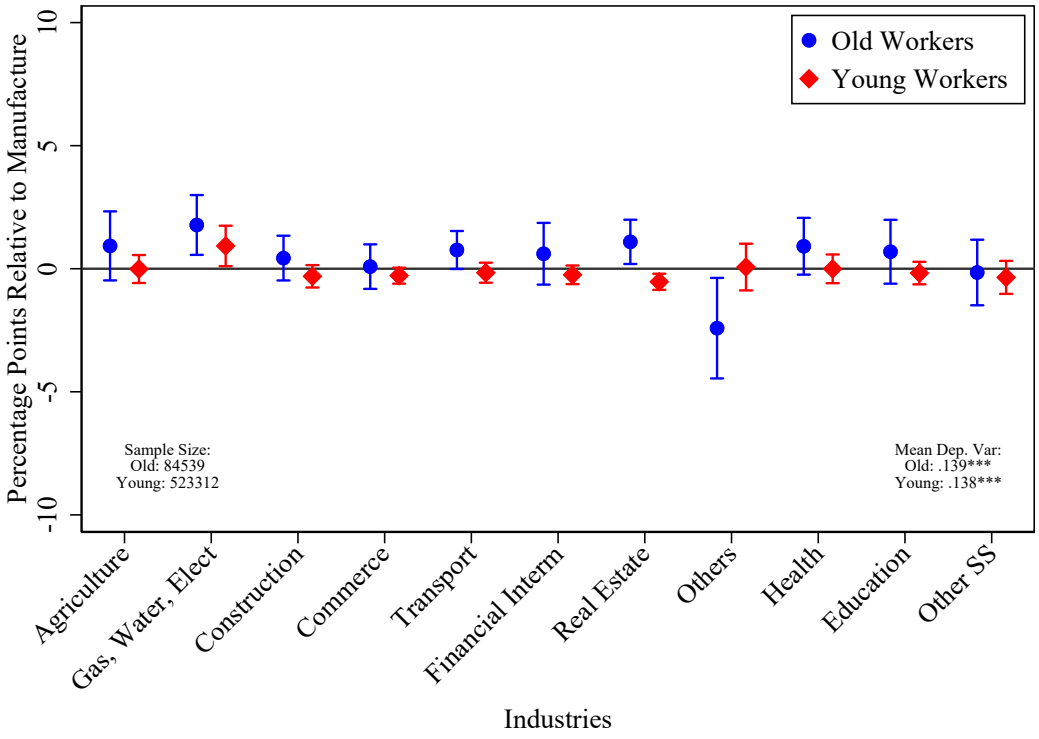


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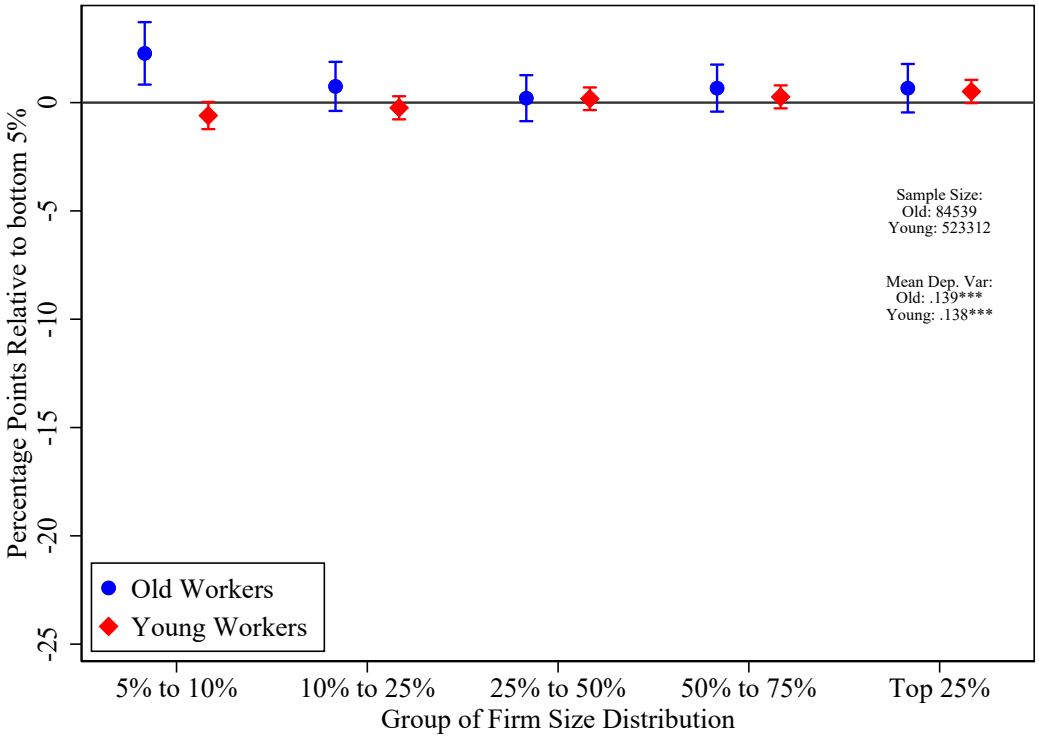
Figure 22: Establishment Size Effects (PLACEBO)



This plot

Table 6: LPM: Results

	Bunching	
	Old Workers	Young Workers
Worker Characteristics		
Female	0.0305***	0.00145
	(0.00435)	(0.00146)
Some College	0.00578	-0.00477**
	(0.00428)	(0.00156)
Non-white	-0.00683	-0.00482**
	(0.00415)	(0.00182)
Firm Owner Characteristics		
Female	0.0249***	-0.00271
	(0.00412)	(0.00141)
Some College	-0.0539***	-0.00583
	(0.00631)	(0.00340)
Non-white	0.0000292	0.0100***
	(0.00415)	(0.00177)
Matching Characteristics		
Manager	0.180***	0.00872***
	(0.00614)	(0.00240)
Same Gender	0.00127	-0.00259
	(0.00400)	(0.00134)
Same Race	0.0100**	-0.00320
	(0.00388)	(0.00167)
Worker has more Educ.	0.0123	-0.000473
	(0.0116)	(0.00490)
Firm Size		
7-11 Emp.	-0.106***	-0.00926*
	(0.00973)	(0.00465)
12-35 Emp.	-0.162***	-0.00470
	(0.00784)	(0.00402)
36-172 Emp.	-0.204***	-0.00823*
	(0.00737)	(0.00392)
172-773 Emp.	-0.212***	-0.0111**
	(0.00751)	(0.00395)
More Than 733	-0.215***	-0.0112**
	(0.00765)	(0.00397)
Dep. Var Mean	0.222	0.145
Industry F.E.	Yes	Yes
Year F.E.	Yes	Yes
State F.E.	Yes	Yes
Observations	61816	315727
Adj. R-squared	0.110	0.00149

D Back of the Envelope Calculations

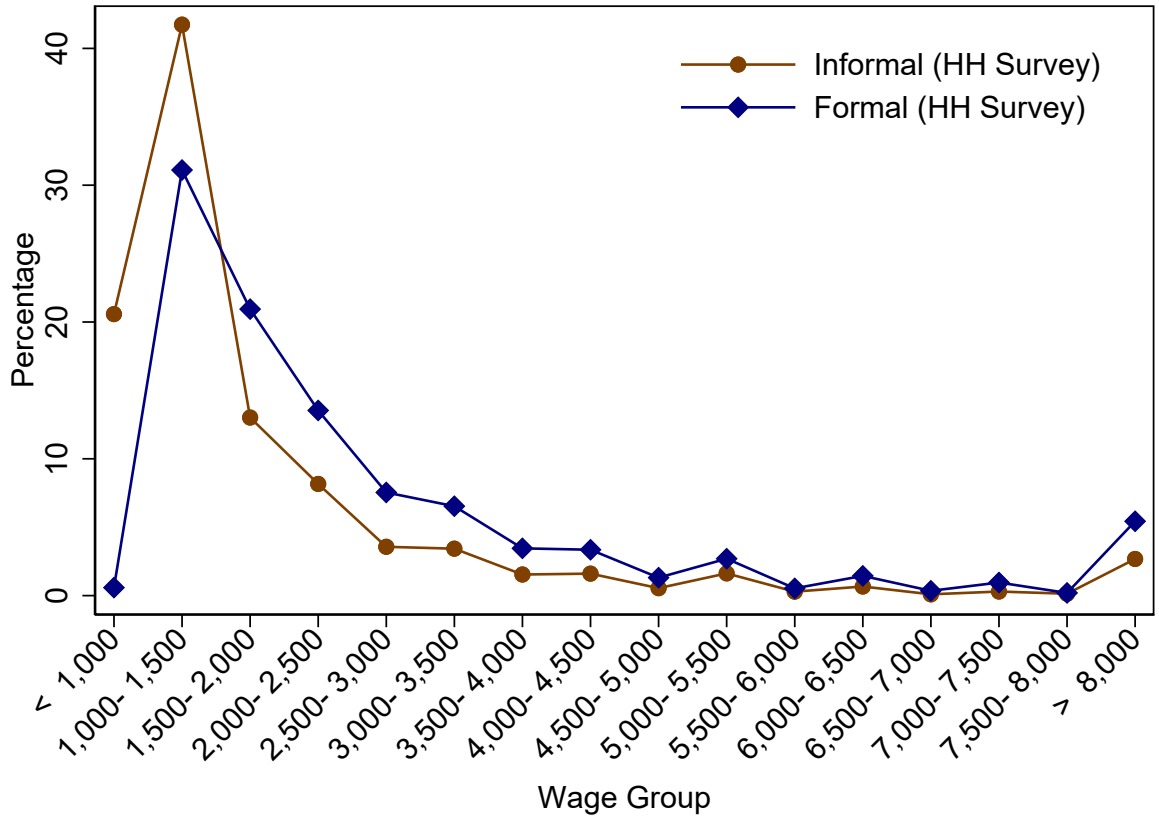
The inputs for the back of the envelope calculation are:

1. Income distribution of informal workers and PUT receivers
2. Proportion of formal workers receiving PUT
3. Fraction of the wage paid under the table for PUT receivers for each wage group
4. Marginal tax rate and tax brackets for income tax and contributions
5. Total number of informal, private, public and formal workers

Income distribution of informal workers and PUT receivers

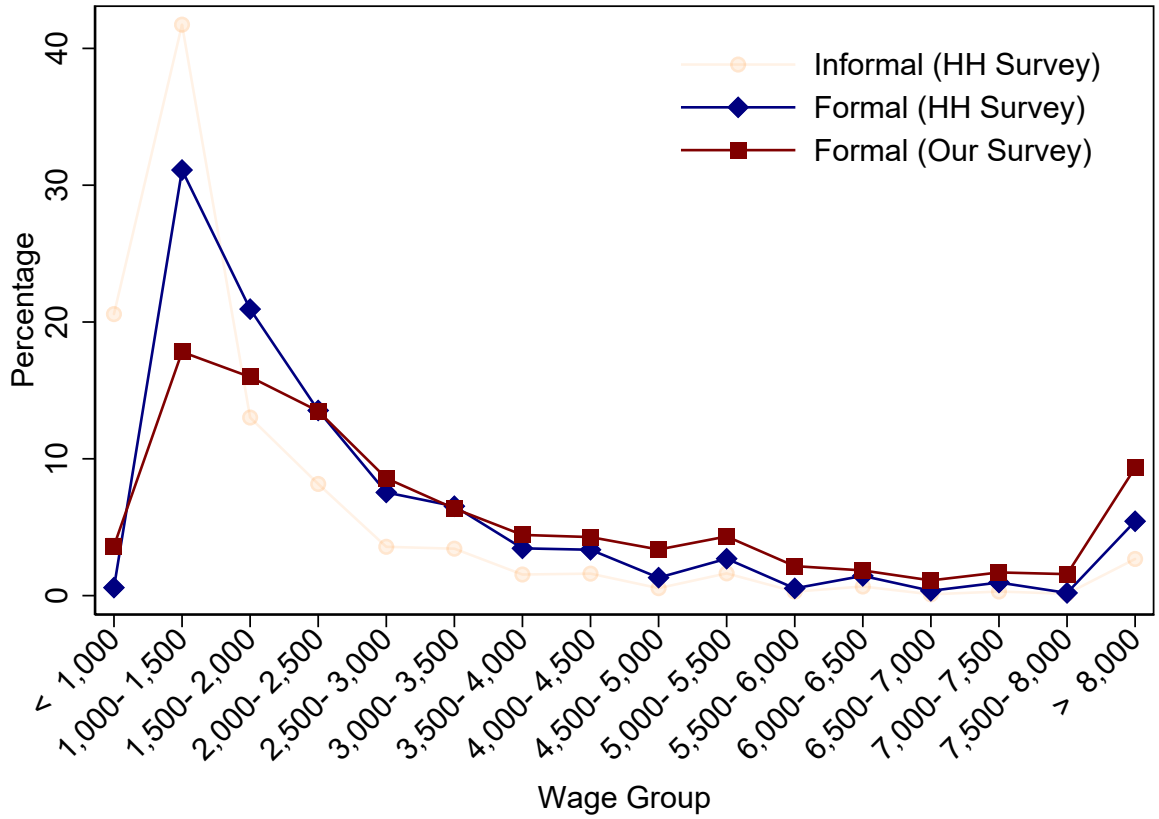
We recover the income distribution of informal workers from PNAD-C. On the other hand, we recover PUT receivers income distribution from our survey. However, our survey over-sample educated people and therefore it contains a higher fraction of high income earners. To make the comparison fair, we reweight our survey using the formal workers' income distribution from PNAD-C. From that, we recover the re-weighted PUT receivers' income distribution.

Figure 23: Income Distribution
(Informal v.s. Formal Employees)



Notes: this figure shows the percentage of respondents in each earnings bin. Red indicates all formal workers in our survey. Black indicates PUT receivers in our survey. Orange indicates informal workers in the PNAD-C survey. Blue indicates formal workers in the PNAD-C survey.

Figure 24: Income Distribution
(Our Survey v.s. PNAD-C Formal Employees)



Notes: this figure shows the percentage of respondents in each earnings bin. Red indicates all formal workers in our survey. Black indicates PUT receivers in our survey. Orange indicates informal workers in the PNAD-C survey. Blue indicates formal workers in the PNAD-C survey.

Proportion of formal workers receiving PUT is recovered from Figure (1)

Fraction of the wage paid under the table for PUT receivers for each wage group is recovered from Figure (**??**)

Marginal tax rate and tax brackets for income tax and contributions

Table 7: Income Tax (2022)

Tax Base (R$)	MTR
$<$ *R*$ 1,903.98	0
1,903.98 - 2,826.65	0.075
2,826.65 - 3,751.05	0.15
3,751.05 - 4,664.68	0.225
$>$ *R*$ 4,664.68	0.275

Table 8: Private Employee's SSC (2022)

Contribution Base (R$)	MTR
$<$ *R*$ 1,212	0.075
1,212 - 2,427	0.09
2,427 - 3,641	0.12
3,641 - 7,087	0.14
$>$ *R*$ 7,087	0.00

Table 9: Public Employee's SSC (2022)

Contribution Base (R$)	MTR
$<$ *R*$ 1,212	0.075
1,212 - 2,427	0.09
2,427 - 3,641	0.12
3,641 - 7,087	0.14
7,087 - 12,136	0.145
12,136 - 24,273	0.165
24,273 - 47,333	0.19
$>$ *R*$ 47,333	0.22

Additionally, employer's contributions are flat and equal to 20% of gross salary.[32] Additionally, the minimum wage is *R*$ 1,212 in 2022.

Total number of informal, private, public and formal workers are recovered from PNAD-C.

[32]Public sector is less clear in this point.

E Lawsuit Evidence