Payments Under the Table:

Employer-Employee Collusion in Brazil*

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Abstract

We study formal workers who receive part of their salary *off the books*, a practice we refer to as "payments under the table" (PUTs). First, we present findings from an original representative survey of formal workers in Brazil to document novel empirical facts about the scope and economic significance of PUTs. A quarter of formal employees admit to receiving PUTs for about 20% of their wages, with higher-wage workers evading a larger share of their total wages. This translates into significant revenue losses for the government, totaling 4.7% of labor income taxes. Second, we leverage rich administrative data and several complementary research designs to provide causal evidence on how workers' and employers' incentives shape collusive tax evasion. On the employee side, we document bunching in reported wages just below the social security ceiling, where employees' pension benefits max out. We show that the bunching is driven by collusive wage adjustment rather than alternative explanations. On the employer side, we use novel data on PUT-related labor lawsuits, matched to employer-employee records, to study the role of labor lawsuits in preventing PUTs, the leading risk employers face. We find that employers increase incumbent workers' reported wages in response to a PUT-related lawsuit by 1%, driven by an increase in the risk they face. This effect is small relative to a full-compliance benchmark, suggesting that current whistleblowing institutions alone are insufficient to deter PUTs. Overall, these findings challenge existing assumptions about the effectiveness of third-party reporting and underscore the need for tailored policy tools to address tax evasion in developing countries.

JEL Codes: H26, O17, J46

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1 Introduction

Tax evasion weakens governments' ability to provide public goods and compromises the efficiency and fairness of tax systems. In response, governments invest substantial resources in enforcement strategies designed to reduce tax evasion (Slemrod 2007; 2019). One of the most effective innovations is third-party reporting, where income is reported to the tax authority not only by the recipient but also by an independent party, such as an employer or financial institution. This system discourages unilateral underreporting, as tax authorities can easily identify discrepancies between self-reported and third-party-reported income. When coupled with withholding at the source, third-party reporting is usually seen as a fundamental tool to fight tax evasion. Formal employees' wages, subject to third-party reporting and withholding by their employers, are perhaps the most prominent example of this system in practice.

The effectiveness of third-party reporting, however, rests on an important assumption: employers and employees do not collude to underreport wages (Kleven et al. 2016). Previous research has shown that collusive tax evasion is prevalent in settings such as the value-added tax (Naritomi 2019, Carrillo et al. 2023, Doerr and Necker 2021). More recent work has also shown that *wage* underreporting may be more prevalent than previously thought (Best 2014, Kumler et al. 2020, Bjørneby et al. 2021, Bíró et al. 2022). Accounting for the under-reporting of formal employee wages pushes us to think about informality in developing countries as a spectrum rather than a binary concept where employees are either formal or not (see Ulyssea (2020), Ulyssea et al. (2023) for a detailed discussion on informality).

However, the literature lacks a comprehensive understanding of the prevalence and mechanisms of collusive underreporting of wages - who participates, how it is carried out, and at what scale - despite its potentially significant revenue and distributional implications. The literature has also offered little guidance on alternative policies that can complement third-party reporting of wages to increase its efficacy[1]. These gaps motivate a closer examination of the incentives faced by employers and employees when deciding whether to collude to evade taxes on wages, and how they respond to changes in these incentives.

This paper makes progress in these directions, directly measuring the phenomenon of formal workers receiving part of their wages *off the books*, a practice we refer to as "payments under the table" (PUT). Because tax evasion is invisible in administrative records (Slemrod and Weber 2012) and household surveys do not recover this information, we designed and implemented a novel and unique large-scale survey among 8,000 formal employees, employers, and accountants in Brazil to provide the first direct and systematic evidence of PUT and an exhaustive characterization of who engages in this practice. We then leverage rich administrative data to examine the determinants of PUTs, providing causal evidence on how PUTs respond to employers' and employees' incentives, thereby informing complementary policies to limit the practice of PUT.

[1] Naritomi (2019) and Carrillo et al. (2017) are good examples of policies that complement third-party reporting in the VAT context

We set the scene, presenting the results of our novel survey of employees in Brazil. When asking directly, about 24% of formal private employees admit to receiving PUTs for about 20% of their wages, with high-wage employees underreporting a larger share of their wages. Formal employees in the top 5% of the wage distribution underreport up to three times more than those in the bottom 50%. Employees working in small establishments are twice as likely to receive PUTs than those in large firms. Furthermore, we show that, even when controlling for demographics, income, and firm size, more frequent interaction between employer and employee strongly predicts engagement in PUTs. When analyzing the payment methods, we find that cash is present in between 40-50% of all PUTs, but it becomes less relevant as we move upwards in the wage distribution. For high-wage earners, bank transfers and virtual payments are more prevalent. Informal payments do not come *as deus ex machina*. If books add up, reported income and expenses must be consistent. We present the results of long structured interviews with accountants about bookkeeping strategies.

A conservative accounting exercise suggests that PUTs imply revenue losses for 4.72% of the labor income tax and 2.49% of Social Security Contributions in Brazil. Together, this accounts for 0.32% of the GDP, representing about a third of the revenue losses from classic informality, defined as those employees whose employers do not contribute on their behalf.[2] However, more than 50% of the amount evaded for PUTs can be allocated to the top 10pc of the wage distribution, while this number is only 27% for classic informality. This highlights that PUTs is significantly more regressive than classic informality.

Validation is critical when providing the first direct measures on a largely understudied topic. In our main survey, we conducted an experiment to elicit truthful responses to sensitive questions, yielding a proportion of employees receiving PUTs similar to that observed in direct measures. Furthermore, we complemented our employee survey with additional data sources. First, we conduct surveys with firm owners and in-depth interviews with accountants to corroborate our baseline estimates from the other side of the collusion. Second, we collected labor lawsuit documents in which employees sued employers in labor courts for receiving PUTs. These documents contain extensive information, including payment methods, amounts paid under the table and officially reported payroll amounts, and evidence of workplace conflicts. We use AI tools to process, recover, and organize the information contained in these documents. These alternative approaches yield results comparable to those of the main employee survey, thereby validating our findings.

Having established the extent and distribution of PUTs, we move to understand how employers' and employees' incentives shape collusive tax evasion and which policies can complement third-party reporting. Employers and employees face very different types of costs when engaging in PUTs. Employers are exposed to whistle-blowing, tax audits, and labor inspections. They also must deal with PUTs' accounting side. On the other hand, workers partially forgo social secu-

[2]Classic informality includes both employees in non-registered establishments and employees in registered establishments hired entirely *off-the-books*.

rity benefits and proof of income when receiving PUTs. Showing that PUTs are marginal to both types of incentives is crucial because it opens the door to a wide range of policies to complement third-party reporting and increase tax compliance.

We leverage rich administrative data to study the trade-offs employers and employees face when PUTs' costs increase. On the employee side, we study the ceiling in the social security system, which breaks the link between wage reporting and pension benefits. On the employer side, we study the leading risk employers face when paying under the table: lawsuits in labor courts.

We show that PUTs are marginal to changes in workers' incentives in two steps. First, we document a significant bunching at the ceiling of the social security system, which is larger for workers closer to retirement age, consistent with workers' incentives to maximize their pension benefits. Below the ceiling, additional reporting increases pension benefits, while above the ceiling, the benefits max out, discontinuously changing the workers' incentives to report wages. Second, we provide conclusive evidence that the bunching is explained by collusive wage adjustment: employees earn above the ceiling but whose employers report up to it, rather than by alternative explanations.

The bunching responses are consistent with adjustments in PUTs but could also reflect labor supply responses or institutional rigidities (e.g. employees closer to retirement may prefer to work harder to maximize pension benefits). We rule out both alternative explanations. First, we show that bunching heterogeneity is consistent with groups of employees with higher PUTs in our survey. In particular, bunchers are more likely to work in smaller firms, hold managerial positions, and match demographic characteristics with their employers. Second, we leverage the ceiling annual updates to show that bunchers' wage dynamics exhibit a clear strategic pattern. We find that, even when labor contracts are non-flexible, workers adjust their reported wages from one year to the next to precisely target the new ceiling, whereas they show no wage change within a given year. Finally, we develop a test that combines proxies for *true* wages with the discontinuity at the ceiling, showing that bunchers' *true* wages abruptly increase relative to non-bunchers. This is critical because adjustments to PUTs and alternative stories yield different predictions about bunchers' *true* wages.

In the last part of the paper, we use novel data on PUT-related labor lawsuits merged with matched employer-employee data to study the role of labor courts, the primary whistle-blowing institution, in affecting employers' incentives and in limiting PUTs. First, we examine the triggers of labor lawsuits, finding that workplace conflict precedes collusion breakdowns. All lawsuits occur after the termination of the employment relationship. Second, we move to understand the *propagation* effect of a lawsuit: how do employers adjust incumbent workers' wages when a former employee reports PUTs in labor courts?

We use an event-study design to show that employers increase the reported wages of other employees by 1% in response to a former employee's lawsuit, whereas firms sued for non-PUT-

related issues show no effect. Consistent with the survey results, which indicate that employees in small firms and in managerial positions are more likely to receive PUTs, we find that these groups also exhibit larger responses. Compared to the extent of PUTs, this estimate suggests modest effects of labor courts in limiting PUTs: Back-of-the-envelope calculations suggest that the full-compliance response to a lawsuit would imply an increase in reported wages between 8-16%.

We provide evidence on the mechanisms underlying the employers' responses. Our interviews with accountants indicate that employers' risk of engaging in PUTs with other employees increases following a lawsuit for two reasons. First, employers underestimate the likelihood of workplace conflicts that can trigger lawsuits. Second, other employees become more likely to sue in response to a former employee's lawsuit, since they may learn from each other or called to testify in labor courts. Consistent with the latter mechanism, we find suggestive evidence of learning in networks of coworkers. Using an event study design, we show that employees become more likely to sue their employers for PUTs after a new coworker with lawsuit experience joins the firm, compared with a control group that faces the arrival of a new coworker without lawsuit experience. We show that results are driven by those coworkers who are more likely to interact with the lawsuit-experienced employee.

Our results show that PUTs are widespread and sizeable in contexts like Brazil. They also show how employers' and employees' incentives shape collusive tax evasion, providing valuable insights for designing policies that complement third-party reporting to enhance its efficacy in reducing this practice. They suggest that relying solely on third-party reporting may be insufficient to prevent PUTs when collusive tax evasion between employers and employees is prevalent. Strengthening labor court processes to trigger tax audits, enhancing enforcement capabilities, and improving the link between reported wages and social security benefits could be effective complementary measures to reduce PUTs.

Our paper contributes to several strands of the literature. First, we contribute to the literature on tax evasion and third-party reporting. The *Internal Revenue Service* has released tax gap reports for the last 20 years (IRS 2022 for the latest), consistently showing no misreporting for income subject to third-party reporting and withholding. Kleven et al. (2011) use random audits to unmask the evasion rate of different types of income in Denmark. Similarly to the United States, they find no evidence of misreporting for income subject to third-party reporting, such as wages. An extensive literature studying tax evasion using *traces of income* has evolved under the critical assumption that income is accurately reported for wage and salary earners (Feldman and Slemrod 2007, Artavanis et al. 2016, Bazzoli et al. 2021, Schmutz 2018). For example, Chetty et al. (2013) interpret the bunching responses of self-employed as purely reporting, while the wage earners' responses are interpreted as adjustments in actual earnings. Kleven et al. (2016) develops a framework to rationalize these results in developed economies.

Recent papers have documented collusive tax evasion in other areas, such as VAT and property transaction taxes. Doerr and Necker (2021) shows evidence of collusive tax evasion for service

provision in Germany, where the client receives a lower price while the contractor does not provide an invoice to evade taxes. In Brazil, Naritomi (2019) shows that consumers can get a lower price at the last stage of the VAT chain while the retailer evades VAT payments. They also show how interventions that reduce consumers' incentives to participate in collusive tax evasion substantially increase tax compliance. Carrillo et al. (2017) shows that the effectiveness of third-party reporting for VAT can be limited when tax authorities face constraints to credible enforcement in Ecuador. More recently, Carrillo et al. (2023) shows that collusive tax evasion between firms can go far enough that they release "ghost" invoices so their clients can claim them as deductions. These papers have advanced the literature by showing the limits of third-party reporting as a silver bullet to fight tax evasion.

We know much less about employer-employee collusion on PUTs. Some papers have investigated PUTs but always through an indirect approach, mostly interpreting wage changes in administrative data as PUTs adjustments. Interestingly, this emerging literature covers many countries, from Latin America to Eastern Europe. Even in Norway, Bjørneby et al. (2021) provides experimental evidence of PUTs in small firms. Some have considered the interaction of PUTs and the minimum wage (Bíró et al. 2022, Gavoille and Zasova 2023). Others have interpreted responses to pension or health insurance regulations in reported wages as adjustments in PUTs (Lauletta and Bérgolo 2023, Bergolo and Cruces 2014, Kumler et al. 2020). Paulus (2015), Kumler et al. (2020), Calijuri et al. (2023) have addressed the measurement of PUTs as the gap between reported wages in administrative and survey data. An exemption is Williams and Padmore (2013), which conducts a survey for several European countries about PUTs. However, it mostly captures the extent of formal wages paid under the table but does not provide much disaggregation to understand who engages in this practice. Additionally, it focuses more on cross-country comparisons without providing revenue or inequality implications. Finally, it does not speak to the incentives that employers and employees face when engaging in PUTs.

While these papers have questioned the strength of third-party reporting on wage, the literature is far from having a clear understanding of the topic. Our paper provides the first direct and systematic evidence, documenting the extent of and who engages in PUTs, their revenue and distributional implications, and how employers' and employees' incentives shape collusive tax evasion in the same setting.

Second, this paper contributes to the large literature on informal employment in developing countries. The traditional view of informality highlighted firms' decisions to comply or not with regulations. Therefore, all workers employed in unregistered firms are hired informally (Rauch 1991, La Porta and Shleifer 2014). Ulyssea (2018) extended this view of informality by considering registered firms that hire some of their workers *off-the-books*. More recently, Haanwinckel and Soares (2021) uses a compensating differentials model to show that highly productive workers may also be employed informally by unregistered establishments. These two papers have made significant progress on adding layers of complexity to the informality phenomenon. Yet, informality remains a binary concept defined at the worker level. This paper conceptualizes informality as

a spectrum, on which even formal workers in registered establishments may receive part of their wages informally.

2 Institutional Context and Data

Like most developing countries, informal labor relations are a large component of the Brazilian labor market. Individuals with no link to social security represent 31.3% of Brazilian employees.[3] Among workers in an employer-employee relationship, 78% are formally employed, meaning their employers listed them in the payroll, making contributions on their behalf. The latter is the universe of workers we study in this paper.

Formal labor ties are associated with benefits and costs for the employee and employer. Formal employment is very salient in this context, as workers have a *signed Carteira de Trabalho*, a booklet that give them access to social security benefits and can observe how much is reported monthly by the employer. Workers are entitled to severance payments, pensions, maternity leave (restricted to women), and unemployment insurance. They also have to contribute to the social security system and pay income taxes, which are withheld (detailed schedule is detailed in Appendix E). In turn, employers must comply with minimum wages, union wage floors, and contributions to the social security system for each employee.

Finally, there are different tax regimes for firms, which determine whether they face profit or revenue taxes and how much contributions they pay on behalf of the employees. Table A1 shows the fraction of employees that work in each of these tax regimes in 2022, as well as the fraction of employees across the firm size distribution.

Legal Framework for Payments Under the Table

In Brazil, paying under the table constitutes a violation of both tax and labor Laws. In the first case, employers and employees violate several articles of the Tax Law. For example, Article 113 defines the primary tax obligations, stating that taxpayers must declare all income and fulfill tax obligations. Employees are not paying income taxes, and employers do not pay contributions when incurring PUTs. Article 1 in Law N^o 8137/1990 states:

> It constitutes a crime against the tax system to suppress or reduce taxes, social contributions, or any accessory through the following conduct:
>
> 1. Omit information or make a false statement to the tax authorities;
> 2. Defraud tax inspection by inserting inaccurate elements or omitting operations of any nature in a document or book required by tax law;
>
> Setting penalties of imprisonment of two to five years and a fine.

[3] Among Self-Employed individuals, who comprise 33% of the Brazilian Labor force, this share is even higher. Calculations made with PNAD-C in the first trimester of 2022.

However, the Labor Courts have jurisdiction over various laws and codes that differ from those mentioned above. First, Labor Courts are responsible for processing and judging disputes arising from labor relationships.[4] This means that they mediate employer-employee relationships, and they do not process or judge obligations to the tax authority or the government. Second, regarding the subject matter, the Labor Courts' jurisdiction is determined by the "Consolidation of Labor Laws" (CLT - *Consolidação das Leis do Trabalho*).[5] Articles related to employees' payments are specified in the first chapter of the CLT. It specifies that employers have an obligation to report salaries in the employees' booklet (*Carteira do Trabalho*) regardless of payment method. [6] Then, only the employer violates the labor law when engaged in PUTs. This makes Labor Courts a safe institution for employees to report PUTs, where they can receive compensation and avoid exposing themselves to judgment for other civil responsibilities.

Data

This paper combines several data sources. For simplicity, we list the data based on survey or administrative sources. First, we collect our own data based on a survey of formal employees, firm owners, and accountants. We complement these data with the Brazilian household survey to reweight our sample and to recover estimates of informality. [7]

1. **Employees**: Using the online survey platform Lucid MarketPlace [8], we conducted the first large-scale survey on PUT in March 2022. We surveyed an initial sample of 12,000 Brazilian employees.[9] Self-employed, part-time workers, informal employees, and those under 18 years of age were excluded. Our final sample comprises 9,000 formal employees and 7,297 private-sector employees. Table A2 provides a balance table comparing our survey with the Brazilian Household Survey (PNAD-C). We reweight our sample based on workers' demographics, firm characteristics, and earnings.

2. **Firm Owners**: We partner with Oppen Social, a large survey company in Brazil, to conduct 313 phone surveys, making sure that we were talking to the firm owner or a high-ranked manager with knowledge of the firm's wage-setting policy.

3. **Accountants**: We surveyed 55 accountants in two ways. We conducted 36 in-depth interviews for 30/40 minutes and collected the remaining answers through short versions of the questionnaire distributed through the *WhatsApp* group of the Sao Paulo School of Accountants.

[4] Constitutional Amendment N^o 45/2004 expanded Labor Courts' umbrella beyond employment relationship to any labor relationship.

[5] Competência da Justiça do Trabalho e Comum - Jurbrasil

[6] Article 39 states that employees can bring omissions in the booklet to Labor Courts. Section VIII explicitly outlines the penalties for employers failing to accurately report employees' wages. Full document: *Consolidação das Leis do Trabalho*

[7] We refer the reader to supplementary material in our website containing detailed explanations on all datasets and questionnaires used. We make all non-confidential data publicly available for researchers.

[8] See Coppock and McClellan (2019) for a study on its external validity

[9] Respondents were compensated for their participation in the survey.

4. **Pesquisa Nacional por Amostra Domiciliar - Continua (PNAD-C)**: This is the national household survey conducted by the Brazilian Institute of Geography and Statistics (IBGE). We use this data for two reasons: it allows us to build the correct weights for our survey of formal employees, and to recover information on informal employees, which is used to benchmark the accounting exercise presented in Section 3

Second, we use several sources of administrative data. These include the matched employer-employer (RAIS), ownership records, labor lawsuit records, property records, and registries of all federal aid programs' recipients. They can all be merged using the individual social security number.

1. **Relação Anual de Informações Sociais (RAIS)**: 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. RAIS only tracks hired employees and does not show firm owners.

2. **Ownership Records**: We assembled public and confidential data sources to build a universe of formal firm owners, which can be merged to RAIS using the firm identifier (*CNPJ*)

3. **Labor Lawsuit Data**: We collected the universe of labor lawsuits related to PUT (*pagos por fora* in Portuguese) in Brazil between 2014 and 2019. These 220,000 lawsuits are cases where an employee sues an employer in the Labor Court for receiving PUTs. The data contains detailed information on the case, including employees and employer identifiers.Also, we accessed a random subsample of 100,000 PDFs containing the claim sent by employees' lawyers to the judge. These documents contain information on PUT amounts, payment methods, conflict in the workplace, etc. Appendix D presents the full methodology on how we process these documents using AI.

4. **Property Records**: Universe of properties in the Municipality of Sao Paulo. It includes several property characteristics such as size and assessed values. Property owners can be identified based on their CPF.

5. **Cadastro Único**: Comprehensive administrative registry made by the Ministry of Social Development covering the universe of households that receive a federal social welfare program.

3 Payments Under the Table: The Big Picture

This section shows the results of our novel survey about PUT in Brazil. We focus our attention on formal employees working full-time in the private sector. One advantage of our setting is that there is a clear definition of formal employees who must have a booklet that provides access to social security benefits. We use this definition, which the Brazilian government uses as well.

Like most online surveys, it overrepresents high-income earners and highly educated individuals. We rely on the national household survey to reweight our sample. Table A2 presents a balance table comparing our survey with the government household survey. Column (2) uses our survey re-weighted. We can approximate most of the summary statistics, which makes our results more reliable in representing the Brazilian labor force population.[10]

3.1 Prevalence of PUT

The first challenge in surveying illegal payments is explaining clearly what we mean by PUTs. Note that the concept entails very different situations, from receiving half the salary in cash every month to using the firm's credit card for personal expenditures. We want to capture at least three general features. First, the illegal nature of PUTs, meaning that taxes or social security contributions should legally be paid for these payments. Second, some degree of periodicity, meaning that it has to correspond to payments made in the concept of wages. Third, we want to refer to situations where some degree of employer-employee collusion exists. This means that, at a minimum, they are both informed. Note that by surveying employees, we recover the share of workers aware of PUTs, alleviating concerns that PUTs could be unilaterally decided by employers without employees' knowledge.[11]
However, clarity comes at a price. It is possible that respondents do not consider a specific form of payments (that we would like to capture) when answering the question. For example, very common among high-income earners are the use of a company car and housing subsidies, among others. The following paragraph provides the exact explanation we offer to respondents regarding PUTs.

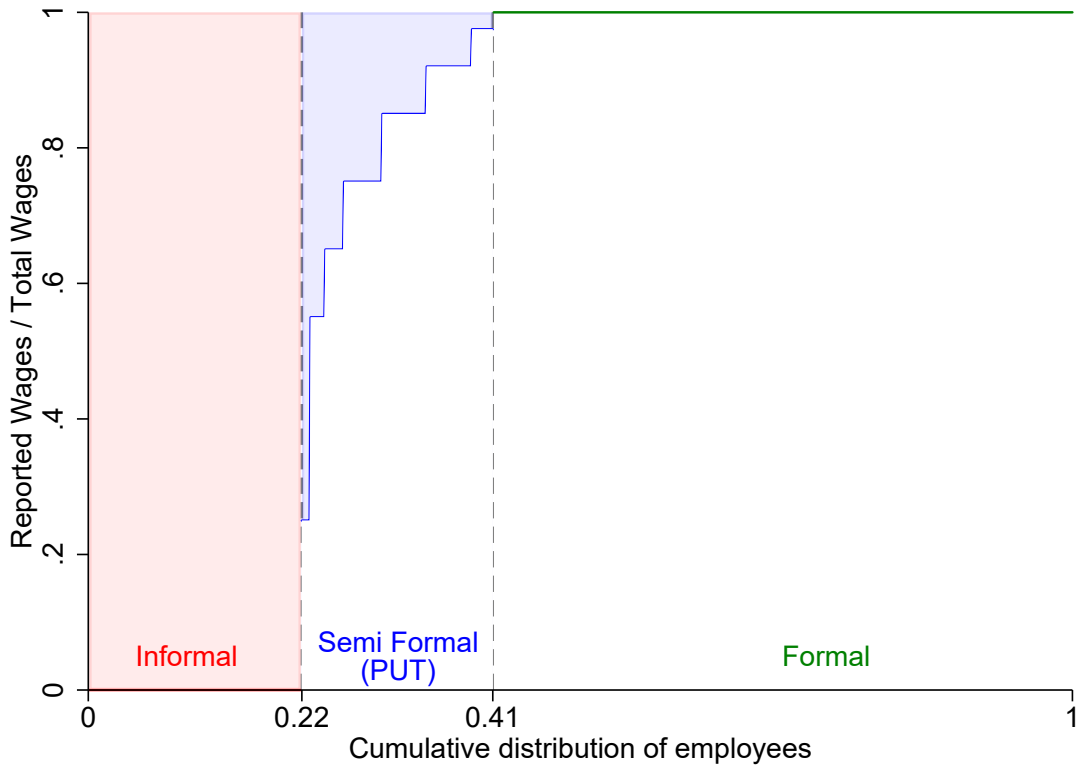
> *"In Brazil,* ***some formal workers (with CTA) receive part of their wages under the table, meaning that they are not registered on the firm's payroll.*** *Therefore, total wages have two parts:*
>
> - ***In firm's payroll*** *(paying taxes and making contributions to social security)*
> - ***Not registered in firm's payroll*** *(saving taxes or social security contributions)*
>
> *The following questionnaire concerns this type of informality: formal employees (with CTA) who receive part of the wage under the table.* ***It is important to remember that all responses are 100% anonymous and only used for this research project. We thank you for your collaboration.***"

[10] We did not recover location, so we cannot use regions as an additional input in the reweighting process. However, the survey company we partnered with confirmed that they collected their sample to represent all regions in Brazil accurately. In a follow-up paper, where we replicate the survey in several Latin American countries, we include a question on location that we use in the analysis.

[11] Additionally, when surveying employers, we show that similar order of magnitudes relative to the survey to employees.

We first document that about 24% of formal private employees (21% of all private employees) admit to receiving PUT. On average, PUT receivers underreport 20% of their wages.

Figure 1: Payments Under the Table in the Brazilian Labor Market



Notes: This Figure shows the ratio of reported wages over total wages for employer-employee relationships in the Brazilian economy. Then, the total shaded region represents the share of total payroll that is *off-the-books* in the Brazilian economy. The red shaded area represents the 22% of employees who are informally employed. This number comes equivalently from our own survey to employees or PNAD-C, because we obtained the same share of informal workers. The remaining 78% of employees are separated between fully formal (in green) and semi-formal (in blue). Semi-formal employees represent the PUT receivers. This information comes from our own survey, which is the only source that contains information on PUTs. The blue shaded area represents the additional under-reported wages documented in this paper. We input that the entire wage is not reported for fully informal employees, contrary to fully formal employees, for whom we input full reporting. All results are re-weighted based on the Brazilian Household Survey.

Figure 1 has two purposes. First, it summarizes the extensive and intensive margin of PUTs in a single plot. Secondly, it emphasizes that informality should be understood as a spectrum rather than the traditional binary concept.

When validating the extensive margin, a classic concern with sensitive questions is the willingness of respondents to admit the truth. We follow the current literature to design a List Experiment (Castañeda et al. 2020, Coffman et al. 2017), which confirms our result. Appendix C details the implementation of the experiment. In line with these results, about 30% of firm owners admitted to paying their employees under the table, and almost 50% of them know a case of PUTs. Con-

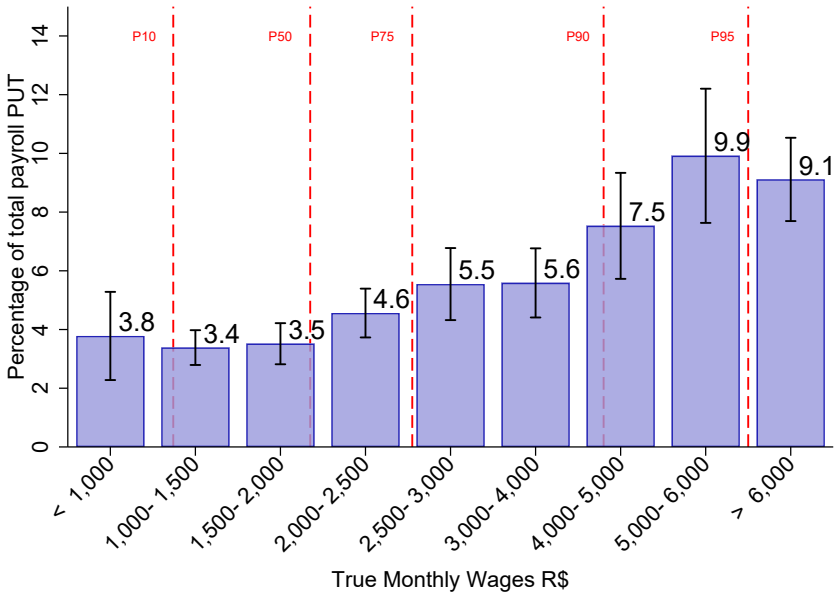
sidering that most surveys to employers were by phone, we expect significant under-reporting. Consistently, our interviews with accountants reveal a widespread practice of payments under the table.

We use the PUT-related lawsuit documents to validate the intensive margin by recovering the fraction paid under the table. As explained in Section 2, these documents are written by the employee's lawyer to initiate a lawsuit, and thus are addressed to the judge. Given the lack of structure, we use AI tools to process them, emulating human reading at a very large scale. Figure A2b clearly shows that the distribution of the fraction paid under the table is shifted to the right in the lawsuit documents compared to the survey responses. This is consistent with selection into reporting and with lawyers overclaiming PUTs to obtain larger compensation for their clients. However, the order of magnitude is not very different and the shape of the distribution is similar.

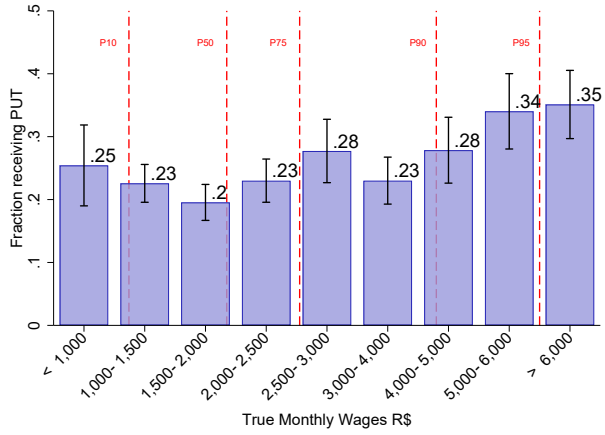
3.2 *Who* receives PUTs?

The next step is to describe who, among the formal employees, are the PUT receivers. Understanding the distribution of PUTs across the wage distribution is critical for the distributional implications of this form of tax evasion. Figure 2 clearly shows that PUTs are proportionally larger for high-wage earners. Moreover, this result is explained both for the extensive and the intensive margin. Strikingly, workers in the top 5% of the wage distribution evade almost three times more than workers in the bottom 50% as a percentage of their income.

Figure 2: Distribution of Payments under the Table across the Wage Distribution



(a) Total Payroll



(b) Extensive Margin

(c) Intensive Margin

Notes: Panel (a) shows the fraction of the total payroll paid under the table for each wage group. It combines the extensive and the intensive margin by inputting a zero for those who do not receive PUTs. Panel (b) shows the fraction of formal private employees receiving PUT for each reported wage group. Panel (c) shows the average percentage of the underreported wage for each true wage bin. It is calculated on the basis of the midpoints of the bin options provided to respondents. The x-axis in panel (b) corrects the reported salary to account for underreporting based on a follow-up question in which we asked if they answered their salary thinking about their total or reported salary. Results are robust to such correction. The black vertical lines represent 95% confidence intervals. We reweighted all statistics based on *sex, age, education, establishment size, and income group*.

Figures A3 and A4 validate these important results. Firm owners report that they are more likely to pay under the table to high-skill and more tenured workers, as well as managers. On the intensive margin, the PUT-related labor lawsuits reveal a very sharp pattern in which employees

with higher total wages were receiving a larger fraction of their wages under the table.

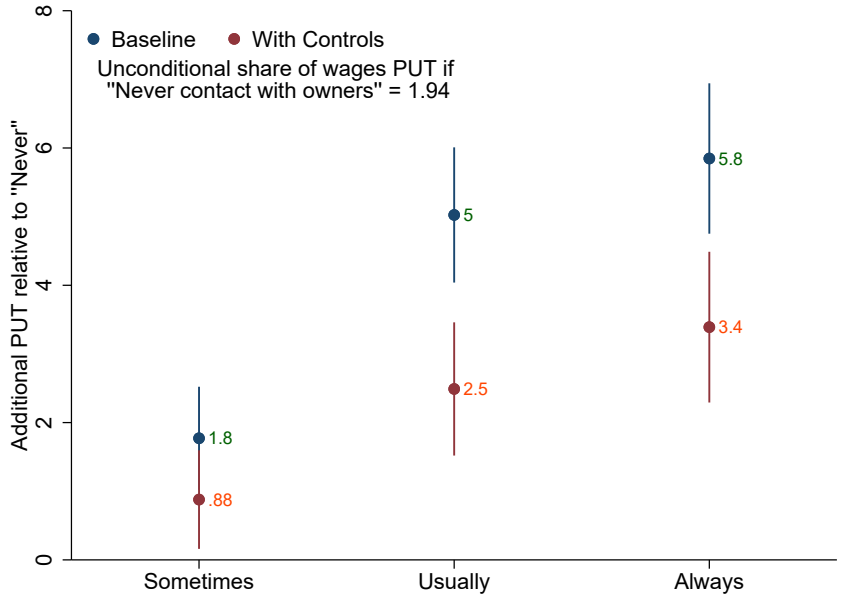
Several features may explain the regressivity of PUTs, which differs from the classic informality. First, income tax rates are increasing, making incentives to evade stronger for high-wage earners. Second, there is a mechanical component that makes this form of tax evasion relevant for high-wage earners, which is the interplay with the minimum wage. If you are an unproductive formal employee, meaning that your true wages are low, there is not much room to pay under the table, given that, at least, the minimum wage must be reported. In addition, as with any form of collusive tax evasion, interactions between the employer and the employee can contribute to a successful collusion. Higher-paid employees, who are closer to managerial positions, may find it easier to interact with owners or personnel in charge of wage setting. We provide direct evidence of the role of employer-employee interaction to facilitate PUTs. We asked questions regarding the employer-employee relationship, including *family business*, *managerial position*, and *frequency of interaction with owners*. In Appendix B, we provide the results for all proxies for proximity in both the extensive and intensive margins. In what follows, we use our variable about *frequency of interaction* to run the following regression and present the results in Figure 3.[12]

$$\text{PUT}_i = \alpha + \beta_S \mathbf{1}[Z_i = \text{Sometimes}] + \beta_U \mathbf{1}[Z_i = \text{Usually}] + \beta_A \mathbf{1}[Z_i = \text{Always}] + \gamma X_i + \varepsilon_i \quad (1)$$

Where PUT_i is the fraction of total payroll paid under the table (extensive and intensive margin together). Z_i is a categorical variable indicating how often the employee interacts with the owner. We left in the base the category *"Never"*. X_i is a set of controls, including demographics, the other proximity variables, and fixed effects by income and firm size.

[12]Surveys of firm owners and accountants confirm that collusion is usually an agreement between the two parties. We show these results in Figures A5.

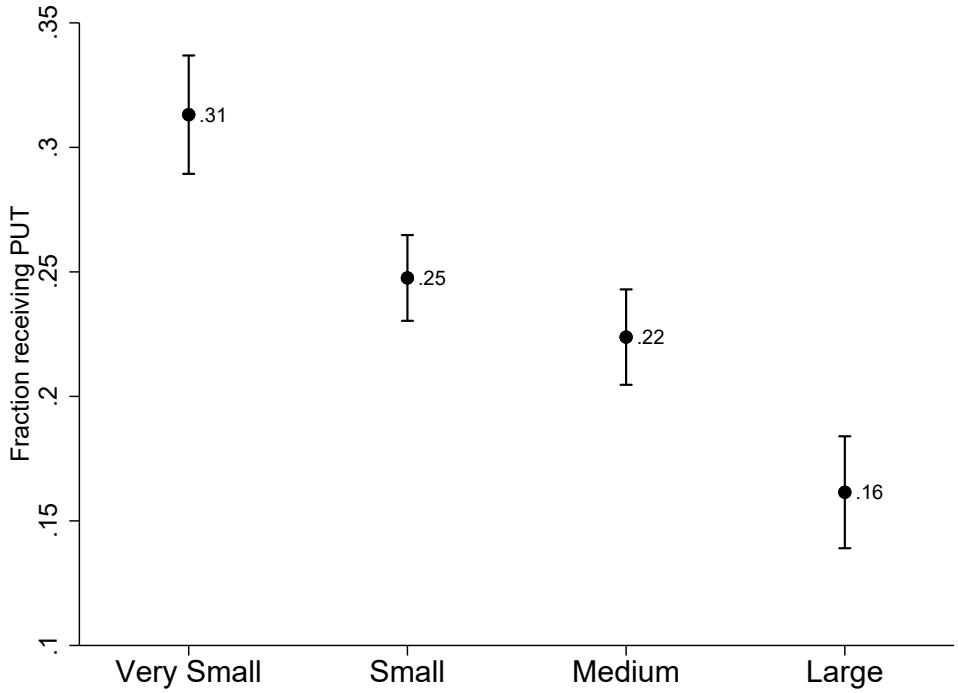
Figure 3: *How often do you interact with the owners?*



Note: This figure plots the estimated coefficients β from Equation 1. Coefficients in red include the set of controls specified in X_i. The y-axis shows the additional fraction of the total payroll paid under the table relative to those employees who never had contact with the owner. Observations are reweighted. Error bars denote 95% confidence intervals.

Firms' characteristics are also relevant for PUTs. Proximity between the employer and a significant fraction of the employees is less likely to happen in larger corporations. Moreover, small and medium-sized firms are more likely to trade with informal firms, implying unreported revenues (possibly in cash) that can be used to pay under the table. Finally, large firms are more likely to be audited, increasing the risks of paying under the table. Kleven et al. (2016) shows that an employer's risk increases exponentially with firm size as long as a single employee reporting triggers a tax audit. They also show that, even in large corporations, a fraction of high-wage employees will receive PUTs if only PUT receivers can report. Consistently, Figure 4 shows evidence that PUTs are more relevant in small and medium-sized firms than large corporations. However, PUTs are non-negligible in large corporations, suggesting that even large firms have found a way to carry out PUTs.

Figure 4: Proportion receiving PUT by firm size



Notes: This figure shows the proportion of survey respondents that report receiving PUT for each firm size. *Very Small* refers to firms with 1 to 10 employees. *Small* refers to firms with 11 to 100 employees. *Medium* refers to firms with 101 to 1000 employees. *Large* refers to firms with more than 1000 employees.

These findings are consistent with accountants' interviews, where they find PUTs more likely in small and medium-sized firms, but still common across the board (see Figure A6). Table A1 in Appendix B presents detailed information on the firm-size distribution, comparing our survey, the Brazilian Household Survey, and administrative records (*RAIS*), and shows consistent values across the sources.

3.3 Revenue Implications

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 on earnings reporting. In particular, we focused on revenues coming from income tax and social security contributions (both from the employer and the employee). As a benchmark, we conducted the same exercise for "classic" informality (those workers fully off the books). While this exercise provides an order-of-magnitude estimate of PUTs' fiscal costs, it also presents challenges and requires several assumptions. Some are worth highlighting here. First, we only consider the mechanical without accounting for behavioral responses to formalization. Second, we consider only social security contributions and income taxes, considering that the first can

be deducted from the income tax base. We also include the fact that firms that pay profit taxes can deduct wage reporting from the profit tax base. Third, we do not include government expenses that exist because of PUTs but would be saved otherwise.[13] Appendix E explains all the assumptions in detail. While credible, we try to follow the most conservative ones, interpreting our back-of-the-envelope calculations as lower bounds.

Table 1: Revenue Losses for PUTs and Informality in 2022

Sources of Evasion by Type of Informality	% of GDP	% of Labor Income Tax	% of Soc. Sec. Contributions
Payments Under the Table (PUT)			
Income Taxes	0.11%	4.74%	-
Contributions to Social Security	0.21%	-	2.32%
Total	**0.32%**	**-**	**-**
Classic Informality			
Income Taxes	0.10%	4.92%	-
Contributions to Social Security	0.79%	-	9.05%
Total	**0.91%**	**-**	**-**

Notes: This table reports the back-of-the-envelope calculation for revenue gains due to eliminating classic informality and payments under the table. For the numerator, the exercise registers all PUTs in the economy and formalizes all informal employees without adjusting for behavioral responses. We use the social security contribution and income tax schemes to calculate how much the government would collect. We apply the corresponding income tax deductions and consider the profit taxes that would not be paid due to an increase in payroll reporting. For the denominator, we take all revenues collected by the government in the concept of social security contributions and income taxes, including the public sector, which is excluded from the numerator. More details in Appendix E.

The first takeaway is that while classic informality is 3.52 times larger regarding total payroll evaded, it is only 2.78 times larger regarding tax evasion because PUTs are more relevant for high-wage earners. Second, this gap is entirely explained by the evasion of social security contributions, which everyone pays regardless of their wage level. On the other hand, PUTs and classic informality imply similar evasion of the income tax, which shows that the unequal distribution of PUTs compensates that classic informality entails under-reporting the full wage. It is worth noting that we do not simulate the government expenses on social security associated with PUT formalization. As mentioned before, many social security benefits are linked to the amount reported, so they would also increase (with the same logic applied to classic informality). In this sense, while the only component of our calculations that should be considered pure revenue lost is the income tax, evasion of social security contributions reduces the state's capacity to provide social benefits. Finally, because PUT receivers are richer than informal employees, and the progressivity of the Brazilian tax structure, we find that 50% of all revenues loses due to PUTs can be allocated to the top 10% of the wage distribution, while only half of it corresponds to the top 10% when it is due to classic informality.

[13] Policies such as the *Abono Salarial* would likely be affected.

3.4 Mechanics

We use our surveys to characterize how these payments are made. This implies looking at the two sides of the same coin: how the employees receive the PUTs and how the employers do their accounting. The answer to this question is complex, given that PUTs are not a simple concept. It can range from simple cases where an employee receives a complementary salary in cash to cases of misuse of benefits and usage of corporate credit cards and others. This section aims to learn about this feature of PUTs by providing the first direct evidence on payment methods and accounting strategies.

The first striking result is that almost 50% of PUT receivers report using cash. The survey of firm owners and the information recovered using ChatGPT 4-o to process PUT-related lawsuit documents validate this. Moreover, about 40% of employees claimed to receive PUTs using *PIX*, the main virtual app in Brazil.[14] We listed other payment methods, which appear to be less common, such as *good and services*.[15]

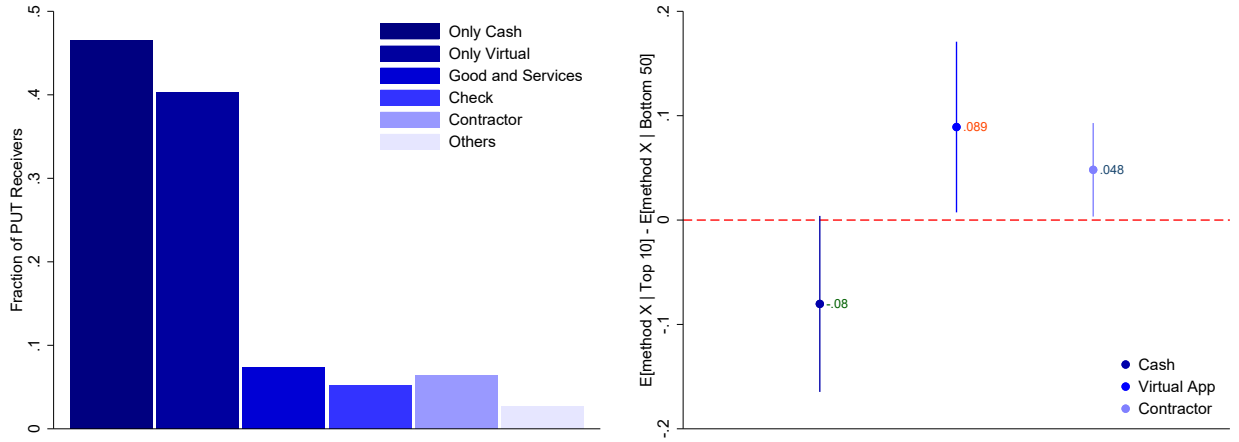
Second, payment methods change across the wage distribution. High-wage earners are more likely to use more "sophisticated" methods. For example, cash is 14% less likely for the top 10% than for the bottom 50%. Instead, virtual apps and contractor arrangements are 21% and 81% more likely for the top 10% than for the bottom 50%, respectively. [16] Once more, Figure A7 validates these facts using artificial intelligence to process PUT-related lawsuit documents.

[14] *PIX* was introduced in 2019 and became widespread in 2020. Unfortunately, we have labor lawsuits from 2014 to 2019, meaning we cannot validate this result with the survey to firm owners.

[15] The categories we used are not consistent across surveys and lawsuit PDFs. The reason is that we have learned along the way what the best way of asking these questions is. For example, in the employee survey, we didn't include the option *Bank Transfer*, which turned out to be very important. We expect *Virtual Payments* to capture part of it.

[16] The latter refers to cases in which an employee's relative or the employee herself opens a firm to be hired as a contractor on top of the employee contract. This is a tax avoidance strategy because the effective tax rate plus contributions on that excess income is significantly smaller than when reported as wages.

Figure 5: Payments Methods



(a) Methods

(b) Difference by Income Group

Notes: Panel (a) shows the proportion of workers who report receiving PUT under each payment method. Panel (b) shows the difference between the top 10 and the bottom 50 of the wage distribution when using *Cash* (dark-blue), *Virtual Apps* (blue), and *Contractor Arrangements* (light-blue) to receive the PUTs. Vertical bars represent 95% confidence intervals.

To understand the employer's side, we interviewed accountants to learn about the accounting side of these payments. We group their answers into three main groups related to how it affects the booking, and how common they are based on accountants' interviews.

1. Inside the official books: employers/accountants under-report payroll and over-report "other costs". There are many items within this general category. Two things are critical. First, there are no labor costs associated with these costs. Second, there is very little reporting and control over these items, especially for small and medium-size firms.

2. Outside the official books: non-reported revenues that never enter the official books are used to pay under the table. Typically requires double-booking.

3. Shifting the accounting problem: owners can distribute profits (the dividend tax rate is zero in Brazil) and send the money to the employees from their personal bank accounts.

Having established the scale and features of PUTs, we now formalize the idea of collusive tax evasion between employer and employee, deriving predictions that we test using the data.

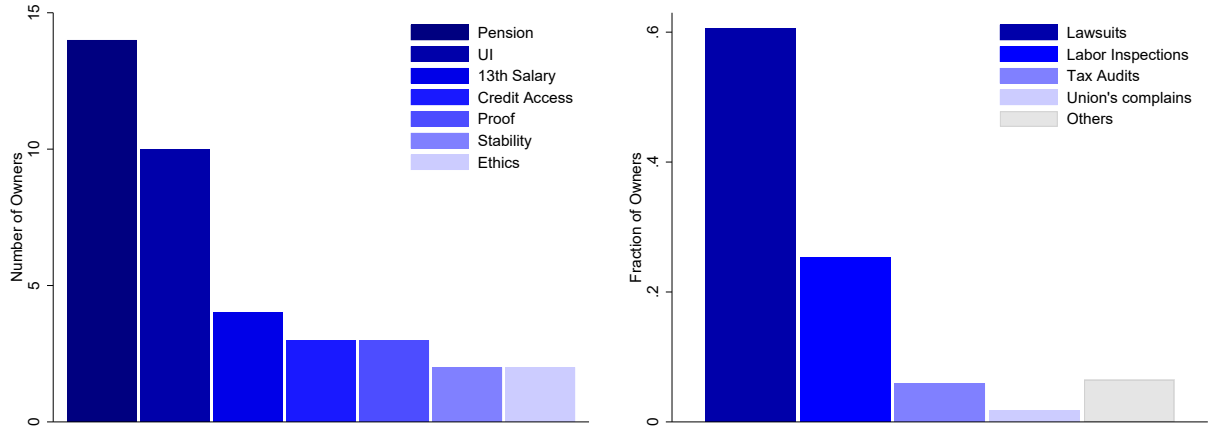
4 The Determinants of Payments under the Table

The notion of third-party reporting as an effective solution to tax evasion relies on a critical assumption: a conflict of interest between parties. Therefore, studying the drivers of employers' and

employees' incentives is crucial for understanding the extent of PUTs and for designing policies that address these incentives to complement third-party reporting and improve tax compliance.

While the gains from PUTs arise from the sum of employers' and employees' evaded taxes, the types of costs they face differ substantially. Using our survey to workers (Figure 6a) and to firm owners (Figure 6b), we elicit what the main costs are to engage in PUTs. On the one hand, employees lose access to social security benefits that are linked to the amount of wages reported. On the other hand, employers face the risk of whistleblowing, mainly in the labor courts.[17]

Figure 6: Main components of PUT costs for employers and employees



(a) Employees' reasons to lower PUT

(b) Main PUT risks for the firm

Notes: This figure is based on responses to the survey of firm owners. Panel (a) builds on two questions. The first question asks whether an employee has ever requested a reduction in PUT. Conditional on answering *yes*, we ask the main reason for doing so. Panel (a) asks *what is the main risk that firms face when participating in PUT?*. We restrict the sample to those who believe that PUT is a widespread practice.

Understanding whether PUTs are marginal to changes in both employers' and employees' incentives is critical for two reasons. First, it empirically shows employer-employee collusive arrangements as both incentives are taken into account to determine the wage setting. Second, it opens the door to a wide range of cost shifters that can complement third-party reporting by creating conflict of interest from both sides of the collusion. In Appendix F, we provide a conceptual framework that formalizes how to think about the determinants of PUTs, who benefits the most from it, and how to translate responses in reported wages to responses in PUTs, which are invisible in administrative records.

In what follows, we zoom in on specific collusion costs and we use quasi-experimental variation to demonstrate that PUTs are marginal to such incentives. For employees, we examine the relationship between pension benefits and reported wages. For the employer, we focus on the role of labor courts as whistleblowing institutions.

[17] Another important cost highlighted by the interviewed accountants is the bookkeeping cost.

4.1 Costs to Employees: Social Security Benefits

As shown in Figure 6a, an important cost of PUTs for workers is the loss of pension benefits. In all countries with *pay-as-you-go* systems, pension benefits are a function of reported wages. In addition, in most of these countries, there is a ceiling to social security contributions that mirrors a pension cap (OECD et al. 2014). Therefore, the ceiling provides a source of quasi-experimental variation in workers' costs of underreporting. Below the ceiling, the marginal dollar reported increases workers' pension benefits. Above the ceiling, the marginal dollar reported has no impact on workers' benefits. Thus, the ceiling discontinuously reduces the cost of receiving PUTs for workers.

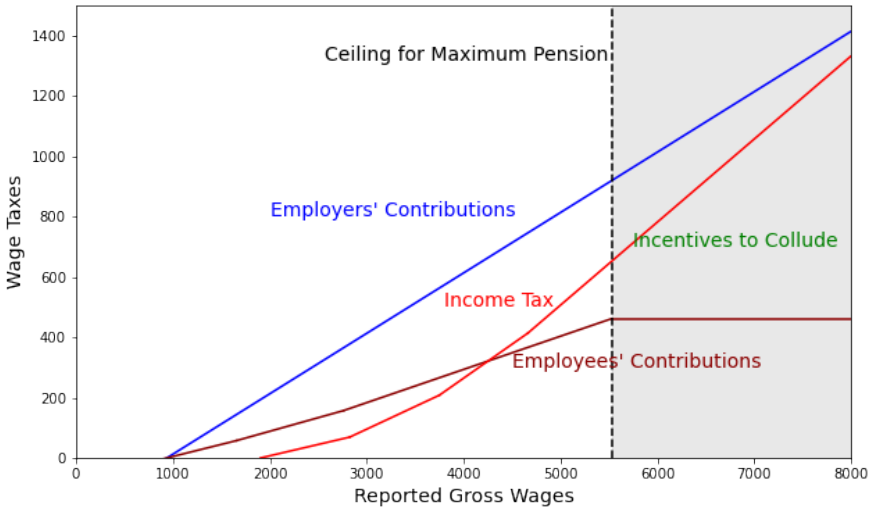
Our setting, Brazil, also has a pay-as-you-go pension system with a ceiling. The monthly pension is calculated based on the following formula:

$$P = \delta \frac{1}{k} \sum_{i=1}^{k} \max \{w_i, \bar{w}\} \tag{2}$$

Where δ is a coefficient that depends on the number of contributory years, and $\bar{w}$ is the ceiling. 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 increases in tenure, workers closer to retirement are more likely to affect their pensions with their current salaries (see Figure A9).

Figure 7 shows how different rates faced by employers and employees change around the ceiling. It is worth noting that the ceiling on employees' pension benefits also caps their contributions. In the absence of pension benefits, the drop in the contribution rate implies that employees retain a larger share of the additional reported wage, which predicts *anti-bunching* in the wage distribution (see Alvaredo et al. (2017) for an attempt to find such a pattern in several countries). However, contributory taxes and benefits are conceptually linked. If workers want to report higher wages due to pension benefits (outweighting the contribution rate), those incentives disappear as the benefits max out, predicting *bunching* at the ceiling.

Figure 7: Tax and contribution rates by reported income in 2017



Notes: This figure shows how the marginal tax and contribution rates change with different levels of reported wages. The blue line refers to the employers' contribution to the retirement system (INSS). Firms in the tax regimes of Lucro Real and Lucro Presumido (covering 60% of total employees) pay 20% on contributions. Moreover, all firms pay contributions to unemployment insurance (FGTS) for 12% of the reported wages. The red line shows employees' income taxes. The slope breaks show increments in the marginal tax rate, which becomes 27.5% way below the ceiling. The dark red line shows employees' contributions to social security. This rate is slightly increasing in wages up to the ceiling, where it becomes flat. Mirroring this pattern, the pension is capped at the ceiling.

4.1.1 Bunching Evidence

We use *RAIS*, the matched employer-employee data, in which employers report workers' monthly wages, to document bunching at the Social Security system ceiling among workers closer to retirement age. To the best of our knowledge, this is the first time such a pattern has been observed, and it constitutes novel evidence that the marginal benefit of wage reporting exceeds its cost for this group of workers.

Figure 8a shows bunching at the ceiling for those workers who are at most 10 years from retirement age. The ceiling is updated annually[18], so in Figure 8b we track this behavior, proving that this finding is robust to different nominal ceilings and year choices.

Figure 8c calculates the excess mass for different groups based on how far they are from retirement age, which captures that workers closer to retirement respond more to the ceiling.[19] We calculate the excess mass as the ratio between the *true mass* we observe in the data and the *expected mass*, which comes from fitting a polynomial, and recover the mass we would observe with a smooth distribution. We replicate this exercise for the wage distribution at different distances to retirement age. We also include a placebo test by selecting another wage bin (different from the

[18] In the following link you can find the time series of both contribution rates and ceilings.

[19] Retirement age was 65 for men and 60 for women before 2019. After that, women's age increased 6 months per year until reaching 62.

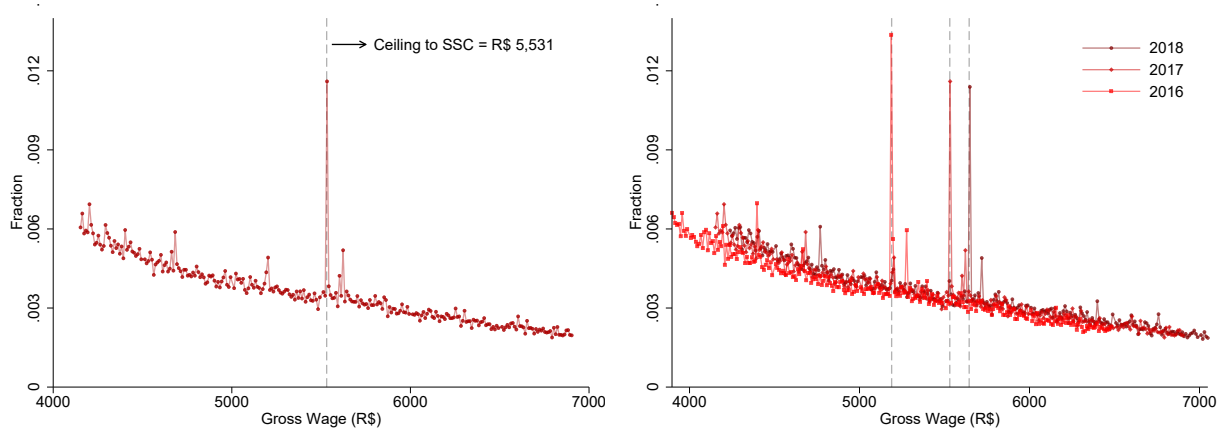
ceiling) and replicating the *excess mass* exercise, demonstrating that the polynomial fit performs well in capturing the true mass when there is no break in incentives. More formally, for each cohort r (years to retirement) separately, we run the following regression to recover $\hat{\beta}_{1r}$, $\hat{\beta}_{2r}$, and $\hat{\beta}_{3r}$. In the regression, we exclude the bin for which we are predicting the mass.

$$p_b = \alpha + \beta_1 bin_b + \beta_2 bin_b^2 + \beta_3 bin_b^3 + \varepsilon_b \;\; \forall b \neq c$$
$$\hat{p}_c = \hat{\alpha} + \hat{\beta}_1 bin_c + \hat{\beta}_2 bin_c^2 + \hat{\beta}_3 bin_c^3$$

Where p_b is the fraction of all workers we observe in bin b, bin_b is the order of the bins relative to the ceiling.[20] Sub-index c refers to the bin of the ceiling. Finally we compute the excess mass $= \frac{p_c}{\hat{p}_c}$ for each cohort r.

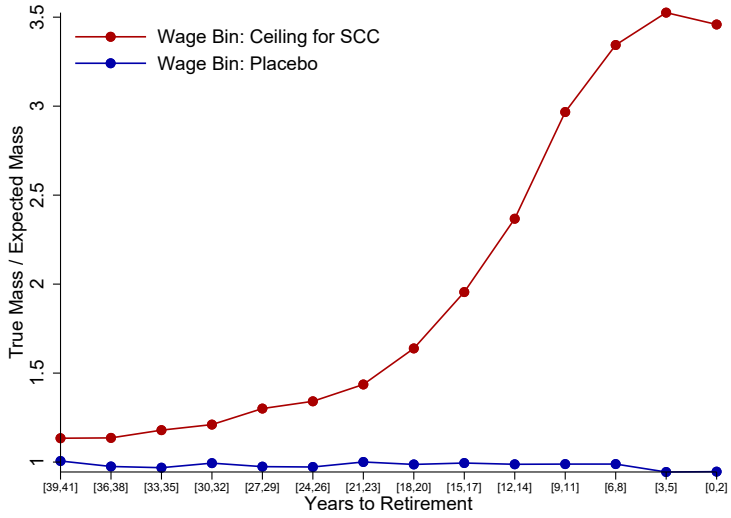
[20] When appending different years, we center the bins relative to the ceiling of each year.

Figure 8: Reported wages around the ceiling



(a) 10 yrs from retirement in 2017

(b) 10 yrs from retirement in 2016-2018



(c) Excess mass by years to retirement

Notes: Panel (a) shows the fraction of workers in each wage bin in 2017. The plot's bandwidth is 25% above and below the ceiling. The dashed line corresponds to the ceiling (R$ 5,531 in 2017). Bin's bandwidth is R$ 10 (about US$ 2). We dropped bins containing rounding numbers for exposition purposes. The x-axis corresponds to the gross wage of active employees in the private sector in December of 2017. Panel (b) replicates plot (a) for 2016 and 2018 when the ceiling had different nominal values. Panel (c) shows the *excess mass* for each group of years to retirement. The *excess mass* is the ratio between the *true mass* and the *expected mass*. The former is based on the actual distribution. The *expected mass* is calculated by fitting a polynomial of degree 3. We recover the *excess mass* for each cohort of years relative to retirement. The x-axis shows these different groups defined by how many years they are far from retirement age. The red line shows the excess mass for the ceiling bin, while the blue line shows the excess mass of another bin (ten above the ceiling). This plot puts together data from 2015 to 2020. Every year is centered at the corresponding ceiling.

The proximity to retirement age shapes the size of the benefits for several reasons. On the monetary incentives, wages at the beginning of the career are typically lower, becoming less likely to be part of the contributory salaries considered in the formula 2 (see Figure A9). Moreover, they are also more likely to contribute for more years, meaning that one contributory salary is expected

to be averaged with more salaries, reducing the marginal effect of reporting on increasing the pension. Finally, Consistent with a large literature on behavioral biases on retirement savings, pension benefits are likely to become salient closer to retirement age (Goda et al. 2015, Shin et al. 2019, Benartzi and Thaler 2007, Goda et al. 2019).[21]

4.1.2 Ruling out alternative explanations

Figure 8 shows that employers cap the reporting of employees' wages when the reporting-benefit link shuts down at the ceiling. However, this pattern is consistent not only with employers adjusting PUTs to report up to the ceiling but also with a standard labor supply story. For example, when workers closer to retirement want to increase their pension, they can also work harder to increase their wages. While there is no legal requirement to pay wages at the ceiling, we also need to rule out the possibility of an implicit social norm that leads firms to anchor wages at the ceiling, as suggested in Kleven et al. (2011). [22]

We rule out both alternative explanations. First, we connect the bunching to the survey evidence by testing whether bunchers' characteristics align with those of employees who are more likely to receive PUTs. Second, we leverage the ceiling updates to show that bunchers' wage dynamics exhibit a clear strategic pattern. Finally, we develop a direct test based on *true* wages to show that bunching is explained by evasion responses rather than real responses.

Heterogeneity analysis: bunchers vs. non-bunchers

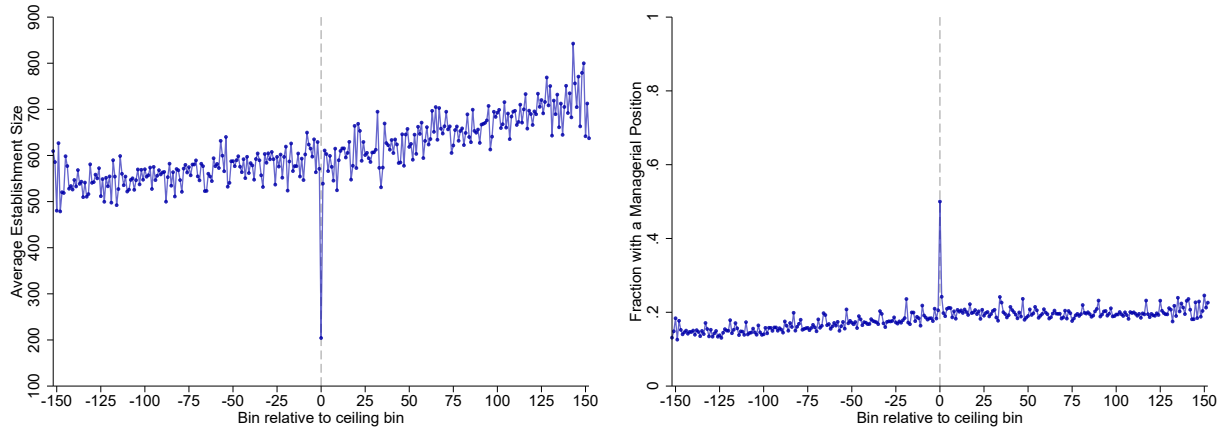
In our survey evidence, we find that workers in smaller firms, and those holding managerial positions, are more likely to engage in PUTs. Turning to the bunching evidence, we show that the heterogeneity analysis around the ceiling of social security contributions is consistent with our survey. 9 shows a sharp dfference in both firm size and likelihood of holding a managerial position. We find that the average firm size of bunchers is half of that of non bunchers just around the ceiling. We also show that bunchers are more than two times more likely to be in managerial positions than non-bunchers.[23]

[21] Indeed, some survey respondents showed regret: *These payments under the table were initially beneficial. However, it is currently harmful as I get closer to retirement*

[22] Work in different contexts has shown that bunching responses are more likely to be driven by evasion rather than real responses. See Saez (2010), Chetty et al. (2011) for individuals and Best et al. (2015), Bachas et al. (2021), Garriga and Scot (2023) for firms.

[23] We also test for the more frequent interaction channel by matching characteristics of owners and employees. We find that employees bunching at the ceiling are more likely to match demographic characteristics with their employers (see Table A5)

Figure 9: Reported wages around the ceiling



(a) Establishment Size

(b) Managerial Position

Notes: This figure shows heterogeneity on bunchers and non-bunchers. Panel (a) shows the average establishment size (number of employees) where individuals in each wage bin work. Panel (b) shows the fraction of employees in each wage bin that hold a managerial position. In both cases, the sample was pooled from 2015 to 2020. Each year, we center the bins with respect to the ceiling bin before pooling. Therefore, bin zero refers to the wage bin of the ceiling (dashed line). Positive bins are for individuals earning above the ceiling, and negative bins contain individuals earning below the ceiling.

Wage dynamics within and across years

We study bunchers' wage dynamics to document strategic reporting behavior as an alternative smoking gun supporting PUTs rather than real labor supply responses. Because the ceiling updates annually, we follow workers over time to compare how reported wages change from one year to another and within a given year. The premise is that workers bunching at the ceiling adjust their wages to closely follow the ceiling, not even responding to standard within-year payment differences.[24]

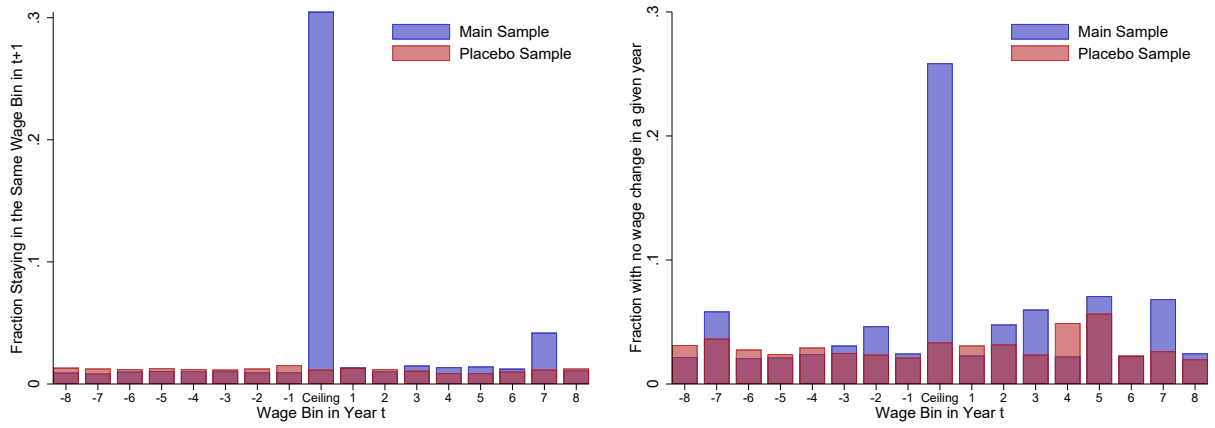
To conduct the across-year analysis, we first fix the group of bunchers and non-bunchers at year t based on whether workers locate at the ceiling or in the surrounding bins (see Figure A10 for an illustration on how these bins are chosen). We then follow individuals into $t+1$ to determine whether they remain in the same bin. Note that the wage bins do not remain constant in nominal terms, but their positions relative to the ceiling remain fixed. For the within-year analysis, we define bunchers and non-bunchers in the same way, but here we use monthly wage data to calculate the share of workers in each wage bin who do not experience any wage change within a year. In both analyses, we conduct a placebo test to confirm that our results are not driven by centering the wage bins at the ceiling. We replicate the entire exercise, but departing from a different (and fake) ceiling.

First, Figure 10a shows that bunchers are 30 times more likely to remain in the ceiling bin

[24]In Brazil, most workers receive a thirteen-month salary paid in December, which is subject to income taxes and social security contributions and must be reported by the employer.

than non-bunchers in their corresponding bins, proving that bunchers update their salaries to target the new ceiling. This is strong evidence against the labor-supply adjustment hypothesis. The literature indicates that it is difficult to adjust employment to meet a specific target, especially when labor contracts are rigid. Our evidence goes one step further, implying that employees adjust employment year after year to reach the moving ceiling for the labor-supply hypothesis to hold. Second, Figure 10b shows the probability that an employee remains in the same bin within a year. This should be quite unlikely (as can be observed from the other groups) because, by law, employers must pay an additional salary in December. We find sharp evidence that bunchers are more likely to remain in the same wage bin.

Figure 10: Wage changes across and within years



(a) Across years

(b) Within years

Notes: This figure shows that bunchers and non-bunchers show very different patterns of wage changes. Panel (a) plots the fraction of employees in each wage bin in t remains in the same wage bin in $t+1$. Panel (b) shows the fraction of employees in each wage being with no wage changes between January and December in a given year. Blue bars refer to *bunchers* and *non-bunchers* around the true ceiling, while the red bars are the placebo (where we replicate the exercise for wage bins centered at a fake ceiling). The mid-bar at 0 always refers to the *bunchers'* bins (ceiling), and we show 8 bins to the right and to the left, which correspond to *non-bunchers*.

Test on true wages

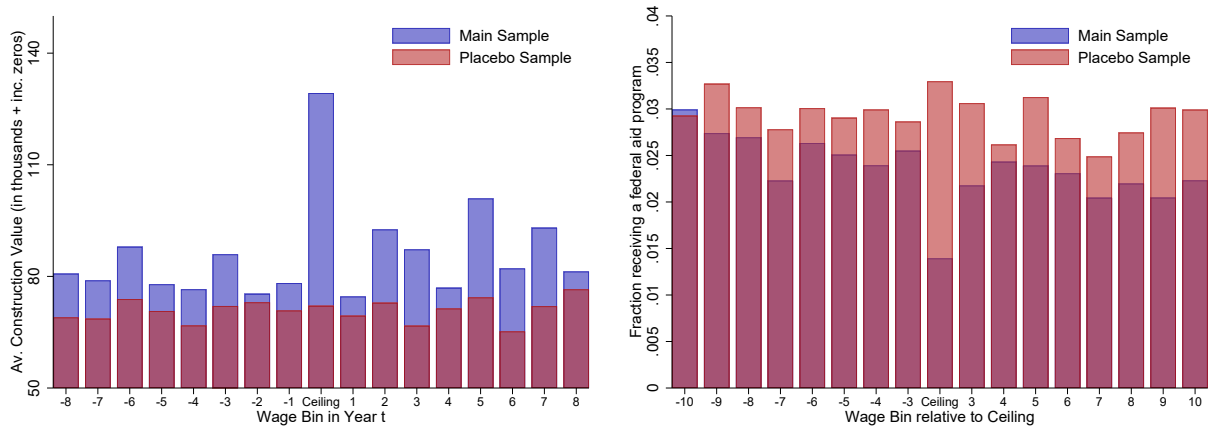
Whether the bunching is driven by adjustments in PUTs or by alternative stories yields different predictions for the true wages of the bunchers. On the one hand, when workers receive PUTs and report up to the ceiling, their true wages equal the sum of both components. On the other hand, when workers increase their labor supply or employers anchor wages at the ceiling, workers' true wages equal their reported wages (see Appendix G for a formalization).

This clear conceptual distinction is hard to observe empirically as PUTs are invisible in administrative records. Therefore, we develop a test that combines proxies for true wages with the discontinuity at the ceiling. First, we measure real estate wealth by merging employee identifiers between the employer-employee data and the full registry of property ownership, which includes

properties' size and valuation, for the municipality of Sao Paulo.[25] Second, we measure the likelihood that workers are in *Cadastro Unico*, a dataset containing the universe of households that receive any federal aid program.[26] Finally, we follow the same strategy as in the previous section, where we compare bunchers to non-bunchers to evaluate discontinuous changes in true wages.

Figure 11a shows that bunchers hold about 50% more real state wealth than non-bunchers, despite being contiguous in the distribution of reported wages. Such a difference is explained by both the likelihood of owning a property and the construction value conditional on ownership. Consistently, Figure 11b shows that bunchers are almost twice less likely than non-bunchers to take up for any federal program.[27]

Figure 11: Indirect evidence of true wages



(a) Real Estate Wealth

(b) Federal Aid Program

Notes: Panel (a) shows the average real estate wealth owned by workers in each wage bin. We restrict the analysis to workers employed in the municipality of Sao Paulo because we only have property records for that jurisdiction. Construction value is measured as size times price per square meter, where the latter is assessed by the government for property tax purposes. We input a zero for workers who are not found in the property records. Panel (b) shows the fraction of employees receiving a federal aid program in each wage bin. Receiving a federal aid program is defined as finding the employee in the dataset *Cadastro Unico* in 2019. Blue bars refer to *bunchers* and *non-bunchers* around the true ceiling, while the red bars are the placebo (where we replicate the exercise for wage bins centered at a fake ceiling). The mid-bar at 0 always refers to the *bunchers'* bins (ceiling), and we show 8 bins to the right and to the left, which correspond to *non-bunchers*.

Policy Implications: the role of workers' benefits

We showed clear evidence of bunching at the ceiling of the social security system, and that such pattern is explained by employers collusively adjusting PUTs rather than real responses. This means that PUTs are indeed marginal to employees' incentives. Proving this point is critical, as it opens the door to a wide range of policies that affect employees' incentives to complement third-

[25] We restrict the employer-employee data for those workers employed in the municipality of Sao Paulo to avoid geographic selection into the ceiling.

[26] Figure A11 shows that these two measures are correlated with wages in the full population.

[27] Note that the workers around the ceiling are already at the top of the income distribution. Therefore, the baseline probability of receiving a federal aid program is low, and the likelihood of owning a property is approximately 40%.

party reporting, such as strengthening the link between reporting and benefits or increasing the salience of current benefits. To complement this analysis, we provide experimental evidence that workers' willingness to receive PUTs depends on their knowledge of the benefits associated with wage reporting.

We conducted a *randomized control trial* on information provision among those who admitted to receiving PUTs. At the end of the survey, we provided information about the benefits of reporting to a randomly selected group of PUT receivers. Then, we asked the final questions of the survey regarding the preferences for increasing or reducing payments under the table.[28] Concretely, we provided the following message to the treatment group:

> *In this part of the research, we would like to mention certain benefits associated with declaring wages on the official payroll that workers often forget or are unaware of. These benefits include:*
>
> Retirement: *For the calculation of the retirement benefits you will receive in the future, only the wages declared on the payroll are taken into account. This means that any portion paid under the table is not considered, and you will receive a smaller pension than if your entire salary had been declared.*
>
> Access to Credit: *Many banks require pay stubs from the last 6 months or 1 year of employment to determine whether they will grant you credit and the interest rates on loans.*
>
> Unemployment Insurance: *The amount used to calculate unemployment benefits is based on the wages declared on the payroll. Therefore, the portion of the salary paid under the table is not considered if you need unemployment insurance.*
>
> Survivor or Accident Pension: *The calculations made by the Social Security System (INSS) for survivor pensions for your dependents or pensions for accidents and disability are also based on the wages declared on the payroll.*
>
> *And others!*

Then, we study their responses to the following questions:

- *From 1 to 10, what is the probability you will try to renegotiate your salary in order to report higher wages in the next 3 months?*
- *Would you accept a new contract where the **total** salary is 5% lower, but the reported part of the wage is higher?*
- *Next time you start a job, would you choose one with 5% higher **total** salary but part of it non-reported?*

[28] We expect little demand effects given that both the treatment and control groups answered multiple questions about PUTs before the experiment. However, the experiment's results must be taken as a complementary exercise rather than a main result.

Table 2: Effects of information provision on the intention to reduce PUTs

	Negotiate lower PUT			5% Lower Wage with no PUT			5% Higher Wage with some PUT		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment	.408**	.393***	.346**	.0494*	.0543***	.0532**	-.0309	-.0353*	-.0355*
	(0.202)	(0.141)	(0.139)	(0.029)	(0.021)	(0.021)	(0.026)	(0.019)	(0.019)
Some College		-.0816	-.228		-.009	.0156		-.00508	-.0267
		(0.156)	(0.174)		(0.023)	(0.026)		(0.021)	(0.024)
Female		.0147	.0993		-.0276	-.0258		.0107	.00802
		(0.148)	(0.147)		(0.022)	(0.022)		(0.020)	(0.020)
Dep. Var Mean	5.82	5.82	5.82	.69	.69	.69	.24	.24	.24
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Size + Income FE	No	No	Yes	No	No	Yes	No	No	Yes
Observations	1945	1940	1940	1945	1940	1940	1945	1940	1940

Notes: This table presents the results from the RCT we conducted within the survey. We randomly assigned the respondents who admitted to receiving PUTs to a treatment or control group. The treatment group received information on the benefits of reporting. The outcomes variables are based on the following questions: *From 1 to 10, what is the probability you will try to renegotiate your salary to increase reported wages in the next 3 months?* (Columns 1 to 3), *Would you accept a new contract where the total salary is 5% lower, but the reported part of the wage is higher?* (Columns 4 to 6), and *Next time you start a job, would you choose one with 5% higher total salary but part of it non-reported?* (Columns 7 to 9). "Controls" include *manager*, *education*, *gender*, *family business*, *age*, and *tenure*. "Size + Income FE" include fixed effects for wage and firm size groups. All results are reweighted..

Table 2 shows significant effects on the intention to reduce PUTs across all questions in response to the information provided. The effects are between 5 to 14%, depending on the specific question. Although this experiment only evaluates effects on the willingness to reduce PUTs -rather than on actually reducing them-, it goes beyond the specific incentives around the ceiling of the social security system and shows that salience of other benefits can also play a role in shaping employees' incentives. Altogether, this section shows that there is room for policy interventions that complement third-party reporting by reducing workers' incentives to engage in PUTs in order to increase tax compliance.

4.2 Costs to Employers: Labor Lawsuits

In this subsection, we examine labor lawsuits as a whistleblowing institution to reduce employers' incentives to engage in collusive tax evasion. We do so for two reasons. First, Figure 6b shows that labor lawsuits are the leading risk that employers face when paying under the table. Second, it speaks to how the public finance literature has thought about whistleblowing in employer-employee collusion arrangements. For instance, in Kleven et al. (2016), the asymptotic prediction of negligible PUTs relies on *who* reports and the *propagation effect* of a single report to the *tax authority*, which is assumed to trigger a tax audit that uncovers all PUTs in the firm.

In our context, workers do not report PUTs to the tax authority, but to labor courts. A la-

bor lawsuit is a particular whistle-blowing institution where employees report employers in labor courts for not complying with the *Labor Law*. These labor courts are specialized forums to handle labor disputes. Their origin goes back to the European legal traditions, particularly those of Spain, France, and Portugal (Botero et al. 2004). This institution is present in most Latin American countries. On the other hand, countries with the *Common Law Tradition*, such as the United States, have historically addressed labor disputes through the general courts. They have also developed specialized agencies outside the judiciary system. For example, the U.S. Department of Labor has robust whistleblower programs that trigger labor and tax inspections.[29]

However, labor lawsuits were not designed to trigger tax audits or labor inspections, and they do not. While they increase the expected cost of paying an employee under the table, the occurrence of a lawsuit has potentially less severe consequences for other employer-employee collusive arrangements within the firm than a tax audit would. Finally, the incentives for employees to report PUTs to the tax authority are limited. PUTs also violate the *Tax Code*. In this case, the employee also commits an offense when evading the income tax.[30]

Empirically eliciting *who* reports in labor courts and the effects on PUTs with other employees (*propagation effect*) is crucial to understand the extent and mechanism by which labor lawsuits can prevent PUTs. In what follows, we do three things. First, we examine the factors that trigger a labor lawsuit. This provides a better understanding of *who* sues. Second, we estimate the causal effect of a former employee's labor lawsuit on other employees' wages, thereby recovering the *propagation effect* of the lawsuit. Finally, as lawsuits do not trigger tax audits, we provide suggestive evidence on the underlying mechanisms.

4.2.1 Who reports? Lawsuits and conflict in the workplace

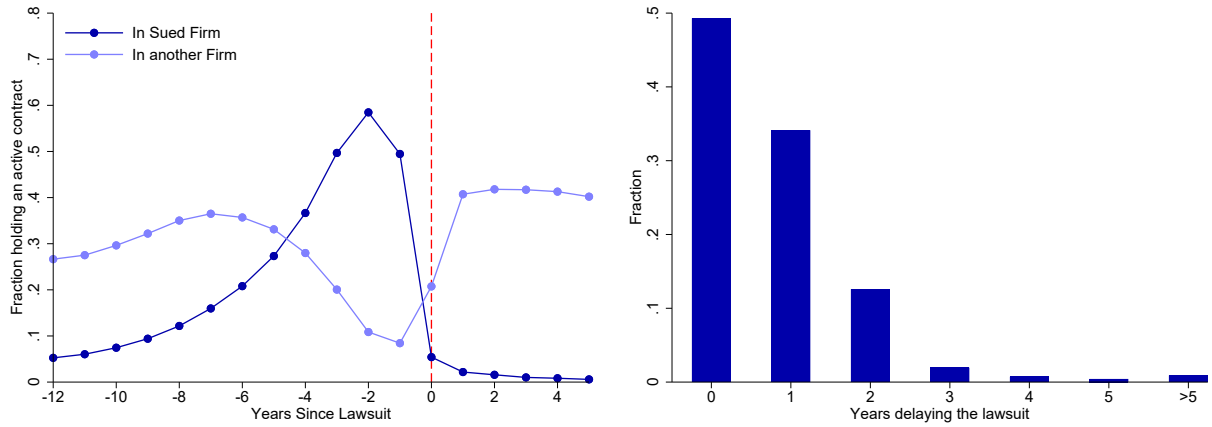
The first point we document is that employees have left the firm before initiating a lawsuit against their employers. Moreover, lawsuits happen relatively soon since the job separation. For the employees who end up suing, Figure 12a shows that their probability of having an active contract in the firm they sue drops to zero at the moment of the lawsuit. We can also see that the probability of being outside the formal labor market drastically increases when the lawsuit happens.[31] This is consistent with employees having less incentives or motivation to go through a lawsuit if they have already found a new job.

[29] The Wages and Hours Division (WHD) recovered more than $ 230 million in back wages for over 190,000 workers in fiscal year 2021. This is a result of investigations triggered by complaints, including those submitted by whistleblowers.

[30] Indeed, we find that 65% of employees suing their employers in labor courts for PUTs would be paying income taxes on the under-reported income.

[31] This is simply one minus the sum of both lines. Alternatives to formal employments are unemployment, informality or outside the labor force.

Figure 12: Employees' Dynamics and Lawsuits



(a) Employment

(b) Lawsuit delay

Notes: Panel (a) shows the employee's dynamics around the lawsuit. The x-axis is the years relative to when the lawsuit happened. The dark blue line plots the probability that the worker who ends reporting has an active contract in December of the given year in the reported firm. The light blue line shows the probability that such a worker is employed in another firm. The red dashed line indicates the year when the lawsuit happened. Panel (b) shows how many years have passed between the lawsuit and the employee's separation from the firm.

An advantage of our rich administrative data is that we can observe employees' separation and motives.[32] We show that conflicts in the workplace precede labor lawsuits. Restricting our sample to those employees who separate from their firm, we study how suers differ from their coworkers regarding the reason for separation.[33] We regress each possible reason for separation on a *dummy* variable that indicates whether an employee ends up suing the firm. We add several demographics as regressors to benchmark the size of the coefficients.

We find that those who end up suing are 31% more likely to be fired by the employer compared their coworkers who separated from the firm in the same time frame. Moreover, they are 44% less likely to have voluntarily quit. When we look at quitting driven by a preceding conflict with the employer, those who end up suing are 150% more likely than their coworkers to report such a reason. Finally, when looking at non-conflictive separations suers are 50% less likely to separate due to a pre-specified termination date of the labor contract, 22% less likely to separate due to a transfer within the firm, and 75% less likely to separate due to retirement.

[32] Including retirement, quitting, reallocation, firing with and without a fair reason, and others.

[33] In Table A6, we conduct an alternative exercise. We construct a prediction model to determine who ends up suing their firm, based on reasons for separation and other demographic factors. These results show that even when we don't condition on separation, the conflicting separations are key predictors of lawsuits.

Table 3: Conflict at the Workplace

	P(Reason = X if Separation = 1)					
	Fired	Quit w/o reason	Quit w/ reason	Contract	Transfer	Retirement
Suer	0.177***	-0.092***	0.003***	-0.071***	-0.011***	-0.003***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Female	0.000	0.000	0.000***	-0.000	0.000**	0.000***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Nonwhite	-0.003***	-0.006***	-0.000***	0.013***	-0.002***	-0.002***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Less than High School	0.043***	-0.066***	0.001***	0.019***	-0.001***	0.003***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
High School	0.031***	-0.045***	0.000**	0.014***	0.000	0.001***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Dep. Var Mean - Coworkers	.57	.21	0.002	.14	.05	0.004
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4.6M	4.6M	4.6M	4.6M	4.6M	4.6M

Notes: This table shows how employees' characteristics predict different separation motives. The sample contains all employees in firms where at least one employee sued the firm they worked for. The variable "Suer" is an indicator variable identifying the employees that ended up suing at most one year after they appeared as employees. Those for who the "Suer" variable is zero are coworkers who also separated from the same firm as the Suer in the same time frame. The different columns have outcome variables as indicators of the possible reason for separation. "Fired" refers to those employees who were fired with or without cause. "Quit w/o reason" refers to those who unilaterally finished the labor contract without cause. "Quit w/ reason" refers to employees who had a cause to finish the labor contract unilaterally. The last three columns refer to separation motives with no explicit conflict associated. "Contract" refers to cases where the labor contract had a pre-specified termination date. "Transfer" refers to changes in the labor contract within the same firm. "Retirement" refers to labor contract termination due to retirement. All regressions have occupation, age and firm times year fixed effects. Standard errors are clusterized at the fixed effect level.

4.2.2 Propagation effect: How do employers respond to a lawsuit from a former employee?

We next explore if lawsuits affect wages. We use the universe of PUT-related labor lawsuits from 2014 to 2019.[34] Our treatment event is *staggered*, as firms are sued in different years, potentially leading to the well-known biased estimation problem in the presence of dynamic treatment effects. Therefore, we follow Baker et al. (2022) and implement a *matching stacked difference in difference* to causally estimate the effects of a lawsuit on the wages of other employees in the firm (propagation effects). For each firm-event, we created a one-to-one matching based on non-sued firms with the same pre-period characteristics (industry, number of employees, legal form, state, and year of opening). This allows us to create event-specific datasets that we stack and then saturate with individual-time-cohort FE.

[34]Most firms were sued only once for PUTs in our time period. If they were sued more than once, then we consider only the first event. Exceptionally large firms with hundreds of cases are dropped. Using aggregate statistics about all labor lawsuits (14 million cases), about 90% of firms were sued less than 5 times between 2014 and 2019.

For both sued and non-sued firms, we restrict our sample to firms active in the three periods before and after the lawsuit. Finally, we define incumbent workers as those who remain in the same firm for the six years around the lawsuit. [35] This sample guarantees that we are looking at the reported wages of employees for whom the employer sets their wages rather than picking wage variation from movers. We provide robustness checks to rule out that employers adjust other margins, such as hours worked and tasks performed by their employees.

The key identification assumption is that incumbent workers' wages follow parallel trends across treated and nontreated firms. This rules out concerns about survival bias, meaning that incumbent workers in sued firms are likely to be the most productive and therefore high-wage employees. This average difference in levels between workers in treated and control firms indicates that the pre-trends do not overlap, rather than that the slopes differ. In addition, we add firm fixed effects to control for time-invariant characteristics.[36] Equation 3 shows the exact regression.

$$\ln w_{jt} = \gamma_j + \delta_t * \alpha_{c(j)} + \sum_{k \neq -1} \beta_k \mathbf{1}(k = t)\mathbf{1}(j \in \text{treated}) + \varepsilon_{jt} \tag{3}$$

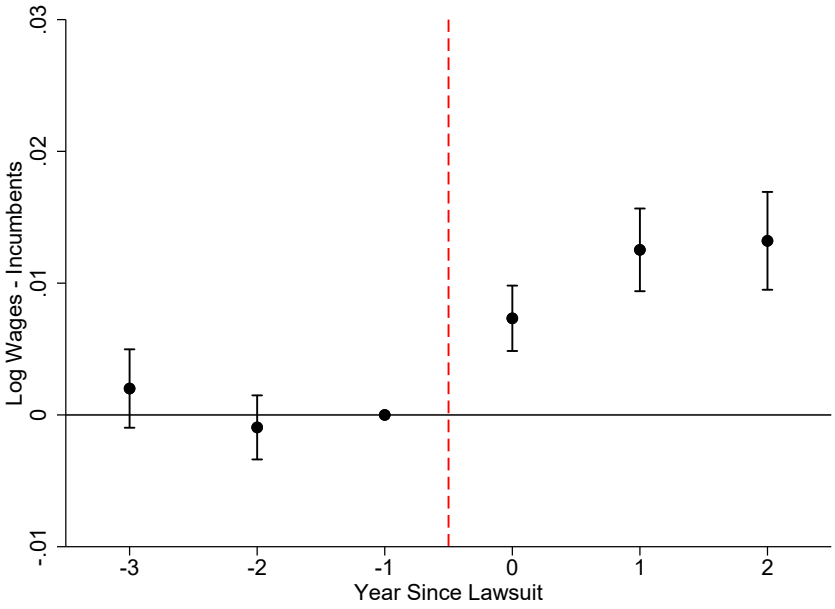
Here, the sub-index t refers to the year relative to the lawsuit (ranging from -3 to 3). c defines the cohort of firms. Because the same firm can be used a control for two firms that were treated in different years, the cohort allows to differentiate these cases. The sub-index (j) refers to a given firm j, which is defined by its firm-id interacted with the cohort. β_k's are our coefficients of interest, which capture the increase in average wages in treated versus nontreated firms relative to the difference in the year before the lawsuit ($k = -1$). We add firm fixed effects. Because we are stacking different "cohorts" of lawsuits, we add time fixed-effects interacted with cohort fixed-effects. This strategy avoids the problems of staggered dif-in-dif approaches when there may be heterogeneous treatment effects over time by saturating unit- and time-fixed effects with indicators for dataset identifiers (Baker et al. 2022). Finally, we cluster standard errors at the firm level (treatment level).

We find that firms respond to a former employee's lawsuit by increasing, on average, the reported wages of other employees by 1%. Furthermore, we do not find evidence of different pretrends between the treated and control individuals. Then. we modify Equation 3 to exploit heterogeneity at the individual level. We run the regression at the individual level, including individual fixed effects rather than firm fixed effects. Clusters remain at the firm level. From Section 3, we know that PUTs are decreasing in firm size and are more prevalent for managerial positions. Figures 13b and 13c are consistent with these facts. Smaller firms and managerial positions show stronger responses than larger firms and non-managerial positions.

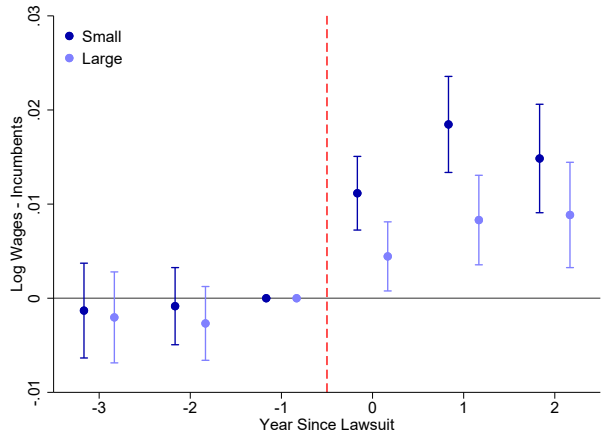
[35] We make sure that keeping only incumbent workers does not affect the one-to-one matching by dropping observations that lose their matching observation because that firm has no incumbent workers during the entire period.

[36] We add worker fixed effects when we look at heterogeneity at the employee level

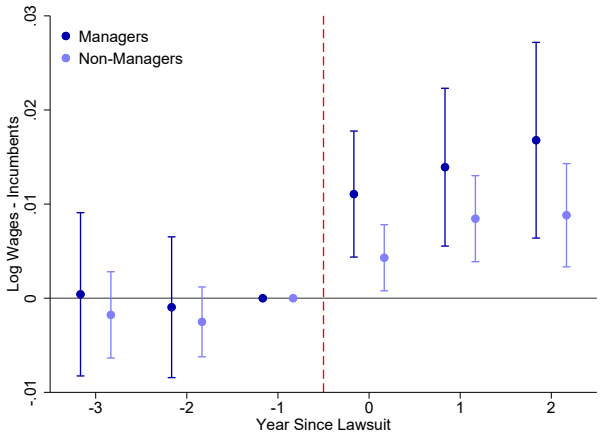
Figure 13: Lawsuit effects on average wages of incumbent workers



(a) All firms



(b) By firm size



(c) By managerial position

Notes: This Figure shows coefficients β_k in Equation 3. The sample comprises active employees who have worked in the same firm for the entire period but never appear in the lawsuit data. Treatment is defined at the firm level. The treated group contains firms that were sued for PUT. The control group contains firms that match the treated firms one-to-one based on their characteristics in the pre-period. A combination of *industry, number of employees, legal form, state, and year of opening* form a cell. Event time is centered in the lawsuit year. We include unit fixed effects and cluster standard errors at the firm level (treatment level). Panel (a) shows results at the firm level. Panel (b) runs separate regression for incumbent workers in small and large firms. We define small firms as those in the bottom 25% of the firm size distribution in the year the matching is conducted. Panel (c) runs separate regressions for incumbent workers who hold managerial positions and those who do not.

Robustness checks and additional results

Conceptually, we are interested in estimating the propagation effect of a lawsuit on other employer-employee collusion. The first distinction is that this parameter is not the same as the overall effect of a lawsuit on PUTs. The latter also incorporates the effect of employees who leave the firm because of a lawsuit and may find a job where they receive more or less PUTs. For example, if a lawsuit generates the dismissal of one employee who finds a job in the informal sector, that will increase the overall effect in PUTs because now this employee is evading the entire wage.

Two things can happen for the effect of a lawsuit on other employer-employee collusion in the firm (the parameter of interest). The job relationship may survive or not. The latter reflects cases in which the positive surplus is attributable solely to collusive tax evasion. However, our conceptual framework is informative for the first case, where the employer and employee decide how much to pay under the table, conditional on a match surviving. This is the main reason why we study the effect on reported wages of incumbent employees in the firm. However, this presents several challenges because ofthe other existing margins of response. In what follows, we present a series of results that validate our estimates and interpretation.

First, we show that firms do not respond to the lawsuit by increasing employees' working hours or changing their tasks. These are responses consistent with lawsuits as income shocks that could drive the increase in reported wages. We estimate specification 3 using hours worked and changes in occupation[37], showing null effects of lawsuits in these margins.

Second, we replicate the same identification strategy but for non-PUT-related labor lawsuits. We accessed a small sample of other labor lawsuits unrelated to PUTs.[38] These are labor lawsuits that we should not expect much effect on reported wages, at least coming from a reduction in PUTs. These labor lawsuits are about sexual harassment in the workplace and unfair dismissal for maternity reasons. They are as expensive as the ones for PUTs, making the income shock channel comparable. Using these labor lawsuits, we find no effects on the reported wages of other employees in the firm. Even with the small number of non-PUT-related labor lawsuits, we can reject the coefficient equal to that of the PUT-related lawsuits.

Finally, to avoid using sued firms as the treated group, we built a network of firms connected through ownership. This allows us to estimate the effect of a lawsuit in firms that are connected to the one that was sued because the same individual owns them. When using this strategy, we still find positive and significant effects on the reported wages of other employees in connected firms.

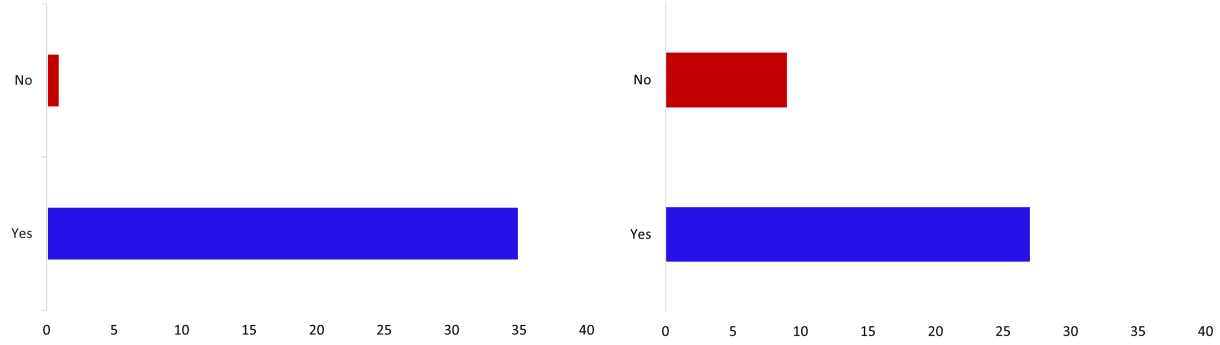
Appendix H provides a detailed discussion of the robustness exercises together with the formal presentation of these results.

[37] We use 3 and 5-digit level specification, both results show null effects.
[38] This data came as part of a parallel project.

4.2.3 Underlying Mechanisms

The results presented in Figure 13, together with the robustness analysis in Appendix H, are consistent with an increase in the marginal cost of employers for engaging in PUT with their employees. At the same time, it rules out alternative interpretations regarding adjustment in other margins (e.g. more hours worked, promotion, change in occupation). However, we can be more precise in understanding what the key drivers of the employer's marginal cost adjustment are. On the one hand, employers may have misperceived the probability of being sued, and they may update their beliefs after a lawsuit occurs. On the other hand, when an employee sues, other employees in the firm can learn about this possibility (or its benefits), leading to an increase in real (rather than perceived) risks. Figure 14 shows evidence from in-depth interviews with accountants suggesting that both margins may play a role.

Figure 14: Accountants' Responses in Interviews



(a) Does a lawsuit trigger other lawsuits?

(b) Do employers underestimate lawsuit risks?

Notes: This figure shows the responses of 36 accountants who agreed to be interviewed about PUTs for about 45 minutes. Panel (a) shows the accountants' answer to whether a lawsuit can trigger other lawsuits in the firm. Panel (b) shows the accountants' answer to whether employers underestimate lawsuit risks before getting sued.

In Appendix I, we perform an exercise using administrative data to prove that workers who interact with coworkers with lawsuit experience become more likely to sue their employers.

4.2.4 Discussion: how large are these effects?

We established that employers increase the reported wages of incumbent employees by, on average, 1%, as the lawsuit on PUTs from a former employee increases the risk (perceived or real) of being reported. A much harder (but relevant) task is to determine how much employers reduce PUTs with the incumbent workers. Empirically, PUTs are not observable in administrative records, so we cannot rely directly on the data. Theoretically, an increase in the cost of PUTs does two things simultaneously. First, it weakly reduces total workers' compensation. Second, it partially substitutes PUTs for reported wages.

For simplicity, we interpret that each additional gross dollar reported comes at a reduction

of one dollar paid under the table. Taking the results from our survey, we know that about 7% of the total payroll is paid under the table.[39] Therefore, with full compliance, we should expect to see an increase in reported wages of almost 8%.[40]. This should be considered a lower bound of the effect with full compliance because it assumes that employees in firms sued for PUTs have the same wage misreporting as the average employee. If we assume that 40% of the employees in sued firms receive, on average, 35% of their wages under the table (see Figure A2b), then we should expect an effect of up to 16.3% increase in reported wages.

For completeness, in Appendix F.2, we extend our conceptual framework to explicitly include the likelihood of reporting in labor court at the employer-employee match. Assuming convex fines on the amount PUT as well as fixed fines,[41] we derive an expression for the substitution rate between PUTs and reported wages when the likelihood of a lawsuit increases. As expected, bargaining power and the convexity of the cost function play a critical role.

In perspective, labor lawsuits seem to have modest effects to limit PUTs, as conflict is a prerequisite for reporting, and the effect on the reported wages of other employees is significantly smaller than we would expect under full compliance. The latter finding is consistent with whistleblowing not triggering tax audits, as assumed under standard theories of the topic, but rather with whistleblowing operating through different mechanisms, such as those found above. It is clear that low state capacity undermines tax compliance: one institution is responsible for tax compliance, and another is where workers report tax evasion, yet these institutions do not coordinate to prevent PUTs.

5 Conclusion

This paper provides the first systematic, direct evidence of payments under the table, challenging traditional assumptions about the effectiveness of third-party reporting in preventing tax evasion. Our findings highlight that 24% of formal private employees in Brazil receive some fraction of their wages under the table, and this practice is more prevalent among higher-wage employees and small- to medium-sized firms. PUTs contribute significantly to fiscal losses, with our estimates showing revenue losses of 0.32% of Brazil's GDP, 4.72% of the income tax base, and 2.49% of social security contributions.

We leveraged rich administrative data and quasi-experimental variation in both employers' and workers' costs of engaging in PUTs to show how incentives shape collusive tax evasion. This evidence turns out crucial for two reasons. First, it enables us to validate several findings from

[39] A quarter of all formal employees admit to receiving 20% of their wages. Weighting this by the wage level of PUT receivers gives almost 7% of the total payroll.

[40] If $w_u + w_o = 1,000$, then $w_u = 70$. The increase in reported wages with full compliance would be $\frac{w_u}{w_0} = 70/930 = 0.0753$

[41] Several features that we observe in the lawsuit data justify these assumptions. Most PUT-related lawsuits also include demands for "moral damage" mapping to a fixed cost.

our survey, thereby strengthening our understanding of how PUTs operate in practice. Second, showing that PUTs are marginal to both incentives opens the door to a wide range of policies to complement third-party reporting and increase tax compliance.

On the employees' side, we find strong evidence of strategic reporting at the ceiling of the social security system, where the link between wage reporting and employee benefits shuts down. Even when employers report wages, employees bunch at the ceiling, and the bunching is more pronounced for workers who value pension benefits more. We rule out alternative explanations, reassuring that PUT adjustments drive our results.

On the employers' side, we study the role of labor lawsuit at preventing PUTs, which is the leading risk employers face. We find that employers increase employees' reported wages in response to a PUT-related lawsuit, consistent with an increase in the risk they face. However, the magnitude of the effect is small relative to the full-compliance benchmark, suggesting that current whistleblowing institutions alone are insufficient to deter this practice.

The findings of this paper have important policy implications. They suggest that simply relying on third-party reporting may not be enough to prevent wage misreporting when collusive tax evasion between employer and employee is prevalent. Strengthening labor court processes to trigger tax audits, enhancing enforcement capabilities, and improving the link between reported wages and social security benefits could be effective complementary measures to reduce PUTs.

This paper also opens new avenues for future research, particularly in exploring how similar dynamics unfold in other countries. The external validity of this paper represents a significant advance in the literature. The existing scattered evidence suggests that PUTs are particularly prevalent in middle-income countries, including Brazil, Mexico, and Argentina in Latin America, as well as in several Eastern European countries.[42] On the contrary, PUTs appear significantly smaller in very underdeveloped countries with high-informality rates, and in developed economies. While little is yet understood about the cross county determinants of PUTs, the preliminary evidence is consistent with a race between development and tax enforcement as in Besley and Persson (2014). When the vast majority of the economy is informal, tax enforcement on the small group of formal firms becomes easier. As the formal sector expands and state capacity lags, tax compliance in the formal sector declines until state capacity catches up, as observed in developed economies.

Another promising research avenue is to understand how PUTs distort labor markets and affect the government's capacity to provide public goods. An attempt in this direction is the recent working paper Franco (2025), studying how optimal tax formulas change when PUTs are prevalent. By providing robust evidence of PUTs' scale, drivers, and consequences, we hope this paper contributes to a deeper understanding of taxation in developing countries.

[42] See Feinmann et al (2025, WP), where we extend the evidence to several Latin American countries.

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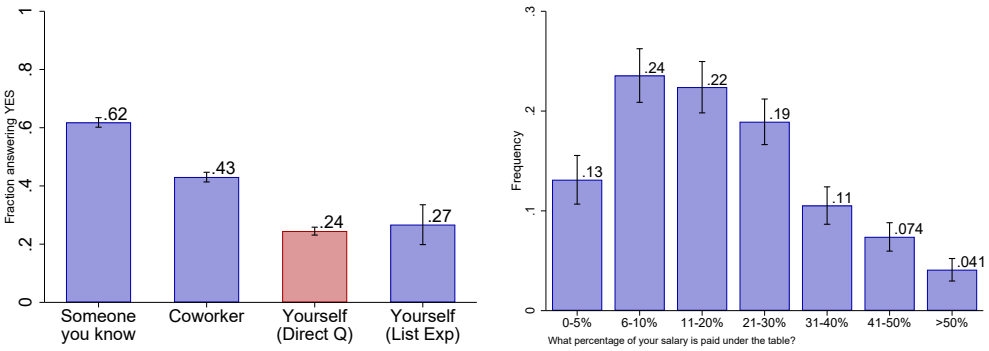
Online Appendix

A Appendix Figures

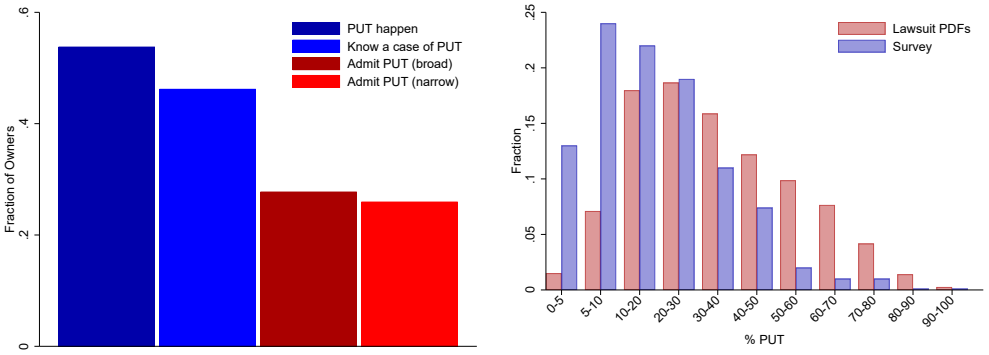
Figure A1: Extensive and Intensive Margins of PUTS



(a) Extensive (b) Intensive

Notes: Panel (a) captures the extensive margin of PUTs. It shows the proportion of respondents in each of the following categories. "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. "Coworker" is the proportion of respondents that report that they know at least one coworker at their current establishment who receives part of their salary as PUT. "Yourself (Direct Q)" is the proportion of respondents that report receiving at least some part of their salary as PUT. "Yourself (List Exp)" is the proportion of workers that receive PUT derived from the list experiment. Panel (b) uses only respondents who admitted to receiving PUTs. It shows a histogram of the fraction of the total wage that is paid under the table. All results are reweighted. Vertical bars represent 95% confidence intervals.

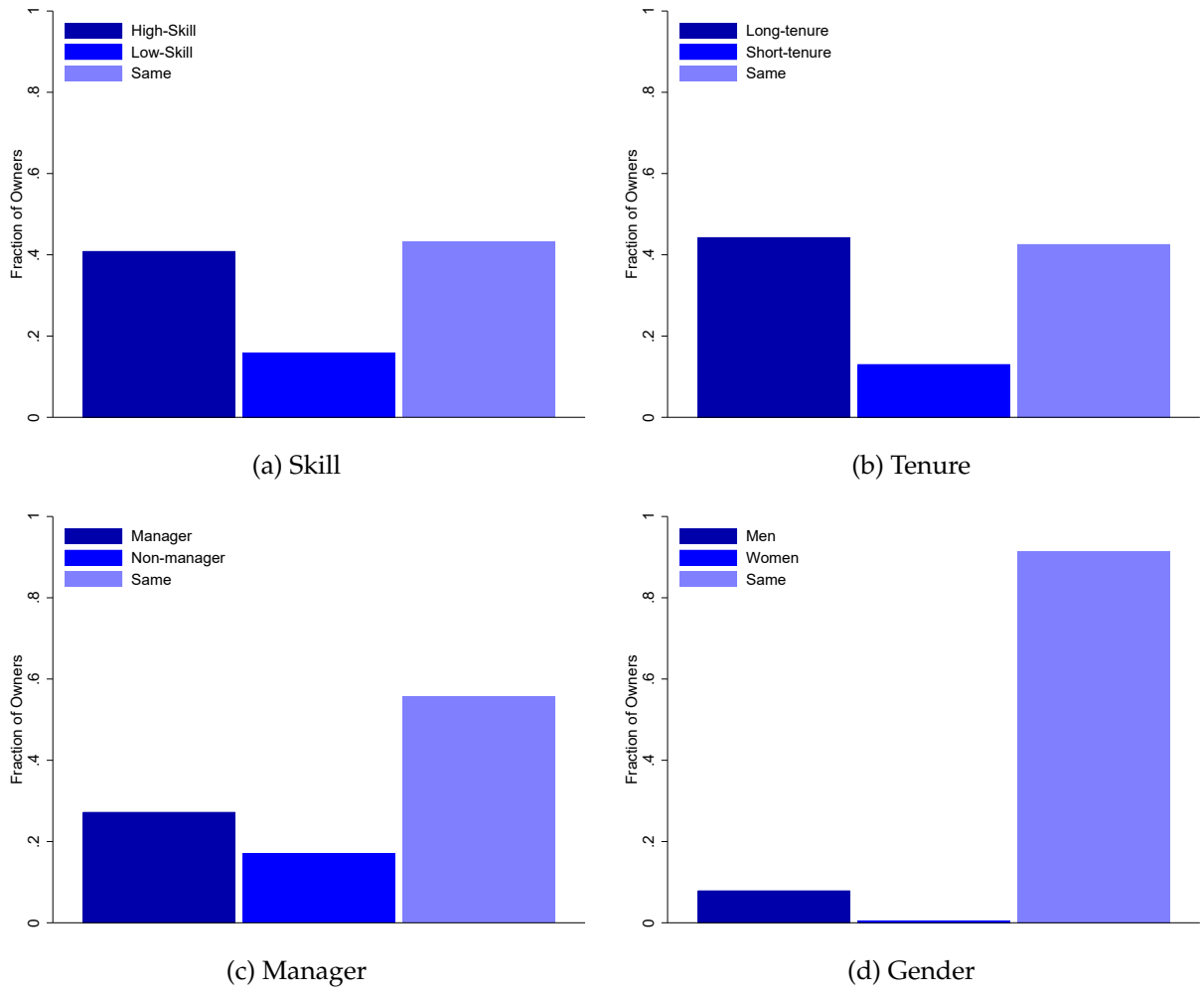
Figure A2: Validation of Extensive and Intensive Margins



(a) Firm Owners' Responses (b) Lawsuit Documents

Notes: Panel (a) shows the responses of firm owners when asked about their knowledge of PUTs. We gradually asked 1) whether they know PUTs happen, 2) whether they know a specific case, 3) whether it happens in their firms, including *"I prefer not to answer"* and without including it (4). Panel (b) shows overlapping histograms of the intensive margin of PUTs from the survey results and from the lawsuit PDFs.

Figure A3: Employers' responses to *Who are you more likely to pay under the table?*



(a) Skill

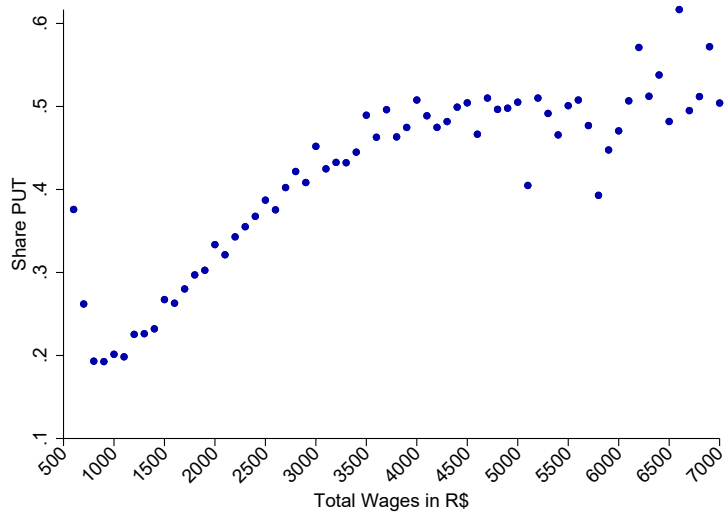
(b) Tenure

(c) Manager

(d) Gender

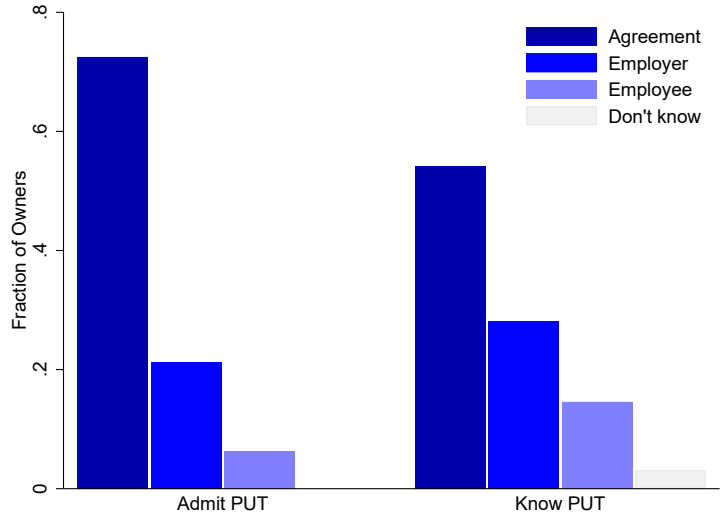
Notes: This figure shows firm owners' responses to question about which type of employees they are more likely to engage in PUT with. Panel (a) asks between high-skill and low-skill; panel (b) between long-tenure and short-tenure; panel (c) between managers and non-managers; and panel (d) between men and women. In all these comparisons we allowed firm owners to respond they are equally likely to collude with both groups.

Figure A4: Fraction paid under the table across the wage distribution (Validation)



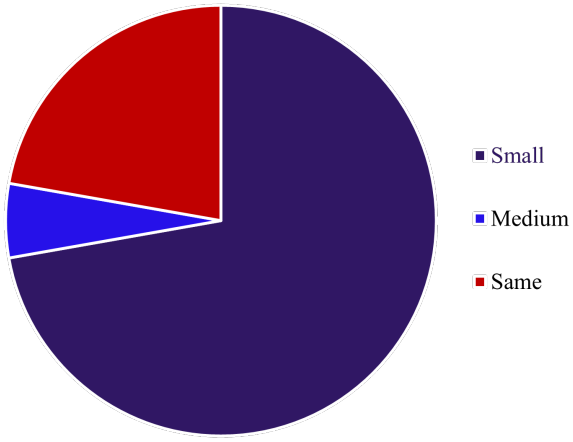
Notes: This figure shows the fraction paid under the table over total wages. PUTs and reported wages are recovered from the PDFs, and used to construct total wages and the ratio. We drop extreme values reported wages way below the federal minimum wage. See Appendix D for a detailed description of the data collection and cleaning.

Figure A5: *Who typically propose the PUTs?*



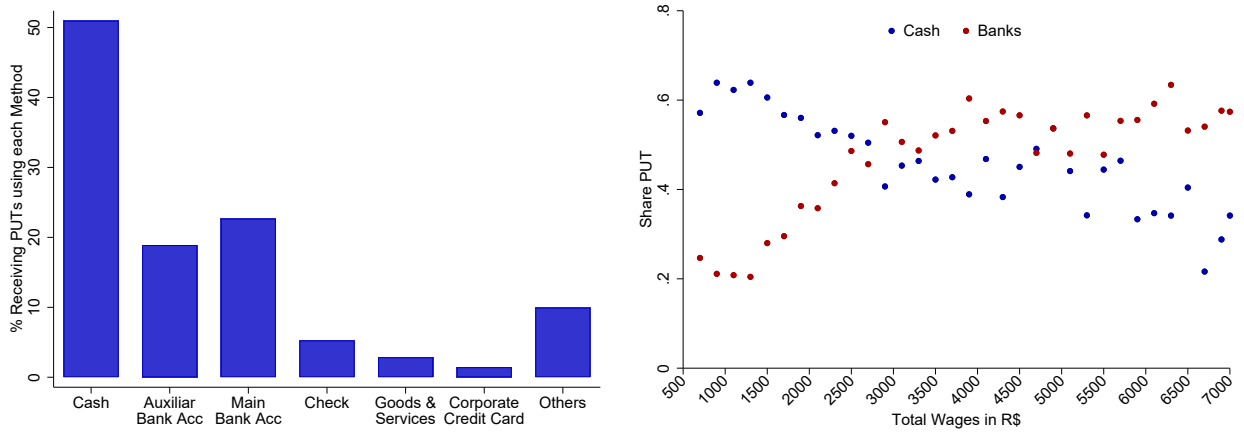
Notes: This plot shows employers' answer to the question *Who typically propose the PUTs?*. The sample is divided into two groups. Firm owners who admitted to paying under the table and those who know about PUT but didn't admit to doing it. We exclude those with no knowledge of PUTs.

Figure A6: Interviews with Accountants - *Where are PUTs more likely to happen?*



Notes: This pie chart shows accountants' responses about the type of firms where PUTs are more likely to happen. We presented four options: *Small*, *Medium*, *Large*, *Same*, where the last category indicates that the accountants find PUT equally likely to happen for the different firm sizes.

Figure A7: Payments Methods (Validation with ChatGPT 4-0)

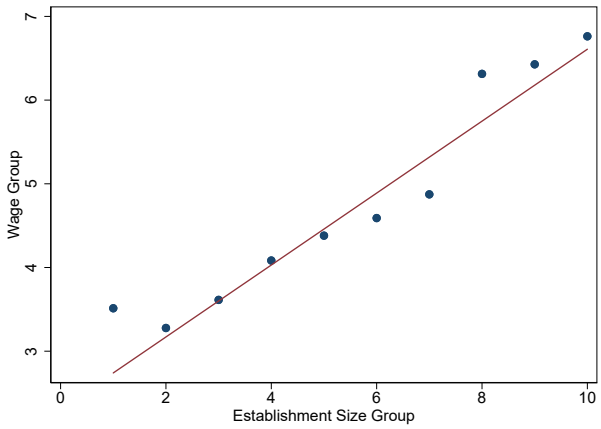


(a) Methods

(b) Methods by Income

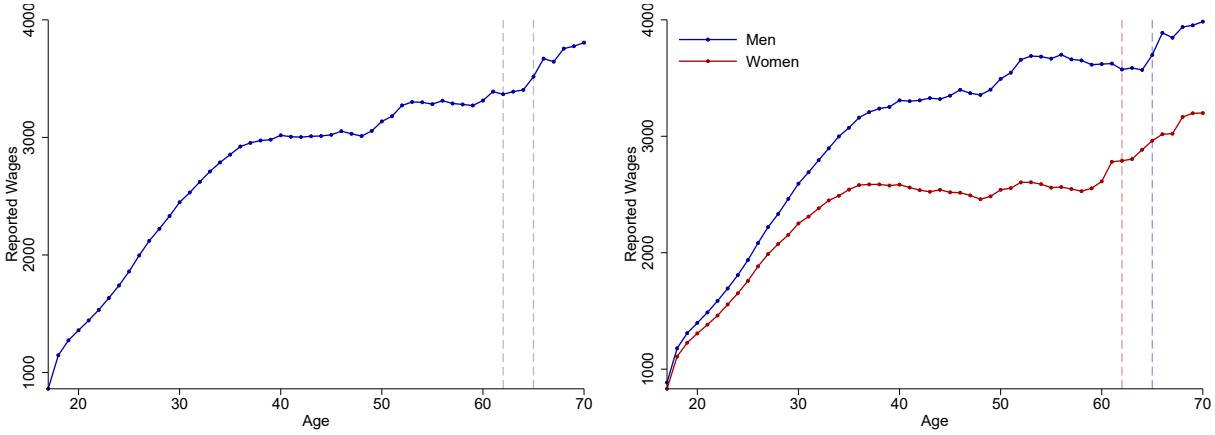
Notes: Panel (a) shows a tabulation of the payment methods recovered from the PUT-related documents. Categories were pre-specified in the prompt to ChatGPT 4-o. Details on the exact categories provided and the quality of the job performed by ChatGPT 4-o can be found in Appendix D. Panel (b) plots the share of documents reporting cash as a payment method (blue) and the share reporting a bank transfer as a payment method (red). The last group includes both *transfer to the same bank account where wages are paid* and *another bank account*.

Figure A8: Correlation: Number of Coworkers and Wages



Notes: This figure shows the correlation between establishment group size and wage group reported in our survey of formal employees. As expected, employees working in larger establishments earn, on average, higher wages.

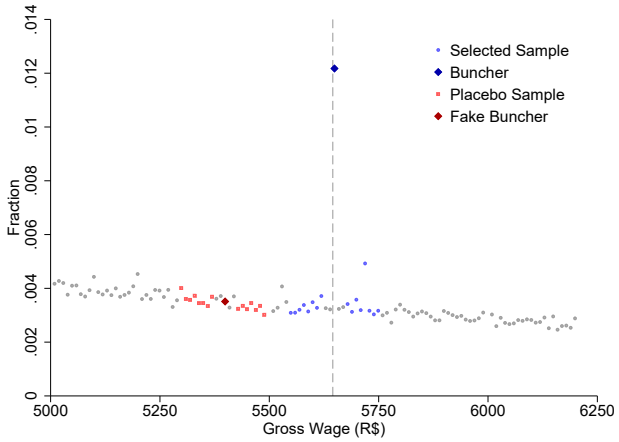
Figure A9: Average wages across age in 2017



(a) All (b) By gender

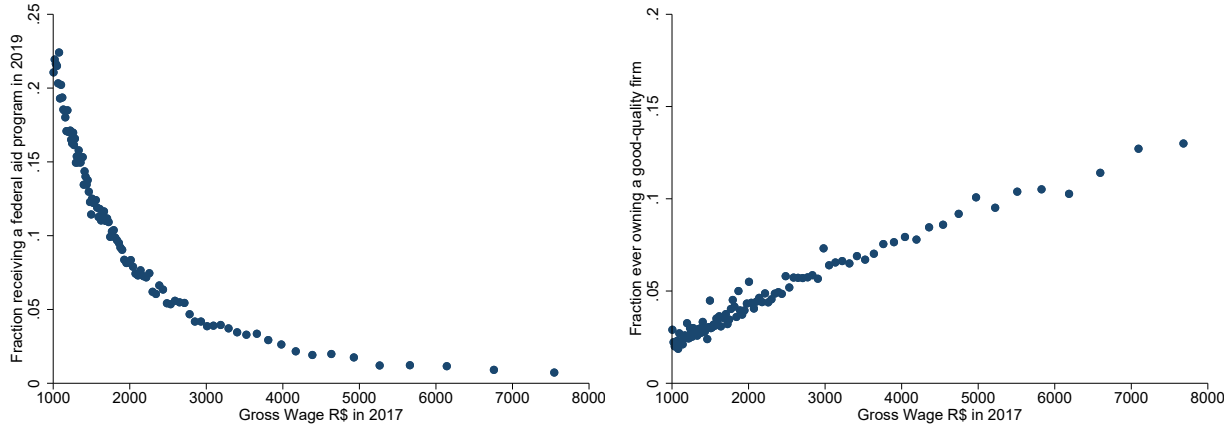
Notes: This figure shows the average wages by age using cross-sectional data for the universe of active employees in the Brazilian formal private sector in 2017. Panel (a) averages across all types of workers. Panel (b) differentiates between men and women. The dashed lines refer to the retirement age for women and men, 62 and 65 in 2017, respectively.

Figure A10: Sample selection for bunchers vs. non-buncher analysis



Notes: This figure illustrates our strategy to compare bunchers vs. non-bunchers and the placebo test we build. First, we define as bunchers as all the workers in the wage bin of the ceiling (dark blue diamond). Then, we define as non-bunchers as those who are in the wage bins $[c-8, c-3]$ and $[c+3, c+8]$. This means that the non-bunchers are those who report in one of the ten wage bins surrounding the ceiling and skipping the closest six bins. Each wage bin has a range of about US$ 2, so the comparison is between those who earn at the ceiling bin and those reporting between 6 and 16 dollars more or less. Second, we replicate this sample selection for another part of the wage distribution. We call fake bunchers to the employees working in the bin that plays the role of the ceiling, meaning it's at the center of the non-bunchers in the fake sample.

Figure A11: Indirect measure of true wages

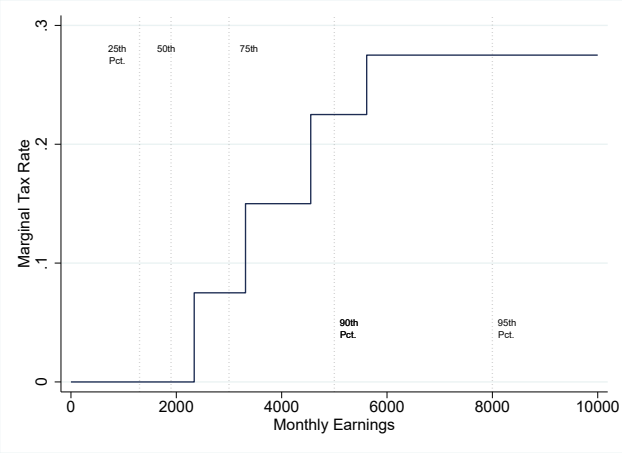


(a) Federail Aid Program

(b) Ever Owning a Good Quality Firm

Notes: This figure shows indirect measures of true income. Panel (a) shows that receiving a federal aid program is sharply decreasing in wages for formal employees. The y-axis represents the fraction of employees in each bin that shows up in *Cadastro Unico* (a data set containing all individuals and relatives who receive a federal aid program). Panel (b) replicates this exercise but uses a different proxy for true income: the likelihood of ever owning a good-quality firm. Ever owning a good quality firm is defined as showing up as the owner of a firm that opened before 2016, with a different firm identifier than the firm where they were employees in 2017, and with legal form *limited liability*. It shows a sharp positive relationship between ownership and wages in 2017.

Figure A12: Non-linear Income Tax Scheme



Notes: This figure shows the marginal income tax rate scheme (IFRS) for 2023. The income distribution is calculated using PNAD-continua in 2023, including all formal employees.

B Appendix Tables

Table A1: Firm Size and Tax Regime Distribution in 2022

Category	**% of Employees**
Firm Size (RAIS)	
1 to 5 employees	13.80%
6 to 10 employees	10.00%
11 to 50 employees	26.83%
More than 50 employees	49.57%
More than 1,000 employees	13.42%
Firm Size (PNAD)	
1 to 5 employees	12.49%
6 to 10 employees	12.73%
11 to 50 employees	20.79%
More than 50 employees	53.99%
Tax Regime	
SIMPLES	32.53%
Lucro Presumido	17.82%
Lucro Real	49.65%

Notes: This table contains information on the distribution of employees. *Firm Size* groups firms based on their number of employees. In the first case, the data comes from the matched employer-employee. The second case is based on a Brazilian household survey. *Tax regime* groups firms based on the regime they are regarding tax purposes.

Table A2: Balance Table

	(1) Lucid	(2) Lucid Reweight	(3) PNAD
Demographics			
Female	0.478	0.421	0.394
Age: 18-30	0.413	0.343	0.361
Age: 31-45	0.490	0.458	0.427
Age: 46-55	0.0774	0.159	0.152
Age: more 56	0.0187	0.0396	0.0603
Less than Highschool	0.0692	0.160	0.200
Highschool	0.268	0.473	0.518
More than Highschool	0.662	0.366	0.282
Firm Size			
Establishment size: 1 to 5	0.132	0.132	0.124
Establishment size: 6 to 10	0.0883	0.116	0.128
Establishment size: 11 to 50	0.218	0.222	0.207
Establishment size: more than 50	0.561	0.530	0.540
Total Wages			
Income: less than 3000	0.593	0.759	0.788
Income: between 3000 and 6000	0.250	0.170	0.150
Income: more than 6000	0.158	0.0707	0.0622
Observations	7297	7292	57903

Notes: This table compares different summary statistics for our survey (column 1), our survey reweighted (column 2) and the government household survey (column 3). In all cases, the sample is restricted to full-time formal employees older than 18 years old in the private sector.

Table A4: Employer-Employee Relationship

	= 1 if PUT receiver			% of wage as PUT		
	(1)	(2)	(3)	(4)	(5)	(6)
Managerial Position	.225***	.229***	.231***	4.22***	2.71***	1.19
	(0.011)	(0.011)	(0.012)	(0.779)	(0.796)	(0.815)
Family Business	.0628***	.0613***	.0591***	-.38	.299	.933
	(0.010)	(0.010)	(0.010)	(0.754)	(0.755)	(0.754)
Contact with Owners: Always	.122***	.13***	.114***	4.04***	3.92***	3.97***
	(0.015)	(0.015)	(0.016)	(1.404)	(1.401)	(1.434)
Contact with Owners: Usually	.101***	.108***	.097***	3.53**	3.12**	2.89**
	(0.015)	(0.015)	(0.016)	(1.434)	(1.440)	(1.458)
Contact with Owners: Sometimes	.0565***	.0598***	.0519***	.407	.683	.367
	(0.014)	(0.014)	(0.014)	(1.442)	(1.440)	(1.446)
Female		-.0359***	-.0382***		-1.54**	-.824
		(0.010)	(0.010)		(0.778)	(0.775)
Some College or More		-.0391***	-.0272**		4.94***	1.54*
		(0.011)	(0.012)		(0.829)	(0.929)
Dep. Var Mean	.24	.24	.24	22.84	22.84	22.84
Age FE	No	Yes	Yes	No	Yes	Yes
Firm Size x Income Group FE	No	No	Yes	No	No	Yes
Observations	7292	7279	7279	1945	1940	1940

Notes: This table explores how different variables related to employer-employee proximity predict the engagement in PUTs (columns 1-3) and how much is it paid under the table (columns 4-6). Our preferred specifications are columns 3 and 6, which control for firm size and income group, key determinants of PUTs. *Managerial Positions* are typically associated with closer ties to the owner of the firm. *Family Business* also involve some higher level of connection between the employees in the firm. Finally, we asked how often the have *contact with the owners*. We leave in the base those who answer never. We also add some demographics (gender and education) to benchmark the results.

Table A5: Matching characteristics and bunching prediction

	Probability of Being a Buncher	
	True	Placebo
Match Race	0.0280***	-0.000206
	(0.004)	(0.003)
Match Gender	0.00824**	-0.00311
	(0.003)	(0.002)
Nonwhite Owner	0.0110**	0.00261
	(0.004)	(0.003)
Female Owner	0.0281***	-0.00313
	(0.003)	(0.002)
Nonwhite Worker	0.000121***	1.83e-08
	(0.000)	(0.000)
Female Worker	0.0229***	-0.00198
	(0.003)	(0.003)
Dep. Var Mean	.1035343	.0658614
N	57963	51932
Size + Year + Industry FE	Yes	Yes

Notes: This table shows that matching characteristics with the employer is a relevant predictor of bunching. To construct this table, we followed the strategy explained in Figure A10. Both columns show results of regressing a dummy variable indicating whether the employee bunches on several characteristics. Column (1) presents the results for the true sample of buncher and non-bunchers, meaning that the bunchers earn the ceiling to the social security system. Column (2) presents the placebo results, where we run the same regression but create a fake group of bunchers and non-bunchers who do not have differences in incentives. We add several controls, including firm size, year, and industry fixed effects.

Table A6: Conflict at the Workplace

	Probability of Suing			
	(1)	(2)	(3)	(4)
Fired with cause	0.045***	0.044***	0.044***	0.044***
	(0.001)	(0.001)	(0.001)	(0.001)
Quit with cause	0.058***	0.053***	0.048***	0.048***
	(0.002)	(0.002)	(0.002)	(0.004)
Fired without cause	0.029***	0.029***	0.027***	0.028***
	(0.000)	(0.000)	(0.000)	(0.000)
Quit without cause	0.012***	0.012***	0.010***	0.010***
	(0.000)	(0.000)	(0.000)	(0.000)
End of labor contract	0.002***	0.003***	0.004***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
Female		-0.002***	-0.003***	-0.003***
		(0.000)	(0.000)	(0.000)
Nonwhite		-0.006***	-0.001***	-0.001***
		(0.000)	(0.000)	(0.000)
Less than High School		-0.002***	0.001***	0.000***
		(0.000)	(0.000)	(0.000)
High School		0.002***	0.001***	0.001***
		(0.000)	(0.000)	(0.000)
Dep. Var Mean - Incumbents	0.003	0.003	0.003	0.003
Controls	No	Yes	Yes	Yes
Ind+Occ+Year+Size FE	No	No	Yes	No
Occ+ YearxFirm FE	No	No	No	Yes
Observations	10.9M	10.9M	10.9M	10.8M

*Notes:*This table shows the effect of different variables on the probability of suing. The outcome variable is a dummy for whether the employee sues the employer. The sample contains all individuals who ended up suing their firm when they were employees in such firms. It also contains all the coworkers they had in at the time. The first five coefficients split for different reasons for separations. The baseline group contains employees who did not separate. All regressions have year-fixed effects, and standard errors are clusterized at the individual level. Column (4) has firm-fixed effects interacted with year-fixed effects, and standard errors are clusterized at the level as well.

Table A7: Effect of Lawsuit on Incumbent Workers

	Log Wages				Δ Occup	Hours Worked
	(1)	(2)	(3)	(4)	(5)	(6)
Treated x Post Lawsuit	0.0108***	0.0180***	0.0103***	0.0182***	-0.00235	-0.0603
	(0.002)	(0.003)	(0.002)	(0.004)	(0.003)	(0.038)
Sample	All	Small	Large	Manager	All	All
Obs (ind x time)	6937602	487824	6449778	356427	5781335	6864310

Notes: This table shows the coefficient β for the regression $\ln w_{i_{(j)}t} = \gamma_i + \delta_t + \beta \mathbf{1}(t > 0)\mathbf{1}(j \in \text{treated}) + \varepsilon_{i_{(j)}t}$. Columns (1) to (4) explore the heterogeneities shown in Figure 13b and 13c. Columns (5) and (6) use as outcome variable changes in occupation and hours worked, respectively. As the methodology explains, these regressions have saturated fixed effects at the unit x time.

C List Experiment

Treatment

Next, we present four (4) statements about possible work experiences. You must indicate how many of these statements correspond to your experience. In this way, if you indicate that two cases correspond to your experience, we are not going to identify which are these cases.

For example, if three (3) of the statements presented are true regarding your current work experience, answer as the number "3".

- In the last 12 months, you thought about changing jobs because you are frustrated with your relationship with your boss and/or with your co-workers.
- Although you are offered a 10% higher salary, in a position with similar obligations and the same location, you would prefer to continue your current job.
- Your current salary is made up of two parts: One part that is declared in the payment sheet and in the labor card (on which you pay taxes and contributions) and another part that is not declared on the payment sheet (on which you do not pay taxes or contributions).
- Since you have started you current job, you have witnessed at least one situation of discrimination based on gender, race, religion or physical handicap.

Control

Next, we present three (3) statements about possible work experiences. You must indicate how many of these statements correspond to your experience. In this way, if you indicate that two cases correspond to your experience, we are not going to identify which are these cases.

For example, if within the two (2) statements presented are true regarding your current work experience, answer as the number "2".

- In the last 12 months, you thought about changing jobs because you are frustrated with your relationship with your boss and/or with your co-workers.
- Although you are offered a 10% higher salary, in a position with similar obligations and the same location, you would prefer to continue your current job.
- Since you have started you current job, you have witnessed at least one situation of discrimination based on gender, race, religion or physical handicap.

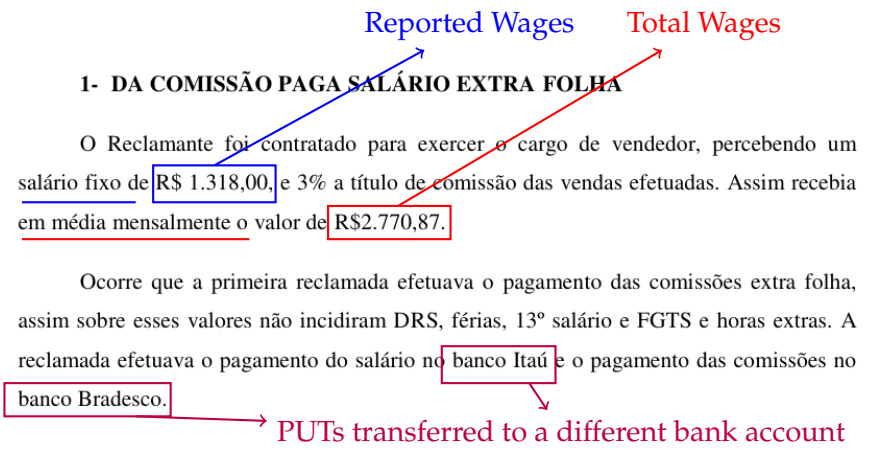
At the beginning of the questionnaire[43], we randomly split our main sample in treatment and control group. The treatment group is presented with four sentences, while the control group is presented with three. The differential sentence refers to PUTs, as it is highlighted in red. Respondents are asked about how many of these sentences are true for their personal case. We emphasize that, by answering the total number of sentences, we are not able to know which one in particular is true.[44]

We can recover the fraction of respondents who find true the PUTs sentence by comparing the average response of the treatment and the control group. The result is presented in Figure A1a.

D AI Tools and PUT-related Lawsuit PDFs

In addition to the administrative records on PUT-related labor lawsuits, we purchased a random subsample of X PDFs of the lawsuits. These PDFs are the initial claim made by the employee's lawyer to the judge, where they describe all labor law violations that took place, and the claimed compensation. However, these PDFs are not structured in a standard format, and each lawyer writes the information in their own way. The following examples illustrate the information contained in two different PDFs.

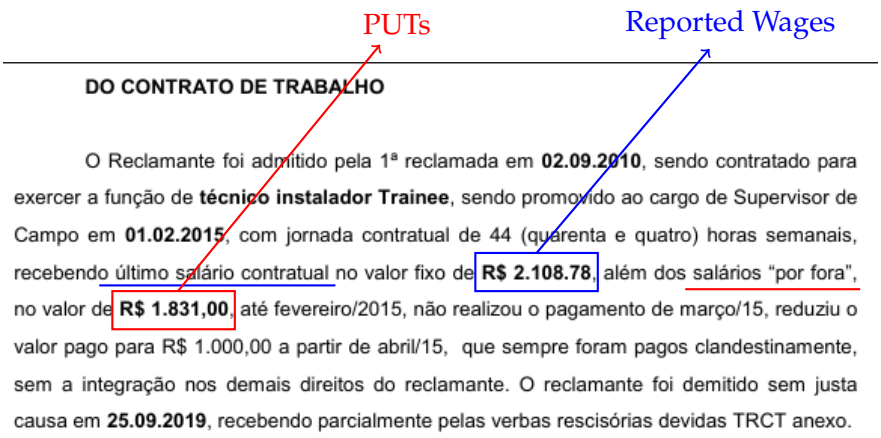
Example 1 - Lawsuit PDF



[43] The only questions before the List Experiment are the filters to define our relevant sample.

[44] This is only possible if the response is none or all. That is why sentence one and two are designed to correlate negatively.

Example 2 - Lawsuit PDF



While the lawyer in Example 1 writes the reported and total wages, the lawyer in Example 2 mentions the reported wages and the amount paid under the table. Moreover, in Example 1, we can explicitly find how the payments were made. The degree of discretion that lawyers have in writing their claims makes conventional text analysis methods impossible. Therefore, we need to use Artificial Intelligence (AI) in order to recover reliable information. We used the most updated version of ChatGPT available when we were writing this paper (4-o). We rely on the API version of the model due to the large amount of information to process. In the next part, we discuss the specific instructions and the output. Then, we explain the additional decisions we have to make based on the output provided by ChatGPT. Finally, we discuss issues of reproducibility, and how we address them given the existing options.

E Back of the Envelope Calculations

The goal of this exercise is to recover an order of magnitude for the government's revenue losses due to PUTs and classic informality. Therefore, the exercise consists in calculation how much revenues the government would collect if we formalize all informal employees and if all PUTs are reported in the payroll. This implies making several decisions that affect the final calculation. This appendix makes these decisions explicit, mentioning how we expect the results to change because of each. As a general rule, we try to keep the estimates as a lower bound, implying that (as long as they are sensible) we prefer conservative assumptions.

We call this exercise *back of the envelope calculation* because it assumes no behavioral responses. This is the first assumption, and it is an important one. Relaxing this assumption is virtually impossible in this setting, given that it would require information on the elasticities of employment and total wages to be forced to move one dollar paid under the table to the books.

The *back of the envelope calculation* requires the following inputs:

1. Total number of workers in each income group
2. Fraction of informal employees, PUTs receivers, and the fraction of the wage under-reported
3. Wage-related tax rates and corporate tax rates (deductions)

We use the Brazilian matched employer-employee to recover to total number of formal employees in the Brazilian private sector with an active contract in December of 2021 (last year of the data we have access to). This accounts for about 37.4M employees. Using the Brazilian household survey in the first semester of 2022, we recover the fraction of total employment in the Brazilian private sector that is formal, allowing us to recover the number of 10.5M informal employees. In the same way, we can assign these totals to wage bins because the household survey informs us about the proportion in each wage bin. We use the same wage bins we provided in the survey such that we can assign to those bins the percentage that receives PUTs and the fraction paid in that way.

We use the results of our survey to compute the fraction of formal employees who receive PUTs in each wage bin. Table A8 summarizes these results.

Table A8: Number of Employees by Wage Group and Formality Status

Wage Group	**Informal**	**Formal**	**PUTs**
$<$ 1,000	3,232,489	349,880	87,470
(1000, 1500)	4,307,572	1,260,000	2,899,651
(1500, 2000)	1,376,553	8,533,085	1,706,617
(2000, 2500)	849,612	5,256,064	1,208,895
(2500, 3000)	343,243	2,812,451	787,486
(3000, 4000)	462,303	3,475,430	799,349
(4000, 5000)	187,497	1,395,350	390,698
(5000, 6000)	177,105	890,345	302,717
$>$ 6,000	373,129	2,182,611	763,914
Total	10,550,000	37,400,000	

The next step is to compute the average PUTs that individuals in each wage bin receive. For classic informality, this average equals one, given that their whole wages are not reported. For the PUT receivers, we use the average fraction paid under the table that PUT receivers responded to. Given that we gave them intervals, we take the mid-point to calculate the averages. This gives us the average amount evaded by each wage group for both formal and informal employees. Finally, we calculate the taxes and contributions that would be paid if reporting these amounts.

Taxes on Employees

We will consider only two wage-related taxes to employees: social security contributions (only INSS), SSC for short, and income tax (IRRF). The tax base for the second is calculated after

deducting SSC. Therefore, we start calculating the revenue losses for employees' SSC, then we deduct them, and we finally calculate the revenue losses for the income tax.

Table A9: Employee's wage-related tax rates in 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

(a) Contributions to the INSS

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

(b) Income Tax Rate (IRRF)

Taxes on Employers

The employer's side is more complicated because their contributions depend on the tax regime. Moreover, the tax regime also determines whether firms pay taxes on profit or revenues. This is a crucial aspect because, for firms paying profit taxes, increases in reported wages can be deducted from the profit tax base, reducing the total tax payments. Finally, the profit tax rate varies with profit level and industry.

There are three main tax regimes relevant to employer-employee relationships:

1. SIMPLES (57% firms - 33% employees)
    - Revenue taxes
    - FGTS: $\sim$ 12% of gross wages
    - INSS: filled in *Documentaco de Arrendacao do Simples Nacional* (DAS)
    - INSS: Firms in Anexo IV subject to normal INSS (20% of gross wages)
2. Lucro Presumido (35% firms - 18% employees)
    - Presumptive profits (effectively revenue taxes)
    - FGTS: $\sim$ 12% of gross wages
    - INSS: $\sim$ 20% of gross wages
3. Lucro Real (8% firms - 49% employees)
    - Profit taxes: $\sim$ 20% if profits $>$0 (varies by industry and profit level)
    - FGTS: $\sim$ 12% of gross wages
    - INSS: $\sim$ 20% of gross wages

These contributions are applied monthly. Moreover, they must be paid for 2.5 additional months. This is because Brazil has a *13th salary* and vacations. Finally, firms in Lucro Real and Presumido (67% of employees) have an additional 10% cost on gross wages for *Sistema S*, *SAT* (work accident insurance), and *salario educacao*. Table A10 shows the details of revenue collection for social security contributions. In the previous description, we have ignored state and municipal contributions, CPSS, PIS, Pasep, and others for the employer. **To keep calculations simple and conservative, we assume a flat employer's contribution rate of 20%, including the deductions in profits**.

Table A10: Contributions on the gross wage by category in 2022 (25.5% total revenues)

Previdência Social	**73.11%**
Empregador	
Contrib. para o INSS - Patronal	41.72%
CPSS - Parcela Governo	2.82%
Previd. dos Estados - Governo	3.97%
Previd. dos Municípios - Governo	1.64%
Empregado	
Contrib. para o INSS - Empregado	16.84%
CPSS - Parcela Servidor	2.07%
Previd. dos Estados - Servidor	1.97%
Previd. dos Municípios - Servidor	0.82%
Contrib. p/ Custeio das Pensões Militares	1.26%
Contribuição Voluntária Montepio Civil	0.00%
Seguro Desemprego	**18.17%**
FGTS	18.17%
Outros	**9.01%**
Salário Educação	3.14%
Sistema "S"	3.17%
PIS - Folha de pagamento	0.10%
Pasep	2.28%
Cota-Parte Contrib. Sindical	0.00%
Contrib. p/ Ensino Aeroviario	0.03%
Contrib. p/ Ensino Profiss. Maritimo	0.02%
Contrib. Rurais	0.26%
Contribuição para o Fundo de Saúde - PMDF/BMDF	0.00%

Source: *Receita Federal do Brazil*

Table A11: Income Taxes by Category in 2022 (27.43% total revenues)

Pessoa Física	**33.72%**
IRPF	6.03%
IRRF - Trabalho União	27.26%
IRRF - Estados	0.00%
IRRF - Municípios	0.00%
Contrib. s/ Concursos e Prognósticos	0.42%
Pessoa Jurídica	**47.91%**
IRPJ	30.81%
CSLL	17.10%
Retenções não Alocáveis	**18.37%**
IRRF - Não Residentes	6.08%
IRRF - Capital	10.63%
IRRF - Outros	1.66%

Source: *Receita Federal do Brazil*

F Conceptual Framework

We present a conceptual framework to capture the cost-benefit trade-off that employers and employees face when engaging in PUTs. At a general level, it allows us to conceptualize the collusion at the employer-employee level, where PUTs increase the private surplus to the detriment of government revenues. We use this framework to understand what determines the optimal amount of PUT and how it affects employees' total compensation. Then, we derive comparative statics that we can test in our empirical applications in administrative data, exploiting variation that increases employers' and employees' costs of engaging in collusive tax evasion.

Intuitively, the sum of all wage-related taxes constitutes the benefits of the collusion. Employers face several labor costs, while employees pay income taxes and social security contributions. The sum of these benefits mirrors the government's losses (see Table A9 and A10). Profit taxes reduce these benefits (Appendix F.4 explains this point in detail). [45]

On the other hand, employers and employees face different costs related to PUTs. Employers are exposed to the risk of whistle-blowing, detection in a tax audit or labor inspection, union complaints, etc. In addition, employers must deal with the bookkeeping of PUTs, informally called *cooking the books*. For the employees, PUTs imply losing access to several benefits related

[45] Note that most Brazilian firms, as in many other developing countries, face revenue taxes rather than profit taxes, and the ones in the latter group face additional labor costs, compensating for the profit tax rate. Appendix E provides the exact numbers for each tax regime.

to social security (e.g., unemployment insurance, pension) and proof of income (e.g. access to credits). Workers are likely to differ in how much they value such benefits. This means that, under the same rules, employees may demand different amounts of PUTs.

F.1 Baseline Framework

Environment

We capture this collusion problem in a Nash bargaining framework, where the employer and the employee bargain over a surplus using reported wages, which the government observes and taxes, and PUTs.[46]

The structure of the model is as follows: In the absence of taxes, an employer-employee match produces an exogenous surplus $(y - z)$.[47] They bargain with the official wage (w_o) and the unofficial wages or PUTs (w_u). The government can tax the official wage but not the PUTs. For simplicity, we assume linear income taxes (τ) paid by the employee.[48] We model employers' and employees' costs in a general way, calling $C_f(w_u)$ and $C_e(w_u)$ the cost faced by them, respectively.

$$U_e = (1 - \tau)w_o + w_u - C_e(w_u) - z \tag{F.4}$$

$$U_f = y - w_o - w_u - C_f(w_u) \tag{F.5}$$

$$S(\cdot) = U_f + U_e \tag{F.6}$$

Note that even when the employer does not pay labor costs directly but faces evasion costs, she still has incentives to engage in PUTs as long as it implies paying a lower pre-tax wage with the employee receiving a higher post-tax wage. The optimization problem is

$$\max_{w_o \geq 0;\, w_u \geq 0} \left\{ \left((1 - \tau)w_o + w_u - C_e(w_u) - z\right)^{\phi} \left(y - w_o - w_u - C_f(w_u)\right)^{1-\phi} \right\}$$

Where ϕ represents the employee's bargaining power. In addition, the strict concavity of the problem does not allow for corner solutions in both the official and unofficial wages. Therefore, the problem is set up such that the employer-employee match can be achieved. However, the setting is flexible enough to allow corner solutions in one of the two control variables, keeping Equations F.4 and F.5 positive in the optimum. Because we are interested in PUTs, we focus only on cases where $w_o > 0$ (formal employees have some reported wages). Then, we only look at the slackness condition for w_u. A detailed derivation is provided in the supplementary material posted in our

[46] Nash bargaining is an appealing framework since stable collusion requires no agents to have incentives to deviate.

[47] y can be interpreted as how much the employee produces, and z as her outside option. Both are assumed to be exogenous, ruling out the misallocation effects of PUTs.

[48] Adding employers' social security contributions only changes the relative price of giving one dollar to the employer or the employee, but the solution's intuition remains unchanged.

website. Consistently, our empirical applications focus on PUTs changes conditional on the job existing. This means that we do not study the employment consequences of PUTs neither in the conceptual framework nor in the empirical part.[49]

Corner solution: no PUTs ($w_u = 0$)

$$\frac{(y - w_o)}{((1-\tau)w_o - z)} < \frac{(1-\phi)(1 + C_f'(0))}{\phi(1 - C_e'(0))} \tag{F.7}$$

With $w_o = \frac{\phi(1-\tau)y+(1-\phi)z}{1-\tau}$. This expression highlights the importance of employers' and employees' fixed costs of engaging in PUTs for the extensive margin.[50] [51] Intuitively, this captures cases such as setting up a bookkeeping strategy for illegal payments, getting exposed to employees lawsuits which carry fixed costs, among others.

Interior solution ($w_u > 0$)

The optimal amount of PUTs (w_u^*) satisfies:

$$\tau = \frac{\frac{\partial C_f(w_u^*)}{\partial w_u} + \frac{\partial C_e(w_u^*)}{\partial w_u}}{1 + \frac{\partial C_f(w_u^*)}{\partial w_u}} \tag{F.8}$$

Note that this equality holds as long as $\frac{\partial C_e(\cdot)}{\partial w_u} < 1$, because $\tau \in (0,1)$. Importantly, this expression shows that, for an interior solution, the optimal level of PUTs depends on the tax rate and marginal cost of evasion. Whether the employer or the employee has more bargaining power becomes irrelevant. The optimal level of PUTs maximizes the private surplus, at the expense of government revenues and total surplus.[52] Using the FOC for w_o, and replacing for the optimum w_u, we get the optimal amount of reported wages (w_o^*).

$$(1-\tau)w_o^* = \phi(1-\tau)[y - w_u^* - C_f(w_u^*)] + (1-\phi)[z + C_e(w_u^*) - w_u^*] \tag{F.9}$$

This expression is very similar to the solution for wages in a standard search and matching model. However, there are a few differences. First, note that w_u^* enters linearly in both terms,

[49] We recognize employment effects and misallocation could be important consequences of PUTs. However, we are interested in disentangling the incentives of employers and employees to participate in collusive tax evasion and how they respond to changes in these incentives.

[50] Note that if $C_f'(0) = 0$ and $C_e'(0) = 0$, then this inequality doesn't hold for any ϕ (you get $\frac{\phi}{1-\phi} < \frac{\phi}{1-\phi}$), meaning that you get $w_u^* > 0$.

[51] Some examples of this are logistical costs regarding accounting strategies or costs associated with labor lawsuits or audits that do not depend on the amount paid under the table

[52] Total surplus may decrease if there is *real* evasion costs, rather than a transfer to other agents in the economy (see Chetty (2009) for a discussion).

highlighting the substitutability between the official and unofficial after-tax wage. However, it also enters indirectly through the cost functions of both employers and employees. This means that the official wages also change to compensate for the evasion costs.

Important for our applications Section 4, under mild assumptions (see Supplementary Material), it is easy to prove that:

1. w_u^* increases in τ and decreases in the employer's and employee's marginal cost
2. w_o^* increases when w_u^* decreases and vice versa
3. The substitution rate between the official and unofficial wages depends on the tax rate, relative convexity of the cost functions, and the bargaining powers

An important takeaway is that the reported wages adjust in response to the optimal amount of PUTs. This means that total compensation does not remain constant when there is evasion. In fact, the substitution rate between these payment forms determines who benefits the most from the surplus taken away from the government. In Appendix F.3, we use this conceptual framework to investigate questions related to incidence and welfare.

F.2 Application to Risk of a Lawsuit

Let's assume $C_f(w_u) = p\left(\frac{w_u^\gamma}{\gamma} + F\right)$, where p is the perceived probability of being sued; w_u is the amount paid under the table or unofficial wages; γ sets the convexity of the marginal cost of paying an additional dollar under the table; and F is a fixed cost that the employer pays if sued. One interpretation for the convexity on w_u is that costs may increase in w_u because PUT-related lawsuits also include claims for *moral damage* and several other reasons that are more likely to appear if the amount evaded is larger.[53] Administrative costs of going through a lawsuit, such as paying lawyers, motivate the fixed costs F.[54] Finally, a change from p_b to p_a (with $p_a > p_b$) represents an increase in the perceived probability of being reported.

This implies that Equation F.8 takes the form:

$$w_u^* = \left(\frac{\tau}{(1-\tau)p}\right)^{\frac{1}{\gamma-1}}$$
$$\frac{\partial w_u^*}{\partial p} = -\left(\frac{1}{\gamma-1}\right)(w_u^*)^\gamma\left(\frac{1-\tau}{\tau}\right) < 0 \iff \gamma > 1$$

Therefore, as long as the cost function exhibits some degree of convexity on the unofficial wages, an increase in the perceived probability of being sued reduces payments under the table in equilibrium (as shown in Figure A13a). On the other hand, Equation F.9 implies:

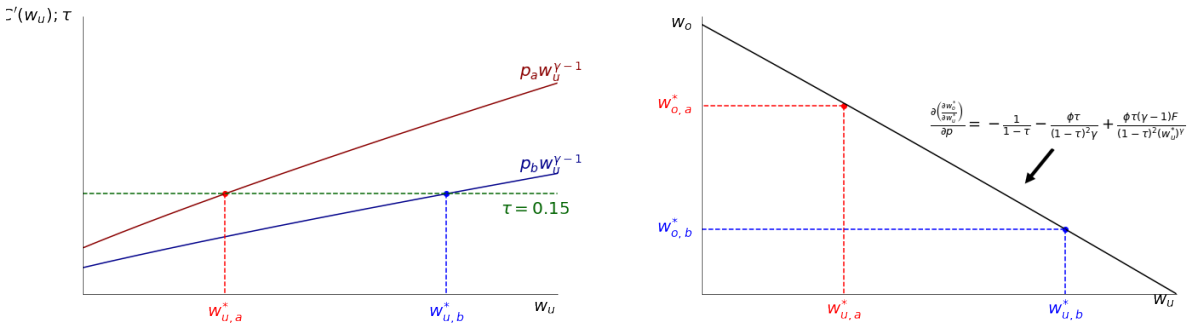
[53] An alternative way of modeling is making the probability of reporting a convex function of the amount paid under the table. This is consistent with very few employees willing to sue if they were receiving too few PUTs.

[54] Fixed costs allow to capture effects on the extensive margin.

$$(1-\tau)w_o^* = \phi(1-\tau)y + (1-\phi)z - \phi\left[p\left(\frac{(w_u^*)^\gamma}{\gamma} + F\right)\right] - w_u^*$$
$$\frac{\partial(1-\tau)w_o^*}{\partial p} = \phi\left[\frac{1}{\gamma-1}\frac{(w_u^*)^\gamma}{\gamma} - F\right] + \frac{1}{\gamma-1}\frac{w_u^*}{p} > 0$$

A sufficient condition for this expression to be positive is that p is small enough. Moreover, the effects in reported wages are expected to be larger for those evading larger shares. Intuitively, if the payments under the table are large, the reduction in marginal cost is larger than the increase in the direct costs due to the increase in p.

Conceptual framework prediction: Effect of ↑ p in PUTs and reported wages



(a) Change in optimal PUTs (w_u^*)

(b) Change in optimal reported wages (w_o^*)

Notes: This Figure shows the effect of changes in the probability of a lawsuit on the unofficial and official wages. The pre-specified parameters are $\gamma = 1.85$; $p_b = 0.0002$; $p_a = 0.00035$; $\tau = 0.15$; $\phi = 0.5$; $F = 1,000$; and $(y-z) = 5,000$. This numeric exercise implies a range of values for $w_u = [500, 3000]$ and $w_o = [1000, 4000]$. Panel (a) plots the marginal cost of PUTs and the tax rate on the unofficial wages. w_{ub}^* and w_{ua}^* show the optimal solution to the unofficial wages in a Nash Bargaining equilibrium (Equation F.8) before and after the lawsuit, respectively. Panel (b) plots the optimal official wages for different values of p in the y-axis. The x-axis plots the optimal unofficial wages for different values of p, making explicit the substitution rate between the two in response to changes in p. We use the interval $p \in (0.0002, 0.001)$. w_{ob}^* and w_{oa}^* show the optimal solution to the official wages in a Nash Bargaining equilibrium (Equation F.9) for the same pre-specified values of p than in plot (a), respectively.

F.3 Incidence and Welfare

With taxes and no evasion

$$U_e = (1-\tau)w_o - z \tag{F.10}$$

$$U_f = y - w_o \tag{F.11}$$

$$S(\cdot) = U_f + U_e \tag{F.12}$$

The optimization problem is:

$$\max_{w_o \geq 0} \left\{ ((1-\tau)w_o - z)^{\phi} (y - w_o)^{1-\phi} \right\}$$

Solving with respect to w_o we get:

$$\begin{gathered} w_o^*(1-\tau) = \phi y(1-\tau) + (1-\phi)z \\ U_f^* = (1-\phi)\left[y - \tfrac{z}{1-\tau}\right] \\ U_e^* = \phi\left[y(1-\tau) - z\right] \\ \tfrac{\partial U_e^*}{\partial \tau} = -\phi y \\ \tfrac{\partial U_f^*}{\partial \tau} = -\tfrac{(1-\phi)z}{(1-\tau)^2} \end{gathered}$$

The first thing to note is that the total private surplus gets reduced with taxes. The condition for a solution to exist becomes $y > \frac{z}{1-\tau}$. Therefore, increasing taxes will reduce the number of matches that exist. On the other hand, if the previous condition holds, taxes will change the optimal w_o. Both employer and employee are weakly worse off with taxes. Finally, increasing τ reduces the employee's utility, and it does it more the larger the employee's bargaining power. Intuitively, if the employee has all the bargaining power, she keeps all the surplus of the relationship, while the employer gets zero utility. The employer cannot have less than zero utility for the match to survive, meaning the employee absorbs all the tax payments.

The exercise is analogous if we assume payroll taxes rather than income taxes. In that case the problem becomes:

$$\max_{w_o \geq 0} \left\{ (w_o - z)^{\phi} (y - w_o(1+\tau))^{1-\phi} \right\}$$

Where the analogous conditions hold:

$$\begin{gathered} w_o^* = \tfrac{1}{1+\tau}\left[\phi y + (1-\phi)(1+\tau)z\right] \\ U_f^* = (1-\phi)\left[y - z(1+\tau)\right] \\ U_e^* = \phi\left[\tfrac{y}{1+\tau} - z\right] \\ \tfrac{\partial U_e^*}{\partial \tau} = -\tfrac{\phi y}{(1+\tau)^2} \\ \tfrac{\partial U_f^*}{\partial \tau} = -(1-\phi)z \end{gathered}$$

With taxes and evasion

In this case, we must make assumptions about the employers' and employees' cost functions. We focus on the case of interior solutions to highlight the gains from the collusive tax evasion. This means we won't have fixed costs (which can induce extensive margin responses in PUTs). For simplicity, we also set employers' evasion cost to zero. Let's the employees' cost to have the following functional form: $C_e(w_u) = \frac{\varepsilon_i w_u^{\gamma}}{\gamma}$, where ε_i controls the level of the cost function for individual i[55], and γ its convexity.

[55] It can be interpreted as how much this individual values the benefits linked to reported

Using Equations F.8 and F.9 we find:

$$w_u^* = \left(\frac{\tau}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}}$$
$$w_o^*(1-\tau) = \phi(1-\tau)\left[y - \left(\frac{\tau}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}}\right] + (1-\phi)\left[z + \left(\frac{1}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}} \tau^{\frac{\gamma}{\gamma-1}} \frac{1}{\gamma} - \left(\frac{\tau}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}}\right]$$

Note that we can re-write the optimal reported wage after-tax as:

$$w_o^*(1-\tau) = \underbrace{\phi(1-\tau)y + (1-\phi)z}_{=w_{o,NE}^*(1-\tau)} - \left(\frac{\tau}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}} (\phi(1-\tau) + (1-\phi)) + (1-\phi)\left(\frac{1}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}} \tau^{\frac{\gamma}{\gamma-1}} \frac{1}{\gamma}$$

Where $w_{o,NE}^*$ is the optimal gross reported wages in the case of no evasion. Note that the after-tax official wage equals to the after-tax official wage in case of no evasion plus two additional terms. Indeed, we can do some algebra and find out that $w_o^*(1-\tau) < w_{o,NE}^*(1-\tau)$ if the following inequality holds:

$$\underbrace{\gamma}_{>1}(1-\phi\tau) > (\tau - \phi\tau)$$

This is always true under the convexity assumption (note that the parenthesis in the LHS is always larger than in the RHS because $\tau \in (0,1)$).

The second interesting comparison is what happens to employees' total wages when PUTs are possible.

$$w_o^*(1-\tau) + w_u^* = w_{o,NE}^*(1-\tau) + \phi \underbrace{\left[\left(\frac{1}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}} \tau^{\frac{\gamma}{\gamma-1}}\right]}_{A} + (1-\phi) \underbrace{\left[\left(\frac{1}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}} \tau^{\frac{\gamma}{\gamma-1}} \frac{1}{\gamma}\right]}_{B}$$

The first thing to note is that employees' total wages are higher in the case of collusive tax evasion than non-evasion. The second thing to note is that how much more employees get is a convex combination of terms A and B. Suppose the employee has zero bargaining power; then term A goes to zero. All the additional compensation is explained by the cost of receiving PUTs of the employee, leaving the U_e unchanged with respect to the non-evasion case. Later, we show that this means the employer fully captures the gains from evasion. Now, suppose that the employee has all the bargaining power. The term B goes to zero. Note that A is always larger than B. Therefore, in this case, the employee captures the gains from collusive tax evasion. In the background, the official wages adjust when employees receive some amount of PUTs. If the employee has zero bargaining power, then the official wages will adjust more downwards to the point of the utility in the non-evasion case (break-even). If the employee has some bargaining power, official wages will adjust downwards but at a lower magnitude, retaining some additional utility for the employee.

Then, we can calculate the utility for the employee when collusive tax evasion is possible:

$$U_e^{PUT} = U_e^{NE} + \phi \left(\frac{1}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}} \tau^{\frac{\gamma}{\gamma-1}} \frac{(\gamma-1)}{\gamma}$$

We can do a similar derivation for the utility of the employer

$$U_f^{PUT} = y - w_o^* - w_u^*$$
$$U_f^{PUT} = y - w_{o,NE}^* - \frac{1}{1-\tau}\left[(1-\phi)\left(\frac{1}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}} \tau^{\frac{\gamma}{\gamma-1}} \frac{1}{\gamma} - \left(\frac{\tau}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}} (1-\tau\phi)\right] - \left(\frac{\tau}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}}$$
$$U_f^{PUT} = U_f^{NE} + \frac{(1-\phi)}{1-\tau}\left(\frac{1}{\varepsilon_i}\right)^{\frac{1}{\gamma-1}} \tau^{\frac{\gamma}{\gamma-1}} \frac{(\gamma-1)}{\gamma}$$

Where the only difference with the expression for the employee is that the additional utility with collusive tax evasion is divided by $(1-\tau)$, this reflects that if the official wage can go down to fully compensate the increase in PUTs ($\phi = 0$), then that income is not taxed. However, it is taxed if the employee gets it. In other words, because the surplus of the collusion is distributed through the official wage (and in this model, only the employee pays wage taxes), then $(1-\tau)$ shows the substitution rate of giving a dollar to the employer relative to the employee.

F.4 Employers - Profit Taxes and Labor Costs Deductability

This part provides a simple exercise showing that higher profit taxes may reduce PUT. We abstract from the employer-employee collusion and focus on how different tax rates may interact in employers' incentives to engage in PUT. Firms are typically taxed on profits or revenues. Typically, the share of firms taxed on revenues is larger in developing countries. Best et al. (2015) shows that revenue taxation reduces corporate income evasion by 60-70% in Pakistan, a setting with limited tax capacity. This is a very important result because it shows that even when revenue taxes reduce production efficiency, these effects are more than compensated for large cost elasticities related to evasion. However, looking only at corporate income evasion misses a (potentially large) cross-elasticity related to revenue collection due to the reporting of those costs. In settings where PUTs are prevalent, reporting more labor costs implies more taxes. In fact, most of the accountants we interviewed mentioned that PUTs would be more minor if firms in Brazil would pay profit taxes rather than revenue taxes.

To illustrate how the interaction between profit taxes and other labor costs (for simplicity, we only consider payroll taxes), let us assume that a given firm j maximizes profits based on how much wages to report (we fix firm's hiring decisions).

$$\max_{\alpha} \left[F(L) - (1-\alpha)wL(1+\tau_l)\right](1-\tau_p) - \alpha wL \tag{F.13}$$

Where α is the share of the wages to pay under the table, τ_l and τ_p are the payroll and profit tax rate, respectively. The first order condition to this problem is

$$\tau_l = \frac{\tau_p}{(1-\tau_p)} \tag{F.14}$$

This means that if the payroll taxes are higher ($\tau_l > \frac{\tau_p}{(1-\tau_p)}$), then evasion is desirable and vice versa. If we expand the setting to add a quadratic cost of evasion, as is typically done[56], the FOC becomes:

$$\alpha^* = \frac{(1+\tau_l)(1-\tau_p)}{\kappa_j(wL)} \tag{F.15}$$

This expression makes explicit that the relevant tax rate in an employer's decision to evade depends on the *effective* tax rate paid for an extra dollar reported, which depends both on the labor costs and the possibility of deducting it from profit taxes.

G Real versus reporting responses: a test

Many institutional settings feature a ceiling $\bar{y}$ at which the incentives to *report* earnings change discontinuously—for instance because the marginal tax rate, the contribution rate, or the benefit accrual schedule exhibits a kink or notch at $\bar{y}$. A robust empirical regularity in such environments is *bunching*: an excess mass of *reported* earnings at (or just below) the ceiling. Observing bunching in reported earnings, however, does not by itself identify the underlying behavioral margin. Reported bunching can arise either because agents adjust *real* labor supply/compensation so that true earnings concentrate at $\bar{y}$, or because agents adjust *reporting* (misreporting/underreporting) while true earnings remain above the ceiling.

This section develops a simple test that leverages the distribution of reported wages around $\bar{y}$ together with information on *true* wages (when observable) to distinguish between these competing mechanisms.

Notation. Let y denote *true* earnings (or true wage income), and let r denote *reported* earnings to the authority. By definition, $r \leq y$ under underreporting, and we define evasion (or misreporting) as

$$e \equiv y - r \geq 0. \tag{G.16}$$

Let $\bar{y}$ be the ceiling at which the policy schedule changes, generating bunching in the distribution of r.

[56] We add $-\frac{k_j}{2}(\alpha wL)^2$ at the end of Equation (F.13)

Mechanism 1: real (labor-supply or wage-setting) response. In a class of models, bunching is generated because individuals (or employers) adjust *real* outcomes so that true earnings concentrate at the ceiling. A reduced-form representation is that individuals choose hours/effort ℓ and true earnings are $y = a\ell$ (or an employer sets the worker's contract), while taxes depend on true earnings through a piecewise-linear schedule with a kink at $\bar{y}$:

$$T(y) = \begin{cases} \tau_\ell y, & y \le \bar{y}, \\ \tau_\ell \bar{y} + \tau_h (y - \bar{y}), & y > \bar{y}, \end{cases} \qquad \text{with } \tau_h > \tau_\ell, \tag{G.17}$$

and utility takes the canonical form $U = c - v(\ell)$ with $c = y - T(y)$. In this environment, optimizing behavior can generate bunching at $\bar{y}$ in the distribution of *true* earnings y (and therefore also in reported earnings if $r = y$).

Crucially, under a pure real-response story, reported earnings coincide with true earnings for bunchers:

$$r = y \quad \text{for individuals bunching at } \bar{y}. \tag{G.18}$$

Graphically, in a scatter plot with r on the horizontal axis and y on the vertical axis, observations should lie on (or very near) the 45° line, including in the neighborhood of $\bar{y}$.

Mechanism 2: reporting (evasion) response. Alternatively, reported bunching can be generated even if true earnings do *not* concentrate at $\bar{y}$. In this class of models, agents earn true income y (determined by real effort, productivity, or wage-setting absent reporting distortions) but choose how much to report, $r \le y$, trading off lower tax liability against a convex cost of evasion:

$$U = \big(y - T(r)\big) - v(\ell) - \kappa(e), \qquad e = y - r, \quad \kappa'(e) > 0,\ \kappa''(e) > 0. \tag{G.19}$$

The first-order condition with respect to r equates the marginal tax saving to the marginal evasion cost:

$$T'(r) = \kappa'(y - r). \tag{G.20}$$

When $T'(\cdot)$ changes discretely at $\bar{y}$ (or when the schedule features a kink/notch in a way that makes the reporting incentives discontinuous), optimal reporting can generate a spike in the distribution of *reported* earnings at $\bar{y}$ even if the distribution of true earnings is smooth through $\bar{y}$. Under this mechanism, for individuals who report $r \approx \bar{y}$ (the bunchers), true earnings exceed reported earnings on average:

$$y > r \quad \text{for a nontrivial fraction of individuals with } r \approx \bar{y}. \tag{G.21}$$

Graphically, the cloud of points near $r = \bar{y}$ should sit *above* the 45° line, reflecting $y - r > 0$ among bunchers.

Testable implications. Both mechanisms predict excess mass in the distribution of reported earnings around $\bar{y}$. The distinguishing prediction concerns the *gap* between true and reported

earnings for workers located at the bunching point.

Let B denote a "bunching window" around the ceiling in reported earnings, e.g.

$$B \equiv \{r \in [\bar{y} - \delta,\ \bar{y} + \delta]\}, \tag{G.22}$$

for a small $\delta > 0$ (in practice chosen to capture the spike in the histogram of r). The key implication can be stated as a conditional moment:

$$\mathbb{E}[y - r \,|\, r \in B] \approx 0 \qquad \text{(real response / institutional anchoring)}, \tag{G.23}$$

$$\mathbb{E}[y - r \,|\, r \in B] > 0 \qquad \text{(reporting/evasion response)}. \tag{G.24}$$

Equivalently, conditioning more tightly on reported earnings at the spike,

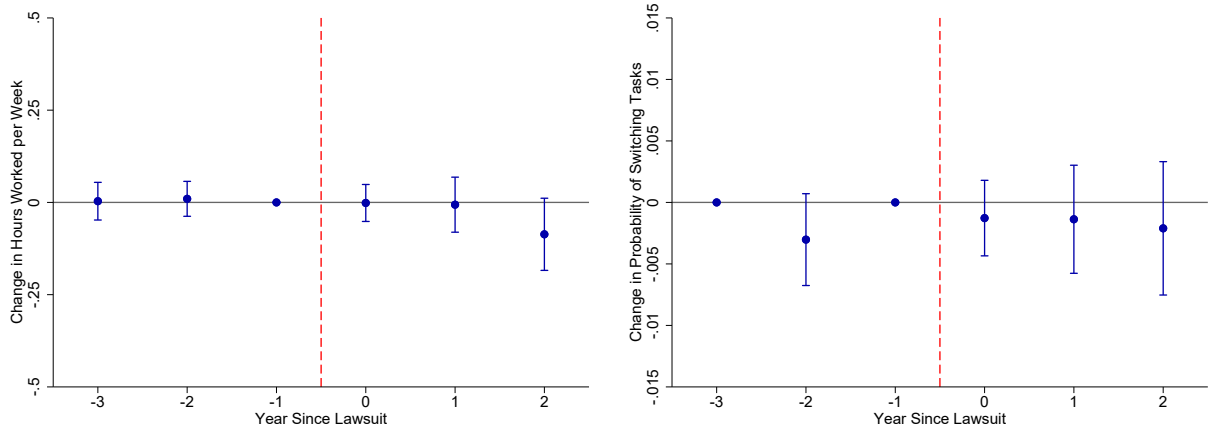
$$\begin{aligned} &\mathbb{E}\left[y^{\text{true}} - y^{\text{reported}} \,\middle|\, y^{\text{reported}} \approx \bar{y}\right] \approx 0 \quad \text{under real responses,} \\ &\mathbb{E}\left[y^{\text{true}} - y^{\text{reported}} \,\middle|\, y^{\text{reported}} \approx \bar{y}\right] > 0 \quad \text{under reporting responses.} \end{aligned} \tag{G.25}$$

Interpretation and visualization. A convenient way to present the intuition is to plot the joint distribution of (r, y) in the neighborhood of $\bar{y}$. Under real responses, the mass of observations piles up at $(\bar{y}, \bar{y})$ and follows the 45° line. Under evasion, the mass piles up at $r = \bar{y}$ on the horizontal axis while remaining dispersed above $\bar{y}$ on the vertical axis, producing a vertical "stack" above $(\bar{y}, \bar{y})$. This yields a direct mapping from observed bunching in r to a falsifiable implication about whether bunchers' true earnings also concentrate at $\bar{y}$.

Scope. The test is not limited to labor-supply models. It also applies to environments where employers anchor contractual wages to institutional ceilings (e.g., payroll tax caps or contribution ceilings). Such anchoring is still a real-response mechanism: it predicts $y = r$ among bunchers. By contrast, any mechanism that generates bunching primarily through reporting choices predicts $y > r$ for at least some bunchers, and therefore a strictly positive conditional gap as in (G.24)–(G.25).

H Robustness Checks for the Lawsuits' Effects

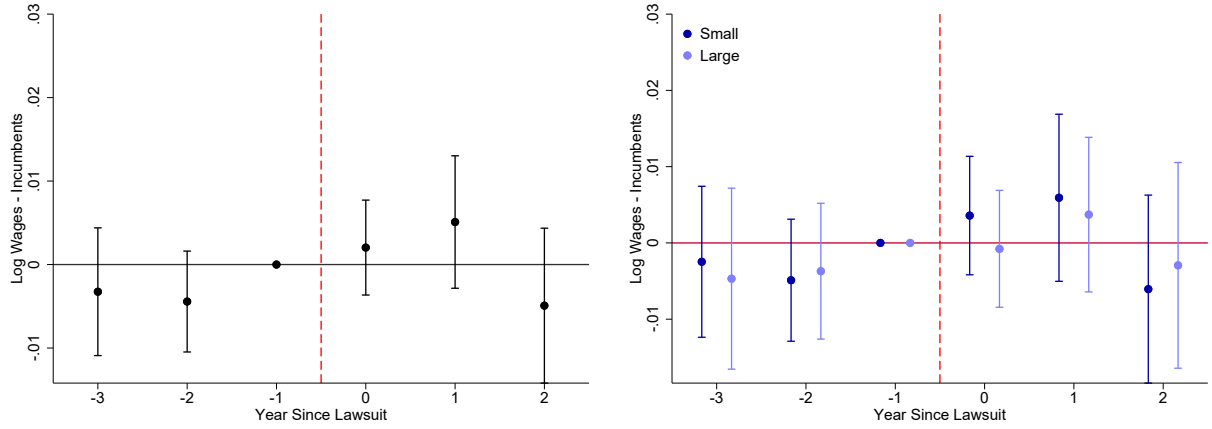
Figure A14: PUT-related lawsuit effects on hours worked and tasks performed



(a) Hours Worked (b) Tasks Performed

Notes: This plot shows the estimates for Equation 3 using outcomes different from reported wages. Panel (a) shows the effects on hours worked. Panel (b) shows tasks performed. We approximate tasks performed as the occupation reported in the administrative data. We then estimate the probability of switching occupations. Because we are estimating the effects of changes, the first period has no previous one to calculate the difference. The sample contains active employees who have worked in the same firm for the entire period but never appear in the lawsuit data. Treatment is defined at the firm level. The treated group contains firms that were sued for PUT. The control group contains firms that match the treated firms one-to-one based on their characteristics in the pre-period. A combination of *industry, number of employees, legal form, state, and year of opening* form a cell. Event time is centered in the lawsuit year. We include unit fixed effects and cluster standard errors at the firm (treatment) level.

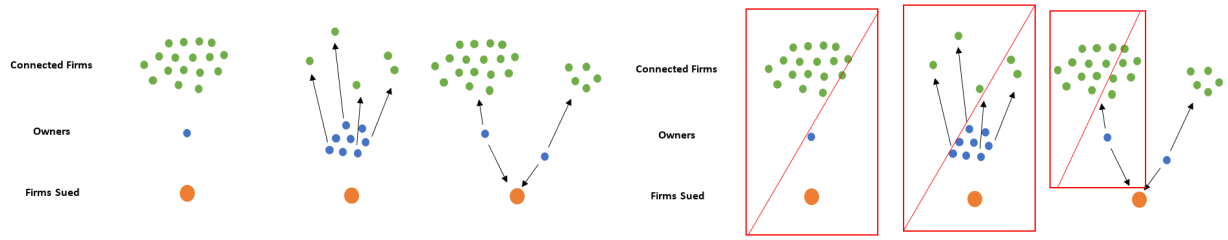
Figure A15: Effects of Non-PUT-related Lawsuits



(a) All (b) By Firm Size

Notes: This plot shows the estimates for Equation 3 using a different sample. Rather than using sued firms for PUT-related reasons as treatment groups, we use those sued for sexual harassment and unfair dismissal for material reasons. We replicate the matching strategy and run Equation (3). Panel (a) presents the overall effects. Panel (b) presents heterogeneity by firm size, replicating Figure (13b). A test of difference between PUT-related and non-PUT-related lawsuits rejects equality with a p-value of 0.0359

Figure A16: Sample Selection for Connected Firms



(a) Full Sample

(b) Selected Sample

Notes: This plot shows how the sample of connected firms was built. Panel (a) illustrates how sued firms can be connected to other firms. First, owners of sued firms can own many other firms. Second, a sued firm can be owned by many owners simultaneously. Third, a sued firm can have a small number of owners, and each of them can either own many firms or just a few. Panel (b) shows that we restrict our attention to cases where a sued firm is owned only by a few individuals who simultaneously own only a few extra firms. This selection implies that the owners are more engaged in their firms.

Table A12: Effect of Lawsuit on Incumbent Workers

	Log Wages				Connected Firms
	(1)	(2)	(3)	(4)	(5)
Treated x Post Lawsuit	0.0108***	0.0180***	0.0103***	0.0182***	0.00377**
	(0.002)	(0.003)	(0.002)	(0.004)	(0.0016)
Sample	All	Small	Large	Manager	All

Notes: This table replicates Table A12 and incorporates the effects for *connected firms* in Column (5)

I Learning Among Coworkers

We can leverage our rich administrative data to test for the *change in the real risks employers face*. We developed a strategy based on *suers-movers*. These are defined as employees who sued their firm and moved to work for another firm later on. We define the new coworkers at the firm where the suer-mover arrives as the treatment group.

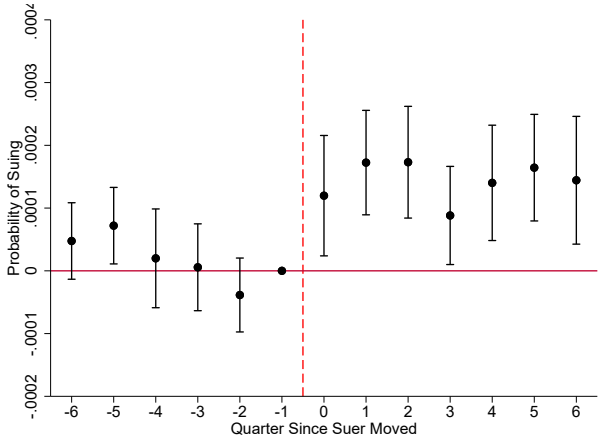
Two potential sources of endogeneity come up from how we define the treatment group. First, employers who hire workers who sued in the past may differ from those who prefer not to do it. Second, employees who had sued will likely move to specific types of firms, perform certain tasks, etc. The first source of endogeneity is not concerning in our setting, given that it is very unlikely that employers know whether a new employee has gone through a lawsuit in the past. However, the second source of endogeneity is still concerning. Therefore, we built a control group of new coworkers of a non-suer-mover (a random mover with no previous lawsuit experience). If employees work in the type of industry, occupation, or region where lawsuits are more common, that would be reflected in higher lawsuit probabilities (in levels) between treatment and control. However, as long as the lawsuit probability of the two groups has been growing with the same

trend, we can identify the additional effect of having a new coworker with lawsuit experience in the firm (assuming trends would continue in the absence of the move). Equation I.26 specifies the model.

$$s_{it} = \alpha_i + \delta_t + \sum_{k \neq -1} \beta_k \mathbf{1}[D_{it} = 1]\mathbf{1}[k = t] + \varepsilon_{it} \tag{I.26}$$

Where $D_{it} = 1$ for the employees who had a *suer-moving* coming to their firm, and $D_{it} = 0$ to those employees who had a random mover (with not suing experience) moving to their firms. α_i and δ_t indicate individual and time fixed effects. Time is measured relative to the moving quarter.

Figure A17: Effects of having a suer-mover on the probability of reporting



Notes: This plot shows the effect of being exposed to a coworker with lawsuit experience in the probability of starting a lawsuit. The sample is constructed as follows. The *suer-movers* are defined as employees who carried out a lawsuit in 2015 and moved to a new firm in the same year. This allows us to observe reporting behavior for some periods pre- and post the treatment. The *non-suer-movers* are taken at random from the sample of new hires in 2015. The treatment group is defined as the *suer-mover*'s new coworkers. The control group is defined as the *non-suer-mover*'s new coworkers. We drop new coworkers hired only after the arrival of the *movers*.

Figure A17 shows that new coworkers increase the probability of suing for PUT-related motives after the suer-mover arrives at the firm. In addition, Table A13 explores homophily heterogeneity to show that coworkers more likely to interact with the suer-mover (measured as sharing characteristics) drive the results. For example, coworkers who share gender, race, age, and occupation with the suer-mover are 4.26 times more likely to sue after meeting the suer-mover relative to the control group.[57]

[57] This comes from summing all the coefficients and dividing the result by the dependent variable mean.

Table A13: Effect of suer-mover on new coworkers

	Probability of Suing (x100)
Treated x Post	.00027
	(.002)
Treated x Post x Gender	.01541***
	(.0043)
Treated x Post x Gender-Race	.02112***
	(.0043)
Treated x Post x Gender-Race-Age	.01734**
	(.0068)
Treated x Post Move x Gender-Race-Age-Occupation	.03443***
	(.0.107)
Dep. Var Mean	0.0207
Time + Individual FE	Yes
SE Clustered	Firm-level
N (individual x quarter)	61,058,258

Notes: This table expands the results for Equation I.26 to include interactions for homophily characteristics. We create variables for whether the new coworker and the *mover* share certain characteristics. We create these dummies as sets that include the previous ones. Therefore, each coefficient should be interpreted as the effect on the lawsuit probability of the additional matching characteristic.