How does the minimum wage affect outsourced workers?
Causal evidence from cleaning workers in Brazil
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November 12, 2022

Abstract

This paper provides causal evidence on the effect of implementing or increasing a wage floor (an occupation-specific minimum wage) on the wage difference between outsourced, insourced, and informal workers, the employment of outsourced and insourced workers, and the size of the informal labor market. To do so, I use matched employer-employee data from Brazil focusing on the labor market for cleaning workers. Brazil has regional occupation-specific wage floors that increased in response to yearly federal minimum wage increases that affected all regions and occupations starting in 2000. Since regions with lower wage floors were much more affected, to estimate the causal effect, I compare regions with lower wage floors in 1999 against regions with higher wage floors in 1999. Estimation results show that a 23% wage floor increase, the average real increase between 2000 and 2010, decreases the outsourced wage penalty in half. This reduction in the wage gap makes outsourced workers relatively more expensive than insourced workers, which reduces outsourcing employment by 70%. The majority of this reduction in outsourced worker employment comes from less entry of new outsourced workers or from workers transferring into formal jobs in other occupations, and only the minority comes from workers leaving the formal labor market. Finally, I find no significant effect on informal worker employment and a 40% reduction in the informal wage penalty.

1   Introduction

Some research suggests that outsourced workers earn significantly less than similar insourced workers. I define outsourced workers as those hired from a contractor firm, a firm that provides services to other firms, and insourced workers as those hired from firms that do not provide services to other firms. For instance, Dube and Kaplan (2010) find that outsourced janitors earned 4.5% less than insourced janitors in the U.S. between 1983 and 2000, and Goldschmidt and Schmieder (2017) find that being transferred to a contractor firm is associated with a fall in wages of 10% over ten years in Germany for cleaning, catering, and security workers. Furthermore, they show suggestive evidence that this wage difference happens because insourced workers benefit from firm-specific rents, while outsourced workers do not. One possible policy to reduce this wage gap is increasing the federal minimum wage. Since outsourced workers usually earn the minimum wage while insourced workers earn more, increasing it could increase the wages of outsourced workers more than the wages of insourced workers, reducing the difference. Bilal and Lhuillier (2021) suggests that this policy could attenuate the distributional consequences of outsourcing by structurally estimating a general equilibrium model using data from France. However, causal evidence of its effectiveness in reducing the outsourcing wage penalty is still missing.

Moreover, although the federal minimum wage increase could reduce the wage difference between outsourced and insourced workers, it could also have unintended consequences on employment. More specifically, it could reduce employment of outsourced workers and of workers in other occupations that are not commonly outsourced. To attenuate the effects on employment of workers in other occupations that are not commonly outsourced this paper proposes another policy, which is an occupation minimum wage (wage floor) increase. A wage floor increase would also increase outsourced workers' wages more than insourced workers' wages but its consequences on employment would be restricted to occupations that are commonly outsourced. Nonetheless, the wage floor increase could still reduce formal employment for workers in occupations that are commonly outsourced and increase unemployment or informal sector employment, which is characterized by an employment contract not reported to the government. Therefore, this paper shows causal empirical evidence on the effect of a wage floor increase on the wage gap between outsourced and insourced workers by answering: 1. Does increasing the wage floor reduce the wage difference between outsourced and insourced workers in that occupation? 2. Are there any consequences for that occupations' employment both in the formal and informal sectors?

To provide causal evidence of a wage floor increase in the outsourcing labor market, this paper studies the labor market for cleaning workers in Brazil for three reasons. First, I focus on the Brazilian labor

market because it has regional wage floors that increased due to annual federal minimum wage increases valid for all regions and occupations starting in 2000 when the country elected a left-wing president. Second, I focus on cleaning workers because they are often outsourced[1] and their lower wage floors make them more responsive to the federal minimum wage increase. Third, Brazil has data on wages and employment that can be separated by outsourcing and occupational status for the formal and informal sector.

First, to estimate the causal effect, Brazil's federal minimum wage almost doubled between 2000 and 2010, and I use it as an exogenous variation that increased wage floors. Since the federal minimum wage increase impacted regions differently depending on their wage floors in 1999, I construct a simulated instrument that predicts each region's wage floor between 2000 and 2010 based only on their wage floor in 1999, the federal minimum wage increase, and their cost of living increase. The simulated instrument works similarly to a differences-in-differences strategy by comparing regions with high 1999 wage floors, which were less impacted by the federal minimum wage increase, to regions with low 1999 wage floors, which were more impacted by the federal minimum wage. To interpret my results as causal, I assume that regions with lower wage floors in 1999 would have evolved in parallel to regions with higher wage floors in 1999 without the federal minimum wage increase. I cannot test this assumption but I show suggestive evidence that it is true by showing that it is valid between 1995 and 1999. Second, notice that for this to be a valid instrument, I need some micro-regions that had wage floors close to the federal minimum wage in 1999, which I achieve by focusing on cleaning occupations.

Finally, I use two main sources of data. For the formal labor market, I use the ''Relação Anual das Informações Sociais'' (RAIS from now on, Annual List of Social Information in free translation) data, which is a matched employer-employee data set that covers all formal employment contracts between 1995 and 2017. It has information on workers' wages, contracted hours, and occupations, which I use to identify cleaning workers. On the employer side, it has their industry code, which I use to identify contractor firms. Since informal work is illegal, it is not registered in the RAIS data. So, to get information about the informal labor market, I use the sample that responded to the expanded questionnaire of the 2000 and 2010 decennial censuses, which asks people to specify if they are informal workers and has information on employment and wages for both informal and formal workers. However, it does not have information

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[1]In Brazil, 24% of outsourced workers were employed in cleaning in 2010 according to RAIS 2010 and classifying outsourced workers as those hired by firms with the following industry classifications CNAE 2.0: 7830-2/00 Fornecimento e gestão de recursos humanos para terceiros (human resources managing); 8011-1/01 Atividades de vigilância e segurança privada (gardening); 8111-7/00 Serviços combinados para apoio a edifícios, exceto condomínios prediais (building maintenance); 8121-4/00 Limpeza em prédios e em domicílios (building cleaning); 8211-3/00 Serviços combinados de escritório e apoio administrativo (office and administrative services); 8291-1/00 Atividades de cobranças e informações cadastrais (client data and charging activities); 8292-0/00 Envasamento e empacotamento sob contrato (packaging)

on outsourcing status, so I compare all informal workers against all formal workers, both outsourced and insourced, using the census data.

My results confirm my hypothesis that a wage floor increase reduces the wage difference between outsourced and insourced cleaning workers and reduces outsourced cleaning worker employment. They show that a 23% wage floor increase, which is the average yearly growth between 2000 and 2010, decreases the outsourced/insourced hourly wage gap by 16 percentage points, which reduces the hourly wage gap from 32% to 16% (a 48% reduction). This reduction in the wage difference happens because the majority (approximately 70%) of outsourced cleaning workers in my sample earn exactly the wage floor, while insourced cleaning workers' wages show more variation and are usually higher than the wage floor. Therefore, when the wage floor increases, it directly pushes outsourced cleaning workers' wages up, while insourced cleaning workers are less affected by it, reducing the difference between the two. Looking at employment, I find that a 23% wage floor increase reduces the number of outsourced cleaning workers by 70% and has no significant effect on the number of insourced cleaning workers. Combining the employment and wage results, since the effect on outsourced cleaning worker wages is stronger than on insourced workers' wages, outsourced cleaning workers become relatively more expensive to the firm than insourced cleaning workers. On the one hand, this dis-encourages firms from outsourcing cleaning, reducing outsourced cleaning worker employment and increasing insourced cleaning worker employment. On the other hand, insourced cleaning workers experience a reduction in employment because they become relatively more expensive than informal sector cleaning workers. The net effect of those two sides brings the employment effect for insourced cleaning workers close to zero.

For the informal labor market, I find that a 23% increase in the wage floor reduces the informal/formal monthly wage difference by 4 percentage points, which reduces the 2000 informal/formal monthly wage gap from 10% to 6% (a 40% reduction). Analogous to outsourced vs. insourced cleaning workers, informal cleaning workers earn close to the wage floor and are more affected by its increase than formal workers, which usually earn more. Finally, looking at informal sector employment, I find no statistically significant effects of an increase in the wage floor on informal sector employment. Similar to insourced workers, informal cleaning workers experience a reduction in employment since they become more expensive but also an increase in employment since they become relatively cheaper when compared to insourced cleaning workers, which also brings the net effect to zero.

This project is directly related to the literature on how outsourcing has positive, productive consequences but negative distributional consequences (Bilal and Lhuillier, 2021; Weil, 2014; Goldschmidt and Schmieder, 2017; Dube and Kaplan, 2010; Dorn et al., 2018; Drenik et al., 2020; Felix and Wong, 2021).

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It contributes by providing the effect of a policy, the minimum wage increase, that could alleviate the distributional consequences of domestic outsourcing. To the best of my knowledge, this is the first paper that estimates the effect of a rise in the minimum wage on the outsourcing labor market. Moreover, this project is also related to the literature on the impact of a minimum wage rise on employment and wages ((Derenoncourt et al., 2021a,b; Cengiz et al., 2019; Harasztosi and Lindner, 2019; Aaronson et al., 2018; Dube et al., 2016; Manning, 2021; Card and Krueger, 1994; Clemens and Wither, 2019; Wolfson and Belman, 2019; Dustmann et al., 2022; Brown and Medoff, 1989; Engbom and Moser, 2021; Lee and Saez, 2012; Giuliano, 2013)). Its main contribution is studying one specific market to better understand how a minimum wage rise re-allocates workers between different types of work arrangements. Finally, it also contributes to the literature on the informal labor market (Ulyssea, 2020; Almeida and Carneiro, 2012; Dix-Carneiro et al., 2021; Samaniego de la Parra and Fernández Bujanda, 2020) by estimating the impact of the minimum wage in the informal sector.

2 Institutional Context

To causally estimate the impact of the wage floor on wages and employment for outsourced, insourced, and informal workers, I study the market for cleaning services in Brazil, which is useful for three reasons. First, besides the federal minimum wage, Brazil has local minimum wages, which are wage floors that vary across regions and occupations. Second, Brazil's federal minimum wage more than doubled between 2000 and 2016 through yearly increases, which provides an important variation for my empirical strategy. Third, cleaning occupations are often outsourced and their wages are usually close to the federal minimum wage. Wages in Brazil are most often set as monthly wages for a full-time worker[2], i.e., at least 40 hours per week, and that is the wage information available in my data, so from now on when I talk about wages, I am referring to monthly wages.

Unions in Brazil can negotiate the lowest wage allowed for an occupation with employers, i.e., the wage floor, which can be higher than the federal minimum wage and is set for the location and occupation the union covers, usually at the state or city level. All workers of an occupation in the same local labor market are represented by the same workers union, even if they work for different firms. Similarly, firms that hire those workers are also represented by the same employers union. The workers and the employers unions meet every year around the same date to negotiate a Collective Labor Agreement that contains the

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[2]This is different than what happens in the US and other countries that set hourly wages instead of monthly wages. In Brazil wages are negotiated monthly together with how many hours the worker is contracted to work per week. Thus, the minimum wage and wage floors are set monthly for a full time worker (40 hours per week), and workers working less than 40 hours per week have their minimum wage or wage floors proportionally adjusted.

wage floor in one of its clauses. For example, in 2009, the cleaning workers union of the State of Espirito Santo negotiated a wage floor of R$ 487.30. In the agreement, they also mentioned that the wage floor for 2008 was set at R$443.00.[3] At the end of the agreement, the two parties who signed the contract were the workers union (SINDILIMPE) and the employers union (SEACES). The federal minimum wage in 2009 was R$465.00, and in 2008 it was R$ 415.00, so the wage floor was higher than the federal minimum wage in both those years.

Maintaining workers' purchase power is the unions' main objective in the negotiation and they are often able to negotiate wage floors substantially higher than the federal minimum wage. I interviewed a representative of SINDEAC, which is the cleaning workers union for Belo Horizonte, the capital of the State of Minas Gerais, to understand how they set wage floors. They said that the unionized workers agree on a collective labor agreement and present it to the employers. To determine their asking wage floor, they usually increase the previous year's wage floor by last year's perceived increase cost of living in the city, with the objective of maintaining workers' purchase power. They enforce the wage floor since they have a contract signed by workers' and firms' representatives, and firms breach the contract if they fail to comply. Different from many other countries, unions in Brazil have not lost much economic power in the last couple of decades. Until 2017, unions had a constant source of revenue because all workers in an occupation were required to contribute to their local union by law and paid union dues equal to one day of work per year. These contributions gave the unions negotiating power, by hiring lawyers to represent them and staff to build publicity strategies, which allowed them to negotiate wage floors considerably higher than the federal minimum wage.

Before 2000 there was a lot of variation in wage floors between regions but over the next 15 years, the increase in the federal minimum wage compressed the wage floors distribution. I use this compression in the wage floor distribution to causally estimate the effect of the wage floor on employment and wages. Between January 2003 and January 2015, Brazil's federal minimum wage doubled, going from 348.42 to 696.60 reais, deflated using January 2013 as the base year[4]. Figure 1 shows the evolution of the real (red and green lines) and nominal (blue and purple lines) federal minimum wage between 1995 and 2021. Note that the real federal minimum wage was stable before 2000, grew until 2015, and has been stable ever since. The federal minimum wage sets the minimum monthly wage for a full time worker in the country by a presidential decree at the beginning of every year and is later approved by Congress.

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[3]You can access the complete agreement in this link: http://sindilimpe-es.org.br/wp-content/themes/sindilimpe/styles/sindilimpe/download/Conven%C3%A7%C3%A3o%202009.2011.pdf

[4]Brazil had significant inflation during this period. Figure 1 reports both the nominal minimum wage and the real minimum wage, which takes inflation out of consideration. Notice that the nominal minimum wage increased much more than the real minimum wage due to inflation.

The federal minimum wage growth between 1995 and 2021 was the product of negotiations between the Federal Government and significant labor unions that started in 2003 when President Lula, a member of the left-wing-leaning Labor Party, took office. This led to the government introducing a rule in 2006 that increased the minimum wage every year by the sum of the inflation in the previous year and the GDP growth rate two years before that year. For instance, if in [Y] inflation was [i%] and in [Y-1] the GDP grew [g%], then in [Y+1] the minimum wage rose by [i+g%]. This rule turned into law in 2011 and was in effect for the minimum wage adjustment between 2012-2016. This increase in the federal minimum wage compressed the wage floors. Appendix figure 11 illustrates this compression with a boxplot of the wage floors for every year between 1999 and 2010, which shows a decrease in wage floor variation as the federal minimum wage grew.

Finally, I chose to focus on cleaning occupations because they are often outsourced and their wage floors are more likely to be impacted by the federal minimum wage increase because they are often close to the federal minimum wage. For instance, in my analysis period (1999-2010), outsourcing was regulated by a Supreme Court decision in 1993, Sumula 331/1993, that said that only occupations not related to a firm's main activity could be outsourced. Thus, it was always clear that cleaning tasks could be outsourced, since they are usually not the firm's main activity, and they are the biggest occupation within outsourced workers since 24% of all outsourced workers work in cleaning[5]. Furthermore, their wage floors are often close to the federal minimum wage and when the federal minimum wage increases, there is a large share of micro-regions that need to adjust their cleaning wage floors to meet the new federal minimum wage.

However, besides directly hiring employees or legally contracting another company to provide cleaning services, private firms in Brazil also frequently hire cleaning workers in the informal labor market. The formal labor market includes employment contracts that must be reported to the Ministry of Labor. However, in the informal labor market, workers do not have an employment contract. Hiring an informal worker is illegal but cheaper for the firm because they do not have to pay payroll taxes. Since larger firms are more likely to get caught hiring informal workers, they are less likely to do so. Table 1 shows some descriptive statistics about the informal labor market for cleaning workers in Brazil. Cleaning workers are often hired informally. For instance, in 2000 36.5% of cleaning workers were informal workers. However,

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[5]Calculated using the RAIS data and classifying outsourced workers as those working on firms with the following industry classifications CNAE 2.0: 7830-2/00 Fornecimento e gestão de recursos humanos para terceiros (human resources managing); 8011-1/01 Atividades de vigilância e segurança privada (gardening); 8111-7/00 Serviços combinados para apoio a edifícios, exceto condomínios prediais (building maintenance); 8121-4/00 Limpeza em prédios e em domicílios (building cleaning); 8211-3/00 Serviços combinados de escritório e apoio administrativo (office and administrative services); 8291-1/00 Atividades de cobranças e informações cadastrais (client data and charging activities); 8292-0/00 Envasamento e empacotamento sob contrato (packaging).

between 2000 and 2010 there was a large formalization effort in Brazil that reduced the proportion of informal cleaning workers to 18.2%. Informal work often has worse conditions for the worker because it usually pays less, hires for less hours, and provides less job security and other benefits such as unemployment insurance. For instance, while 80% of formal cleaning workers are full time workers, only 57% of informal cleaning workers are. Moreover, in 2010 informal workers earned 32% less monthly wages than formal workers and 9.1% less hourly wages. Some but not all of this large wage difference is due to the reduced hours as the hourly wage difference shows.

3   Data and descriptive statistics

This section first describes the data set I constructed that covers wages and employment information for formal outsourced and insourced workers and informal workers. Then, it describes statistics about the labor market for cleaning services, showing that outsourced workers earn 30% less than insourced workers and 20% of cleaning workers are hired informally in my sample. Finally, it goes over my method of inputting wage floors for each micro-region.

To estimate the impact of the wage floor on the wage gap between outsourced and non-outsourced workers and its consequences in the informal labor market, I use two data sets that contain information on workers' employment and wages. An administrative data set that covers all formal employment contracts in Brazil (RAIS) from 1995 to 2016 and the sample that answered the extended questionnaire of the decennial census for 2000 and 2010, which contains information about the informal labor market. The RAIS data contains all relevant employment information such as wages, contracted hours, job tenure, days of paid leave, and occupation. Furthermore, it includes demographic information about each employee, such as education, age, race, and information about each establishment, such as the number of employees, 6-digit industry code, and city. Since wages in Brazil are set monthly, the RAIS data only provide monthly wages, but I use the weekly contracted hours to calculate hourly wages by dividing the monthly wages by weekly hours times 31/7.

The RAIS data contains two different wage variables: the whole data has information on total earnings received by the workers in the month of December, i.e., the December wage, and after 2002, the data also contains information on the monthly contracted wage. December wages might be higher than contracted wages for three reasons. First, workers might get extra pay for overtime, which cannot exceed two hours per day and should be rewarded by at least 50% more than a regular contracted hour. Second, some companies distribute bonuses and a fraction of profits to employees in December. Third, companies often

close down between Christmas and New Year's Day and ask all employees to take paid vacation time. In Brazil, workers have the right to take 30 days of paid vacation every year and two days before any paid vacation the worker must receive four-thirds of their wages for that period. For example, if a worker's contracted monthly wage is 3000 Reais and they took 5 days of paid vacation, in December they will earn 3000 reais for their regular wage plus 167 (=(3000/30)*5/3) reais for paid vacation which totals 3167 reais. However, for most cases the contracted wage and the December wage should be the same. In fact, appendix figure 3 shows a binscatter for the average contracted wage vs. the average December wage for each micro-region after 2002, and they are highly correlated around the 45 degrees line. Thus, for years before 2002, I use the December wage as the contracted wage.

Moreover, I used the expanded questionnaires from the decennial censuses of 2000 and 2010, which were answered by a 11.7% sample of the population in 2000 and a 10.7% sample of the population in 2010 and have information on informal and formal labor market wages and employment and on how many individuals are out of the labor force. The questionnaire also contains demographic information such as education, age, and race. The main advantage of the census questionnaire is that it has information on the informal labor market and, like RAIS, we can aggregate the sample at the municipality level. [6] The census surveys individuals between August and November and asks for wages in the current month, so formal workers may report higher values than their contracted wage if they took payed vacation or did overtime. Similar to RAIS, the census only contains information on monthly wages and weekly hours, so I use both to calculate the hourly wage.

I restricted the sample to workers between 18 and 65 years old in cleaning occupations[7] who had a positive wage, were not self-employed, were hired in December, and worked for a private firm. Following other papers in the field[8], I classify workers as outsourced using the industry code of the establishment that hired them.[9] Moreover, I aggregated the data at the micro-region level. The Brazilian Institute of Geography and Statistics (IBGE) defines micro-regions as a set of municipalities that share the same labor market, similar to the definition of commuting zones. I also restrict the sample to only micro-regions with outsourced workers in 1999, 2000, and 2010 ending up with 136 out of 558 micro-regions, which represents 62% of the population and 71% of cleaning workers according to the decennial census. For my main analysis, I restrict the sample to only 2000 and 2010 to maintain consistency between the census

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[6]Another dataset that has information on the informal labor market is PNAD that runs annually, but PNAD does not have municipality information and only has information at the state-level.

[7]I use the occupation code to identify cleaning workers. The data-sets use four slightly different versions of "Classificacao Brasileira de Ocupacoes" or Brazilian Occupation Classification, CBO from now on. Appendix table 7 summarizes the occupation codes used for each version.

[8]Similar to Goldschmidt and Schmieder (2017); Dube and Kaplan (2010); Dorn et al. (2018)

[9]Brazilian industry code classification (CNAE) also has four different versions within the RAIS data sets and census questionnaires. Appendix table 8 summarizes the codes used for each version.

and RAIS.

To estimate the impact of wage floors on employment and wages for outsourced and insourced workers, I leveraged the different wage floors across micro-regions. However, data on wage floors was not readily available. Even though the wage agreements are available for download at "Sistema Mediador"[10] (mediator system in free translation) from 2007 until today, I needed data since 1999 to implement my estimation strategy[11]. To overcome this, I used the distribution of contracted wages for outsourced and insourced workers to calculate the wage floors for each occupation in each region. If the wage floor is binding, we should observe a mass of workers earning the wage floor. Thus, the mode of the outsourcing contracted wage distribution is the wage floor. Appendix figure 8 panel (a) exemplifies how this works. It shows the cumulative distribution of wages for outsourced and insourced workers in the micro-region of Manaus[12]. I define wages here as the ratio between the monthly contracted wage and the federal minimum wage. Notice that a mass of outsourced workers earn exactly the same wage without any rounding. We will call this wage the wage floor in that occupation for that micro-region in that year. Appendix A.3 goes into more detail about how I implemented this procedure.

Finally, To calculate the simulated instrument I need information on micro-regions' specific changes in cost of living. However, Brazil does not release consumer price indexes at the micro-region level, so I use another variable as a proxy for the evolution in cost of living in each micro-region, the evolution of the prices of a basic basket of goods published by the "Departamento Intersindical de Estatística e Estudos Socioeconômicos" (DIEESE, Inter-union Department of Statistics and Socioeconomic Studies). DIEESE is a research center organized by the labor movement in Brazil, and according to their website over 700 unions in Brazil are associated with them. They provide monthly information on the total cost of a basket of 13 goods that are considered necessary to maintain the well being of an adult worker over a month for 17 state capitals. I use the price of the basket of goods calculated in the state capital for all micro-regions in that state. For the states with capitals not in the data, I use the average price of the basket of goods across state capitals in their regions[13].

To show the baseline wage differences and proportion of workers in each work arrangement, table 2 has some summary stats for the sample. It has sample means and standard deviations for the whole

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[10]Available at this website http://www3.mte.gov.br/sistemas/mediador/ConsultarInstColetivo.

[11]Another issue is that each agreement presents the wage floor in a very different format, which makes the compilation of all wage agreements into a data set especially challenging. Future versions of this paper will include a validation of my imputation method using the data cleaned since 2007.

[12]In the state of Amazonas, located in the North region.

[13]Brazil has five regions: North composed of the states of Acre, Amazonas, Roraima, Rondonia, Para, Amapa, Tocantins; Northeast composed of the states of Maranhao, Piaui, Ceara, Rio Grande do Norte, Paraiba, Pernambuco, Alagoas, Sergipe, and Bahia; Center-West composed of the states of Mato Grosso, Mato Grosso do Sul, Goiania, and the country capital Brasilia; Southeast composed of the states of Minas Gerais, Espirito Santo, Rio de Janeiro, and Sao Paulo; and South composed of the states of Parana, Santa Catarina, and Rio Grande do Sul.

sample in the first two columns, restricts the sample to only the year 2000 in the middle two columns, and restricts the sample to only the year 2010 in the last two columns. All monetary variables are in 2000 reais terms deflated using the INPC, and statistics are calculated weighting by the number of workers in each micro-region in that year. The first three lines contain the evolution of micro-region aggregate variables. They show the main source of variation for my instrumental variable strategy, which is the federal minimum wage, grew 71% in real terms between 2000 and 2010, which made wage floors grow 23% within the same period. Moreover, the next nine lines show statistics for formal workers using the RAIS data, and it shows that the proportion of outsourced workers during the sample period was 34%. Moreover, it shows the baseline wage differences in 2000 when outsourced workers made on average 31% less than insourced workers in monthly wages and 26% less in hourly wages in 2000. Finally, the last nine lines show statistics for all workers using the census, and they show that 20% of cleaning workers in the sample are informal. With respect to the baseline wage differences, they show that informal workers monthly wages were an average of 10% smaller than formal workers but their hourly wages were 16% higher on average in 2000. This large difference between the informal worker wage penalty for monthly wages and the wage surplus for hourly wages comes from the fact that informal workers worked 15% less hours than formal workers on average in 2000.

4   Empirical Strategy

To estimate the causal effect of an increase in the wage floor on wages and employment of outsourced, insourced, and informal workers, I take advantage of the fact that different micro-regions were more or less influenced by the federal minimum wage rise depending on their wage floors in 1999. To estimate the causal effect, I implement an instrumental variable strategy, by calculating a simulated instrument that predicts the micro-regions' wage floors using only their wage floors in 1999 and the federal minimum wage in that year.

$$\log(y_{mt}) = \alpha + \beta \log(WF_{mt}) + \mu_m + \rho_{rt} + \gamma X_{mt} + u_{mt} \tag{1}$$

Equation 1 estimates the effect of the wage floor on worker's wages and employment after aggregating the data at the micro-region by year level. It shows a regression of the log of the dependent variable, $\log(y_{mt})$, against the log wage floors, $\log(WF_{mt})$, controlling for micro-region (μ_m) fixed effects, region[14]

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[14]Brazil is divided into five regions, North, Northeast, Centerwest, Southeast, and South. Those five regions are subdivided into 27 states plus the country capital Brasilia. Each state is also divided then into 558 micro-regions.

specific time fixed effects (ρ_{rt}), and a set of economic activity controls (X_{mt}) that include log GDP per capta, log population, and log cost of living index. Then, β is the elasticity of y with respect to the wage floor. The dependent variables (y_{mt}) are log-wages and log-employment for outsourced, insourced, and informal workers. However, this regression does not estimate the causal effect for three possible reasons. First, it overestimates the effect, because micro-regions that are experiencing high economic growth are also hiring more workers and increasing their wages, which increases the power of unions. Second, it underestimates the effect, because micro-regions that are experiencing a decrease in wages could also observe an increase in the power of unions if the reduction in wages encourages workers to participate in their unions more. An increase in the power of unions makes it more likely that the wage floor will increase in the micro-region. Finally, measurement error in the wage floor imputation could create attenuation bias.

To estimate the causal effect of the wage floor on wages and employment, I take advantage of the rise in the federal minimum wage to construct a simulated instrument. Wage floors increase for three reasons: first, to make sure they are above the federal minimum wage, second, to cover any cost of living increases in the micro-region that happened in the previous year, and third, due to an increase in the power of unions. The second reason could create an endogeneity issue if we believe that changes in prices in the previous year influences wages and employment for cleaning workers in that year for some reason besides the increase in the wage floor. As I discussed before, the third reason creates an endogeneity issue in the estimation, since an increase in the power of unions might be associated with an increase in wages and employment. For instance, increases in prices of some goods in the previous year could increase the wages of insourced cleaning workers who are working for the firms that produce those goods in this year. Thus, I estimate two possible simulated instruments: one that isolates increases in the wage floor that are only due to the federal minimum wage increase and another one that isolates increases in the wage floor that are only due to the federal minimum wage increase and increases in cost of living in that micro-region in the previous period.

There are two possible simulated instruments in this context. Let's first assume there are no increases in the cost of living in the micro-region. In this case the predicted wage floor for micro-region m in period t (SWF_{mt}^1) is

$$SWF_{mt}^1 = \begin{cases} WF_{m1999}, & \text{if } WF_{m1999} > FM_t \\ FM_t, & \text{if } WF_{m1999} \leq FM_t, \end{cases} \tag{2}$$

where FM_t is the federal minimum wage in period t. In other words, SWF_{mt}^1 is equal to the wage floor

in 1999 if that wage floor is still higher than the federal minimum wage in t and is equal to the federal minimum wage otherwise. Assuming that there are increases in the cost of living in the micro-region, the labor union negotiates a wage floor according to last year's perceived increase in cost of living. Therefore, we can define the perceived growth in cost of living between 1999 and $t-1$ as

$$\Delta CL_{m,t-1}^{1999} = CL_{m,t-1}/CL_{m1999}, \tag{3}$$

where $CL_{m,t-1}$ and CL_{m1999} are the perceived cost of living in micro-region m in $t-1$ and 1999. Adding cost of living to the predicted wage floor for micro-region m in period t, we get

$$SWF_{mt}^2 = \begin{cases} WF_{m1999} \cdot \Delta CL_{mt-1}^{1999}, & \text{if } WF_{m1999} \cdot \Delta CL_{mt-1}^{1999} > FM_t \\ FM_t, & \text{if } WF_{m1999} \cdot \Delta CL_{mt-1}^{1999} \leq FM_t. \end{cases} \tag{4}$$

In other words, SWF_{mt}^2 is equal to the wage floor in 1999 times the growth in cost of living between 1999 and $t-1$ if that is higher than the federal minimum wage in t and equal to the federal minimum wage in t otherwise.

Finally, I can use either simulated instruments to estimate the first stage equation, which is

$$\log(WF_{mt}) = \theta \log SWF_{mt}^g + \mu_m + \rho_t + u_{mt}, \tag{5}$$

where g is equal to 1 if we calculate the simulated instrument according to 2 and equal to 2 if we calculate the simulated instrument according to 4. The instrumental variable strategy will isolate the changes in the wage floor that are only due to the rise in the federal minimum wage or the regional increase in cost of living in the previous year. I weight this regression by the number of cleaning workers in each micro-region in that year, so I can interpret the results at the worker level. Moreover, I cluster standard errors at the micro-region level since this is the level of the treatment.

To interpret the final estimation as causal we need to make two assumptions. First that the rise in the federal minimum wage impacts the wage floor. This assumption can be directly tested by estimating regression 5. Figure 4 shows the binscatter of the wage floor against the simulated instrument after removing micro-region fixed effects, region specific year fixed effects, and the economic activity controls. Notice that wage floors and the simulated instruments are strongly correlated with a F-stat of 214 for SWF^1, which does not account for increases in cost of living, and 435 for SWF^2, which accounts for increases in cost of living. Second is the exclusion restriction, i.e., once we account for micro-region and

year fixed effects, the simulated instrument only influences wages and employment through its impact on the micro-regions' wage floor.

The first and second panels of figure 2 show how the simulated instrument works. It has the average value of the simulated instrument over time grouping micro-regions based on the first year when their 1999 wage floor becomes lower than the federal minimum wage. In other words, the simulated instrument is comparing micro-regions with lower wage floors that were pushed to be equal to the federal minimum wage sooner against micro-regions with higher wage floors that took longer to be affected by the federal minimum wage increase. If we call the federal minimum wage increase the treatment, the micro-regions with higher wage floors the control, and the micro-regions with lower wage floors the treated, this strategy is analogous to a differences and differences strategy. Therefore, the exclusion restriction is the same as the differences and differences identification assumption that micro-regions with low wage floors in 1999 would have evolved in parallel to micro-regions with high-wage floors in 1999.

$$\log(WF_{mt}) = \beta_t \log(WF_{m1999}) + \mu_m + \rho_{rt} + \gamma X_{mt} + u_{mt}, \ \ \text{for} \ \ t \in \{[1995, 1998] \ \text{and} \ [2001, 2010]\} \ (6)$$

The exclusion restriction is impossible to test, since we do not observe the hypothetical world in which the federal minimum wage did not increase, but I can at least show that the parallel trends assumption is true between 1995 and 1998, when the federal minimum wage was stable. To do so, I estimate equation 6, with the sample going between 1995 and 2010, removing 1999 from the sample, and taking 2000 as the base year. The regression coefficients (β_t) show the percent effect of having a 1% higher wage floor in 1999 on the average difference between wage floors in 2000 and t. Therefore, if the estimated β_t for $t \in [1995, 1998]$ are statistically equal to zero, it means that the average wage floor of micro-regions with a 1% wage floor gap in 1999 evolved in parallel between 1995 and 1998. Appendix figure 5 show the estimated results. The points are the estimated β_t for each year and the vertical lines are 95% confidence intervals calculated using standard errors clustered at the micro-region level. Between 1995 and 1998 all coefficients are statistically equal to zero, which shows that at least in the pre-treatment the parallel trends assumption is valid. Furthermore, after 2000 all coefficients are statistically significant and negative, which shows that wage floors for micro-regions with a 1% higher wage floor in 1999 grew slower than the ones with a 1% lower.

5 Results

This section goes over my main results and some robustness checks. My main results for the formal labor market for cleaning workers show that a wage floor increase reduces the outsourcing wage penalty, reduces outsourced worker employment, and has no effect on insourced worker employment. Focusing on the informal labor market for cleaning workers, my results show that a wage floor increase reduces the informal wage penalty. Moreover, these results are robust to removing the economic activity controls and/or switching the region-specific year fixed effects to nationwide year fixed effects.

5.1 Main Results

Confirming my main hypothesis, I show that an increase in the wage floor reduces the outsourced wage penalty for cleaning workers since it has a stronger effect on outsourced cleaning workers' wages than on insourced cleaning workers' wages. This makes outsourcing cleaning work relatively more expensive to firms than insourcing cleaning work, incentivizing firms that were previously outsourcing to switch to insourcing. Therefore, my employment results show that a wage floor increase reduces outsourced cleaning worker employment and has no significant effect on insourced cleaning worker employment. Looking at the informal labor market, I show that a wage floor increase reduces the informal cleaning workers' monthly wage penalty and increases the informal cleaning workers' hourly wage surplus since it increases informal cleaning workers' monthly earnings without reducing their hours significantly. Finally, concerning informal cleaning worker employment, I find that a wage floor increase reduces informal cleaning worker employment, but those results are not statistically significant.

Tables 3 to 10 show the results of estimating regression 1 for formal cleaning workers using RAIS data. The first panel in all tables shows OLS estimates. The second panel shows 2SLS estimates using 5 as the first stage and the simulated instrument defined as in equation 2, which does not take into account changes in cost of living. Finally, the third panel also shows 2SLS estimates but with the simulated instrument defined in equation 4, which considers changes in cost of living. All regressions are weighted by the number of workers in that micro-region in that year and standard errors are clustered at the micro-region level. Note that both simulated instruments strongly predict the wage floor between 2000 and 2010, with an F statistic of 214 for the simulated instrument that does not consider changes in cost of living and 440 for the one that does.

Table 3 shows that a wage floor increase reduces the wage difference between outsourced and insourced cleaning workers by presenting the results for formal cleaning workers' log contracted wages, with hourly

wages in the first three columns and monthly wages in the last three columns. For both monthly wages and hourly wages, the first and second columns contain results restricting the sample to outsourced and insourced cleaning workers, respectively, and the third column contains results using the wage difference as the dependent variable defining the wage difference as log outsourced cleaning worker wages minus log insourced cleaning worker wages. The IV results using SWF^1 as the instrument in the second panel show that a 1% increase in the wage floor increased insourced cleaning workers' hourly and monthly wages by 0.74% and 0.72%, respectively, and it increased outsourced cleaning workers' hourly and monthly wages by 1.43% and 1.46%, respectively, which implies a reduction in the wage difference of 0.69 percentage points for hourly wages and 0.74 percentage points for monthly wages.

Comparing those results with the OLS results in the first panel and the IV results using SWF^2 in the third panel, we can see that all three estimators are very similar, which is suggestive evidence that omitted variable bias is less concerning in this set-up. The OLS estimates show that a 1% wage floor increase reduces the wage difference by 0.50 percentage points for hourly wages and 0.55 percentage points for monthly wages, and the IV results using SWF^2 as the instrument show that it reduces the wage difference by 0.70 percentage points for hourly wages and 0.75 percentage points for monthly wages. I get my main results by using SWF^1 as the simulated instrument because I do not have to assume that lagged perceived increases in cost of living do not influence wages in this year. To get a sense of the magnitude of my results, a 23% wage floor increase, which is the average increase between 2000 and 2010 among all 135 micro-regions in my sample, reduces the hourly outsourced wage penalty for cleaning workers by 16 percentage points and the monthly wage penalty for cleaning workers by 17 percentage points, which would bring the average hourly wage difference in 2000 from 32% to 16% (a 50% reduction) and the monthly wage difference in 2000 from 31% to 14% (a 55% reduction).

Focusing on employment variables, my results show that a wage floor increase reduces outsourced cleaning worker employment and has no effect on insourced cleaning worker employment. Table 4 shows the results with the log number of worked hours defined as the number of cleaning workers times the average contracted weekly hours for outsourced, insourced, and all cleaning workers in the first three columns and the log number of workers for outsourced, insourced, and all cleaning workers in the last three columns. The IV results using SWF^1 as the instrument show that a 1% increase in the wage floor reduces the cleaning worker outsourced number of worked hours and the number of workers by 2.7% and 3%, respectively, and it reduces the cleaning worker insourced number of worked hours and the number of workers by 0.004% and 0.12%, respectively, but both are not statistically different from zero. If we use SWF^2 as the instrument, we find similar results, which are that a 1% wage floor increase reduces the

number of outsourced cleaning workers and worked hours by 2.6% and 2.3%, respectively, which are both statistically significant, and no statistically significant effect on insourced number of cleaning workers or worked hours. Therefore, I interpret this result as evidence that a wage floor increase reduces outsourced cleaning worker employment and has no effect on insourced cleaning worker employment, which reduces the proportion of outsourced cleaning workers. Looking at the magnitude of my results, a 23% wage floor increase reduces the number of outsourced cleaning workers by 69% and the total number of cleaning workers by 15%, which implies that the proportion of outsourced cleaning workers reduces by 64% going from 34% to 12%.

The results on employment are in line with the large effects reducing the wage difference between outsourced and insourced cleaning workers. Since an increase in the wage floor increases outsourced cleaning workers' wages more than it increases insourced cleaning workers' wages, it changes the relative price that firms face when deciding between outsourcing or insourcing cleaning services. More specifically, the wage floor increase makes outsourced cleaning workers more expensive compared to insourced cleaning workers, which makes some firms that were previously outsourcing cleaning switch to insourcing, reducing outsourced cleaning worker employment. For insourced cleaning workers, on the one hand, there is an increase in insourced cleaning worker employment because some firms that were previously outsourcing cleaning services are now insourcing it. On the other hand, there is a reduction in insourced cleaning worker employment because some firms that were paying insourced cleaning workers close to the minimum wage are now observing an increase in the cost of those workers and might switch to the informal labor market or into not hiring that occupation. The net effect of those two forces is zero.

When analyzing the informal labor market census data in tables 5 and 6, we see that a wage floor increase reduces the informal cleaning worker wage penalty and likely decreases the proportion of informal cleaning workers. The format of these tables is the same as the ones described previously, with the first panel showing OLS results and the second and third panels showing 2SLS results using SWF^1 and SWF^2 as the instruments, respectively. Since the census data has a 10% representative sample of the population, I have fewer observations to calculate the averages for each micro-region, which brings the first stage F statistic down to 96 using SWF^1 as the instrument and to 240 using SWF^2 as the instrument. Nonetheless, both instruments are still strong predictors of the wage floor.

Table 5 shows that a wage floor increase increases both informal and formal cleaning workers' wages, with the effect being stronger for informal cleaning workers, thus, decreasing the wage difference. It shows the results with log hourly reported wages in the first three columns and log monthly reported wages in the last three. For hourly and monthly wages, the first column shows results restricting the sample

to informal cleaning workers, the second to formal cleaning workers, and the third column uses the log difference between informal and formal cleaning workers' wages as the dependent variable. The 2SLS estimates using SWF^1 as the instrument show that a 1% increase in the wage floor increases informal cleaning workers' hourly and monthly wages by 0.69% and 0.47%, respectively, and increases formal cleaning workers' hourly and monthly wages by 0.32% and 0.29%, respectively, reducing the difference by 0.37 percentage points in hourly wages and 0.18 percentage points in monthly wages but the results on the wage difference are not statistically different from zero. The results using SWF^2 as the instrument are smaller in magnitude, showing that a 1% increase in the wage floor reduces the hourly and monthly wage difference by 0.14 and 0.04 percentage points, respectively. The results using OLS are also smaller in magnitude, although still within the confidence interval of the IV results, showing that a 1% increase in the wage floor reduces the wage difference by 0.07 percentage points for hourly wages and increases the wage difference by 0.01 percentage points for monthly wages. In terms of magnitude, a 23% wage floor increase reduces the informal monthly wage penalty by 4.1 percentage points, which is a 60% reduction from the 2000 penalty of 10%. On the other hand, in 2000, informal cleaning workers had an hourly wage surplus of 16%, since they usually work fewer hours than formal cleaning workers, and a 23% wage floor increase increases this surplus by 8.6 percentage points, going to 25%. The reduction in the informal wage penalty is happening because informal cleaning workers usually earn close to the wage floor, so when the wage floor increases, they are more affected by it.

Looking at informal worker employment, table 6 shows suggestive evidence that a wage floor increase reduces both formal and informal worker employment, although the coefficients are not statistically significant. It shows the effects for log number of worked hours calculated as average weekly hours times the number of cleaning workers in the first three columns and log number of cleaning workers in the last three columns. For both the log number of worked hours and the log number of workers, the first column shows the results for formal cleaning workers, the second column for informal cleaning workers, and the last column for all cleaning workers. The results using SWF^1 as the instrument show that a 1% wage floor increase reduces both the formal number of cleaning worked hours and the number of cleaning workers by 1.4% and reduces informal number of cleaning worked hours and the number of cleaning workers by 2.4% and 2.1%, respectivley, and reduces both the number of cleaning worked hours and the number of workers for all cleaning workers by 1.6%. Results using SWF^2 as the instrument and OLS results confirm this direction but are smaller in magnitude. Nevertheless, the reduction in all cleaning workers' employment was smaller in magnitude than the reduction in informal cleaning worker employment, which implies that the proportion of informal cleaning workers should shrink. Appendix

table 11 shows that a 1% increase in the wage floor decreases the proportion of informal workers by 0.5% but it is not statistically different from zero. The effect on the proportion of informal workers is smaller in magnitude using SWF^2 as the instrument but has the same direction. In terms of magnitude, a 23% wage floor increase reduces the number of informal cleaning workers by 46% and reduces the total number of cleaning workers by 36%, which implies a 15% reduction in the proportion of informal workers bringing the 2000 proportion of informal workers from 20% to 17%.

Similarly to the formal labor market, the results on informal cleaning worker employment can be explained by wage effects. As mentioned before, we should observe an increase in informal worker employment on one side, from firms that were previously insourcing and switched to informal workers. However, as the wage results show, informal worker wages also grow with the wage floor increase, which increases the cost of an informal worker. This increase in cost implies that some firms that were previously hiring informal cleaning workers decide to decrease employment in cleaning, reducing informal cleaning worker employment. Since the effects on informal cleaning worker employment are negative but not statistically significant, the reduction of informal cleaning worker employment is either stronger or equal to the increase of informal cleaning worker employment.

5.2 Robustness Checks

My main results are robust to removing the economic activity controls and/or switching the region-specific year-fixed-effects to nationwide year-fixed-effects. More specifically, the robustness checks on outsourced and insourced workers for hourly and monthly wages confirm the finding that an increase in the wage floor impacts outsourced workers' wages more than insourced workers' wages reducing the wage difference between the two. When looking at employment, the results for different controls and fixed effects specifications are generally smaller in magnitude for outsourced workers but still confirm the general trend of a reduction in the proportion of outsourced workers. Concerning informal workers in the census, the robustness of the wage results confirms that an increase in the wage floor impacts informal workers' wages more strongly than formal workers' wages reducing the difference between the two. Moreover, the effects of informal and formal sector employment are still not statistically significant and cannot confirm if the proportion of informal workers would increase or decrease.

Appendix tables 12 through 15 show the robustness checks for the formal sector using the RAIS data. For each variable, they show three different specifications. First, removing the economic activity controls and replacing the region-specific year-fixed-effects with nationwide year-fixed-effects. Second, keeping the economic activity controls and replacing the region-specific year-fixed-effects with nationwide year-fixed-

effects. Third, removing the economic activity controls and keeping the region-specific year-fixed-effects. Both hourly and monthly wages effects are robust to the different controls and fixed effects specifications, as tables 12 and 13 show with the effect of a 1% increase in the wage floor on the outsourcing wage penalty is always around 0.7 percentage points. Concerning employment, tables 14 and 15 show that the results with different controls and fixed effects specifications are smaller in magnitude for the outsourced number of cleaning worked hours and the number of cleaning workers and larger in magnitude for the insourced cleaning number of worked hours and the number of cleaning workers. Nonetheless, they still show that a wage floor increase reduced the proportion of outsourced workers. Moreover, appendix tables 18 through 23 show robustness checks for informal and formal sectors using the census data. They show that the effects on wages are robust to different controls and fixed effects specifications. However, the effects on employment are less robust and still not statistically significant.

6 Discussion

To interpret the results, this section discusses their implications on workers' earnings and firm profits. My main results show that an increase in the wage floor reduces outsourced cleaning worker employment, which implies a reduction in the size of the outsourced cleaning labor market. I use a simple model to estimate how this reduction in the size of the outsourced cleaning labor market is distributed among the three parties that participate in that market: contract firms, current traditional firms that outsource cleaning, and current outsourced cleaning workers. I find that this reduction is equally distributed between those three parties, which implies that an increase in the wage floor does not change the distribution of economic surplus within the outsourcing cleaning labor market.

Nonetheless, this does not mean that a wage floor increase reduces overall workers' earnings because cleaning workers could transfer into other occupations in the formal labor market. To understand what happens to overall worker earnings, I decompose the reduction in outsourced cleaning worker employment into a decrease in hiring and an increase in separation. I find that only 7% of the reduction in employment is explained by an increase in separation, and, within those, only half are workers leaving the formal labor market, while the other half are workers switching into other occupations inside the formal labor market. Therefore, although the employment effects on outsourcing cleaning workers are quite large, workers leaving the formal labor market only explain 3.5% of them. The other 93% of the reduction in employment is explained by a decrease in hiring, i.e., contract firms deciding to not hire as many workers as they would have hired if the wage floor had not increased.

6.1 Distribution of Economic Surplus

To understand how the reduction in the size of the outsourcing cleaning market is distributed among workers and firms, I build a simple model of the outsourcing labor market. In the model, a wage floor increase reduces employment and increases the price that contract firms charge traditional firms for their services. As a result, the reduction in the size of the outsourcing labor market is equally distributed among current outsourced workers, contract firms, and current traditional firms who outsource. Therefore, the wage floor increase does not change the distribution of economic surplus within the outsourcing labor market.

I assume that there is a finite set of contractor firms that act like a Stackelberg oligopolist, where each contract firm j chooses the number of outsourced cleaning workers they hire (n_j). The main product of those firms is providing cleaning services to other firms, so I assume that the labor market has search frictions and contract firms are always able to find the workers that are willing to work for the wage floor. Thus, outsourced workers in this model always earn the wage floor ($\underline{w}$). They are subject to a demand for outsourced workers ($p(N)$), which is determined by traditional firms' decision to outsource or not. The price that contract firms charge traditional firms for each outsourced cleaning worker is p, and the total number of outsourced workers is $N = \sum n_j$. This demand for outsourced workers is decreasing in the price of outsourcing (p) since an increase in the price of outsourcing will make some traditional firms that were previously outsourcing switch to insourcing, reducing the number of outsourced workers demanded.

Each contract firm maximizes profit by choosing n_j given the total demand for outsourced workers $p(N)$, which can be summarized by the following profit maximization problem:

$$\max_{n_j \geq 0} \left(p \left(\sum_{k=1}^{K} n_k \right) - \underline{w} \right) n_j. \tag{7}$$

Taking the first-order conditions and re-arranging, contract firms choose n_j such that their marginal revenue is equal to the wage floor, as in

$$\underline{w} = p'(N)n_j + p(N). \tag{8}$$

Adding up equation 8 for all contract firms j, we get the following equation that determines the number of outsourced workers

$$\underline{w} = \frac{p'(N^*)N^*}{K} + p(N^*). \tag{9}$$

In other words, the number of outsourced workers will be determined by the point where the average marginal contract firm revenue is equal to the wage floor. Finally, the price of outsourcing is determined by the price that allows for that demand $p^* = p(N^*)$. Note in equation 9 that contract firms charge a markup above the wage floor for each outsourced cleaning worker they provide.

Assuming that $p(N) = N^\rho$, i.e., the demand for outsourced workers has constant elasticity

$$N^* = \left(\frac{K\bar{w}}{\rho + K} \right)^{\frac{1}{\rho}} \tag{10}$$

and

$$p^* = \frac{K\bar{w}}{\rho + K}, \tag{11}$$

then we can define

$$\text{total current outsourced worker earnings} = N^*\underline{w}, \tag{12}$$

$$\text{total contractor firm profits} = (p^* - \underline{w})N^*, \tag{13}$$

$$\begin{array}{l} \text{total profits of current} \\ \text{traditional firms who outsource} \end{array} = \int_0^{N^*} N^\rho dN - p^*N^* = \frac{(N^*)^{\rho+1}}{\rho + 1} - p^*N^*. \tag{14}$$

Finally, applying my estimation results $1/\rho = -3$.

Now suppose that at state zero, the wage floor is $\underline{w}_0$, the optimal number of outsourced workers is N_0, and the price of outsourcing is p_0. Then after a 1% wage floor increase, the wage floor in state 1 is $\underline{w}_1 = \underline{w}_0 * 1.01$, the new number of outsourced workers is

$$N_1 = \left(\frac{K\underline{w}_1}{\rho + K} \right)^{\frac{1}{\rho}} == \left(\frac{K\underline{w}_0}{\rho + K} \right)^{\frac{1}{\rho}} 1.01^{\frac{1}{\rho}} = 0.97N_0, \tag{15}$$

and the new price of outsourcing is

$$p_1 = \frac{K\underline{w}_1}{\rho + K} = \frac{K\underline{w}_0 1.01}{\rho + K} = 1.01p_0. \tag{16}$$

Therefore, outsourced workers' earnings in state one are

$$\underline{w}_1 N_1 = 1.01\underline{w}_0 \cdot 0.97N_0 = 0.98\underline{w}_0 N_0, \tag{17}$$

i.e., 2% smaller than in state zero, contractor firm profits in state one are

$$(p_1 - \underline{w}_1)N_1 = (1.01p_0 - 1.01\underline{w}_0)0.97N_0 = 0.98(p_0 - \underline{w}_0)N_0, \tag{18}$$

i.e., 2% smaller than in state zero, and total profits of traditional firms who outsource in state one are

$$\frac{(N_1)^{\rho+1}}{\rho+1} - p_1 N_1 = \frac{(0.97N_0)^{\rho+1}}{\rho+1} - 0.98p_0 N_0 = 0.98\left(\frac{(N_0)^{\rho+1}}{\rho+1} - p_0 N_0\right), \tag{19}$$

i.e., also 2% smaller than in state zero. Since both outsourced cleaning workers' earnings, cleaning contractor firms' profits, and the profits of traditional firms who outsource cleaning reduce by the same proportion, the wage floor increase does not change the distribution of economic surplus in the cleaning outsourcing labor market.

6.2 Employment Effects Decomposition

Although my employment results show that a 23% wage floor increase reduces the number of outsourced cleaning workers by 70%, this does not imply that worker earnings go down overall because those workers can end up in other occupations in the formal labor market. To understand the impacts on worker earnings, I decompose the employment effects into a reduction in hiring or an increase in separation. To calculate the increase in separation, I restrict the sample to all outsourced workers in 2000 and apply the same estimation strategy but with an indicator variable equal to one if that worker is an outsourced worker as the dependent variable. I find that only 7% of the reduction in employment is explained by an increase in separation, and within those, only half are workers that move out of the formal labor market.

To understand the sources of the reduction in the number of outsourced cleaning workers I start by investigating the increase in the separation of outsourced workers. To do so, I restrict the sample to only cleaning workers in 2000 and see where they end up in 2010. To calculate the baseline proportions of workers that transfer to other jobs between 2000 and 2010, appendix figure 6 shows the proportion of workers in 2010 in each job given that they were outsourced or insourced cleaning workers in 2000. It shows that among insourced cleaning workers in 2000, only 27% remain an insourced cleaning worker in 2010, 33% work at jobs in other occupations in the formal labor market, 33% move out of the formal labor market, and only 7% work as outsourced cleaning workers in 2010. Therefore, according to the data and contrary to popular belief, cleaning workers moving from insourced to outsourced jobs is not very common. Within outsourced cleaning workers in 2000, only 25% remain outsourced cleaning workers

in 2010, 26% work in other occupations in the formal labor market, 31% move out of the formal labor market, and only 18% work as insourced cleaning workers in 2010. I use this sample to estimate the impact of an increase in the wage floor by estimating equation 1 for insourced or outsourced cleaning workers in 2000 on four different indicator variables: insourced cleaning worker, outsourced cleaning worker, not a cleaning worker still in the formal labor market, and not in the formal labor market.

Appendix table 24 shows that a wage floor increase reduces the proportion of outsourced workers in 2000 that remain outsourced workers in 2010, and half of that reduction is due to workers going to other occupations in the formal labor market while the other half is due to workers leaving the formal labor market. The first four columns show results restricting the sample for only insourced cleaning workers in 2000, and the last four for only cleaning outsourced in 2000. It shows that a 1% wage floor increase reduces the proportion of outsourced workers in 2000 that remain outsourced workers in 2010 by 0.37 percentage points. Moreover, a 1% wage floor increase increases the proportion of outsourced workers in 2000 that move to other occupations in the formal labor market by 0.13 percentage points and outside of the formal labor market by 0.17 percentage points. To understand the magnitude of those results, a 23% wage floor increase reduces the proportion of outsourced workers in 2000 who remain outsourced workers in 2010 by 8.4 percentage points, which is a 34% reduction of the 25% baseline proportion. Those workers that are not outsourced workers in 2010 transfer to either other occupations in the formal labor market or out of the formal labor market. For instance, a 23% wage floor increase increases the proportion of outsourced cleaning workers in 2000 that are in other occupations in the formal labor market in 2010 by 3 percentage points, which is a 12% increase of the 26% baseline proportion, and that are out of the formal labor market in 2010 by 4 percentage points, which is a 13% increase of the 31% baseline proportion.

To compare this reduction in the proportion of outsourced cleaning workers in 2000 that remain outsourced cleaning workers in 2010 to the reduction in the number of outsourced workers, I re-scale the proportions and show that 5 percentage points of the 70% reduction in the number of outsourced workers (7%) is due to an increase in separations. To do so, I start at equation 20 that shows the number of outsourced workers in t at state s (out_t^s) is equal to the number of outsourced workers in $t-1$ (out_{t-1}) that remain outsourced workers in t ($outstay_t^s$), which represents separations, plus the number of new outsourced workers in t ($outnew_t^s$), which represents hirings. There are two possible states, $s = 0$ is without a wage floor increase and $s = 1$ is with a wage floor increase. Equation 21 shows what happens to employment as a response to a wage floor increase, $\eta = -0.7$ is the 70% reduction in the number of outsourced workers, $\theta = -0.083$ is the 8.3 percentage point reduction in the proportion of outsourced workers in 2000 that remain outsourced workers in 2010, and γ is the change in the proportion of the

new outsourced workers in 2010. Then, equation 22 combines equations 20 and 21 and rearranges to show that the change in the number of outsourced workers (eta) is equal to the change of the number of staying outsourced workers ($\theta out_t^0 / out_{t-1}$) plus the change in the number of new outsourced workers ($\gamma out_t^0 / out_{t-1}$). In the data there are 76% more outsourced workers in 2010 than in 2000. If we plug 76% into equation 22 only 5 percentage points is due to the increase in separations and 65 percentage points is due to the reduction in hiring out of the 70% reduction in the number of outsourced workers.

$$out_t^s = outstay_t^s + outnew_t^s \Rightarrow out_t^s = out_{t-1}\left(\frac{outstay_t^s}{out_{t-1}} + \frac{outnew_t^s}{out_{t-1}} \right) \tag{20}$$

$$out_t^1 = out_t^0(1+\eta) \;\; \text{and} \;\; \frac{outstay_t^1}{out_{t-1}} - \frac{outstay_t^0}{out_{t-1}} = \theta \;\; \text{and} \;\; \frac{outnew_t^1}{out_{t-1}} - \frac{outnew_t^0}{out_{t-1}} = \gamma \tag{21}$$

$$out_{t-1}\left(\frac{outstay_t^1}{out_{t-1}} + \frac{outnew_t^1}{out_{t-1}} \right) = (1+\eta)out_{t-1}\left(\frac{outstay_t^0}{out_{t-1}} + \frac{outnew_t^0}{out_{t-1}} \right)$$
$$\Rightarrow \eta = \theta\left(\frac{out_t^0}{out_{t-1}} \right)^{-1} + \gamma\left(\frac{out_t^0}{out_{t-1}} \right)^{-1} \tag{22}$$

$$\Rightarrow -0.7 = -0.083 \cdot 1.76^{-1} + \gamma \cdot 1.76^{-1} = -0.05 + \gamma \cdot 1.76^{-1} = -0.05 - 0.65 \Rightarrow \gamma = -1.15$$

Therefore, although an increase in the wage floor significantly reduces the number of outsourced cleaning workers, only 4% of that reduction is coming from workers losing their jobs and moving outside of the formal labor market. Since the vast majority of the reduction in employment is coming from a reduction in the entry of new outsourced cleaning workers, to understand the effects on overall worker earnings, we would have to understand the general equilibrium effects of the wage floor increase. If those workers are absorbed by other jobs in the formal labor market that pay at least as much as an outsourcing cleaning job would pay, the wage floor increase would increase overall worker earnings. However, if those workers are not absorbed by other jobs in the formal labor market or end up in jobs that pay less than what an outsourcing cleaning job would pay, the wage floor increase would reduce overall worker earnings.

7 Conclusion

To conclude, this paper shows that an increase in the wage floor, which is an occupation-specific minimum wage, reduces the outsourced cleaning worker wage penalty, the proportion of outsourced cleaning workers,

and the informal cleaning worker wage penalty. The reduction in the outsourced cleaning worker wage penalty happens because the effects on outsourced cleaning workers' wages are much stronger than the effects on insourced cleaning workers' wages since the majority of outsourced cleaning workers earn the wage floor while insourced cleaning workers usually earn more. Since there is a stronger effect on outsourced cleaning workers' wages, their relative cost to firms increases when compared to insourced cleaning workers, which reduces the proportion of outsourced workers. With respect to the informal labor market, since most informal cleaning workers earn close to the wage floor while most formal cleaning workers earn more (most formal cleaning workers are insourced) the increase in the wage floor has a stronger effect on informal cleaning workers' wages than on formal cleaning workers wages reducing the informal cleaning worker wage penalty. Even though the relative price between informal and formal workers changed I do not find any significant effects on informal cleaning worker employment.

My main results show that the wage floor increase is an effective policy to reduce the outsourcing wage penalty and, thus, wage inequality within that occupation's labor market by not only reducing the wage gap but also by reducing the proportion of workers at lower-paid outsourced jobs. However, it also significantly reduces that occupation's employment. Therefore, to evaluate the pros and cons of a wage floor increase policy, I first estimate with a simple model that it does not change the distribution of economic surplus between firms and workers within the outsourcing labor market. Then, I show that only a small fraction of the reduction in employment is due to workers that were previously outsourced workers and now are out of the formal labor market. The vast majority of the reduction in employment is due to a reduction in the amount of new outsourced workers contract firms would hire if the wage floor had not increased. As long as those workers are absorbed by other occupations in the formal labor market the wage floor increase does not reduce overall worker earnings.

8 Figures
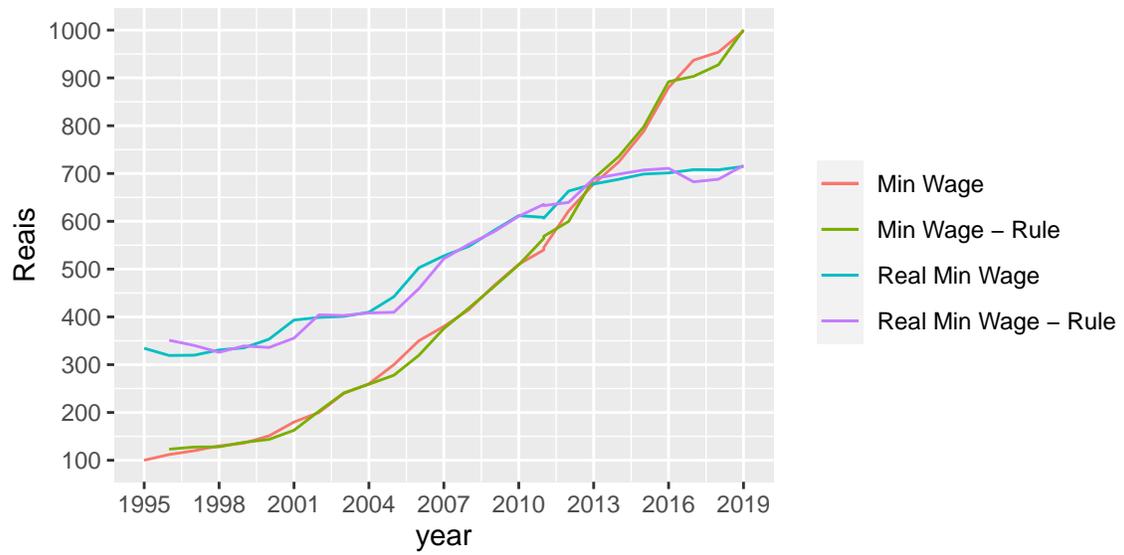
Figure 1: Evolution of the Real Minimum Wage 1995-2019
Real values in jan/2013 reais using INPC, source ipea-data. Data is yearly.
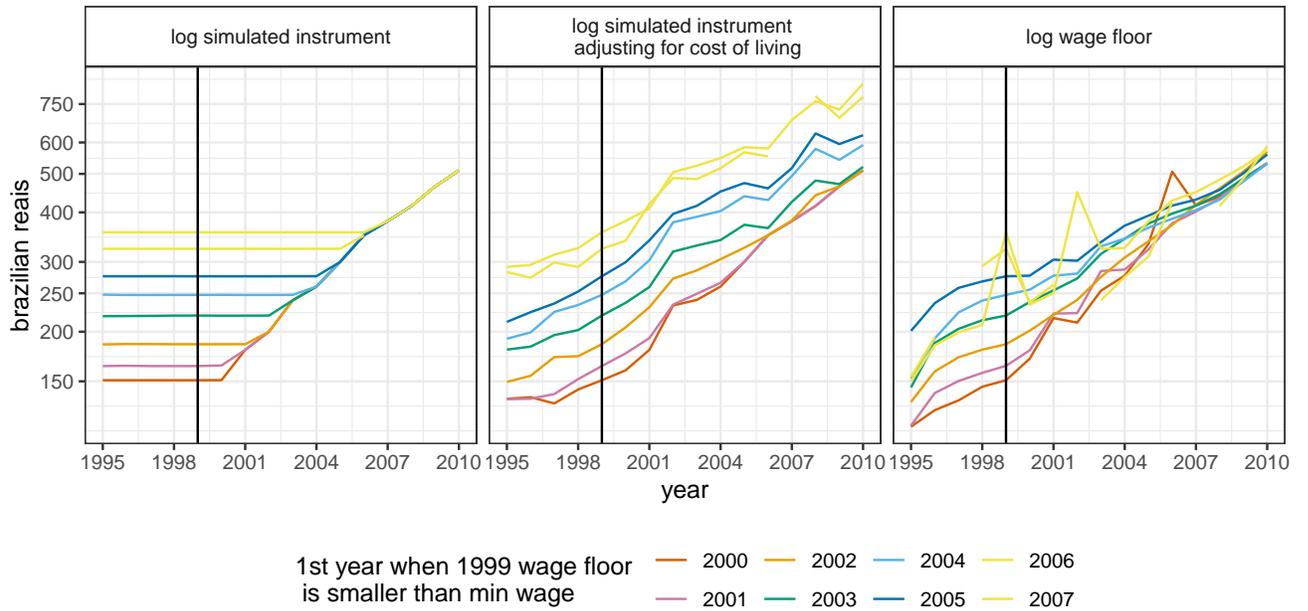
Figure 2: Evolution of the log simulated instrument calculated as in equation 2 for the first panel, equation 4 for the second panel, and the log wage floor for the third panel. The micro-regions were grouped based on the first year their 1999 wage floor is smaller than the minimum wage. The averages were weighted using the number of workers in each micro-region in each year. Values are in nominal brazilian reais.

9   Tables

	2000	2010
Proportion of informal workers	36.5%	18.3%
Proportion of full-time among		
formal workers	81.7%	79.7%
informal workers	56.8%	56.6%
Wage difference (log(formal) - log(informal))		
monthly wages	26.9%	32.0%
hourly wages	1.9%	9.1%

Table 1: This table shows some facts about the informal sector in Brazil. It restricts the sample of the decennial census of 2000 and 2010 to only workers working for a firm, which excludes self-employed workers, between 18 and 65 years old, and in cleaning occupations identified according to table 7

	full sample		2000		2010	
	mean	sd	mean	sd	mean	sd
wage floor	256.1	1179.8	223.31	863.97	273.68	464.07
cost of living index	198.72	4443.5	110.58	90.65	245.96	381.54
federal min wage	221.07		151		258.62	

<div align="center">RAIS data - formal workers</div>

	mean	sd	mean	sd	mean	sd
proportion of outsourced						
workers	0.34		0.35		0.33	
worked hours	0.3		0.31		0.29	
monthly contracted wage						
insourced	216.54	1058.32	221.66	2341.72	213.79	348.85
outsourced	156.76	1268.43	151.96	1011.7	159.34	1387.06
hourly contracted wage						
insourced	1.16	0.03	1.2	0.07	1.14	0.01
outsourced	0.84	0.03	0.82	0.03	0.85	0.04
weekly contracted hours						
insourced	31.19	5.74	32.72	3.46	30.37	5.03
outsourced	26.2	20.92	27.51	14.15	25.49	23.14
observations	270		135		135	

<div align="center">census data - all workers</div>

	mean	sd	mean	sd	mean	sd
proportion of informal						
workers	0.2		0.28		0.14	
worked hours	0.2		0.28		0.14	
monthly reported wage						
formal	496.69	38606.47	272.89	2055.1	658.6	2600.1
informal	404.33	21499.52	245.16	2227.96	519.48	3854.23
hourly reported wage						
formal	3.33	2.5	1.54	0.06	4.62	0.29
informal	3.49	2.81	1.79	0.14	4.72	1.13
weekly reported hours						
formal	41.83	3.07	43.23	2.64	40.82	0.94
informal	35.87	6.96	36.93	6.26	35.09	6.05
observations	270		135		135	

Table 2: Summary statistics for the sample of 120 micro-regions from the RAIS data for formal sector workers, and from the 2000 and 2010 census for all workers. Monetary values calculated in 2000 reais deflated using the INPC. Means and standard deviations are weighted by the number of workers in each micro-region in each year.

	log hourly contracted wage			log monthly contracted wage		
	insourced	outsourced	outsourced - in-sourced	insourced	outsourced	outsourced - in-sourced
OLS						
log wage floor	0.681	1.183	0.502	0.656	1.205	0.549
	(0.138)	(0.156)	(0.187)	(0.146)	(0.14)	(0.179)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - not accounting for increases in cost of living						
log wage floor	0.735	1.427	0.692	0.721	1.46	0.739
	(0.169)	(0.336)	(0.328)	(0.177)	(0.346)	(0.33)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
F-stat 1st stage	214	214	214	214	214	214
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - accounting for increases in cost of living						
log wage floor	0.617	1.318	0.701	0.593	1.339	0.746
	(0.181)	(0.199)	(0.246)	(0.19)	(0.193)	(0.242)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
F-stat 1st stage	440	440	440	440	440	440
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135

Table 3: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log number of worked hours			log number of workers		
	outsourced	insourced	all workers	outsourced	insourced	all workers
OLS						
log wage floor	-1.635	0.118	-0.209	-1.972	-0.003	-0.424
	(0.724)	(0.17)	(0.317)	(0.711)	(0.186)	(0.341)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - not accounting for increases in cost of living						
log wage floor	-2.708	-0.004	-0.655	-3.032	-0.121	-0.87
	(1.057)	(0.208)	(0.329)	(1.033)	(0.236)	(0.359)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
F-stat 1st stage	214	214	214	214	214	214
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - accounting for increases in cost of living						
log wage floor	-2.27	0.104	-0.401	-2.559	0.002	-0.616
	(0.841)	(0.218)	(0.36)	(0.844)	(0.236)	(0.385)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
F-stat 1st stage	440	440	440	440	440	440
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135

Table 4: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log hourly wage			log monthly wage		
	informal	formal	informal - formal	informal	formal	informal - formal
OLS						
log wage floor	0.343	0.27	0.073	0.234	0.245	-0.011
	(0.188)	(0.074)	(0.165)	(0.125)	(0.108)	(0.089)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - not accounting for increases in cost of living						
log wage floor	0.694	0.322	0.373	0.469	0.29	0.178
	(0.332)	(0.169)	(0.373)	(0.3)	(0.121)	(0.225)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
F-stat 1st stage	96	96	96	96	96	96
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - accounting for increases in cost of living						
log wage floor	0.449	0.307	0.143	0.301	0.257	0.044
	(0.233)	(0.121)	(0.212)	(0.176)	(0.115)	(0.127)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
F-stat 1st stage	240	240	240	240	240	240
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135

Table 5: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log number of worked hours			log number of workers		
	formal	informal	all workers	formal	informal	all workers
OLS						
log wage floor	-0.231	-0.342	-0.322	-0.222	-0.182	-0.293
	(0.309)	(0.32)	(0.26)	(0.302)	(0.326)	(0.253)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - not accounting for increases in cost of living						
log wage floor	-1.419	-2.38	-1.65	-1.376	-2.074	-1.58
	(1.231)	(2.377)	(1.415)	(1.228)	(2.335)	(1.431)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
F-stat 1st stage	96	96	96	96	96	96
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - accounting for increases in cost of living						
log wage floor	-0.795	-1.217	-0.97	-0.768	-1.009	-0.917
	(0.546)	(0.937)	(0.58)	(0.543)	(0.927)	(0.584)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
F-stat 1st stage	240	240	240	240	240	240
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135

Table 6: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

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A   Appendix

A.1   Tables

Classification	Codes	Codes labels	data used
CBO-94	55215	trabalhadores de servicos gerais - conservacao, manutencao e limpeza (workers in conservation, maintenance and cleaning general services)	RAIS 1995-2001
	55220	faxineiro (janitor)	
CBO-2002	514225	trabalhador de servico de limpeza e conservacao de areas publicas (workers in cleaning and conservation of public areas)	RAIS 2002-2016
	514320	faxineiro (janitor)	
CBO domiciliar - 1	5142	trabalhadores nos servicos de manutencao e conservacao de edificios e logradouros (workers in the maintenance and conservations of buildings and outside areas)	censo 2000
CBO domiciliar - 2	9112	trabalhadores de limpeza de interior de edificios, escritorios, hoteis e outros estabelecimentos (workers cleaning buildings, offices, hotels and other establishments)	censo 2010

Table 7: Description of the occupation codes used to identify cleaning occupations.

Classification	Codes	Codes labels	data used
CNAE 1.0	7470-5	atividades de imunizacao, higienizacao e de limpeza em predios e em domicilios (activities of cleaning, sanitizing, and extermination in buildings and households)	RAIS 1995-2005
CNAE 2.0	8121-4/00	limpeza em predios e em domicilios (cleaning in buildings and households)	RAIS 2006-2016
CNAE domiciliar - 1	74060	atividades de imunizacao, higienizacao e de limpeza em predios e em domicilios (activities of cleaning, sanitizing, and extermination in buildings and households)	censo 2000
CNAE domiciliar - 2	81011	servicos de limpeza e apoio a edificios, exceto condominios prediais (cleaning and support services to buildings except HOAs)	censo 2010

Table 8: Description of the industry codes used to identify contract firms.

	hiring rate		net matches		separation rate	
	insourced	outsourced	insourced	outsourced	insourced	outsourced
OLS						
log wage floor	-0.061	-0.104	-0.01	-0.005	-0.05	-0.099
	(0.045)	(0.085)	(0.026)	(0.091)	(0.038)	(0.048)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - not accounting for increases in cost of living						
log wage floor	-0.129	-0.084	-0.057	0	-0.071	-0.085
	(0.067)	(0.104)	(0.041)	(0.118)	(0.059)	(0.096)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
F-stat 1st stage	214	214	214	214	214	214
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - accounting for increases in cost of living						
log wage floor	-0.087	-0.118	-0.034	-0.075	-0.053	-0.044
	(0.054)	(0.103)	(0.034)	(0.12)	(0.047)	(0.068)
econ. act. controls	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes
F-stat 1st stage	440	440	440	440	440	440
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135

Table 9: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log prop of outsourced		prop of outsourced	
	workers	worked hours	workers	worked hours
OLS				
log wage floor	-1.548	-1.426	-0.333	-0.278
	(0.481)	(0.513)	(0.137)	(0.134)
econ. act. controls	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes
year FE	no	no	no	no
region-year FE	yes	yes	yes	yes
observations	270	270	270	270
micro-regions	135	135	135	135
IV - not accounting for increases in cost of living				
log wage floor	-2.161	-2.052	-0.525	-0.47
	(0.843)	(0.895)	(0.166)	(0.158)
econ. act. controls	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes
year FE	no	no	no	no
region-year FE	yes	yes	yes	yes
F-stat 1st stage	214	214	214	214
observations	270	270	270	270
micro-regions	135	135	135	135
IV - accounting for increases in cost of living				
log wage floor	-1.943	-1.869	-0.443	-0.382
	(0.606)	(0.622)	(0.142)	(0.137)
econ. act. controls	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes
year FE	no	no	no	no
region-year FE	yes	yes	yes	yes
F-stat 1st stage	440	440	440	440
observations	270	270	270	270
micro-regions	135	135	135	135

Table 10: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log prop of informal		prop of informal	
	workers	worked hours	workers	worked hours
OLS				
log wage floor	0.11	-0.02	-0.023	-0.045
	(0.179)	(0.163)	(0.044)	(0.042)
econ. act. controls	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes
year FE	no	no	no	no
region-year FE	yes	yes	yes	yes
observations	270	270	270	270
micro-regions	135	135	135	135
IV - not accounting for increases in cost of living				
log wage floor	-0.495	-0.73	-0.14	-0.166
	(0.933)	(0.994)	(0.193)	(0.185)
econ. act. controls	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes
year FE	no	no	no	no
region-year FE	yes	yes	yes	yes
F-stat 1st stage	96	96	96	96
observations	270	270	270	270
micro-regions	135	135	135	135
IV - accounting for increases in cost of living				
log wage floor	-0.091	-0.248	-0.085	-0.11
	(0.412)	(0.428)	(0.105)	(0.102)
econ. act. controls	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes
year FE	no	no	no	no
region-year FE	yes	yes	yes	yes
F-stat 1st stage	240	240	240	240
observations	270	270	270	270
micro-regions	135	135	135	135

Table 11: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log hourly contracted wage								
	insourced	insourced	insourced	outsourced	outsourced	outsourced	outsourced - insourced	outsourced - insourced	outsourced - insourced
OLS									
log wage floor	0.846	0.812	0.656	1.385	1.409	1.136	0.54	0.597	0.48
	(0.151)	(0.109)	(0.157)	(0.154)	(0.152)	(0.158)	(0.198)	(0.178)	(0.197)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - not accounting for increases in cost of living									
log wage floor	0.893	0.902	0.622	1.638	1.694	1.324	0.745	0.792	0.702
	(0.168)	(0.113)	(0.182)	(0.278)	(0.243)	(0.328)	(0.252)	(0.231)	(0.333)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
region-year FE	no	no	no	no	no	no	no	no	no
F-stat 1st stage	418	407	230	418	407	230	418	407	230
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - accounting for increases in cost of living									
log wage floor	0.895	0.881	0.538	1.577	1.622	1.227	0.683	0.74	0.689
	(0.16)	(0.126)	(0.201)	(0.21)	(0.193)	(0.203)	(0.244)	(0.214)	(0.266)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
region-year FE	no	no	no	no	no	no	no	no	no
F-stat 1st stage	697	666	454	697	666	454	697	666	454
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135

Table 12: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log monthly contracted wage								
	insourced	insourced	insourced	outsourced	outsourced	outsourced	outsourced - insourced	outsourced - insourced	outsourced - insourced
OLS									
log wage floor	0.839	0.807	0.63	1.386	1.417	1.154	0.546	0.61	0.524
	(0.158)	(0.115)	(0.167)	(0.147)	(0.138)	(0.149)	(0.194)	(0.166)	(0.193)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - not accounting for increases in cost of living									
log wage floor	0.905	0.919	0.601	1.631	1.691	1.35	0.726	0.772	0.749
	(0.172)	(0.119)	(0.192)	(0.278)	(0.24)	(0.334)	(0.243)	(0.222)	(0.333)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	418	407	230	418	407	230	418	407	230
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - accounting for increases in cost of living									
log wage floor	0.898	0.888	0.51	1.569	1.62	1.249	0.671	0.732	0.738
	(0.17)	(0.134)	(0.214)	(0.205)	(0.182)	(0.196)	(0.236)	(0.202)	(0.261)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	697	666	454	697	666	454	697	666	454
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135

Table 13: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log number of worked hours								
	outsourced	outsourced	outsourced	insourced	insourced	insourced	all workers	all workers	all workers
OLS									
log wage floor	-0.76	-0.968	-1.262	-0.214	-0.181	0.097	-0.235	-0.302	-0.12
	(0.873)	(0.769)	(0.899)	(0.162)	(0.154)	(0.16)	(0.298)	(0.286)	(0.334)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - not accounting for increases in cost of living									
log wage floor	-0.906	-1.225	-1.661	-0.423	-0.408	-0.045	-0.551	-0.632	-0.483
	(0.952)	(1.041)	(1.071)	(0.212)	(0.182)	(0.221)	(0.3)	(0.323)	(0.369)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	418	407	230	418	407	230	418	407	230
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - accounting for increases in cost of living									
log wage floor	-0.569	-0.853	-1.494	-0.403	-0.382	0.059	-0.35	-0.435	-0.254
	(0.89)	(0.935)	(0.97)	(0.204)	(0.2)	(0.222)	(0.327)	(0.343)	(0.392)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	697	666	454	697	666	454	697	666	454
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135

Table 14: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log number of workers								
	outsourced	outsourced	outsourced	insourced	insourced	insourced	all workers	all workers	all workers
OLS									
log wage floor	-1.13	-1.357	-1.563	-0.399	-0.368	-0.017	-0.482	-0.554	-0.312
	(0.849)	(0.724)	(0.894)	(0.178)	(0.167)	(0.177)	(0.32)	(0.292)	(0.37)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	yes	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - not accounting for increases in cost of living									
log wage floor	-1.276	-1.631	-1.897	-0.64	-0.635	-0.145	-0.804	-0.907	-0.628
	(0.893)	(0.968)	(1.06)	(0.236)	(0.204)	(0.242)	(0.301)	(0.32)	(0.393)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	418	407	230	418	407	230	418	407	230
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - accounting for increases in cost of living									
log wage floor	-0.94	-1.253	-1.727	-0.617	-0.602	-0.031	-0.614	-0.714	-0.418
	(0.862)	(0.88)	(0.979)	(0.221)	(0.217)	(0.236)	(0.344)	(0.347)	(0.422)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	697	666	454	697	666	454	697	666	454
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135

Table 15: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	prop of outsourced					
	workers	workers	workers	worked hours	worked hours	worked hours
OLS						
log wage floor	-0.129	-0.174	-0.263	-0.085	-0.13	-0.215
	(0.182)	(0.157)	(0.168)	(0.177)	(0.157)	(0.16)
econ. act. controls	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - not accounting for increases in cost of living						
log wage floor	-0.144	-0.205	-0.337	-0.113	-0.168	-0.306
	(0.189)	(0.193)	(0.174)	(0.191)	(0.196)	(0.161)
econ. act. controls	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes
F-stat 1st stage	418	407	230	418	407	230
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - accounting for increases in cost of living						
log wage floor	-0.066	-0.123	-0.301	-0.027	-0.08	-0.256
	(0.173)	(0.171)	(0.17)	(0.17)	(0.171)	(0.16)
econ. act. controls	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes
F-stat 1st stage	697	666	454	697	666	454
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135

Table 16: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log prop of outsourced					
	workers	workers	workers	worked hours	worked hours	worked hours
OLS						
log wage floor	-0.648	-0.803	-1.251	-0.526	-0.666	-1.142
	(0.598)	(0.517)	(0.596)	(0.646)	(0.569)	(0.645)
econ. act. controls	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - not accounting for increases in cost of living						
log wage floor	-0.472	-0.724	-1.27	-0.355	-0.593	-1.178
	(0.685)	(0.74)	(0.833)	(0.744)	(0.807)	(0.89)
econ. act. controls	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes
F-stat 1st stage	418	407	230	418	407	230
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - accounting for increases in cost of living						
log wage floor	-0.327	-0.539	-1.31	-0.22	-0.418	-1.24
	(0.605)	(0.644)	(0.657)	(0.647)	(0.698)	(0.69)
econ. act. controls	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes
F-stat 1st stage	697	666	454	697	666	454
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135

Table 17: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log hourly wage								
	informal	informal	informal	formal	formal	formal	informal - formal	informal - formal	informal - formal
OLS									
log wage floor	0.655	0.6	0.418	0.432	0.451	0.249	0.223	0.149	0.169
	(0.254)	(0.212)	(0.217)	(0.088)	(0.094)	(0.092)	(0.222)	(0.171)	(0.212)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - not accounting for increases in cost of living									
log wage floor	1.007	0.979	0.747	0.55	0.577	0.285	0.457	0.402	0.462
	(0.324)	(0.319)	(0.344)	(0.135)	(0.147)	(0.167)	(0.302)	(0.288)	(0.371)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	208	193	108	208	193	108	208	193	108
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - accounting for increases in cost of living									
log wage floor	0.891	0.856	0.522	0.559	0.589	0.288	0.332	0.268	0.234
	(0.31)	(0.291)	(0.269)	(0.116)	(0.126)	(0.127)	(0.256)	(0.224)	(0.242)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	428	397	263	428	397	263	428	397	263
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135

Table 18: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log monthly wage								
	informal	informal	informal	formal	formal	formal	informal - formal	informal - formal	informal - formal
OLS									
log wage floor	0.535	0.489	0.261	0.36	0.347	0.227	0.175	0.143	0.034
	(0.225)	(0.231)	(0.128)	(0.135)	(0.132)	(0.1)	(0.14)	(0.146)	(0.096)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - not accounting for increases in cost of living									
log wage floor	0.761	0.735	0.457	0.423	0.429	0.236	0.338	0.306	0.222
	(0.269)	(0.295)	(0.27)	(0.124)	(0.135)	(0.106)	(0.176)	(0.19)	(0.213)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	208	193	108	208	193	108	208	193	108
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - accounting for increases in cost of living									
log wage floor	0.711	0.684	0.306	0.451	0.459	0.225	0.259	0.225	0.08
	(0.211)	(0.241)	(0.169)	(0.12)	(0.129)	(0.109)	(0.139)	(0.159)	(0.113)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	428	397	263	428	397	263	428	397	263
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135

Table 19: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

log number of worked hours

	formal	formal	formal	informal	informal	informal	all workers	all workers	all workers
OLS									
log wage floor	-0.333	-0.318	-0.269	-0.12	0.024	-0.446	-0.396	-0.353	-0.367
	(0.43)	(0.29)	(0.482)	(0.509)	(0.39)	(0.553)	(0.393)	(0.265)	(0.441)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	yes	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - not accounting for increases in cost of living									
log wage floor	-0.765	-1.061	-0.99	-0.702	-0.962	-1.786	-0.884	-1.15	-1.206
	(0.726)	(0.782)	(1.156)	(1.223)	(1.33)	(2.142)	(0.78)	(0.853)	(1.279)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	208	193	108	208	193	108	208	193	108
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - accounting for increases in cost of living									
log wage floor	-0.53	-0.747	-0.623	-0.213	-0.366	-0.959	-0.624	-0.814	-0.785
	(0.495)	(0.456)	(0.628)	(0.611)	(0.62)	(0.938)	(0.465)	(0.445)	(0.619)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	428	397	263	428	397	263	428	397	263
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135

Table 20: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

Table with header: log number of workers

	formal	formal	formal	informal	informal	informal	all workers	all workers	all workers
OLS									
log wage floor	-0.28	-0.265	-0.258	0.062	0.199	-0.265	-0.316	-0.273	-0.332
	(0.429)	(0.285)	(0.479)	(0.519)	(0.408)	(0.569)	(0.393)	(0.264)	(0.441)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	yes	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - not accounting for increases in cost of living									
log wage floor	-0.667	-0.962	-0.95	-0.439	-0.687	-1.465	-0.754	-1.016	-1.131
	(0.72)	(0.776)	(1.156)	(1.23)	(1.323)	(2.143)	(0.785)	(0.857)	(1.302)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	yes	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	208	193	108	208	193	108	208	193	108
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135
IV - accounting for increases in cost of living									
log wage floor	-0.448	-0.664	-0.597	-0.01	-0.16	-0.718	-0.509	-0.697	-0.723
	(0.483)	(0.444)	(0.626)	(0.608)	(0.617)	(0.96)	(0.453)	(0.435)	(0.628)
econ. act. controls	no	yes	no	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	yes	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes	no	no	yes
F-stat 1st stage	428	397	263	428	397	263	428	397	263
observations	270	270	270	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135	135	135	135

Table 21: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	log prop of informal					
	workers	workers	workers	worked hours	worked hours	worked hours
OLS						
log wage floor	0.378	0.472	0.067	0.276	0.377	-0.079
	(0.235)	(0.229)	(0.227)	(0.226)	(0.222)	(0.216)
econ. act. controls	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - not accounting for increases in cost of living						
log wage floor	0.314	0.329	-0.335	0.182	0.188	-0.58
	(0.53)	(0.544)	(0.884)	(0.534)	(0.567)	(0.911)
econ. act. controls	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes
F-stat 1st stage	208	193	108	208	193	108
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - accounting for increases in cost of living						
log wage floor	0.5	0.537	0.006	0.412	0.448	-0.174
	(0.314)	(0.328)	(0.418)	(0.309)	(0.334)	(0.412)
econ. act. controls	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes
F-stat 1st stage	428	397	263	428	397	263
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135

Table 22: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	prop of informal					
	workers	workers	workers	worked hours	worked hours	worked hours
OLS						
log wage floor	0.006	0.026	-0.029	-0.02	0	-0.053
	(0.048)	(0.04)	(0.045)	(0.043)	(0.036)	(0.043)
econ. act. controls	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - not accounting for increases in cost of living						
log wage floor	-0.032	-0.017	-0.118	-0.062	-0.048	-0.151
	(0.11)	(0.111)	(0.167)	(0.102)	(0.105)	(0.158)
econ. act. controls	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes
F-stat 1st stage	208	193	108	208	193	108
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135
IV - accounting for increases in cost of living						
log wage floor	-0.009	0.006	-0.071	-0.039	-0.024	-0.103
	(0.075)	(0.074)	(0.091)	(0.069)	(0.069)	(0.088)
econ. act. controls	no	yes	no	no	yes	no
micro-region FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	no	yes	yes	no
region-year FE	no	no	yes	no	no	yes
F-stat 1st stage	428	397	263	428	397	263
observations	270	270	270	270	270	270
micro-regions	135	135	135	135	135	135

Table 23: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results, the second panel shows results using 2 as the instrument and the third panel shows results using 4 as the instrument. All regressions are weighted by the number of cleaning workers in that micro-region in that year. Standard errors in parenthesis are clustered at the micro-region level.

	cleaning insourced in 2000				cleaning outsourced in 2000			
	cleaning insourced	cleaning outsourced	not cleaning	not formal	cleaning insourced	cleaning outsourced	not cleaning	not formal
OLS								
log wage floor	-0.111	-0.111	0.122	0.073	0.03	-0.378	0.157	0.143
	(0.049)	(0.026)	(0.038)	(0.035)	(0.066)	(0.071)	(0.084)	(0.106)
IV: not accounting for increases in cost of living								
log wage floor	-0.138	-0.065	0.09	0.1	0.022	-0.367	0.13	0.175
	(0.066)	(0.054)	(0.049)	(0.042)	(0.072)	(0.064)	(0.08)	(0.101)
econ. act. controls	yes	yes	yes	yes	yes	yes	yes	yes
micro-region FE	yes	yes	yes	yes	yes	yes	yes	yes
year FE	no	no	no	no	no	no	no	no
region-year FE	yes	yes	yes	yes	yes	yes	yes	yes
F-stat 1st stage	126800	126800	126800	126800	370028	370028	370028	370028
observations	179144	179144	179144	179144	139231	139231	139231	139231
micro-regions	135	135	135	135	134	134	134	134

Table 24: Regression results of estimating equation 1, each column is a separate regression. The first panel shows OLS results and the second panel shows results using 2 as the instrument. Standard errors in parenthesis are clustered at the micro-region level.

A.2 Figures
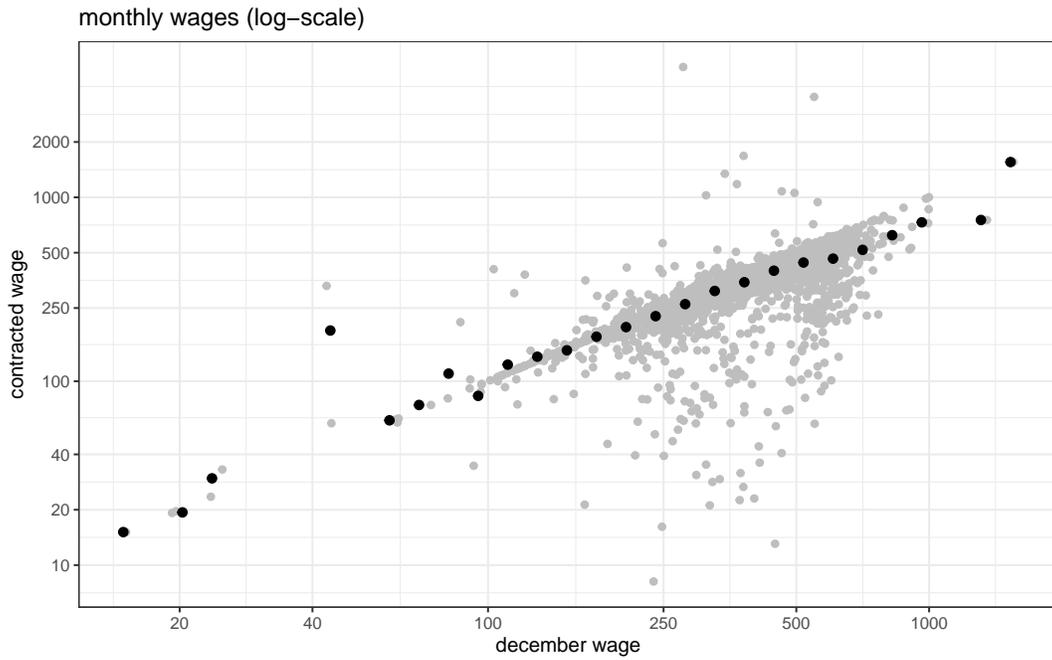
(a) monthly
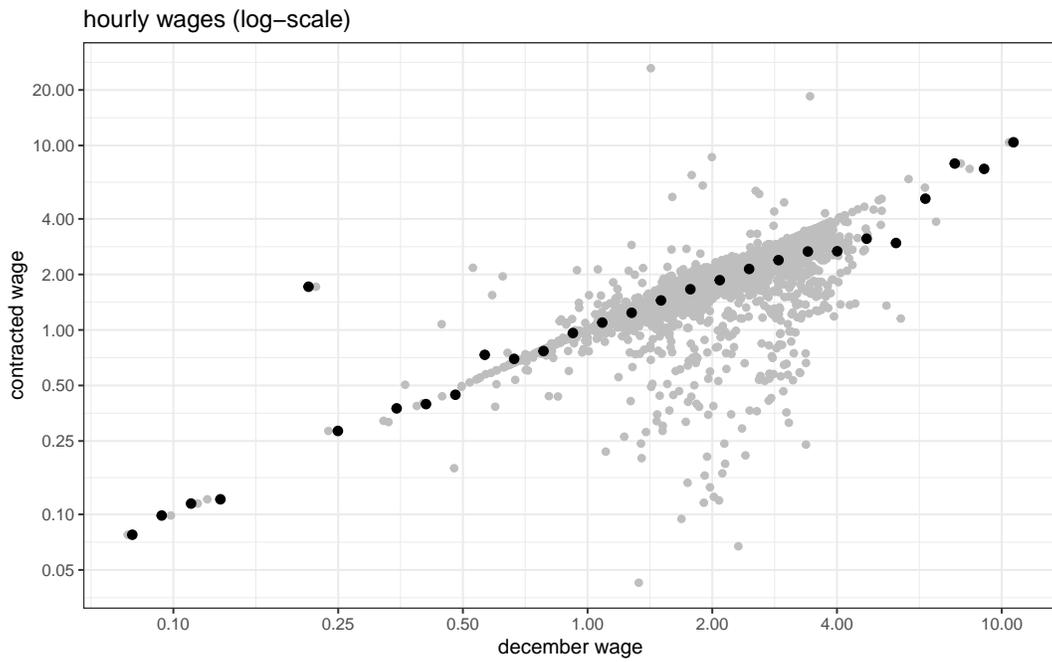
(b) hourly

Figure 3: Scatter plot of the micro-region's average December wage vs the micro-region's average contracted wage for monthly and hourly wages after 2002. Black dots are binscatter dots weighted by the number of workers in December.
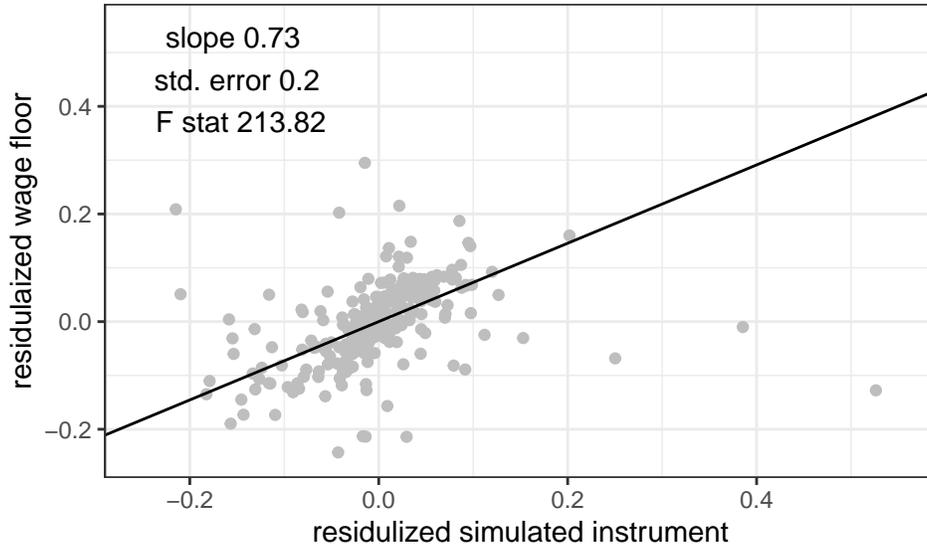
(a) not accounting for increases in cost of living
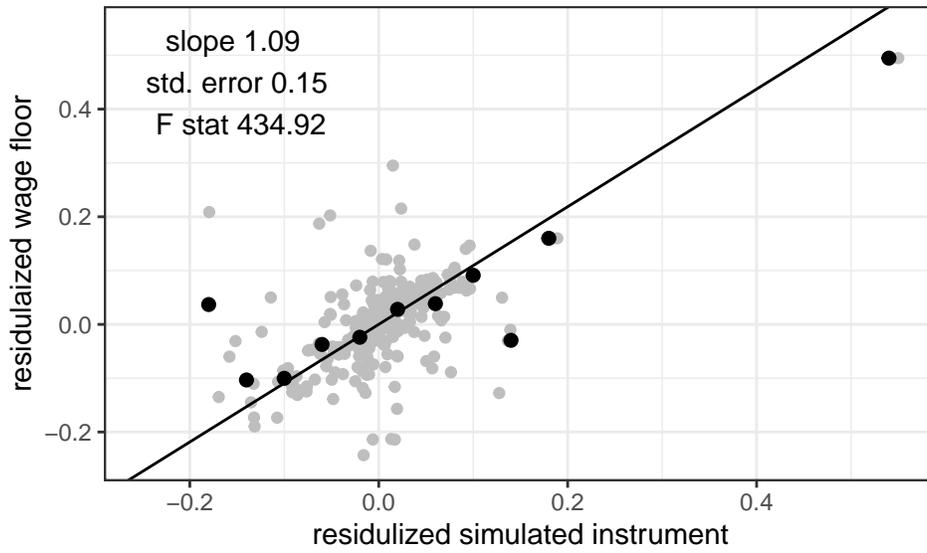
(b) accounting for increases in cost of living

Figure 4: Binscatter of the residualized (microregion FE, region specific year FE, and economic activity controls) log wage floor and log simulated instrument. Source: RAIS
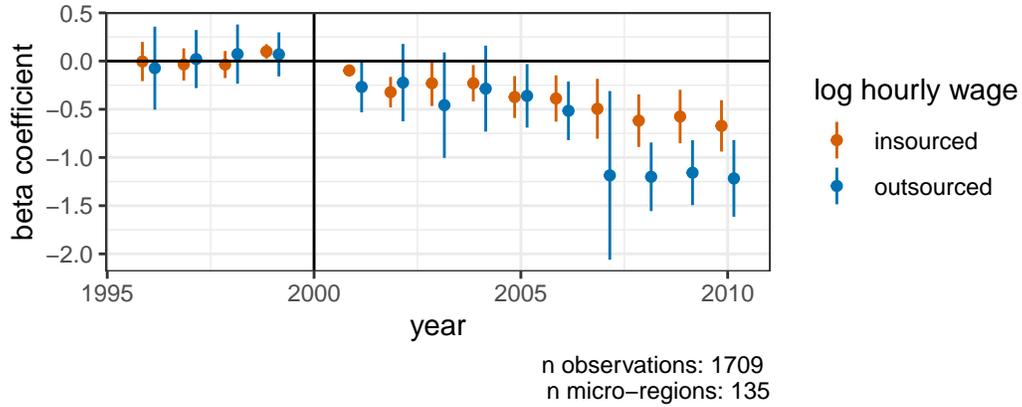
Figure 5: Estimation of regression 6. Source: RAIS. Vertical lines represent 95% confidence intervals with standard errors clustered at the micro-region level. The regression was weighted by the number of cleaning workers.
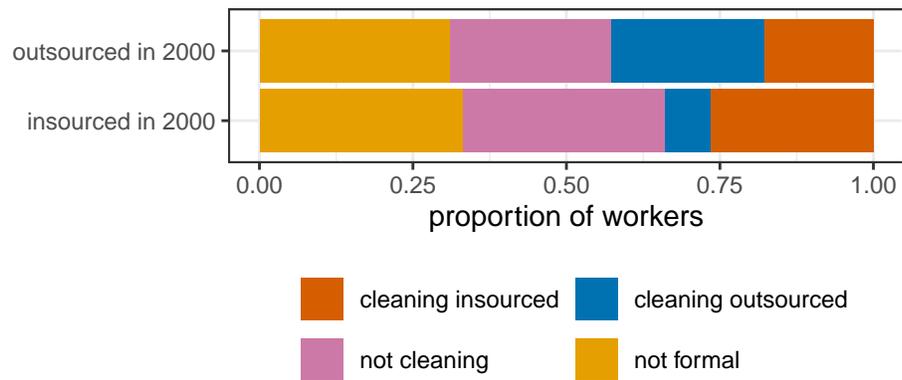
Figure 6: Distribution of jobs 2000 cleaning workers held in 2010 based on their employment contract in 2000. Only cleaning workers in 2000. Source: RAIS.

A.3   Imputing the wage floor

To implement my estimation strategy I need data on wage floors across micro-regions between 1995 and 2016. However, data on the labor agreements is only available after 2007 and each agreement presents the section containing the wage floor in a different format, making it very difficult to integrate. To overcome this challenge I use the distribution of contracted wages in each micro-region in each year to impute the wage floor. The idea behind it is that if the wage floor was binding we should observe a mass of outsourced workers earning exactly the wage floor in each micro-region, so the mode of the outsourcing wage distribution is the wage floor. Figures 7-10 panel (a) exemplify how this work. In panel (a) they show the cumulative distribution of the ratio between contracted wages and the federal minimum wage for each micro-region in 2002 for outsourced (in blue) and insourced (in red) workers. Notice that in all micro-regions there is a large proportion of outsourced workers earning exactly the same wage, without rounding, that is the mode of the outsourcing contracted wage distribution and I call it the wage floor for that micro-region in that year.

To impute the wage floor I need a sample of workers that would be fully subject to the terms of the labor agreement, which implies that I needed to add further restrictions to the sample besides the previous ones of only cleaning workers, between 18 and 65 years old, working at a private company. Since wages in Brazil are negotiated at the monthly level and companies could adjust part-time workers wages to account for their smaller number of hours I restrict the sample to only full-time workers, i.e., working at least 40 hours a week. Furthermore, I also restricted the sample to only workers that were not hired or separated in December, so I would have a full month of employment pay available.

A couple of issues might invalidate this way of imputing the wage floor. First, information on contracted wages is only available after 2002, and before that I rely on information on December wages, which are usually higher than contracted wages and show more variation. Second, some micro-regions might have an outsourcing wage distribution with more than one mode. Third, the wage floor might not be binding in some micro-regions and only a small percentage of workers earn the same wage, in which case the mode could not be the wage floor but just the wage that a larger employer pays.

With respect to the first issue, since only data after 2002 provides contracted wages, I use December wages to calculate the wage floor before 2002. However, December wages are not necessarily the same as contracted wages for two reasons. First, workers can do extra hours besides their contracted hours, and receive one and a half of their hourly contracted wage. In fact, December is a specially demanding month for some industries, which might create a bigger demand for extra hours. Second, workers might

earn bonuses in December. For those two reasons, panel (b) of figures 7-10 that show the cumulative distribution of the ratio between the December monthly wage and the federal minimum wage in 2002 for outsourced and insourced workers shows a smaller proportion of workers earning the wage floor defined in panel (a) and larger proportion of workers earning more than that.
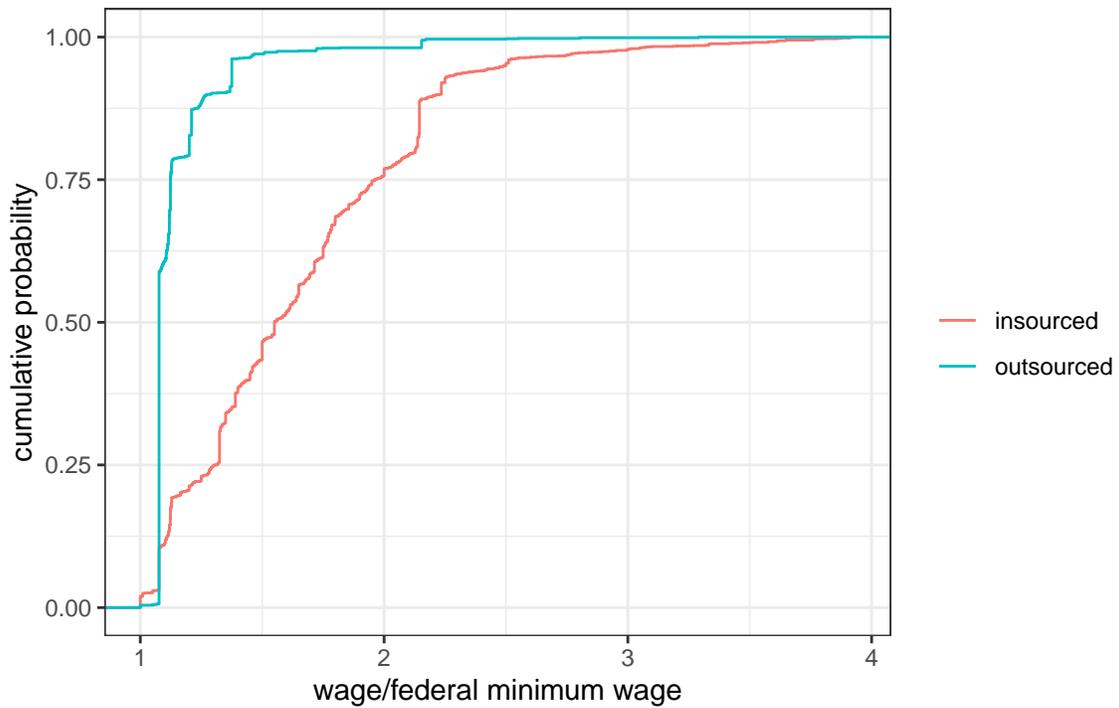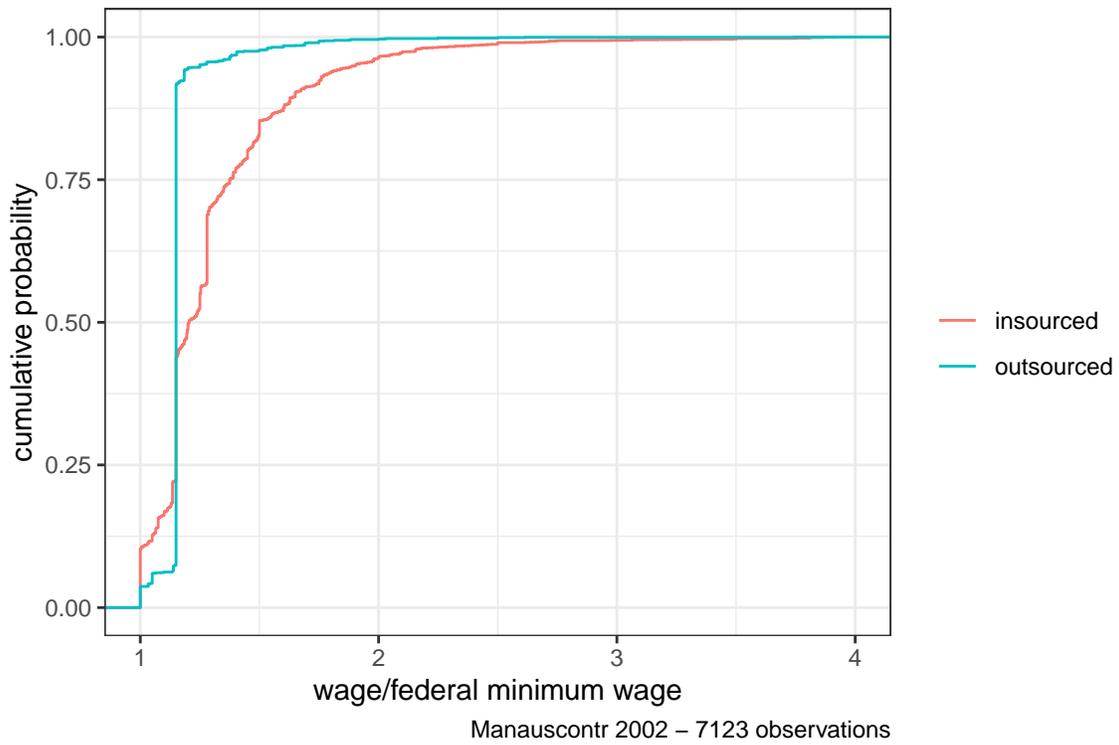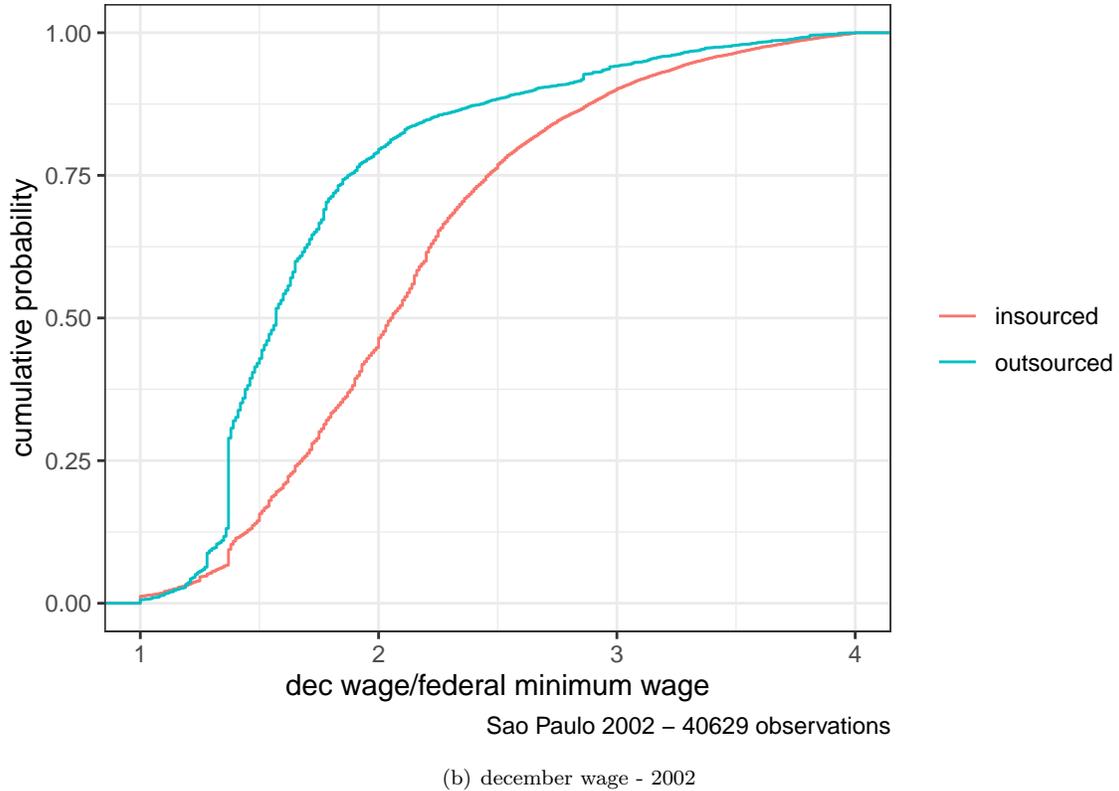
(a) contracted wage - 2002
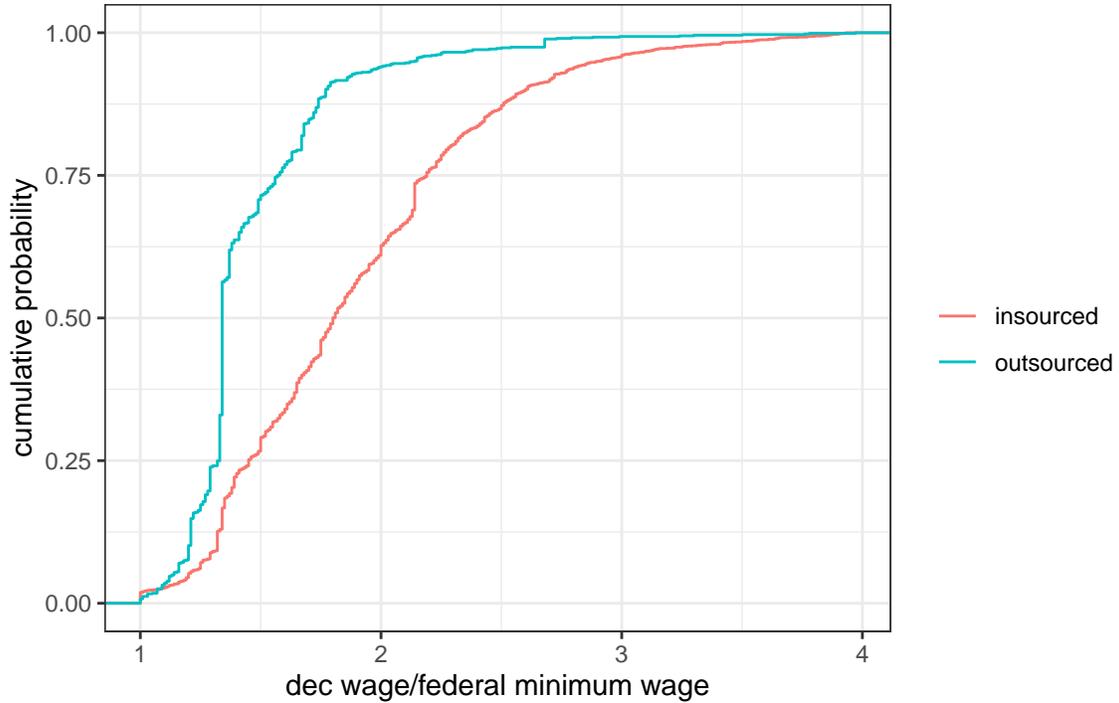
(b) december wage - 2002

Figure 7: This figure shows the cumulative distribution of the ratio between the monthly wage and the federal minimum wage in the micro-region of Florianopolis, SC (located in the South of the coutry) in 2002, for outsourced and non-outsourced workers.59The source of this figure is the RAIS data, and I restricted the sample to only full-time workers in cleaning occupations.
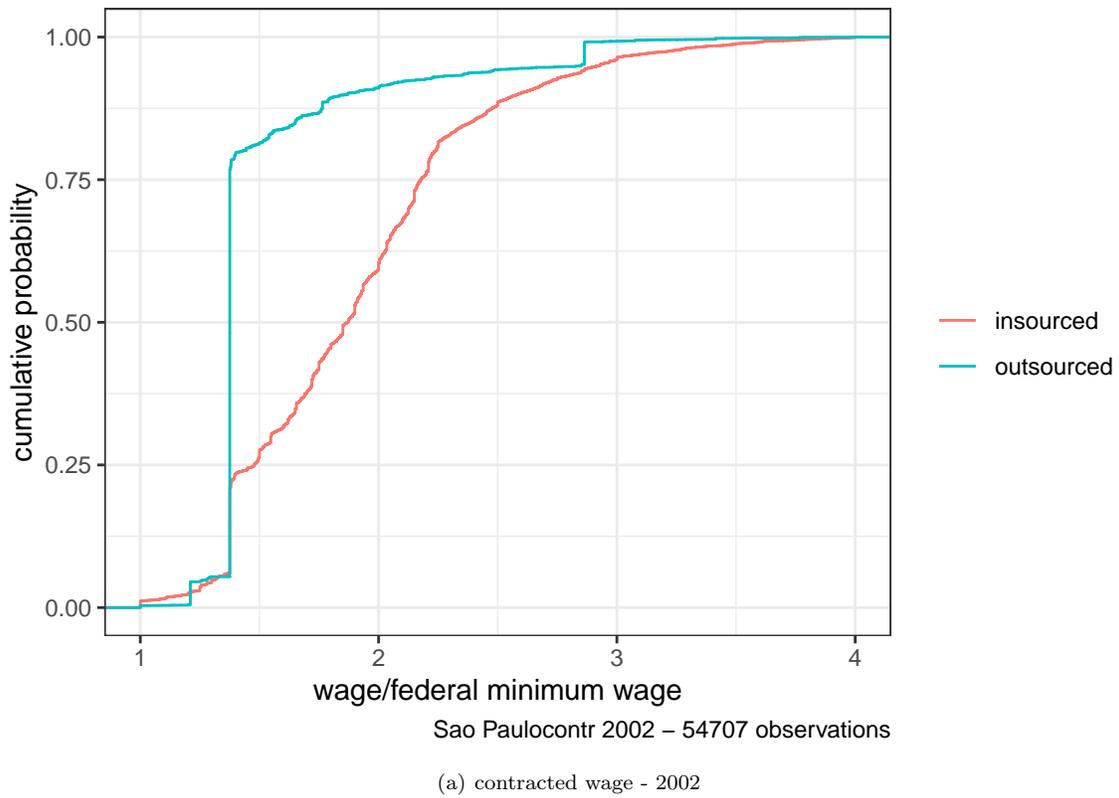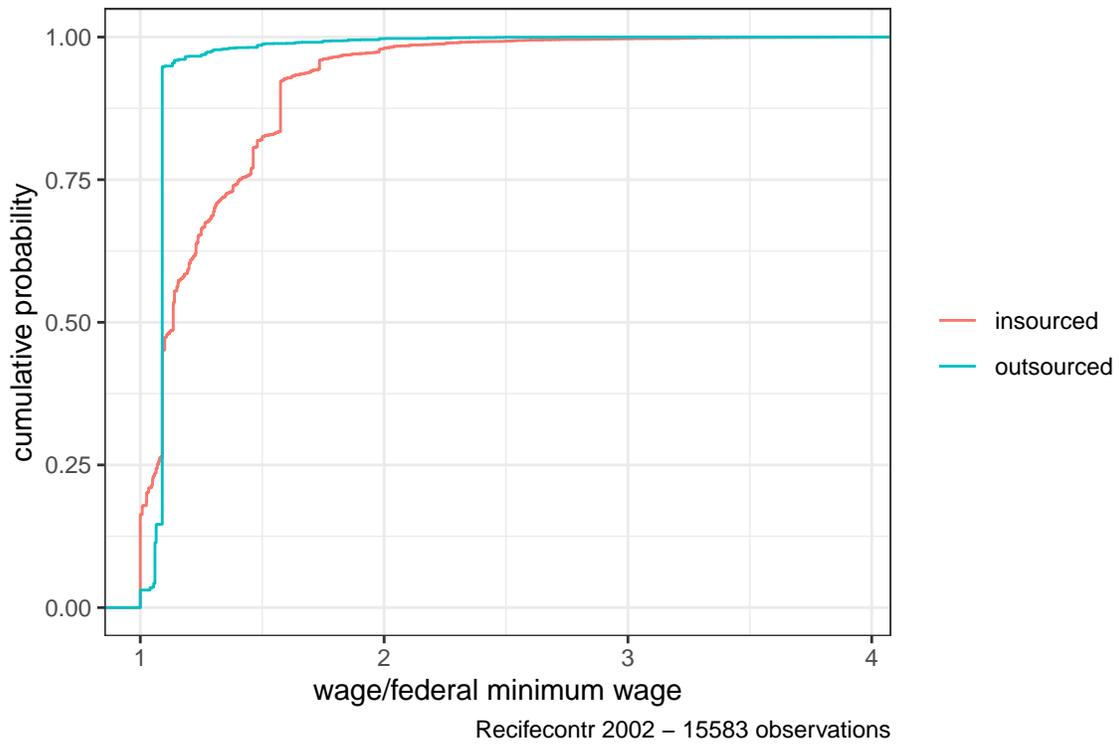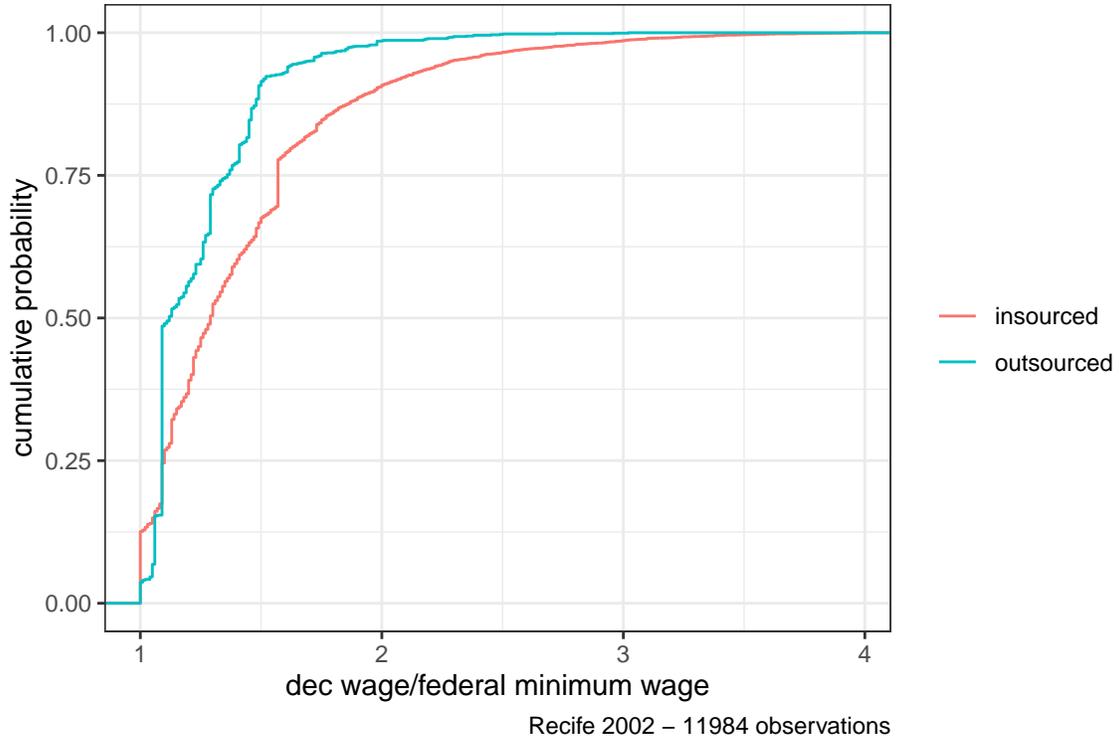
(a) contracted wage - 2002
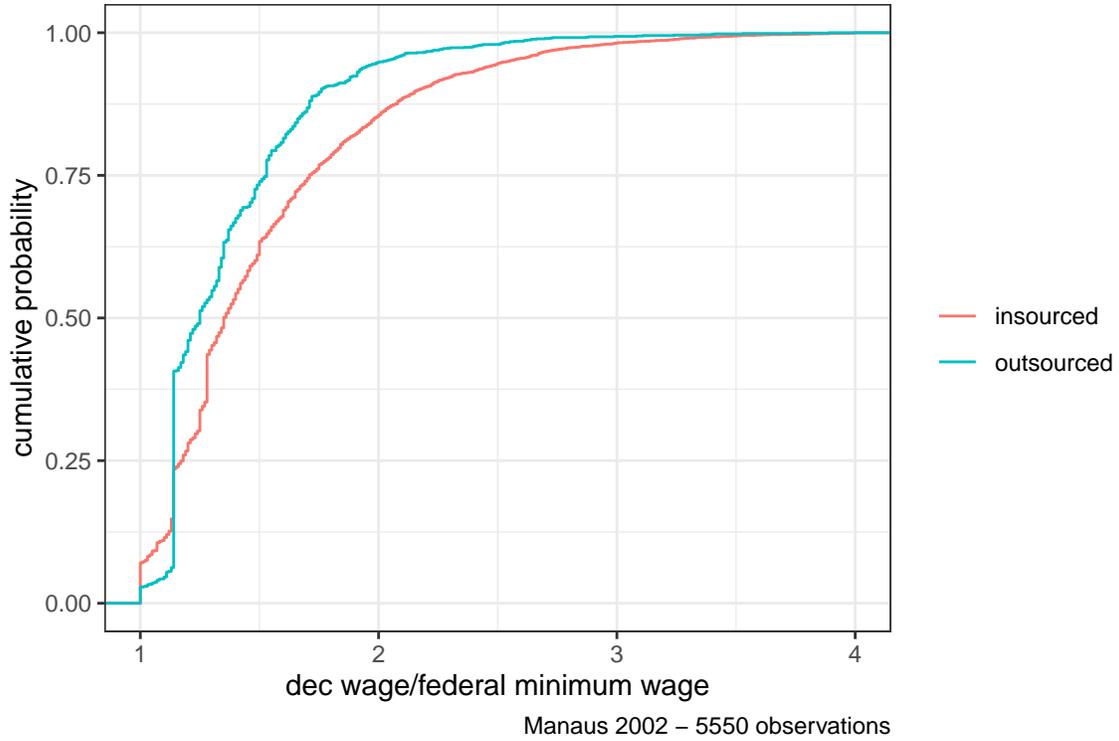
(b) december wage - 2002

Figure 8: This figure shows the cumulative distribution of the ratio between the monthly wage and the federal minimum wage in the micro-region of Manaus, AM (located in the North of the coutry) in 2002, for outsourced and non-outsourced workers. The source of this figure is the RAIS data, and I restricted the sample to only full-time workers in cleaning occupations.

(a) contracted wage - 2002

(b) december wage - 2002

Figure 9: This figure shows the cumulative distribution of the ratio between the monthly wage and the federal minimum wage in the micro-region of Sao Paulo, SP (located in the Southeast of the coutry) in 2002, for outsourced and non-outsourced workers. The source of this figure is the RAIS data, and I restricted the sample to only full-time workers in cleaning occupations.

(a) contracted wage - 2002

(b) december wage - 2002

Figure 10: This figure shows the cumulative distribution of the ratio between the monthly wage and the federal minimum wage in the micro-region of Recife, PE (located in the Northeast of the coutry) in 2002, for outsourced and non-outsourced workers. The source of this figure is the RAIS data, and I restricted the sample to only full-time workers in cleaning occupations.
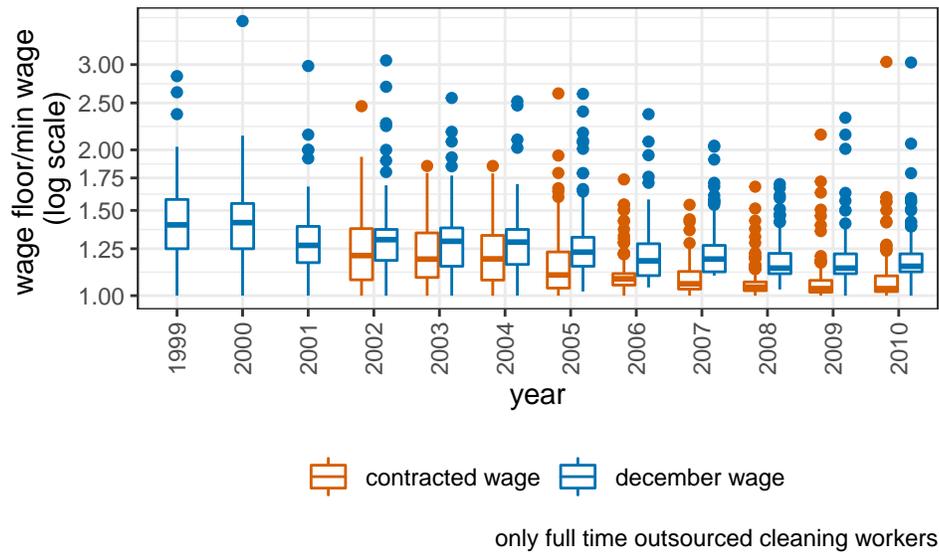
Figure 11: This figure shows the boxplot of the imputed wage floors across micro-regions and years
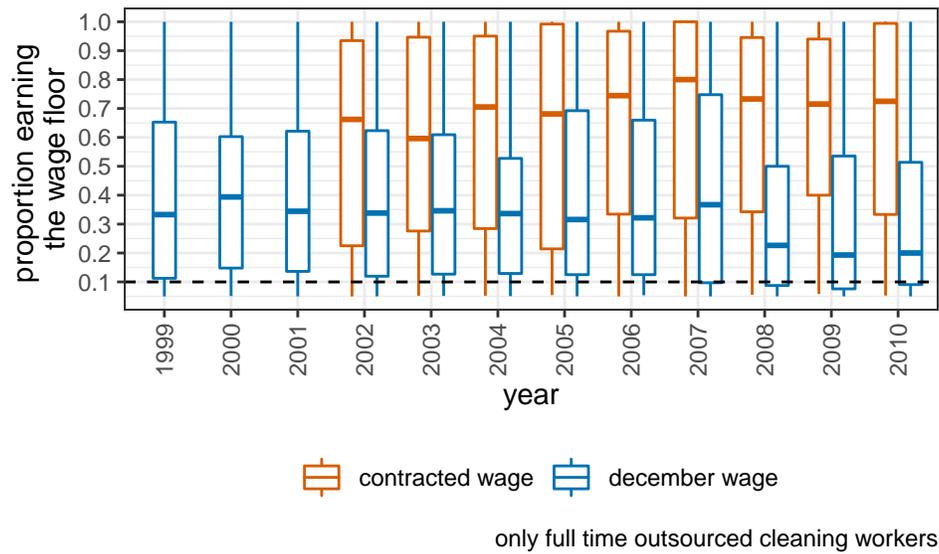

Figure 12: This figure shows the boxplot of the proportion of outsourced workers earning the wage floor across micro-regions and years
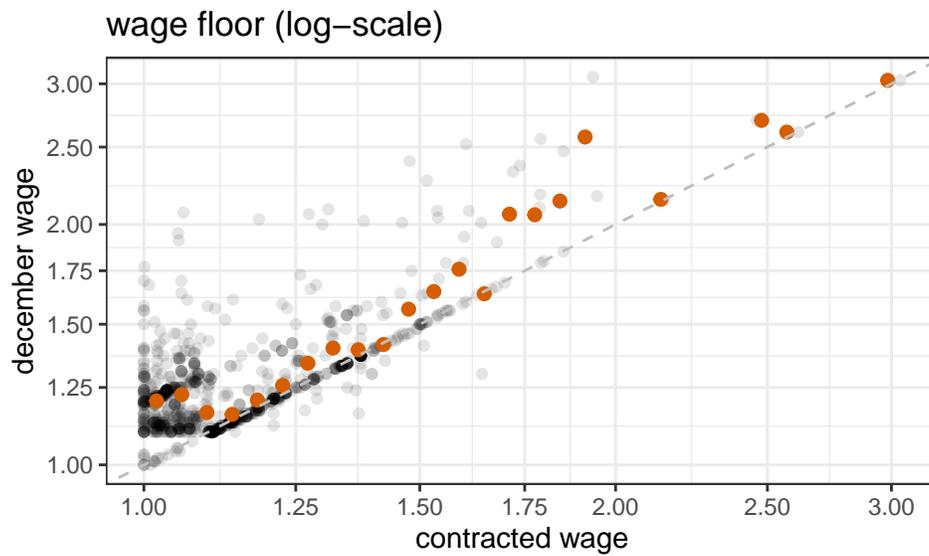
Figure 13: This figure shows the scatterplot of the imputed wage floors using the december wage agains using the contracted wage.