

# Labor Market Institutions and the Composition of Firm Compensation: Evidence from Brazilian Collective Bargaining

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## **Abstract**

This paper studies how collective bargaining—a widespread labor market institution—affects firm compensation, i.e., the wages and job characteristics that are valuable to workers (henceforth amenities). Specifically, I leverage a reform that automatically extended all existing collective bargaining agreements (CBAs) in Brazil to analyze the impact of restricting employers’ ability to phase out negotiated benefits on both wages and amenities. To quantify the value workers place on amenities secured by unions, I measure how textual elements in CBAs influence an establishment’s ability to poach workers from other employers, conditional on wages, using data on the universe of CBAs merged with an administrative linked employer-employee dataset. The causal effects of the reform are estimated using a matched difference-in-difference design comparing establishments with extended CBAs to establishment belonging to firms that do not negotiate directly with unions. I find that automatic extensions increase compensation by 1.6-3.8% in establishments with strong unions, which is driven by additional amenities whose value more than offsets foregone wage gains. These changes in firm compensation lead to an increase in hiring concentrated among low-skill workers, implying an elasticity of labor supply to establishments with strong unions of around 2. Further evidence indicates that the resulting wage and amenity distributions are compressed, suggesting that unions reduce compensation inequality within establishments.

**Keywords:** Collective bargaining; worker’s compensation; industrial relations

**JEL Codes:** J52, J32, K31

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Nearly one third of workers across OECD countries are covered by collective bargaining agreements (CBAs). Even though there is evidence that unions fight for particular job characteristics that are valuable to workers (henceforth amenities) in addition to wages, the impact of unions on overall compensation remains unclear despite growing interest in using more comprehensive measures of job value to understand inequality (Maestas et al., 2018).<sup>1</sup> However, estimating the causal effects of collective bargaining on firm compensation is complicated for two key reasons. First, the amenities provided by firms—e.g., profit sharing, employment protections, break rooms—are absent from conventional data sources and hard to value relative to wages. Second, various factors contribute to both a union’s ability to extract rents through collective bargaining and compensation at a given firm, implying that endogeneity may generate misleading correlations.

In this paper, I exploit quasi-experimental variation and rich data to estimate the causal effect of collective bargaining on firm compensation, inclusive of amenities. The variation comes from a legal reform in 2012 that extended all existing CBAs in Brazil, and thus restricted employers’ ability to phase out negotiated benefits upon their expiration. Combining an administrative linked employer-employee dataset with text analysis for the universe of CBAs, I quantify the value workers place on amenities secured by unions and hence observe this compensation component across covered establishments. The analysis comprises four parts. First, I start by ignoring amenities and analyze the effects of the reform on wages and pay premiums using a matched difference-in-difference design. Second, to incorporate amenities, I build a simple Nash bargaining model providing predictions on how unions trade off wages and amenities when the duration of either of these compensation components is extended. Third, based on the model’s predictions, I estimate the effects of automatic extensions on amenities and wages by union strength using a complementary difference-in-first-differences design. Fourth, I investigate how these changes in firm compensation influence worker flows and the composition of the workforce at affected establishments.

In the first part of the paper, I analyze the differential change in wages between establishments covered by extended CBAs and comparable establishments belonging to firms that do not negotiate directly with unions. I focus on firm-level CBAs because, as described in Section 1, they are the most important way through which unions affect compensation to workers in this context. The identifying assumption is that the evolution of outcomes in establishments without such agreements are similar to those in the establishments with extended CBAs had the reform not taken place. Given concerns due to selection into bar-

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<sup>1</sup>Papers exploring union effects on wages include Freeman and Kleiner (1990); Lalonde et al. (1996); DiNardo et al. (1996); Card (2001); DiNardo and Lee (2004); Firpo et al. (2009); Lee and Mas (2012); Frandsen (2013); Farber et al. (2018). Evidence on other forms of compensation include health insurance (Buchmueller et al., 2002), staffing rules (Schmitz Jr, 2005), and untaxed compensation (Ash et al., 2018).

gaining, the comparison group consists of establishments with similar sectoral coverage as those affected by the reform, minimizing covariate imbalances through a one-to-one matching procedure detailed in Imbens (2015). Common trends prior to automatic extensions along numerous outcome variables support the causal interpretation of the estimated effects.

I find that gains in mean wages among establishments with extended CBAs are 1.6% lower than in comparable workplaces after the reform. This negative wage effect is neither driven by workers that the union might consider “outsiders” (Lindbeck and Snower, 1988) nor fully explained by compositional changes in the workforce (Frandsen, 2013). In fact, decreasing wages are observed among likely union “insiders,” e.g., core occupations, rank-and-file workers, and incumbents. Furthermore, falling pay premiums—as estimated by the establishment fixed effects from AKM models (Abowd et al., 1999)—account for roughly half of the decrease in wages. Hence, if amenities are ignored, one would conclude that automatic extensions reduce compensation despite being regarded as a pro-union policy.<sup>2</sup>

In the second part of the paper, I outline a simple model that pins down conditions under which automatic extensions push unions to bargain for more amenities rather than wages. The model consists of separate but simultaneous Nash bargaining along each compensation component in a two period setting where fallback positions are recursive (Binmore et al., 1986). Recursive fallback positions imply that outcomes from current negotiations determine the status quo (or inside option) in future bargaining rounds after accounting for their duration (or stickiness)—i.e., the parameters affected by the reform. The model demonstrates that unions trade away wages for amenities when 1) amenities become stickier than wages; and 2) unions are strong. The first condition is intuitive since a form of compensation that is locked-in rather than temporary becomes more valuable. The second condition arises from the fact that unions need to overcome employer push-back against making concessions given that automatic extensions expand the time horizons over what is negotiated.

When amenities are stickier than wages—which is the case in Brazil after the reform—strong unions bargain mostly for amenities. Prior to the introduction of automatic extensions in Brazil, wage cuts could only occur through collective bargaining. Having downward nominal wage rigidity guaranteed by the Constitution, plus stable inflation, meant that the reform effectively only extended amenities. As per the model, strong unions are those that are patient, committed to bargaining, and willing to strike. Hence, I use union density as a proxy for strength since a higher proportion of union members (despite universal coverage) implies more support for the union among workers. Importantly, given that automatic

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<sup>2</sup>In Brazil, there is strong support for automatic extensions among unions but generalized disdain for the reform among employer associations (see Table 1). In addition, the efforts to weaken automatic extensions in Estonia, Greece, Portugal, and Spain during the European debt crisis illustrate this pro-union characterization of the policy (Marginson and Welz, 2014).

extensions allowed unions to negotiate under expired CBAs, this ability to hold out—as in Cramton and Tracy (1992)—implied a strengthening of unions in the sense that prolonged negotiations became less taxing.

In the third part of the paper, I construct a wage-equivalent measure of the value that workers place on amenities secured by unions to test the predictions of the bargaining model. In broad terms, this measure is the sum of the predicted influence that the CBA’s text has on an establishment’s ability to poach workers from other employers—akin to the Poaching Index in Bagger and Lentz (2018)—weighted by the inverse coefficient for wages.<sup>3</sup> Since amenities are only measured in CBAs, two important differences relative to the wage analysis arise. First, constructing a panel of CBAs changes the observation level from establishments to bargaining units, i.e., groups of unions and firms negotiating CBAs over time. Second, since the matched establishments from the original design lack CBAs, I employ a complementary difference-in-first-differences strategy that relies only on bargaining units with extended CBAs. While the identifying assumption of constant growth rates in amenity value is hard to verify, evidence from the few bargaining units without an active CBA at the time of the reform suggests that my estimates are a lower bound of the causal effects.

Aligned with the model’s predictions, amenities improve among bargaining units with strong unions by 3-5%. Echoing the model’s second condition, amenity gains have a positive monotonic relation to union density quartiles—the proxy for strength. Importantly, the value of the additional amenities secured by strong unions more than offsets the decline in wages, resulting in higher overall compensation equivalent to a 1.6-3.8% wage increase. Comparing CBAs negotiated prior to and after automatic extensions, bargaining units with strong unions add a wide variety of clauses relative to those with relatively weaker unions. The new clauses include some that are selected into the amenity value measure, such as employment protections and union relations, as well as others excluded from the measure, e.g., food allowance and life insurance.

In the fourth part of the paper, I explore the effects of automatic extensions on workers entering and leaving affected establishments, as well as the resulting changes to the skill composition of the employed workforce. I find that establishments with extended CBAs experience an influx of low-skill workers. Specifically, hire rates increase without any significant change to quit rates. In addition, the average skill at the affected establishments—as estimated by the worker fixed effects from an AKM decomposition (as well as education levels)—decreases. These effects are again driven among establishments belonging to firms

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<sup>3</sup>The ideal model for constructing the amenity measure would predict an establishment’s ability to poach workers. To that end, I train numerous models with a 90% random sample and choose the model that minimizes out-of-sample RMSE. The selected model is an elastic net. All regressions are in first differences to net out time-invariant factors that are specific to an establishment.

that negotiate with strong unions.

Higher overall compensation paired with increased hiring concentrated among low-skill workers suggests that establishments face an upward labor supply curve from such individuals. In fact, the elasticity of labor supply to establishments with strong unions implied by my estimates is of around 2. These new hires coincide with a reduction in within-establishment wage inequality, as measured by a falling 90/10 ratio and standard deviation. Furthermore, there is indirect evidence of compression of amenity value in the sense that added amenities seem targeted at low-skill workers, e.g., employment protections, food allowance, and apprenticeships.<sup>4</sup> Therefore, unions reduce not only wage inequality but also overall compensation inequality, inclusive of amenities, within establishments.

This paper contributes to three related literatures. First, it contributes to the well-established literature that studies the impact of unions on the labor market. There are several papers associating the weakening of unions and declining CBA coverage to higher wage inequality (DiNardo et al., 1996; Card, 2001; Firpo et al., 2009; Frandsen, 2012; Farber et al., 2018). However, studies exploiting quasi-experimental variation in unionization find negligible effects on workers' wages (Freeman and Kleiner, 1990; Lalonde et al., 1996; DiNardo and Lee, 2004; Lee and Mas, 2012; Frandsen, 2013). Interestingly, recent work has focused on whether factors influencing *individual* bargaining, in particular workers' outside option, affect wages (Shapley and Shubik, 1971; Beaudry et al., 2012; Jäger et al., 2018; Caldwell and Danieli, 2018). Relative to these two strands of the literature, I take unionization as given and exploit quasi-experimental variation in *collective* bargaining. Analogous to findings in Caldwell and Harmon (2019) where strong outside options allow high-skill workers to bargain for higher wages, my results show that improved inside options in collective bargaining matter for low-skill workers. In particular, I show that automatic extensions increase hiring of low-skill workers and compress the value of jobs within establishments.

Second, this paper contributes to the broad literature accounting for amenities as a relevant form of compensation for workers' supply of labor. The importance of workplace amenities has been long recognized in the theory of equalizing differences (Rosen, 1986). Work on compensating differentials with longitudinal employer-employee data has relied on revealed preferences due, in part, to the lack of comprehensive information on amenities across firms (e.g., Taber and Vejlín, 2016; Lavetti and Schmutte, 2016; Sorkin, 2018; Lamadon et al., 2019).<sup>5</sup> Meanwhile, variation in specific workplace amenities—both through

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<sup>4</sup>Rationalizing the results in this paper with the canonical two-sided selection in Abowd and Farber (1982) and Card (1996) also implies within-establishment compression of job value (detailed in Appendix G).

<sup>5</sup>In my data, the correlation between pay premiums and negotiated amenities at the establishment level is near zero. While this suggests that differences in pay premiums across establishments are not merely

survey data (Hamermesh, 1999; Pierce, 2001; Maestas et al., 2018) and experimental studies (Flory et al., 2014; Wiswall and Zafar, 2017; Mas and Pallais, 2017)—has been exploited for calculating revealed preference estimates of their dollar value. Using similar revealed preference assumptions, I combine administrative data with text analysis to provide a wage-equivalent measure for the value of a large set of amenities, i.e., those secured by unions through CBAs. Armed with this novel and comprehensive measure, I show that ignoring amenities can be misleading about the effects of automatic extensions on compensation.<sup>6</sup>

Lastly, this paper relates to the literature on imperfect competition in labor markets. Stemming from the work of Robinson (1933), models where employers have market power in wage setting have received renewed interest in economics (Ashenfelter et al., 2010; Manning, 2003). Numerous empirical papers have documented imperfect competition in labor markets (Falch, 2010; Ransom and Oaxaca, 2010; Ransom and Sims, 2010; Staiger et al., 2010; Hirsch et al., 2010; Depew and Sørensen, 2013; Webber, 2015; Dube et al., 2018a,b; Caldwell and Oehlsen, 2018; Lamadon et al., 2019; Kline et al., 2019; Goolsbee and Syverson, 2019).<sup>7</sup> The estimates of the elasticity of labor supply to firms in these diverse settings vary between 0.1 and 4.0, which are low enough to suggest that wages are marked down from workers’ marginal revenue product. Nonetheless, as pointed out by Manning (2011), omitted variables such as amenities may be biasing these estimates downward. I tackle the aforementioned concern directly, providing estimates of elasticities with respect to amenity-inclusive compensation (not just wages) that are within the range of significant monopsony power. In addition, although unions may contribute to the desirability of a particular firm, this paper suggests that automatic extensions can push monopsonistic firms up the supply curve.

The paper is organized as follows. Section 1 describes collective bargaining in Brazil and explains the reform that extended CBAs. Section 2 presents the data sources with descriptive statistics. Section 3 makes the case for identification with a matched difference-in-differences design. Section 4 presents the effects of the reform on wages and firm pay premiums, ignoring amenities. Section 5 formalizes the theoretical effects of automatic extensions on wages and amenities with a simple Nash bargaining model. Section 6 constructs the wage-equivalent measure of amenities and estimates the effects of the reform on both forms of compensation with a differences-in-first-differences strategy. Section 7 discusses the effects of automatic extensions on worker flows and workforce composition. Section 8 concludes.

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compensated by differences amenities, future work should explore this question in closer detail.

<sup>6</sup>Automatic extensions highlight the importance of downward rigidities in determining firm compensation. While downward rigidities in wages have been well documented (e.g., Schmitt-Grohé and Uribe, 2016; Kaur, 2019), to the best of my knowledge, their presence (or absence) in amenities has not been explored.

<sup>7</sup>In the case of Brazil, Haanwinckel (2018) shows that a model where firms compete monopsonistically for labor (among other features) empirically matches several aspects of wage inequality.

# 1 Automatic Extensions in Collective Bargaining

In this section, I provide an overview of how Brazilian unions bargain with employers. I then survey recent international developments regarding automatic extensions, highlighting the relevance of this policy across institutional settings. The section ends with the details on the introduction of automatic extensions in Brazil which I exploit for identification purposes.

## 1.1 Collective bargaining in Brazil

### Institutional features

Unions in Brazil engage in two levels of collective bargaining, leading to firm-level and sectoral collective bargaining agreements (CBAs). In firm-level CBAs, unions negotiate with one or more individual firms. Provisions from firm-level CBAs only apply to workers employed by the signing parties. In sectoral CBAs, unions negotiate with employer associations representing a large subset of firms in a given industry and geographic area.<sup>8</sup>

Sectoral CBAs tend to set a general floor while firm-level CBAs secure augmenting provisions. As documented in Horn (2009), notable improvements in working conditions are only achieved by unions that can negotiate at the firm-level, with most other unions only securing minor extensions of the federal labor code (henceforth CLT for *Consolidação das Leis do Trabalho*).<sup>9</sup> In cases where sectoral and firm-level clauses are in conflict with each other, a “favorability principle” gives precedence to the provision which is considered most beneficial to the worker. Hence, firm-level CBAs are the relevant agreements generating variation in how workers are compensated for their labor across firms.

Establishments are a suitable unit of analysis since CBA coverage, especially from firm-level agreements, is typically homogeneous for all co-workers. This is the result of two features in the Brazilian setting: universal coverage and representational monopoly.

First, universal coverage means that union membership is not required for CBA coverage. As a result, 65% of the formal workforce is covered by a CBA, making Brazil an outlier in the American continent in terms of bargaining coverage (Visser et al., 2015). At the same time, the proportion of workers in the private sector that are affiliated to a union is around 15-20%. Hence, union density is more of a proxy for union strength—in the sense that workers support the union—than a measure of the importance of unions in the economy.<sup>10</sup>

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<sup>8</sup>Sectoral CBAs are rarely extended to firms that are not members of employer associations (Cardoso, 2018).

<sup>9</sup>Although CLT is generous to workers relative to labor regulations in the U.S., Canada, and the U.K., according to the OECD indicators of employment protection regulations, Brazil’s labor code is less strict than most Latin American and European nations.

<sup>10</sup>Appendix Figure A1 shows that the relation between union membership and skill is different in Brazil than in the U.S. In Brazil, unlike the U.S., becoming a union member seems decoupled from resulting

Second, representational monopoly means that only a single union represents the collective interest of a set of workers. In particular, one union represents one category-geography pair.<sup>11</sup> Since categories tend to align with industries, such as metal-workers or bankers, essentially all co-workers are protected by the same CBAs even if occupations differ. In a few cases, categories refer to professions such as administrative assistants. But even when these professions exist within establishments, firm-level CBAs signed with the union of the predominant category tend to apply to all workers. It is only in cases where the minority profession has a separate CBA, that some variation in coverage across workers within establishments exists.

### [INSERT FIGURE 1]

Figure 1 illustrates how the collective bargaining structure in Brazil determines CBA coverage of workers based on where they are employed. The formal workforce is divided into mutually exclusive and collectively exhaustive category-geography pairs—usually labor market  $\times$  industry cells.<sup>12</sup> Two cells are shown where  $A$  has signed a sectoral CBA and  $B$  has not. Within each cell, an establishment is classified according to a two-by-two table depending on whether it is a member of the cell’s employer association and whether it has signed a firm-level CBA. Three simple rules determine coverage. First, workers in all these establishments are covered by CLT. Second, to be covered by a sectoral CBA, the worker must be in an establishment that is a member of the employer association that is also in a cell where such a CBA exists. This refers to the top row establishments in  $A$ . Third, to be covered by a firm-level CBA, the worker must be in an establishment where such a CBA exists. This refers to the left column establishments in both cells  $A$  and  $B$ .

## The collective bargaining process

To understand the potential importance of automatic extensions, I now describe the collective bargaining process in Brazil. In this section, I introduce the term bargaining unit which refers to a group of unions and firms that negotiate the CBAs covering a defined set of workers.

Figure 2 depicts the collective bargaining process for a given bargaining unit. Each unit has a negotiation date (*data-base*), i.e., a calendar date of reference for collective bargaining

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wage advantages.

<sup>11</sup>In terms of revenue, each worker pays a mandatory contribution equivalent to one day’s wage per year to the union representing her collective rights. Workers who decide to become union members pay additional monthly dues that grant them some additional benefits, e.g., discounted prices at union events or facilities. Given that bargaining is costly, unions can also collect contributions to finance negotiations.

<sup>12</sup>The smallest unit of geographic representation is the municipality. Inter-municipal, state, inter-state, and national unions representing a single category also exist. Cross-category interests are represented in national union centers (*centrais sindicais*) which have no bargaining capabilities.

which essentially determines when CBAs expire and negotiations begin. Prior to the expiration of an existing CBA, the union organizes a General Assembly where workers vote on the list of claims (*pauta de reivindicações*) they want to achieve in upcoming negotiations. Negotiations start when the union sends these claims to the employer counterpart, which should occur no later than the negotiation date. Although industries can coordinate to align their negotiation dates, industry alignment is weak.<sup>13</sup>

[INSERT FIGURE 2]

Negotiations tend to occur on an annual basis as most agreements have a 12 month duration. The maximum duration allowed by law is 24 months, so in some cases negotiations take place every two years.<sup>14</sup> Bargaining focuses on issues pertaining to wages and amenities. Wage clauses usually concern floors and adjustments. Amenity clauses include 1) wage supplements, e.g., food allowances, payment schedules, profit sharing agreements; 2) nonwage benefits, e.g., employment protections, paid leave, retirement; and 3) workplace public goods, e.g., working environment, safety equipment, access to company information.

If collective bargaining concludes in an agreement, negotiations end with the filing of the CBA at the regional offices of the Ministry of Labor. After filing, the ministry reviews the CBA to ensure its provisions are in accordance with the law. If no issues are found, the agreement is registered and becomes legally binding. Clauses are then backdated to the start of negotiations. This means that wage benefits that are agreed after the expiration of the previous CBA are paid in arrears. Nonetheless, the fact that some nonwage benefits are hard to backdate implies some loss to workers from delayed negotiations.

Automatic extensions allow an agreement to remain in force after its expiration date. In terms of Figure 2, this means that workers enjoy coverage from the previous CBA during the negotiation period. As such, automatic extensions allow unions to negotiate under an expired agreement. This ability to hold out—as in Cramton and Tracy (1992)—is precisely why automatic extensions are generally viewed as a pro-union policy. In the case of Brazil, the annual frequency of collective bargaining and the prevalence of negotiation delays make automatic extensions highly relevant.

<sup>13</sup>For example, metalworkers in São Paulo negotiate either in September or November, depending on their national union center affiliation. Appendix Figure A2 displays within-category variance in CBA expiration.

<sup>14</sup>There are a few CBAs with durations below 12 months. Many of these agreements are concerned with idiosyncratic events, such as work-shifts during the 2014 FIFA World Cup, and are consequently ignored for the main empirical portion of the paper.

## 1.2 Extension policies in practice

### Cross-country comparison

There is significant cross-country variation in extension policies (see Appendix Table B1). The spectrum of policy types can be divided into four groups. On the weakest side is the U.K., where no extensions exist. It is followed by Australia, Estonia, Japan, Sweden, and the U.S. where a CBA's validity remains until a unilateral termination notice is submitted or a negotiation impasse is reached. The come countries that have imposed time limits to the duration of extensions, e.g., up to 12 months in Portugal and Spain, and up to 3 months in Greece. Finally, in its strongest form, CBAs remain valid until they are renegotiated. This is the case in France, Germany, Ireland, Chile, and Mexico.

Interestingly, automatic extensions were the target of reforms to the collective bargaining structure of countries hit the hardest by the European debt crisis. Under pressure from the European troika, several countries enacted reforms that shortened the extension of CBAs (Marginson and Welz, 2014). In Estonia, a 2012 legislative change required that both parties agree to the extension of the agreement instead of it being automatic. In Greece, a 2012 law placed a 3-month limit on extensions, after which only the base salary in the CBA is irreducible by law. Starting in 2009, Portugal placed an 18-month limit on extensions, which was subsequently decreased to 12 months in 2014. Similarly, a 2012 law in Spain restricted extensions to 12 months as opposed to an indefinite extension.

The economic downturn and subsequent confluence of labor reforms complicates the possibility of identifying the effects of the aforementioned reforms in Europe. Fortunately, changes to extensions in Brazil (detailed below) were unexpected and likely exogenous to economic fundamentals, opening the possibility for a clean identification strategy.

### Extending agreements in Brazil

On September 25th 2012, Brazil changed from having unilateral termination of CBAs upon expiration (like Sweden) to automatic extensions lasting until replacement by a new CBA (as in France). This policy shift was brought by a revision to a legal “consensus interpretation,” known as *Súmula 277*, published by the highest appellate court for labor law—henceforth TST for *Tribunal Superior do Trabalho*.<sup>15</sup> These extensions applied to all existing CBAs that had not already expired. Importantly, all workers—including those hired after the agreement

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<sup>15</sup>Automatic extensions in Brazil ended with the 2017 Labor Reform (*Lei 13.467*). Among other changes, this reform also allowed for firm-level CBAs to include derogation clauses. Even though future work should explore the effects of this reform, it is beyond the scope of this paper.

expired—were covered by the same provisions, precluding the creation of a two-tier system.<sup>16</sup>

[INSERT TABLE 1]

The introduction of automatic extensions came as a shock. *Súmula 277* was modified during one of the regular TST meetings. Comparing quotes 1 and 2 in Table 1 confirms that the new version was a complete reversal of the court’s initial consensus interpretation.<sup>17</sup> As evidenced by quotes 3 and 4 of the same table, the 180 degree turn was unexpected and had (arguably) limited legal precedence to support it. Moreover, Appendix Figure A3 reveals no shift in the density of CBA filing dates around the policy change.

The defenders of the 2012 revision cite the security it provides to workers during negotiations, preventing employers from reducing acquired benefits as a bargaining chip. Anecdotal, there is some support for this claim. For example, the union of journalists in São Paulo experienced a negotiation period that lasted almost 8 months without automatic extensions. During that period, employers stopped paying the travel bonus, i.e., a doubling of wages for journalists on work-related travel (*abono de viagem*). In addition, work hours were made more flexible, resulting in earnings uncertainty for some journalists. These tactics were successful, resulting in a new CBA that did not include a travel bonus and allowed for more flexibility in setting work hours.

Nevertheless, a possible reduction in givebacks (see quote 6 in Table 1) does not necessarily imply that the policy change allowed unions to negotiate better provisions (as stated in quote 5) relative to a counterfactual in which agreements were not automatically extended. As expressed in quotes 7 and 8, the policy may have dissuaded employers from making concessions that they would otherwise be willing to make. For example, knowing that additional employment protections would remain in force even if the economy slides into a recession in the future might detract some employers from making such a concession.

Importantly, the introduction of automatic extensions in Brazil effectively increased the relative duration (or stickiness) of amenities to wages. This is primarily because, prior to the revision of *Súmula 277*, wages already were downward rigid. Specifically, nominal wages are irreducible by article 468 of CLT, meaning that employers can only cut wages when agreed by the union even without automatic extensions.<sup>18</sup> Meanwhile, the amenities negotiated

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<sup>16</sup>On November 2013, TST clarified that provisions continue to apply to all employees, without distinction (*ARR 960-96.2012.5.08.0127*).

<sup>17</sup>Legally, CBAs in Brazil are extended by interpreting the negotiated provisions as being incorporating into each worker’s individual employment contract. Otherwise, expiration under extensions be meaningless.

<sup>18</sup>This restriction also applies to contracted hours, i.e., an hour reduction must be paired with a commensurate increase in hourly pay. While wages are rigid in nominal terms, real wage losses are tightly linked to inflation—5.4% in 2012—since the Brazilian Constitution prohibits indexing to the minimum wage and *Lei 10.192/01* places a similar ban with respect to price indexes.

in CBAs only became rigid after automatic extensions. That is, for CBAs expiring before September 25th 2012, employers could stop making payments from profit-sharing agreements, remove employment protections, flexibilize workday schedules, and cancel accident insurance protections (among others) upon expiration of the CBA.<sup>19</sup> Hence, to the extent that workers value amenities and that the uncertainty of securing these amenities long-term decreased their value, automatic extensions increased the relative value of amenities to wages.

In summary, this section has laid out the institutional background on collective bargaining in Brazil. Moreover, it has elaborated on the relevance of extension policies and the 2012 revision of *Súmula 277*, i.e., the legal reform exploited for identification purposes. Importantly, the section explained why automatic extensions in Brazil increased the relative duration (or stickiness) of amenities to wages. I now move on to present the data used to study how this shock to the collective bargaining process affected firm compensation.

## 2 Data Description

In this section, I describe the data sources employed for the empirical portion of the paper. I then show descriptive statistics from merging the full registry of CBAs into administrative linked employer-employee data. The section ends with information on the clauses negotiated by unions to provide a clearer picture of the amenities included in CBAs.

### 2.1 Data overview

#### Collective bargaining agreements

This paper relies on data from the full registry of CBAs in Brazil. In 2007, the Ministry of Labor launched the *Sistema Mediador* website as part of its efforts to track and store CBAs.<sup>20</sup> On August 2008, the government announced that all agreements from 2009 onward had to be submitted electronically through this website in order to be registered by the ministry, and therefore become legally binding.<sup>21</sup> I extract all CBAs available in *Sistema Mediador* as of September 2018, focusing on agreements filed between 2009 and 2016.

Extracting useful information from CBAs is relatively simple since these are stored in HTML format with a standardized structure. A key variable is the legal identifier (CNPJ)

<sup>19</sup>For example, an expired agreement’s provision increasing the retirement package of railway workers was denied by TST on October 2011 (*AIRR 753000520095150100*).

<sup>20</sup>For a detailed account of how *Sistema Mediador* is used in practice, refer to Appendix C.

<sup>21</sup>Specifically, *Instrução Normativa SRT n° 11/2009* revoked *n° 6/2007* which had mandated submissions on paper. Although a 2012 decision removed the ban on paper submissions (*Processo n° RR - 3895000-45.2009.5.09.0003*), virtually all agreements are registered online through *Sistema Mediador*.

of the signing parties involved, since this allows matching to other data sources. Additional variables of interest include the type of agreement (firm-level or sectoral), validity dates (start and expiration), bargaining dates (negotiation and filing), CBA coverage (geographic and worker category), and clause information (pre-classified groups and full text).<sup>22</sup>

The only information that requires significant work to become interpretable is the category of workers covered by each CBA. Worker categories are introduced as free text, which is not standardized across agreements of similar coverage. Consequently, I train a multinomial one-versus-all (OvA) logit classifier to obtain intelligible coverage information. The classifier is boosted by exploiting the fact that a given union can only represent a single category of workers.<sup>23</sup> The end result has approximately 95% out-of-sample prediction accuracy, which is good enough for the use this variable is given in subsequent analyses.

## Linked employer-employee data

The majority of labor market outcomes of interest for this paper originate from *Relação Anual de Informações Sociais* (RAIS), the linked employer-employee dataset covering all formal jobs in Brazil. Firms submit annual information to the Ministry of Labor on all employees who were on the payroll in the previous year, including their monthly earnings in December, contracted hours, hiring and separation dates, age, gender, education, and race.<sup>24</sup> Worker information is reported at the establishment level along with the CNPJ identifier, industry, and municipality of the workplace.

In order to determine CBA coverage of each establishment, I merge the scraped data from *Sistema Mediador* into RAIS. I restrict attention to CBAs negotiated by unions whose category of representation aligns with industries, rather than the few cases pertaining to professions, because the latter rarely cover most workers in an establishment. For firm-level agreements, I assign coverage to all establishments of a signing firm within the CBA’s geographic coverage. For sectoral agreements, I assign coverage to all establishments whose industry match the worker category represented within the CBA’s geographic coverage.<sup>25</sup> Since it is not always the case that all establishments are members of the relevant employer association, this last approach over-represents sectoral coverage.

<sup>22</sup>For more detailed information on how the data set is cleaned and assembled, refer to Appendix D. Appendix Figure A4 provides an extract of a firm-level CBA highlighting the standardized features.

<sup>23</sup>For more detailed information on how the classifier is trained and tested, refer to Appendix E. The rows in Appendix Figure A2 show the categories used based on article 577 of CLT.

<sup>24</sup>Compliance with the mandatory reporting requirements for RAIS is high because of large penalties when the data are late or incomplete.

<sup>25</sup>This is achieved by building a cross-walk between worker categories and industry codes.

## 2.2 Descriptive statistics

### Characteristics of firm-level and sectoral CBAs

Table 2 shows descriptive statistics for firm-level and sectoral agreements across filing periods. Filing periods are years starting in October so that the 2011/2012 and 2012/2013 periods correspond to the years just before and after the reform, respectively. The date on which CBAs are filed is the relevant time dimension for this study since it captures what signing parties know about the policy environment when they reach an agreement. In addition to giving a broad summary of the aforementioned data collection effort, these statistics highlight two key facts about the Brazilian setting.

[INSERT TABLE 2]

First, the descriptive statistics indicate that the ability to hold out is likely to matter in Brazil. Specifically, negotiations usually extend 3 to 4 months after the expiration of the previous agreement.<sup>26</sup> It is precisely during these periods—that is, when an agreement has expired and no new CBA has been negotiated—that automatic extensions matter for negotiations. In terms of the Cramton and Tracy (1992), extensions would allow unions to hold out as negotiations are carried out under the protection of the expired CBA.

Second, these statistics reveal that firm-level CBAs only apply in a limited subset of establishments that nonetheless account for a disproportionately large share of workers. That is, about 13% of the workforce in the private sector is covered by firm-level CBAs that apply to roughly 18 thousand establishments.<sup>27</sup> In the case of sectoral CBAs, despite being fewer in number, their role as industry-wide floor setters implies broader coverage. However, due to aforementioned data limitations, the reported coverage of over 90% overstates official statistics of 65%.<sup>28</sup> As such, the interesting variation in CBA coverage across establishments in these data comes from collective bargaining at the firm-level.

### Clauses in firm-level CBAs

What type of amenities are secured by unions that negotiate at the firm-level? Table 3 shows the proportion of extended firm-level CBAs that contain at least one clause belonging to a

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<sup>26</sup>To calculate negotiation length I use the difference between the start and filing date of a given CBA. This avoids relying on a panel and introduces little error since expiration and start dates of sequential CBAs tend to coincide (see Appendix Figure A5).

<sup>27</sup>There are local labor markets with more than 50% of the workforce covered by a firm-level CBA that was active during the reform (see Appendix Figure A6).

<sup>28</sup>While a more complete study at sectoral CBAs would be welcome, a more accurate mapping of establishments to employer associations is needed to carry out a meaningful analysis. Nonetheless, robustness checks are implemented to ensure that estimated results are not driven by changes in sectoral bargaining.

corresponding clause type. Clause types are the most general grouping of clauses according to the predetermined lists provided in *Sistema Mediador*. Below each clause type are examples of the amenities encompassed by said group.

**[INSERT TABLE 3]**

Workday provisions constitute the most widespread clause type. Among the possible amenities resulting from such clauses are rest periods between shifts, shorter uninterrupted shifts, and leniency with respect to absences. Another common clause type is that concerning collective bargaining. These clauses can provide amenities that ensure compliance with the CBA, e.g., fines for violating the agreement and mechanisms for conflict resolution such as internal arbitration. Although rare, clauses automatically extending CBAs prior to the revision of *Súmula 277* would fall under this group.

Clauses on wages and wage supplements—while often having a direct impact on the RAIS variable for wage—can also contain valuable amenities. Some examples include restricting the extent to which employers can make wage deduction, setting rules on when and how workers receive pay, and establishing profit sharing agreements. Whether one is a union member or not, positive externalities from clauses on union relations can also be considered amenities. For example, access to company information and the workplace could allow unions to better represent worker interests during negotiations.

Clauses on employment and labor relations provide substantive amenities that protect workers' jobs. Some employment clauses include restrictions on part-time contract and outsourcing. These clauses also reduce probationary periods upon hiring and expand advance notice upon firing. The labor relation clauses provide employment protections directly, e.g., employment guarantees to returning mothers, workers close to retirement, and employees on leave. Restrictions on performing other work functions and rules on sexual harassment are also part of this clause type.

Occupational health and safety concerns are in the purview of CBAs. Public goods at the workplace such as air conditioning, sun protection, and safety equipment are included in this clause type. The clauses also stipulate rules concerning the internal commission for the prevention of accidents (CIPA), which acts as an employee-led safety commission. Finally, holidays and leaves are also augmented by CBAs. Amenities such as vacations and paid leave are included in this clause type.

In short, firm-level CBAs cover a substantial portion of private sector workers. Through these agreements unions secure a variety of amenities for the workers they represent. Put into broad categories, these amenities include 1) wage supplements, e.g., food allowances,

payment schedules, profit sharing; 2) nonwage benefits, e.g., employment protections, paid leave, breaks, advance notice; and 3) workplace public goods, e.g., safety equipment, access to company information, conflict resolution mechanism. Having summarized these data, I now proceed to discuss identification and the empirical strategy.

### 3 Empirical Strategy

This section makes the case for identifying the effects of automatic extensions with a matched difference-in-differences (DID) design. In particular, it explains how I address selection issues in building a suitable counterfactual. The section also presents the main specification I use for studying the impact of automatic extensions on establishment-level outcomes.

#### 3.1 Finding a counterfactual

The identifying assumption in DID posits that the evolution of outcomes in the control group after an intervention represent the expected change to outcomes in the treated group had the intervention not taken place. This requires choosing treatment and control units that are expected to behave similarly in the absence of automatic extensions. Moreover, only the treated units should change their behavior in response to automatic extensions. With these considerations in mind, I discuss the treated and control units used in the main analysis.

Treated establishments are those with an extended CBA, i.e., an agreement that was filed prior but expired after the revision to *Súmula 277*. As such, unions in these establishments could hold out in their first round of negotiations following the introduction of automatic extensions. This means that effects on the treated reveal how agents react to an increase in the relative duration (or stickiness) of amenities to wages conditional on having current negotiated gains guaranteed. While not having an initial holdout option is also interesting from a policy perspective, this paper is interested in the sudden extension of active CBAs, not just those that are negotiated in the future.

Control establishments are those not involved in firm-level collective bargaining. Hence, these establishments are not affected by automatic extensions in the sense that firm-specific pay setting and amenity provision are independent from such collective bargaining. Clearly, there are two potential issues related to this control group’s validity as a counterfactual.

The first potential issue with the control group is that differences in sectoral CBA coverage could introduce biases since these agreements were also extended. I therefore focus on control establishments that are in micro-region×industry cells present in the treated group.<sup>29</sup> This

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<sup>29</sup>A micro-region (*microrregião*) is a legally defined geographic entity roughly equivalent to a county. It

ensures similar sectoral coverage for both treated and control establishments. Moreover, to assuage concerns about the role of sectoral agreements, robustness checks verify that the estimated effects are similar even among establishments without an extended (or treated) sectoral CBA, i.e., filed before but expiring after the policy change. In other words, this last exercise is restricted to category-geography cells similar to  $B$  in Figure 1.

The second potential issue with the control group is that there is selection into engaging in firm-level collective bargaining. Initial evidence of selection was presented in Table 2 which showed that establishments covered by firm-level CBAs are larger than average. Unfortunately, reweighting establishments as in Yagan (2015) to ensure that the distribution of control units match the treated in terms of micro-region  $\times$  industry  $\times$  size cells is too restrictive. The lack of common support across cells drops most of the treated sample. Consequently, other forms of adjustments are required to address selection concerns in creating a suitable counterfactual (see Jäger and Heining (2019); Goldschmidt and Schmieder (2017); Jaravel et al. (2018) for recent papers implementing a matched DID design). The following section explains how I adjust covariate imbalances between treated and control establishments.

### 3.2 Addressing selection

Selection into firm-level collective bargaining is addressed by creating a balanced sample that adjusts covariate imbalances between treated and control establishments. Following Imbens (2015), I carry out this adjustment by trimming the set of potential control establishments based on a selection model and a matching algorithm.

The objective is to select among more than 115 thousand potential control establishments those that are structurally similar to the approximately 16 thousand treated.<sup>30</sup> Given some selection model, the trimming procedure involves the following steps. First, treated establishments are sorted by their log-odds ratio in descending order. Second, starting with the treated establishment with the highest odds of being treated, the control establishment with the minimum absolute distance in log-odds is matched. These two steps are then repeated without replacement until every treated establishment has an assigned match.

#### [INSERT TABLE 4]

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closely parallels the notion of local economies by grouping economically integrated and contiguous municipalities with similar geographic and productive characteristics. Industry is measured by 3-digit aggregated code for an establishment’s main economic activity (CNAE 2.0).

<sup>30</sup>As detailed in Appendix D, these are all private sector establishments in the largest connected set based on 2007-2016 worker mobility that are operating from January 2009 to September 2012 and have more than 10 employees throughout December 2009, 2010, and 2011 (the pre-reform period).

I now discuss the selection models considered for trimming the sample. The selection models take the following general form

$$Extended_i = MicroRegion_i + Industry_i + SizeDecile_i + GrowthRateY_i' \gamma + u_i \quad (1)$$

where the logistic regression for having an extended CBA is run on the pooled sample of treated and control establishments. Micro-region and industry dummies are defined as before (see footnote 29). Size deciles are determined by the industry-specific size distribution among the treated. In some selection models, growth rates in outcome variables prior to automatic extensions are considered.<sup>31</sup> Specifically, column (1) in Table 4 includes no growth rates, column (2) includes the growth rates in mean worker effects and in/outflow rates, column (3) includes all growth rates, and columns (4) and (5) select among all possible covariates using lasso and elastic net, respectively. Panel B in Table 4 shows key statistics and parameters of each model.<sup>32,33</sup>

Panel A in Table 4 shows significant improvements in covariate imbalances—as measured by standardized differences—for the five selection models. Standardized differences assess overlap in the distribution of covariates between treated and control establishments.<sup>34</sup> Large values indicate that the average covariate values in the two groups are substantially different. Although there is no convention on what values of standardized differences are too large, a rule-of-thumb is to worry about covariate imbalance if they exceed 0.5. Hence, this procedure generates a sample of non-negotiating establishments that are arguably similar to those engaged in firm-level collective bargaining.

Given a DID approach, the use of pre-treatment growth rates in outcomes for matching—as in columns (2) to (5)—can be problematic. Matching on outcome trends is successful if, conditional on covariates and pre-policy outcomes, differences in potential outcomes are independent of treatment assignment. As explained in Lindner and McConnell (2018), bias may persist despite common trends when the standard deviation of the error term is high. This is because short-term fluctuations in outcomes become more likely and matching cannot

<sup>31</sup>The growth rates under consideration include establishment-specific average monthly employment, December employment, mean hourly wages, standard deviation of hourly wages, 90/10 log ratio of wages, mean worker effects, proportion of workforce with completed high school, inflow rates, outflow rates, hire rates, layoff rates, probation rates, homologation rates, and quit rates.

<sup>32</sup>Lasso and elastic net regressions are first estimated to improve the prediction accuracy and interpretability of the selection model. The selected covariates are then used in the logistic regression.

<sup>33</sup>Although the elastic net chooses  $\alpha = 1$ , so that only L1 regularization is used (as in lasso), the penalty parameter  $\lambda$  differs from that in column (4) because column (5) selects the largest  $\lambda$  within a standard error of the one that minimizes cross-validation MSE.

<sup>34</sup>These are differences in average covariate values by treatment status, scaled by a measure of the standard deviation of the covariates. Hence, the standardized difference of  $X$  is denoted as  $\Delta_X = \frac{\mu_{X,t} - \mu_{X,c}}{\sqrt{(\sigma_{X,t}^2 - \sigma_{X,c}^2)/2}}$ .

distinguish these fluctuations from the structural trends that falsify a valid counterfactual.<sup>35</sup>

Three additional exercises are critical in lending credence to the validity of the matched control group as a counterfactual. First, it is important to visually inspect raw trends in outcomes around the reform and ensure no unusual changes in the trends of the matched control group that are not present in the pre-matched set. Second, it is critical to show that results are not sensitive to the specific selection model. Panel C in Table 4 already hints at the former since the log-odds across models are highly correlated despite stark differences in degrees of freedom. Third, common trends along multiple outcomes hint at the structural similarity needed for a counterfactual since it is unlikely that short-term fluctuations across different dimensions coincide with those of the treated establishments. I provide evidence on all three fronts in the empirical portion of the paper.

### 3.3 Main specification (DID)

To capture the effects of automatic extensions, this paper compares outcomes across time for two groups of establishments where only one group experienced a CBA extension. The baseline DID specification used to capture the effects of the reform is

$$y_{i,t} = \alpha_i + \delta_t + \sum_{j \in \mathcal{J}} \beta_j (Extended_i \times \delta_j) + \gamma X_{m(i),t} + \varepsilon_{i,t} \quad (2)$$

where  $y_{i,t}$  is an outcome variable measured at the establishment level (e.g., mean log hourly wage),  $Extended_i$  is an indicator for an establishment with an extended CBA,  $\delta_t$  are period fixed effects denoted by  $\mathcal{J} \in [09/10, 15/16]$ ,  $\alpha_i$  are establishment fixed effects,  $X_{m(i),t}$  include micro-region and industry fixed effects interacted with period dummies, and  $\varepsilon_{i,t}$  is an error term. I allow for cross-establishment correlations in outcomes within firms by clustering standard errors at the firm-level. I omit the period prior to the reform so that  $\beta_j$  measures the difference in outcome variable  $y_{i,t}$  between establishments with extended CBAs and counterfactual establishments relative to the difference that occurred in period 11/12. Regressions are weighted by the average establishment size in the three periods prior to the reform to interpret them as how workers in the sample are affected by automatic extension.<sup>36</sup>

The estimates of  $\beta_j$  for  $j \in [12/13, 15/16]$  capture causal effects depending on whether the identifying assumption holds. Inference on  $\hat{\beta}_{09/10}$  and  $\hat{\beta}_{10/11}$  provides direct falsification tests for common trends. However, complementary tests are needed given the limited falsifiability

<sup>35</sup>Levels of the outcome variables are not used in the selection models since this introduces mean-reversion as another source of potential bias.

<sup>36</sup>As noted in Solon et al. (2015), there are cases where using weights reduces the efficiency of the estimates. Results are similar in unweighted regressions.

of the common trends test under the implemented matching procedure (mentioned in the previous section). Moreover, even if all tests do not reject the identifying assumption, any shock that occurs contemporaneously with automatic extensions could still bias the results. By including micro-region and industry time-varying fixed effects in the regression, shocks that are either geography- or industry-specific do not bias the estimates.<sup>37</sup>

In summary, a DID approach with selection adjustments provides an empirical strategy that can identify the impact of automatic extensions. The main text focuses on the elastic net selection model given that covariate choice relies on a data-driven approach—robustness checks to other selection models are provided in the Appendix.<sup>38</sup> I now analyze the impact of automatic extensions on wages and pay premiums, illustrating the shortcomings of ignoring amenities as a crucial component of firm compensation.

## 4 Effects on Wages

This section presents the effects of automatic extensions on wages. I show that gains in mean wages among establishments with extended CBAs are lower than in comparable workplaces after the reform. Importantly, roughly half of this decrease is attributed to establishment-specific pay premiums, indicating that negative wage effects are not driven by compositional changes in the employed workforce. Thus, if amenities are ignored, one would conclude that automatic extensions reduce compensation.

### 4.1 Wages fall

The introduction of automatic extensions negatively affected wages in establishments with extended CBAs. Initial evidence of this is the 1.6% relative decrease in mean wages at the establishment level shown in Figure 3a. Similarly, Figure 3b reveals comparable effects on median wages. In both cases, common trends support the identifying assumption for the DID empirical strategy. However, as discussed in Section 3.2, additional evidence is required to assuage concerns about the matched control group as a valid counterfactual.

Three types of evidence support valid inference under the adjustments accounting for selection. First, Appendix Figure A7 shows no unusual behavior in the raw wage trends of the full set of potential control establishments relative to the matched set of controls. Sec-

<sup>37</sup>Results are similar when using micro-region×industry time-varying fixed effects in the regression.

<sup>38</sup>The growth rates dropped by elastic net are: average monthly employment (first period), December employment (second period), 90/10 log ratio of wages (second period), inflow rates, outflow rate (first period), layoff rates, probation rates (first period), and homologation rates.

ond, while Appendix Figure A8 shows the need for covariate adjustment, the negative wage effects are dampened as pre-intervention trends become more similar. This suggests that the trimming procedure is not simply capturing idiosyncratic short-term fluctuations that revert after the introduction of automatic extensions (Lindner and McConnell, 2018).<sup>39</sup> Third, throughout the paper there is evidence of common trends on multiple outcome variables (see Figure 3, Figure 6, and Figure 7), indicating similar fundamentals across establishments with extended CBAs and their matched counterfactuals.

### [INSERT FIGURE 3]

The negative wage effects are not explained by insider-outsider models. In these models only a specific subset of workers benefit from collective bargaining (Lindbeck and Snower, 1988). But Figures 3c and 3d provide evidence that mean wages fall across groups of workers that are likely insiders. Figure 3c considers workers in core occupations, i.e., employees with the modal occupation code for the establishment. The mean wage for these workers falls by 1.7%, similar to the effects observed on all workers. Figure 3d focuses on non-specialized groups of workers, based on the hierarchy in occupation codes. This “rank-and-file” constitute the lowest hierarchy, i.e., below professionals/technicians and management. Results again show mean wages fall by 1.6% for this group of potential insiders.

Falling mean wages are also not entirely driven by a changing composition of workers. Figure 3e consider the wages of incumbents, i.e., workers hired prior to the introduction of automatic extensions. Although dampened relative to the effects on the entire workforce, mean wages for incumbents still fall by 0.8% (half of the overall effect). While the composition of incumbents cannot be changed due to hires, layoffs could still be driving these negative wage effects. Nonetheless, comparing changes to the wage growth of stayers also reveals negative effects for workers in treated establishments (see Appendix Figure A10).

Figure 3f looks at how the pay premiums of affected establishments change after automatic extensions. Time variation in these premiums is allowed by estimating two 5-year AKM models of the form

$$w_{it} = \theta_i + \psi_{J(i,t)} + X'_{it}\beta + r_{it} \quad (3)$$

for 2007-2011 and 2012-2016, omitting the same reference establishment (see Appendix D for more details). These models provide a parametric way to estimate establishment-specific wage premiums  $\hat{\psi}_{J(i,t)}$  paid to all workers regardless of the skill component  $\hat{\theta}_i$  that workers carry with them across establishments. Since Card et al. (2013), the use of AKM models in labor economics has become widespread. Gerard et al. (2018) provide supporting evidence

<sup>39</sup>Appendix Table B2 shows largely consistent point estimates for wage outcomes across selection models.

for the identifying assumptions of this specification in the case of Brazil. Similar to the results on incumbents, establishment-specific pay premiums fall by 0.9%. This last result carries important implications for the role of collective bargaining in pay setting policies, which I discuss after addressing the robustness of these results.

## 4.2 Robustness checks

The negative wage effects are robust to numerous challenges to the identification strategy. Table 5 summarizes these robustness checks. Column (1) shows that using time-varying fixed effects of micro-region $\times$ industry cells—rather the separate time-varying fixed effects for each component—produce similar results. This is akin to allowing each cell in Figure 1 to have its own time effect and rules out the possibility that cell-specific shocks explain falling wages. Similarly, column (2) reveals that focusing on a balanced panel of establishments does not change the effects. Hence, differential survival post-intervention is not driving these results.<sup>40</sup>

### [INSERT TABLE 5]

Table 5 also provides supporting evidence that the results are not explained by alternate stories. First, column (3) shows that the negative wage effects are present even among establishments not covered by an extended sectoral CBA. Hence, changes in sector-level negotiations, which were also affected by the policy change, are unlikely to be driving the wage results. Second, column (4) reveals that falling wages are also observed among establishments negotiating with the strongest unions.<sup>41</sup> Therefore, even in places where workers are highly engaged in union activities, wages fall among the treated.<sup>42</sup> This suggests that these effects are not explained by unions “resting on their laurels” after CBAs are extended.

Third, column (5) focuses on low informality categories, i.e., metalwork, paper, chemical-pharmaceutical, and air transportation. The negative wage effects even among these categories indicate that changes in informal employment after automatic extensions are unlikely to drive the negative wage effects. Finally, column (6) addresses the fact that Brazil entered a recession in 2014 by focusing on industries with improved business expectations at the time of the policy change. The results show that, among industries that did not anticipate the recession—as proxied by improved business expectations—there is still a negative wage effect. Thus, it is unlikely that wages fall because some industries foresaw the recession and therefore decided to cut back on wages ahead of time.

<sup>40</sup>Appendix Figure A9 shows no significant differential survival among treated and control establishments.

<sup>41</sup>The strongest unions are those in the top quartile of union density (based on micro-region $\times$ category cells) among unique establishments in the matched sample.

<sup>42</sup>Interestingly, household survey data show that worker categories with high union density have lower informality rates (see Appendix Figure A11)—an important factor considered more directly in column (5).

Why does a reform that is considered pro-union cause lower wage growth? In particular, falling wage premiums indicate that collective bargaining under automatic extensions has allowed employers to set lower pay, which may seem counterintuitive at first glance. Clearly, if one takes wages as the only margin through which collective bargaining affects firm compensation, automatic extensions made workers at these establishments worse off. The remainder of the paper takes the more inclusive view that amenities are also a part of compensation and that unions can pressure firms to provide amenities that workers value. Such a stance is critical in the Brazilian setting since automatic extensions effectively increased the relative duration (or stickiness) of amenities to wages.

## 5 Wages and Amenities in a Collective Bargaining Model

This section formalizes the introduction of amenities as a central component of firm compensation influenced by collective bargaining. I propose a simple model with separate but simultaneous bargaining over wages and amenities. The model’s solution illustrates the underlying forces determining how unions trade off wages and amenities when the duration (or stickiness) of either of these compensation components changes. According to the model, wages are traded away for higher amenities when 1) amenities become stickier than wages; and 2) unions are strong. I then map key features of the model to the Brazilian setting to argue that automatic extensions cause lower wage growth at establishments with extended CBAs because unions are focusing more on amenity improvements.

### 5.1 Overview of the model

Let the time-separable function with discounting  $U(\{w_t\}, \{a_t\})$  represent lifetime utility of workers represented by some union. In each period  $t$ , Nash bargaining over wages and amenities occurs, resulting in  $w_t^*$  and  $a_t^*$  respectively. Negotiations over each component are simultaneous but separate, such that the only choice variable  $e_t$  denotes the union’s decision on how much to focus on one form of compensation relative to the other. Dynamics are introduced by having the union’s fallback position (or inside option) during current negotiations depend on previously negotiated wages and amenities. Hence, accounting for dependency on endogenous variables, the bargaining solutions are  $w_t^*(e_t, w_{t-1})$  and  $a_t^*(e_t, a_{t-1})$ .

The bargaining protocol is as follows. Each period there is some an exogenous surplus  $S_t > 0$  that unions and employers bargain over.<sup>43</sup> The union commits to assigning a portion

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<sup>43</sup>While exogenous surplus is a gross simplification (Grout, 1984; Manning, 1987; Jäger et al., 2019), the model’s objective is to uncover the forces driving trade-offs over wages and amenities. Barring differential effects of wages and amenities on surplus, this simplification does not hinder the model’s objective.

of this surplus to wage bargaining  $e_t S_t$  and the remainder to amenity bargaining  $(1 - e_t) S_t$  for  $e_t \in [0, 1]$ . Outcomes are determined by the standard Nash bargaining solution where the union's relative bargaining power in both games  $\gamma \in [0, 1]$  is exogenous. That is, for each component of firm compensation, the solution maximizes the product of two factors (one corresponding to unions and the other to employers) containing the gains if negotiations succeed minus the fallback position if negotiations break down, with each factor raised by the agent's relative bargaining power.<sup>44</sup>

If negotiations succeed,  $w_t^*$  and  $a_t^*$  are valid for the current time period but only  $(1 - \iota)w_t^*$  and  $(1 - \delta)a_t^*$  remain in the next period. Hence,  $\iota \in [0, 1]$  and  $\delta \in [0, 1]$  are component-specific stickiness parameters determining the duration of wages and amenities into next period, i.e., the lower the parameter the longer-lasting (or stickier) the form of compensation. Moreover, given an agreement, there is an exogenous probability  $p \in [0, 1]$  that bargaining occurs next period, in which case current negotiations affect future ones through the fallback positions. In the  $(1 - p)$  probability scenario that bargaining does not occur next period, these fallback positions automatically become the compensation received. Hence, a higher  $p$  makes it more likely that the union can leverage a favorable fallback position.

If negotiations break down, that period's fallback position becomes the compensation for the current time period. In addition, once the fallback position is exercised, bargaining is not possible in subsequent periods so that future compensations in wages and amenities diminish by  $(1 - \iota)$  and  $(1 - \delta)$ , respectively, each period. During negotiations, however, the probability that the fallback position is exercised is given by the exogenous parameter  $\sigma \in [0, 1]$ . For interpretation, I denote  $\sigma$  as the probability of a strike since such an event would trigger the fallback position. Therefore, a higher  $\sigma$  implies that the union is more likely to strike and can consequently exploit the fallback position to its full extent.

Finally, agents are forward-looking and therefore incorporate future benefits from current outcomes as part of the gains considered during collective bargaining. Specifically, the gains from successful negotiations in the Nash bargaining problem are present discounted and account for the probability  $p$  that bargaining continues. Importantly, differences in discounting between unions  $\beta \in [0, 1]$  and employers  $\phi \in [0, 1]$  introduce a crucial feature to the model. That is, the more patient agent is more inclined to favor forms of compensation that last longer (or are stickier).<sup>45</sup> Drawing from the close relation between present discounting and bargaining strength (Rubinstein, 1982), another interpretation is that the stronger agent can successfully secure forms of compensation that are longer-lasting.

<sup>44</sup>The constraints on this maximization problem are that negotiated gains are never lower than the fallback position for either agent.

<sup>45</sup>An equivalent formulation focusing on risk aversion and uncertainty (Binmore et al., 1986), rather than present discounting and time preferences, is likely feasible.

## 5.2 A bang-bang solution in the two-period model

Consider a two-period model. In addition to time separability and discounting  $\beta$  of the lifetime utility function  $U(\{w_t\}, \{a_t\})$ , assume additive separability of each period’s utility, i.e.,  $u(w_t, a_t) = u(w_t) + u(a_t)$ . Hence, the union’s constrained maximization problem is

$$\max_{e_t} \sum_{j=1}^2 \beta^{j-1} [u(w_j^*(e_t, w_{t-1})) + u(a_j^*(e_t, a_{t-1}))] \quad \text{s.t.} \quad e_t \in [0, 1] \quad (4)$$

That is, the union allocates surplus to wage- and amenity-specific negotiations in each period in order to maximize the discounted payoff it obtains from the bargaining outcome of each compensation component.<sup>46</sup> Hence, the optimal allocations  $\{e_1^*, e_2^*\}$  can be obtained through backward induction once the functional form for  $u(\cdot)$  is set (see Appendix F).

[INSERT TABLE 6]

The solution to the simplest version of the model neatly exposes the mechanisms through which automatic extensions influence the trade-offs unions make between wages and amenities. Specifically, Table 6 characterizes the bang-bang solution of the two-period model described above where  $u(\cdot)$  is an identity function.<sup>47</sup> The two-by-two table shows that unions choose to focus on wages or amenities depending on which compensation component is longer-lasting (or stickier) and whether the union is “stronger” than the employer counterpart. While the mapping of parameters to union strength are discussed in the next section, the intuition is that unions focus on the stickiest form of compensation when they can overcome employer push-back against making long-lasting concessions to workers.

It is important to note that the aforementioned trade-off is not the same the hedonic balancing in a compensating differentials story. In the latter, a worker whose marginal revenue product has not changed can get higher wages only in exchange for an equally valued decrease in amenities. As such, the theory of equalizing differences (Rosen, 1986) implies a one-to-one exchange between wages and amenities. Collective bargaining over wages and amenities takes the existence of this trade-off seriously without imposing a one-to-one exchange. That is, a worker whose marginal revenue product has not changed can get

<sup>46</sup>The choice variable  $e$  can also be thought of as the union’s wage-bargaining effort where total effort is fixed. An alternative model where the choice variables are wage- and amenity-specific effort ( $e_w > 0, e_a > 0$ ) and the union’s objective includes a convex cost function on  $e_w$  and  $e_a$  would avoid the simple bang-bang solution resulting from the linearity assumptions above.

<sup>47</sup>Refer to Appendix F for the derivation of the threshold condition pinning down this characterization. Simulations assuming log utility reveal a smoother trade-off between wages and amenities, but the intuition remains the same (see Appendix Figure A12).

higher wages because the union pushes for a change in the composition of firm compensation. While this may imply giving up some amenities, the gains need not match the losses.

### 5.3 Relating the model to the empirical setting

Automatic extensions in Brazil implied that negotiated amenities suddenly became longer-lasting (or stickier) than wages. That is, prior to the introduction of automatic extensions there was a full phase-out of negotiated amenities ( $\delta = 1$ ) while the irreducibility of nominal wages meant that  $\iota$  was roughly equal to inflation. After the 2012 revision to *Súmula 277*, the value of  $\delta$  was approximately zero since amenity phase-out was removed, while  $\iota$  remained relatively constant given stable inflation (between 5 and 9%). In terms of Table 6, automatic extensions implied a shift from the bottom to the top row. Hence, the policy’s impact on bargaining outcomes depends on union strength.

Given stickier amenities, the model predicts that wages are traded away for amenities when union are ‘stronger’ than the employer counterpart. The strength condition favoring unions is captured by the inequality  $\beta\sigma > \phi(1 - p(1 - \sigma))$ , which is more likely to be satisfied as  $\uparrow \beta$ ,  $\downarrow \phi$ ,  $\uparrow p$ , and  $\uparrow \sigma$ .<sup>48</sup> That is, unions are more likely to overcome employer push-back and secure longer-lasting forms of compensation when they are patient, committed to bargaining, and willing to strike—each of these intuitive characteristics of union strength.<sup>49</sup> Moreover, the initial ability to hold out due to automatic extensions can itself be interpreted as boost in the union’s bargaining power since prolonged negotiations become less taxing. This could be captured in the model as an increase in  $\gamma$  which has no effect on the trade-off between wages and amenities, but implies a larger surplus share for workers.

The testable prediction in light of this model and previous results on wages is that the value of negotiated amenities should increase among strong unions. In the Brazilian setting, strength can be proxied with union density because universal coverage implies that high union membership reflects support for the union among workers. With worker support, the union is likely to overcome push-back from employers. Similarly, increased worker involvement permits more commitment to collective actions such as holding out longer under an expired agreement, pressuring for a CBA renewal, and organizing strikes.

In summary, the simple model presented in this section provides an intuitive solution that captures the forces influencing how unions trade off wages and amenities after the

<sup>48</sup>Formally, unions are more likely to be “stronger” than employers when 1)  $\uparrow \beta$  if  $\sigma > 0$ ; 2)  $\downarrow \phi$  if  $p < 1$  or  $\sigma < 0$ ; 3)  $\uparrow p$  if  $\phi > 0$  and  $\sigma < 1$ ; and 4)  $\uparrow \sigma$  if  $\beta > p\phi$ .

<sup>49</sup>While these parameters are considered as exogenous, Appendix Figures A13, A14, and A15 reveal that strikes increased and negotiations were protracted without affecting renewal rates after the reform.

introduction of automatic extensions. The following section tests the model’s predictions, i.e., whether negotiated amenities improve for affected bargaining units with strong unions.

## 6 Effects on Amenities

This section tests whether amenities improved after automatic extensions, especially in bargaining units with stronger unions. Two challenges are addressed: measuring the value of negotiated amenities and identifying the effects of the legal reform on this variable. The section ends with empirical evidence that supports the model’s predictions.

### 6.1 Measuring the value of negotiated amenities

#### Firm value and amenity value

How much do workers value being employed at a specific firm? How much do workers value a specific amenity? Attempts to answer these two critical questions in labor economics have often relied on revealed preference assumptions.

The question about the value of a firm to workers is a daunting one, partly because amenities are rarely observed. More generally, given unobserved utility from a job, economists have used worker flows to infer workers’ preferences over firms. Proxies for the value of a firm include outflow-based measures such as quit rates (Krueger and Summers, 1988), inflow-based measures such as the Poaching Index (Bagger and Lentz, 2018), and general flow-based measures akin to Google’s PageRank algorithm (Sorkin, 2018). While observed features that influence worker flows can be accounted for—e.g., wages, industry, and location—unobserved features such as amenities become part of the unexplained error.

Creating a value measure for a comprehensive set of amenities would help further explain the value that workers assign to firms that have (or lack) said amenities. When variation in amenities is observed—whether in survey data (Hamermesh, 1999; Pierce, 2001; Maestas et al., 2018) or experimental studies (Flory et al., 2014; Wiswall and Zafar, 2017; Mas and Pallais, 2017)—economists have relied again on actual or reported worker flows, conditional on wages, to estimate their value. A similar exercise at a larger scale can be done when variation on a comprehensive set of amenities is observed across firms along with corresponding worker flows. That is, revealed preference would imply that the unexplained portion of firm value is attributed to differences in amenities.

Using changes in CBAs over time to capture differences in establishment-specific amenities, as well as worker flows from linked employer-employee data to estimate firm value, I construct a wage-equivalent measure of how much workers value amenities negotiated by

unions. Specifically, the approach builds a predictive model for the Poaching Index—i.e., the proportion of hires coming from employment—that accounts for wages (from RAIS) and negotiated amenities (extracted from the CBAs in *Sistema Mediador*), among other independent variables.<sup>50</sup> Building a “predictive model” refers to the fact that several regression models are tested and cross-validated to choose the one that best predicts the value of the firm, as given by the Poaching Index. In the end, the resulting model is the usual hedonic regression where the wage-equivalent value of an amenity is the coefficient of that amenity scaled by the coefficient on wages.

I use the Poaching Index as the measure of firm value in my approach for three key reasons. First, a time-varying measure is needed to exploit changes in negotiated amenities. In the case of Sorkin (2018), the structural model assumes time-invariant pay and amenity components. Second, the fact that changes in wages are observed among poached workers enables conditioning on wages, which is needed to construct a wage-equivalent value measure of amenities. In the case of outflow measures, such as quit rates, a change in the wage is not always observable. Third, as shown in Section 7.1, worker inflows rather than outflows is the relevant margin that responds to automatic extensions.

## Predicting the Poaching Index

The objective is to find amenities in textual elements of CBAs that motivate workers to transition to a particular establishment after controlling for wages. The predictive model for the Poaching Index (PI) is in first-differences to net out unobserved time-invariant components differing across establishments that affect poaching.<sup>51</sup> Written as a linear regression model, the prediction exercise is represented by

$$\Delta PI_i = \beta^w \Delta \bar{w}_i + \sum_{g \in \mathcal{G}} \beta^g \Delta clause_{c(i)}^g + \sum_{k \in \mathcal{K}} \beta^k \Delta topic_{c(i)}^k + \sum_{\tau \in \mathcal{T}} \beta^\tau \Delta token_{c(i)}^\tau + X_i' \gamma + \varepsilon_i \quad (5)$$

where  $i$  refers to an establishment and  $c(i)$  indicates the CBA covering workers in  $i$ . Among the independent variables,  $\bar{w}$  is the average wage change for workers poached by the establishment,  $clause^g$  refers to the count of clause group  $g$  in the CBA,  $topic^k$  denotes the proportion of the CBA assigned to topic  $k$ , and  $token^\tau$  represents a count of the individual token (or root word)  $\tau$  in the CBA. The additional independent variables contained in  $X_i$

<sup>50</sup>While Bagger and Lentz (2018) use a 10-year observation window to record hires, this paper relies on two 1-year windows to get a time-varying measure that is influenced by changing CBA coverage. Given that establishments covered by these firm-level CBAs are larger than average (see Section 2.2), noise in the Poaching Index is not a major concern.

<sup>51</sup>First differences in the Poaching Index are residualized using micro-region and category dummies before training the different regression models.

provide improvements to prediction.<sup>52</sup>

The coefficients of the clause groups are of particular interest since they capture how a specific amenity affects poaching. These groups are based on the predetermined list of broad and specific clause groups provided in *Sistema Mediador* which negotiating parties must select before writing each clause. In order to address potential errors in clause classification, I include topic proportions and tokens to the predictive model. Topic proportions are estimated through a Latent Dirichlet Allocation topic model based on tokens from clause titles (Blei et al., 2003). Tokens are individual words present in each CBA after processing, i.e., removing punctuation, stop-words, capitalization, stemming, etc.

Different predictive models are trained and tested using 2010-2011 changes in PI for establishments with a relevant CBA from the 09/10 filing period, i.e., prior to automatic extensions. A relevant CBA means that the agreement’s clauses are active for at least three months during the time between employment transitions.<sup>53</sup> Out of the establishments considered, two changes to the negotiated amenities can occur. First, a new CBA is negotiated in the 10/11 period providing a different set of amenities. Second, the original agreement’s duration makes it a relevant CBA for 2011 as well so that no changes in negotiated amenities takes place. Cases where there is no relevant CBA for 10/11 are ignored.

After training numerous models, the best out-of-sample performance was given by the elastic net estimated on all covariates in Equation 5. Specifically, a 90% random sample was used to train linear regression, elastic net, and random forest models. Cross-validation was used in the training set in order to select the parameters that minimized root mean squared error (RMSE). Given the high dimensionality of the covariate matrix, the linear regression model was heavily over-fitting. Regularization through elastic net provided sizable improvements. Using the reduced set of covariates, the random forest model was trained. Once the models were estimated within the training set, the RMSE on the out-of-sample validation set was used to gauge performance. In the end, the elastic net model performed best with an RMSE of 0.199 within sample and 0.210 out-of-sample. The random forest obtained an RMSE of 0.085 within sample but this rose to 0.212 out-of-sample.<sup>54</sup>

Three important caveats to this approach of measuring amenity value are warranted. First, the underlying revealed preference assumption requires that job-to-job transitions are

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<sup>52</sup>The covariates in  $X_i$  include the change in proportion of workers poached from the establishment (relative to outflows) and the change in their wages, as well as the initial levels of the poaching index and the poached index along with the changing worker effects of these worker flows.

<sup>53</sup>Since changes to PI (and average wages) are determined by December-to-December transitions, a relevant CBA is defined as starting before and expiring after September 26th of a given year. Given that the CBAs considered last at least 12 months and filing periods start on September 26th, this restriction implies that at least one quarter between Decembers has coverage by the negotiated amenities of the CBA.

<sup>54</sup>Both RMSEs are well below the standard deviation of the target variable (0.273).

voluntary. To the extent that systematic differences across establishments for receiving involuntary job-to-job transitions is constant, this bias in PI is removed by taking first differences. Second, while the amenities codified in CBAs are quite comprehensive, there are other amenities that may also influence worker flows, e.g., friends at work. The use of first differences should net out the influence of these unobserved amenities as long as they are time-invariant. Lastly, the measure of amenity value reflects the preferences of poached workers, which may be different from those of other workers, e.g., hires coming from unemployment. With heterogeneous preferences, some amenities may carry a negative value because clauses favoring one type of worker may be looked upon unfavorably by poached workers.

### The value of negotiated amenities

The value of a specific amenity (in terms of wages) is simply  $\hat{\beta}^g/\hat{\beta}^w$ , i.e., the coefficient of its corresponding clause weighted by that of the mean wage changes among poached workers. Table 7 shows the top-ranked clauses from the elastic net regression with their respective wage-equivalent value to poached workers.

[INSERT TABLE 7]

The most valued clauses reveal interesting facts about amenity preferences among poached workers. At the highest value are employment protections, equivalent to a 4.1% increase in wages. This suggests that employment security is a top concern among job switchers. Interestingly, clauses on the renewal/termination of CBAs are also highly valued. This hints at the fact that workers care about the possible uncertainty that arises at CBA expiration, especially prior to automatic extensions. Furthermore, poached workers value a strong union as signaled by the importance of clauses regarding union relations.

The clauses with negative values indicate the amenities that the typical poached workers views unfavorably, but may nonetheless be valued by other workers. For example, staffing rules and disciplinary norms likely restrict some workers' freedom in the workplace. Similarly, clauses with a stronger impact on the left tail of the wage distribution, such as wage floors and allowances, may seem wasteful from the point of view of a worker climbing up the job ladder. Since these other amenities may in fact be valuable to workers coming from unemployment, Section 6.3 also looks at how the probability of having any specific amenity changes after automatic extensions, regardless of whether its corresponding clause group is chosen by the predictive model for PI.

Having wage-equivalent values of clause groups, topics, and tokens, I construct a measure of how much poached workers value a CBA.<sup>55</sup> This is simply the sum of the content of each

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<sup>55</sup>The most valued tokens are shown in Appendix Table B3. Tokens are harder to interpret than clauses,

CBA weighted by the wage-equivalent value of each feature. Appendix Figure A16 displays the kernel density of amenity value among treated firm-level CBAs prior to the policy change. The density is centered at zero with slightly negative mean (-0.027) and a large variance (0.238). Therefore, while the average CBA is not valued favorably by poached workers, the high variation in the value of CBAs suggests that there is strong heterogeneity in the amenity profiles negotiated by unions.

[INSERT FIGURE 4]

Figure 4a shows that the strongest unions secure the most valuable set of amenities. This is yet another sense check, in addition to Table 7, for the measure of amenity value. Considered along with Figure 4b, these data also support the use of union density as a proxy for strength. This second figure shows that establishments covered by stronger unions pay higher pay premiums to their workers. Hence, the strongest unions secure highly valued amenities as well as excess wages for their workers. While this evidence does not align with a compensating differentials story, further work is needed to determine whether differences in pay premiums are not merely compensated by differences in amenities.<sup>56</sup>

## 6.2 Complementary empirical strategy (DIFD)

A different empirical strategy than that presented in Section 3 is needed for studying amenity outcomes since these are measured from observed CBA changes over time. A direct implication of the latter is that the unit of analysis is no longer an establishment but a bargaining unit, i.e., employer-union counterparts that negotiate a sequence of CBAs. Concerning the empirical strategy, since the matched counterfactuals do not directly engage in collective bargaining, their negotiated amenities are always zero. Hence, identification must come from within the set of bargaining units with extended CBAs.

I implement a difference-in-first-differences (DIFD) approach to identify the impact of automatic extensions on negotiated amenities. That is, I take the first difference in amenity value between consecutive CBAs—i.e., (a) the extended agreement and its renewal and (b) a prior agreement and the extended one—and then estimate the average difference between them.<sup>57</sup> Hence, this approach captures a change in growth rates where (a) includes the

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but positive and negative tokens seem to fit preconceived notions of valence. For example, positive tokens include word-roots for immediacy, accomplishments, activeness, and standardizing. Meanwhile, negative tokens include word-roots for conditions, limits, payroll, and reductions.

<sup>56</sup>More directly, Appendix Figure A17 reveals a near zero correlation between pay premiums and negotiated amenities at the establishment level. However, it is unclear whether one should expect to see compensation in the data in the presence of measurement error.

<sup>57</sup>The sample is therefore restricted to the bargaining units in the panel described in Appendix D that have negotiated the CBAs needed to estimate the two aforementioned first differences.

impact of automatic extensions and (b) nets out the general trajectory of the bargaining unit prior to the policy change. The identification assumption therefore relies on constant growth rates in amenity improvement. By showing declining trends in amenity outcomes for bargaining units without extended CBAs, Appendix Figure A18 suggests that any positive estimate from the DIFD strategy is a lower bound of the causal effect.<sup>58</sup>

The regression specification capturing the DIFD effects is

$$CBA_{i,t} = \beta(Treat_{p(i)} \times Post_{p(t)}) + \gamma(X_i \times Post_{p(t)}) + \eta Treat_{p(i)} + \varepsilon_{i,t} \quad (6)$$

where  $CBA$  is the measure of negotiated amenity value covering workers in bargaining unit  $i$  in period  $t$ . Each bargaining unit has four observations grouped into two pairs indexed by  $p(\cdot)$ , where each pair provides a first differences as in (a) and (b) above. The indicator variable  $Treat_{p(i)}$  denotes the pair of observations that include the extended agreement and its renewal. The dummy  $Post_{p(t)}$  is only active for the second observation within each pair, i.e., the renewal when  $Treat_{p(i)} = 1$  and the extended CBA when  $Treat_{p(i)} = 0$ . To control for time-varying micro-region and category fixed effects within each pair, the regression includes the term  $X_i \times Post_{p(t)}$ . Given this specification,  $\beta$  is the coefficient capturing the difference-in-first-differences.<sup>59</sup> Standard errors are clustered at the bargaining unit level.

To test the predictions from the model in Section 5, the DIFD regression is estimated separately for bargaining units with unions of similar strength. Specifically, this analysis is carried out by quartiles of union density based on the micro-region  $\times$  category cells of each bargaining unit. As explained previously, universal coverage implies that union density is a proxy for union strength since it signals worker support for the union. Evidence in favor of this measure was presented previously in Figure 4.

### 6.3 Improving amenities and firm compensation

The DIFD effects show that automatic extensions cause an improvement in negotiated amenities among bargaining units with stronger unions. To make a valid comparison between the impact of automatic extensions on wages and amenities, and therefore estimates on firm compensation, the same DIFD effect in Equation 6 is estimated using the mean wages of the establishments corresponding to the bargaining units in the sample. The only modification in the wage specification is that it also nets out the DIFD effects from the control establishments that are matched to the treated as per the selection model of Equation 1. This is

<sup>58</sup>Although bargaining units without extended CBAs cannot hold out during the first round of bargaining after the reform, they are not an ideal counterfactual since automatic extensions affect future negotiations.

<sup>59</sup>First differences arise from including  $Post_{p(t)}$  within each pair. Hence,  $\eta$  is an estimate of the first difference of the two agreements filed prior to the introduction of automatic extensions.

possible because, unlike amenities, wages in establishments without CBAs are observed.

[INSERT FIGURE 5]

Automatic extensions cause unions with sufficient strength to trade away wages for amenities, which results in higher compensation at affected establishments on average. Figure 5a shows that only the bargaining units in the top quartiles of union density see an improvement in amenity value. The gain for the fourth quartile is equivalent to a 5% increase in wages, while that of the third quartile is marginally significant at 3%.<sup>60</sup> Compared to the smaller negative effects on mean wages in Figure 5b, the results imply a 1.6-3.8% increase in overall firm compensation.<sup>61</sup> Furthermore, the monotonicity of the amenity effects with respect to union density echo the model’s prediction about relatively weaker unions being unable to achieve further gains under automatic extensions due to employer push-back. Consistent with this interpretation, Figures 5c and 5d demonstrate that amenity effects are driven by changes occurring under automatic extensions.

Delving deeper into these results, Table 8 shows all significant changes in amenities between the extended CBA and its renewal for the top and bottom two quartiles of union strength, highlighting the amenities considered as valued by poached workers. The highlighted amenities among stronger unions show that the clause groups driving the increase in amenity value are those related to employment protections and union relations. Relatively weaker unions see increases in four clause groups with value, but two of these have negative valence. Hence, the amenity profile of these bargaining units is changing after automatic extensions, even though the value to workers remains roughly the same.

[INSERT TABLE 8]

These results indicate that automatic extensions push unions to fight for employment security while also boosting their bargaining capacities. Clearly workers value employment protections since they limit employer’s ability to fire pregnant employees, workers returning from sick leave, and employees approaching retirement, among others. These amenities may be particularly salient in Brazil where turnover is high. In the case of clauses on union relations, their impact on workers is more indirect. The clauses essentially increase union power by granting them access to company data and making spaces available for promoting union activities, among other concessions. To the extent that workers benefit from having

<sup>60</sup>The large standard errors are driven by the noise in the dependent variable of the regression.

<sup>61</sup>Using pay premiums instead of mean wages provides a similar range of positive effects on overall firm compensation, i.e., 1.7-3.1%. Interestingly, despite the different identification strategies used, the wage effects in Figure 5b are similar in magnitude to those in Figure 3a.

a well-informed union that can more easily overcome collective action problems, workers' amenity value improves from these clauses.<sup>62</sup>

Ignoring the measure of amenity value, bargaining units with stronger unions experience overall amenity gains. In addition to employment protections and union relations, Table 8 shows that stronger unions add clauses on pays, allowances, life insurance, and injury-prevention training, among others.<sup>63</sup> While these amenities may not be predictive of poaching, one could easily argue that they are valued by other workers, e.g., those coming from unemployment or informality. Hence, it may well be that the estimated impact on amenities from Figure 5a is a lower bound since unions could be focusing mostly on amenities that are particularly valuable to workers other than those being poached. Finally, corroborating the lack of significant amenity improvements from relatively weaker unions, Table 8 reveals few gains as well as some notable losses from such unions.

The analysis thus far has shown that a pro-union policy can negatively affect wages because there is a positive adjustment through amenity compensation. The fact that this can lead to an overall increase in firm compensation implies that one must be cautious about interpreting negative union effects that ignore amenity provision. The remainder of the paper focuses on how these changes to compensation affect worker flows and the skill composition of the workforce to understand both the employment response to improved compensation and subsequent implications for within-establishment inequality.

## 7 Implications for Workers and Employers

Workers and employers are likely to respond to the changes in firm compensation brought by automatic extensions. This section explores how worker flows and the composition of the workforce within-establishments are affected by the shift in compensation. These results shed light on the extent of imperfect competition for workers in the Brazilian labor market as well as the role of unions in compressing the value of jobs within establishments.

### 7.1 Influx of low-skill workers

Automatic extensions, by changing the structure of compensation, lead to an influx of low-skill workers into affected establishments. Figure 6 summarizes these results. The full set

<sup>62</sup>In fact, institutionalizing communication between the union and employers can have positive effects on investments—an outcome outside the scope of this paper. For example, Jäger et al. (2019) show that granting more control rights to workers raises capital formation.

<sup>63</sup>Increasing pay rates such as overtime need not imply a wage increase since worker hours can be adjusted accordingly by either the employer (to avoid labor costs) or by the worker (to increase leisure).

of results by selection model are in Appendix Tables B4 and B5. For robustness checks analogous to those carried out for wage outcomes in Section 4.2 refer to Appendix Table B6.

[INSERT FIGURE 6]

In terms of worker flows, automatic extensions increase hire rates without affecting quit rates. Figure 6a shows hire rates increasing by 0.027 (or 28% of the treated-control differential). At the same time, there is no significant change to quit rates in Figure 6b. Quit rates are measured for workers with at least 12 months of tenure to capture this behavior among workers settled at their jobs. Separations below one year of tenure are common due to probationary periods varying between 0 to 3 months, eligibility for unemployment insurance at 6 months, and union revision of layoffs after 12 months (Cayres Pinto, 2015). Given the increase in hire rates, it is not surprising that layoff rates and quit rates for low tenure workers increase (see Appendix Table B4). Nonetheless, there is evidence of an increase in employment on net (refer to Appendix Table B7). Therefore, affected establishments bring in more workers without affecting those already settled.

Changing worker flows decreases the average skill of the workforce employed at affected establishments. Figure 6c shows that the average skill of workers drops 1.6%. Worker skill, in this case, refers to worker effects estimated in an AKM model covering both pre- and post-treatment periods (2007-2016). Given that firm effects are not allowed to change as in Figure 3f, the impact on worker effects equals that on mean wages (see Figure 3a). Using the two AKMs that allow firm effects to change after automatic extensions (2006-2011 and 2012-2016), the impact on worker effects drops to -1.0%, which is roughly equal to the -0.9% impact on wage premiums. Therefore, the compositional and non-compositional effects on wages are roughly equal in proportion. As additional evidence of the effects on skill composition, Figure 6d shows that the proportion of workers with completed high school falls by 0.008 (or 20% of the treated-control differential).

Consequently, changes to employers' hiring decisions and the pool of workers applying to these jobs explain the falling average skill at affected establishments. In addition, the effects on hire rates and average skill with the DIFD strategy reveal similar results conditional on strong unions, i.e., precisely where firm compensation increased and changed in favor of amenities (see Appendix Figure A19). Interestingly, despite the changing worker flows, automatic extensions do not affect the demographic composition of employees. Figures 6e and 6f reveal that the gender and racial composition of the workforce is unaffected by automatic extensions. Hence, the exclusionary hiring and assortative matching documented in Gerard et al. (2018) does not seem perturbed by collective bargaining under automatic extensions.

## 7.2 Monopsony power and compression

Higher overall compensation paired with increased hiring concentrated among low-skill workers suggests imperfect competition for such individuals in the Brazilian labor market. Specifically, the effects on firm compensation and hire rates (or employment) imply an elasticity of labor supply to establishments with strong unions of 2.31 (or 1.77).<sup>64</sup> As such, these results align with a growing literature documenting employer market power in wage setting (e.g., Hirsch et al., 2010; Dube et al., 2018b; Caldwell and Oehlsen, 2018). Relative to this literature, I estimate elasticities with respect to amenity-inclusive compensation (not just wages) that are nonetheless within the range of significant monopsony power. In fact, using my estimates on a standard monopsony model would imply that workers' compensation in Brazil is equal to their marginal revenue product marked down by a factor of about two-thirds.<sup>65</sup>

[INSERT FIGURE 7]

As automatic extensions allow unions to push employers up the labor supply curve, the resulting distribution of compensation to workers within establishments is also affected. In the case of the wage distribution, Figure 7 shows that automatic extensions shrink the 90/10 wage ratio by 1.4% and the standard deviation of wages by 0.7%. Unfortunately, the amenity distribution is not observed. While there is no direct evidence that the inequality in amenities is reduced, one can argue that the clauses added due to automatic extensions are targeted at low-skill workers (see Table 8). Examples include employment protections, food assistance, internship/apprenticeship, and training for work-related injury prevention.

Even without direct evidence on increased compression in the wage- and amenity-specific distributions, one can leverage the two-sided selection model in Abowd and Farber (1982) and Card (1996) to reach the same conclusion. This model would rationalize the influx of low-skill workers as either a fall in premiums or increased compression (see Appendix G).

Lower premiums could explain an influx of low-skill workers but do not match previous empirical evidence. First and foremost, higher firm compensation in Figure 5 directly contradicts this claim. However, one may argue that costs to employers decreased nonetheless. In other words, workers' value for the newly secured amenities may be higher than employers' costs of providing said amenities, implying that cheaper labor rather than monopsony power explain the increase in hiring. Still, this cost-effectiveness story is unlikely to hold

<sup>64</sup>That is, the DIFD strategy for the top two quartiles of union density give a 2.6% increase in overall compensation, a 0.030 increase in hire rates, and a 4.6% increase in employment. Hence, the elasticity  $\epsilon_{w+a}^S$  is given by  $2 \times (0.030/0.026) = 2.31$  using hire rates or  $(0.046/0.026) = 1.77$  using employment.

<sup>65</sup>Model where firms compete monopsonistically for labor—among other features—empirically matches several aspects of wage inequality in Brazil (Haanwinckel, 2018).

since it requires information frictions. That is, nothing prevented employers from providing the more cost-effective compensation package prior to automatic extensions. A possible response to this objection is that automatic extensions ensure employers' commitment to amenities, thereby making the cost-effective compensation package credible to workers. But even holding the former as a plausible explanation, the fact that employers would be better off under such a scenario does not square with their dislike for the policy.<sup>66</sup>

Increased compression provides a more coherent explanation for the influx of low-skill workers. The compression story squares with employers' dislike for automatic extension since reduced returns to skill make it harder to attract skilled workers to the firm. This change in the attractiveness of the firm due to compression may also explain why hiring is concentrated among low-skill workers. That is, by causing a leftward shift in the skill distribution of job applicants, the average hire is of lower skill if this characteristic is unobserved by employers. Similar to concerns on adverse selection, amenities that are likely to attract low-skill individuals (e.g., employment protections) lead to more low-skill selection into the firm. This may be further exacerbated in the Brazilian labor market where the prevalence of informal work arrangements suggests that many individuals are left at the margin of employment. That is, even small changes in compensation that make the formal job more attractive for inframarginal workers could lead to a substantial change in the applicant pool. In fact, there is some evidence that hire rates among those who never held a formal job increases due to automatic extensions (see Appendix Table B4), suggesting that the composition of firm compensation may be relevant for people at the margin of employment.

This section has shown that higher firm compensation coincides with an influx of low-skill workers into establishments with extended CBAs. The implied elasticity of labor supply to establishments with strong unions is of around 2, suggesting a sizable degree of imperfect competition for workers. Additional results indicate that the resulting wage and amenity distributions are compressed, implying that unions reduce compensation inequality, inclusive of amenities, within establishments.

## 8 Conclusion

The institutions that frame collective bargaining matter for the labor market. In the case of Brazil, a labor court decision that introduced automatic extensions shifted bargaining incentives in favor of amenities relative to wages. That is, by restricting employers' ability to phase out benefits negotiated in CBAs, automatic extensions placed downward rigidities on

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<sup>66</sup>In contrast, the monopsony story implies lower profits as firms are forced up the labor supply curve.

amenities which were already binding for wages. The ability to lock-in amenities increased their value, allowing unions with sufficient strength in overcoming employer push-back to shift the composition of firm compensation toward amenities. Higher amenity-inclusive compensation coincided with increased hires, suggesting a sizable degree of imperfect competition for workers in Brazil. Interestingly, the resulting wage and amenity profiles compressed the value of jobs within establishments with extended CBAs. Consequently, more low-skill workers selected into these establishments giving inframarginal individuals an opportunity to be employed in the formal sector.

The results provide a nuanced way of understanding union effects and the role that firms play in the labor market. In terms of union effects, this paper emphasizes that the often overlooked amenity dimension is crucial for interpreting the impact of this institution on the labor market. As for the role of firms, the results reveal that firm-specific amenity provision should complement the literature on firm-specific pay setting. On this last point, I see two avenues for further research.

The first research avenue relates to the already active literature relying on compensating differentials to explain firm-specific wage premiums. This paper shows that trading away wages for amenities is an empirical fact, even in the collective bargaining setting. However, the relationship between wage premiums and negotiated amenities in these data do not support the idea that high premium firms are simply compensating for (dis)amenities. Further analyses on these data that account for measurement error and other amenities not included in CBAs would provide a stronger empirical footing for making such a claim. Nonetheless, exploiting text analysis as a way to directly observe amenities in other settings would provide more evidence on this open question. Furthermore, CBAs are only one source of rich text data on amenities—similar opportunities exist in other employment contracts.

The second research avenue concerns the relatively small literature on the determinants of firm-specific amenity provision. That is, there is very little evidence on what motivates a firm to offer specific amenities to their employees. This paper shows that collective bargaining is one way to influence employer discretion regarding amenity provision in a way that favors low-skill workers. But one could imagine that, similar to the case of wages, outside options drive employers to offer amenities that attract and retain high-skill workers, e.g., yoga classes, gourmet meals, in-office baristas. Alternatively, there may also be a cost-effectiveness story at play. In other words, providing forms of leisure at work may increase worker productivity, making these amenities more cost-effective than an equally valued wage increase.

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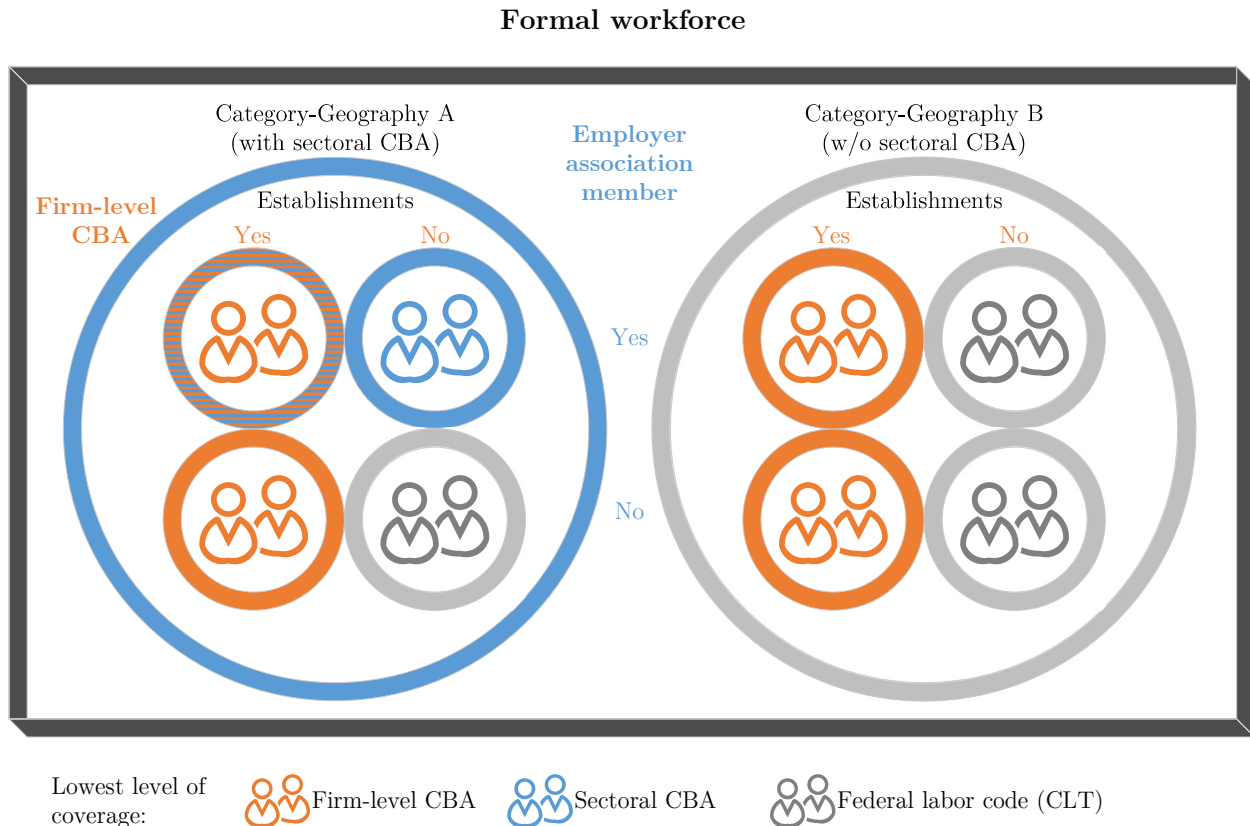
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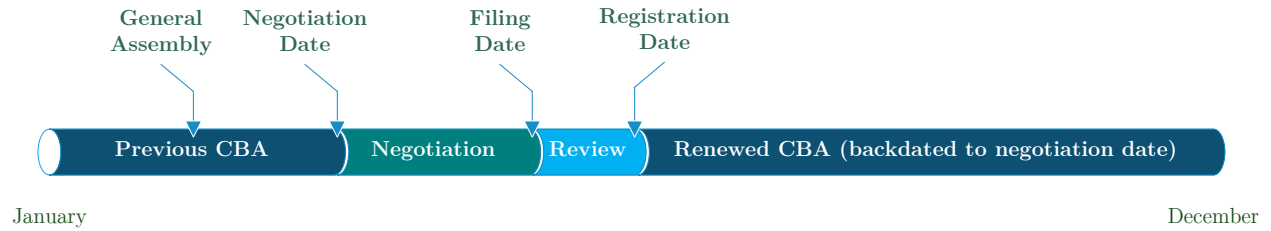
# Figures

Figure 1: Collective Bargaining Structure



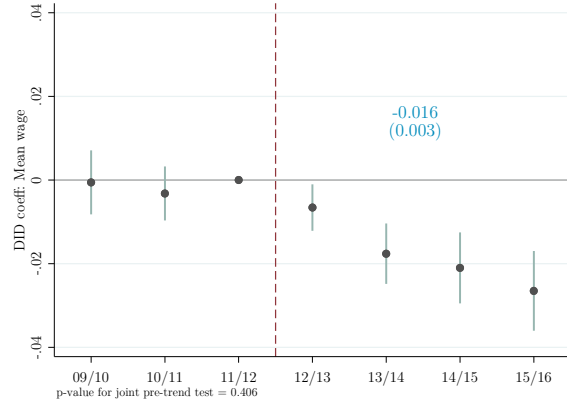
*Note:* The collective bargaining structure in Brazil divides the formal workforce into mutually exclusive and collectively exhaustive cells based on category and geography. A single union is given the monopoly of representing the collective interests of all workers in a given cell. Each category-geography pair may or may not have a sectoral CBA—for simplicity, this figure only shows one of each case (cell A and B). Within each cell are establishments that can be categorized along two dimensions: 1) whether they are members of the employer association signing the sectoral CBA; and 2) whether they have signed a firm-level CBA with their respective union. Again, only one establishment from this 2-by-2 classification is depicted for each cell. Where a worker’s establishment falls under these eight possible combinations determines his or her coverage. Three simple rules determine coverage. First, workers in all these establishments are covered by CLT. Second, to be covered by a sectoral CBA, the worker must be in an establishment that is a member of the employer association that is also in a cell where such a CBA exists. This refers to the top row establishments in A. Third, to be covered by a firm-level CBA, the worker must simply be in an establishment where such a CBA exists. This refers to the left column establishments in both A and B. The “favorability principle” dictates that in cases where sectoral and firm-level clauses are in conflict with each other (possible only for the top left establishment in A), precedence is given to that which is considered most beneficial to workers.

Figure 2: Collective Bargaining Timeline

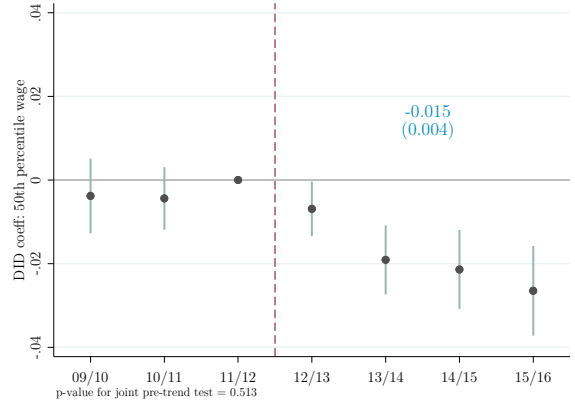


*Note:* Figure depicts the collective bargaining process for a typical bargaining unit in Brazil. Prior to the expiration of an existing CBA, the labor union organizes a General Assembly where workers vote on the list of claims (*pauta de reivindicações*) they want to achieve in the upcoming negotiations. Negotiations start when the union sends these claims to the employer counterpart, which takes place before or on the negotiation date (*data-base*), i.e., the reference date for collective bargaining of a given bargaining unit. Negotiations continue until an agreement is reached, which is fulfilled by the filing date, i.e., the date when the CBA is signed and submitted to the regional office of the Ministry of Labor. The ministry reviews the agreement for legal validity and afterwards registers it in its system, i.e., registration date. Finally, the clauses of the new CBA are back-dated to the start date of the agreement and remain valid until its expiration date. CBA duration is usually 12 months (sometimes 24 months) so that the start/expiration dates tend to coincide with the negotiation date.

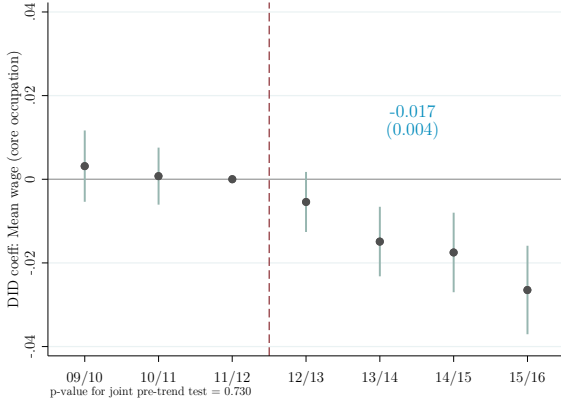
Figure 3: Impact of Automatic Extensions on Wages



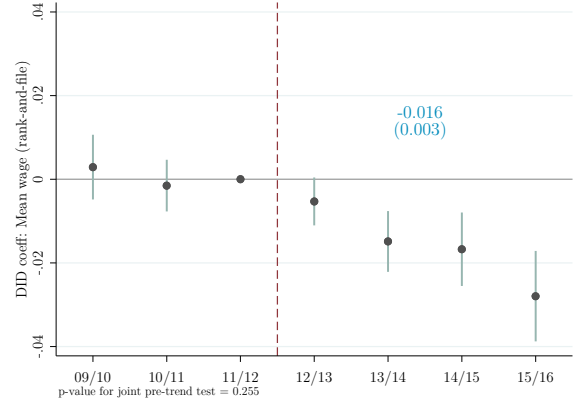
(a) Mean wage



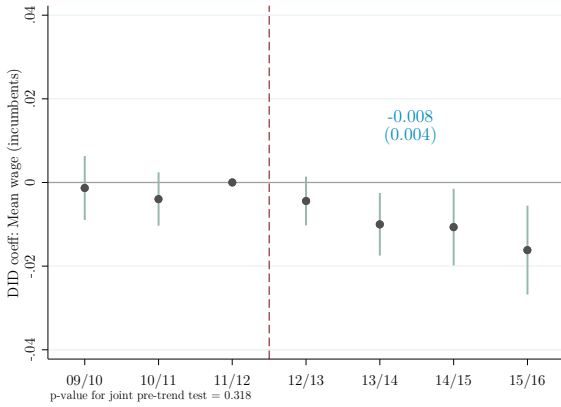
(b) Median wage



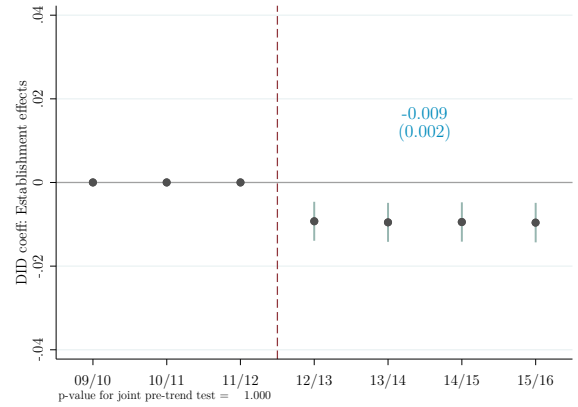
(c) Core occupation



(d) Rank-and-file



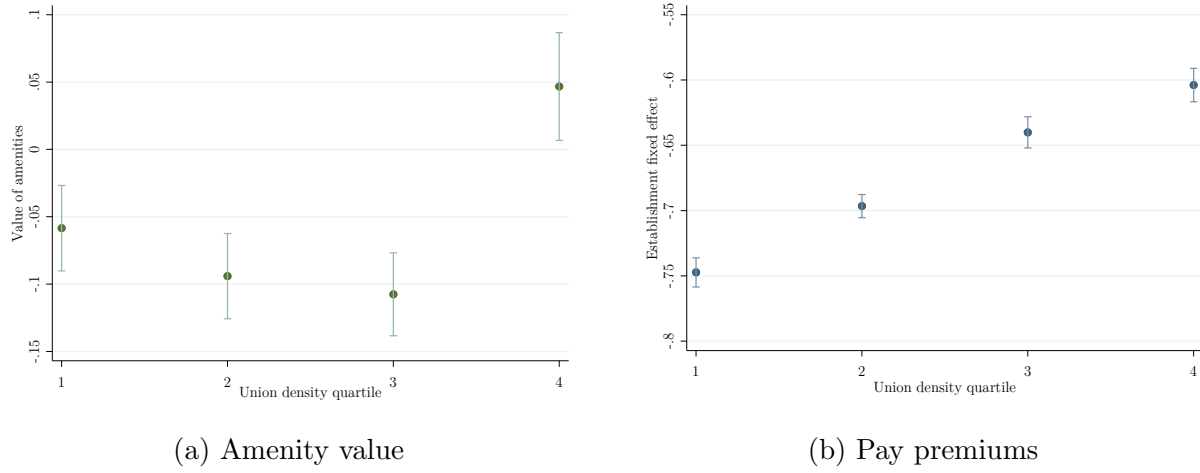
(e) Incumbents



(f) Pay premiums

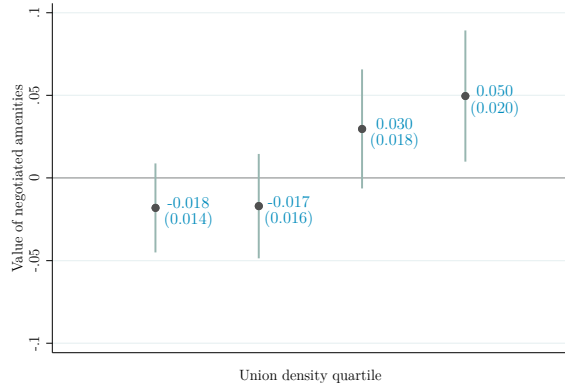
*Note:* Figures show estimates of the  $\beta_j$  coefficients for  $j \in [09/10, 15/16]$  (with 11/12 omitted) from the DID specification in Equation 2 on various labor market outcomes. Confidence intervals at a 95% level are provided for each coefficient. Below each figure are the p-value for a joint test of the null hypothesis that both pre-period coefficients are equal to zero. The overall DID estimates (i.e., the interaction of treatment and post-intervention dummies) with standard errors in parentheses are also reported. Regressions include establishment and filing period fixed effects, as well as separate time-varying fixed effects for industries and micro-regions. Each establishment is weighted by its average employment in the pre-policy period. Standard errors are clustered at the firm level. The analysis sample is based on the elastic net selection model.

Figure 4: Amenity Value and Pay Premiums by Union Strength

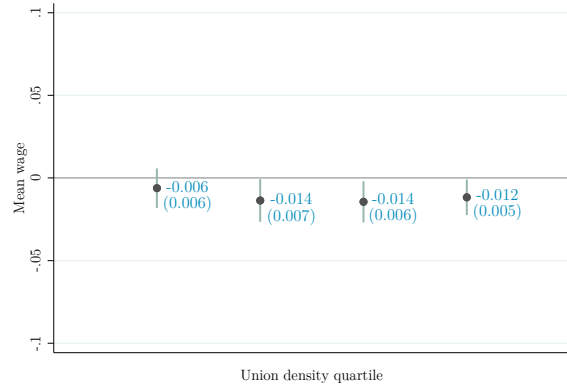


*Note:* Figure shows the scatterplots of amenity value and pay premiums by bins of union density quartiles across establishments covered by firm-level CBAs from the 11/12 and 12/13 filing periods. Amenity value is the wage-equivalent measure obtained from a predictive model of the Poaching Index on textual elements of CBAs. Pay premiums are the establishment fixed effects from an AKM model based on 2007-2016 worker flows. Union strength is based on micro-region $\times$ category union density. Confidence intervals are at a 95% level.

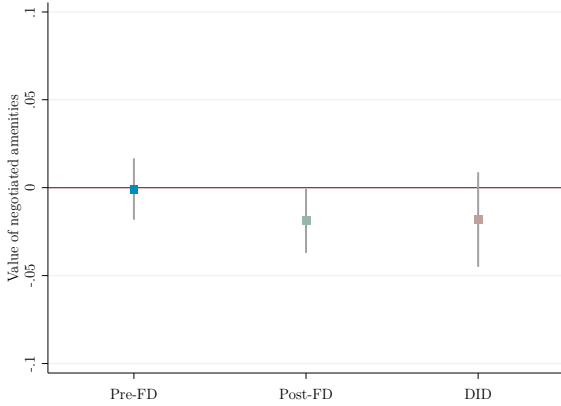
Figure 5: Impact of Automatic Extensions on Firm Compensation



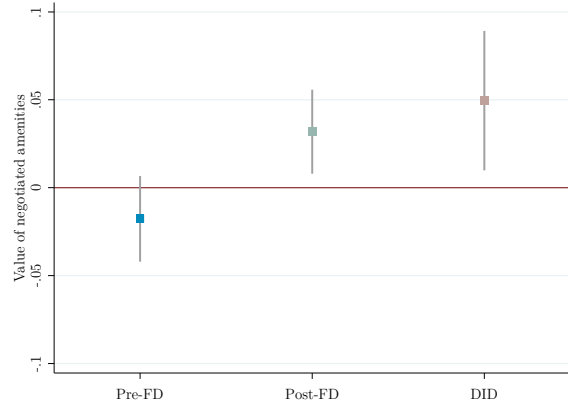
(a) Amenity value



(b) Mean wages



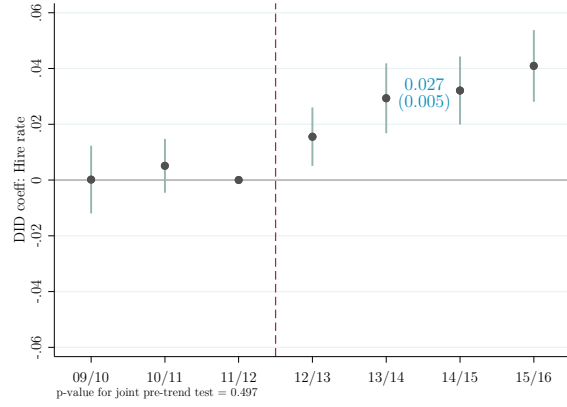
(c) Amenity value: weakest unions



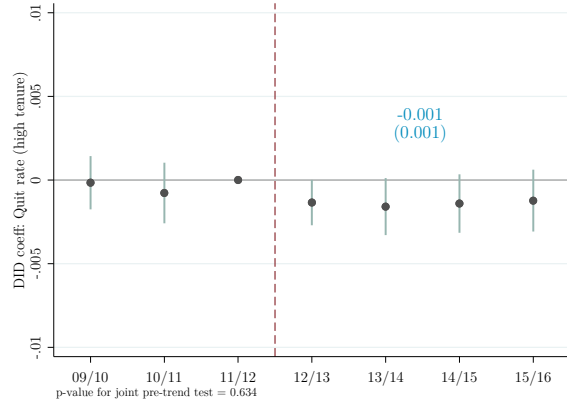
(d) Amenity value: strongest unions

*Note:* Figures show the impact of automatic extensions on amenity value and mean wages by union strength. Sample is restricted to bargaining units with an extended CBA, at least two CBAs filed between 09/10 and 11/12, and at least one CBA filed between 12/13 and 13/14. The coefficients in Figures 5a represent the difference in 1) the change in outcome for the two CBAs closest to the policy change that were filed prior to automatic extensions; and 2) the change in outcome between the CBA filed just before and just after the policy intervention. Figures 5c and 5d illustrate how the coefficients for the bargaining units with unions on the bottom and top union density quartiles in Figure 5a are created. Specifically, these figures show the first differences obtained for the CBAs filed prior to automatic extensions (Pre-FD) and those filed just before and just after the policy intervention (Post-FD). The difference between these two first differences provide the DID estimates reported in Figure 5a. Unlike the case of negotiated amenities, wages do change among firms not involved in collective bargaining. Hence, the coefficients in Figure 5b net out the wage growth from control establishments. Union strength is determined by union density quartiles based on the micro-region $\times$ category cell of the bargaining unit. Amenity value is pinned down by the text of CBAs negotiated by the bargaining units using a predictive model of the Poaching Index. Mean log hourly wages are measured at the establishment level for those establishments that are members of the bargaining units in the restricted sample. Regressions control for micro-region fixed effects and category fixed effects. Standard errors are clustered at the bargaining unit (establishment) level for amenity (wage) outcomes.

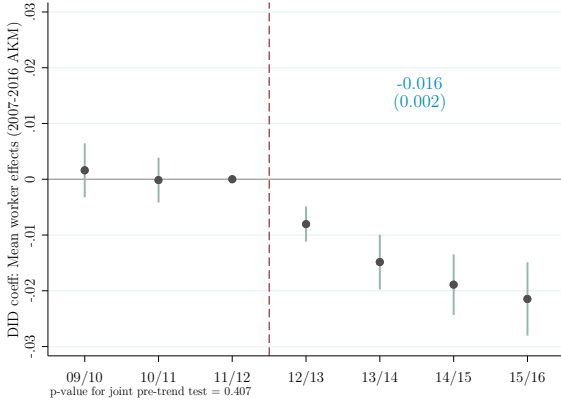
Figure 6: Impact of Automatic Extensions on Worker Flows and Composition



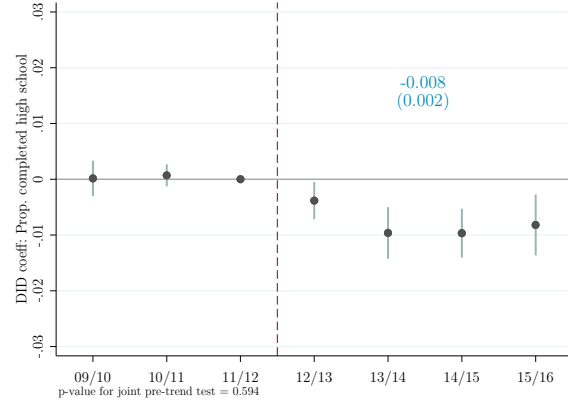
(a) Hire rate



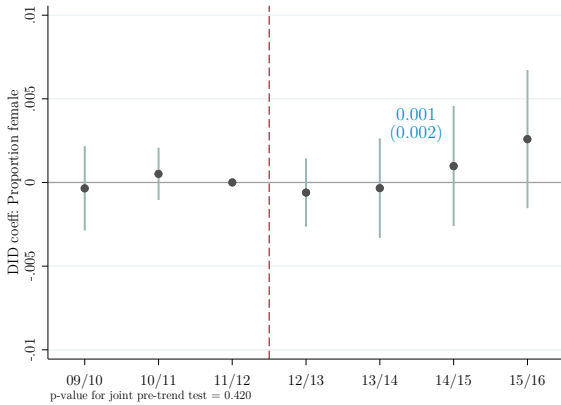
(b) Quit rate



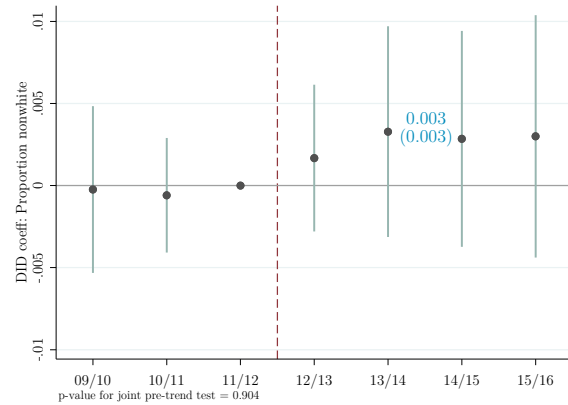
(c) Worker effects



(d) Workers with completed high school



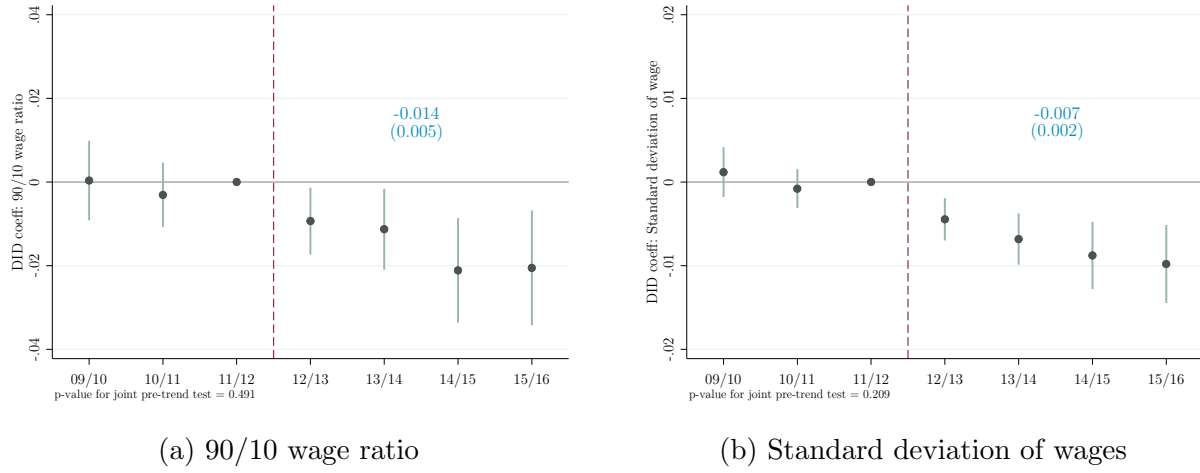
(e) Female workers



(f) Nonwhite workers

*Note:* Figures show estimates of the  $\beta_j$  coefficients for  $j \in [09/10, 15/16]$  (with 11/12 omitted) from the DID specification in Equation 2 on various labor market outcomes. Confidence intervals at a 95% level are provided for each coefficient. Below each figure are the p-value for a joint test of the null hypothesis that both pre-period coefficients are equal to zero. The overall DID estimates (i.e., the interaction of treatment and post-intervention dummies) with standard errors in parentheses are also reported. Regressions include establishment and filing period fixed effects, as well as separate time-varying fixed effects for industries and micro-regions. Each establishment is weighted by its average employment in the pre-policy period. Standard errors are clustered at the firm level. The analysis sample is based on the elastic net selection model.

Figure 7: Impact of Automatic Extensions on Wage Compression



*Note:* Figures show estimates of the  $\beta_j$  coefficients for  $j \in [09/10, 15/16]$  (with 11/12 omitted) from the DID specification in Equation 2 on various labor market outcomes. Confidence intervals at a 95% level are provided for each coefficient. Below each figure are the p-value for a joint test of the null hypothesis that both pre-period coefficients are equal to zero. The overall DID estimates (i.e., the interaction of treatment and post-intervention dummies) with standard errors in parentheses are also reported. Regressions include establishment and filing period fixed effects, as well as separate time-varying fixed effects for industries and micro-regions. Each establishment is weighted by its average employment in the pre-policy period. Standard errors are clustered at the firm level. The analysis sample is based on the elastic net selection model.

# Tables

Table 1: Statements Regarding the Revision of *Súmula 277*

Source	Original	Translation
<i>Panel A. Policy change</i>		
1. Súmula 277 (original)	As condições de trabalho alcançadas por força de sentença normativa, convenção ou acordos coletivos vigoram no prazo assinado, não integrando, de forma definitiva, os contratos individuais de trabalho.	The working conditions reached by virtue of a collective bargaining agreement shall be in force within the agreed time limit, without being integrated into individual labor contracts.
2. Súmula 277 (revised)	As cláusulas normativas dos acordos coletivos ou convenções coletivas integram os contratos individuais de trabalho e somente poderão ser modificadas ou suprimidas mediante negociação coletiva de trabalho.	Contractual clauses of collective bargaining agreements are integrated into individual labor contracts and can only be modified or eliminated through collective bargaining.
<i>Panel B. Unexpected shock</i>		
3. Gilmar Mendes, Justice at STF (Supreme Court)	A alteração de entendimento sumular sem a existência de precedentes que a justifiquem é proeza digna de figurar no livro do Guinness, tamanho o grau de ineditismo da decisão que a Justiça Trabalhista pretendeu criar.	The revision of Súmula 277 without the existence of precedents to justify it is a feat worthy of being included in the Guinness Book of Records, given the extent of the incongruity in the decision that the Labor Court intended to create.
4. Mauricio de Figueiredo Córrea da Veiga, Director at CVA (law firm)	De uma hora para outra o entendimento jurisprudencial sofreu uma guinada de 180°, sem que tivesse qualquer sinalização indicativa da radical mudança... as decisões eram tomadas em um sentido e a partir da publicação da nova redação do verbete sumular o entendimento será em sentido diametralmente oposto.	From one hour to the next the jurisprudential understanding had undergone a 180° turn, without there being any indication of radical change... decisions were taken in one direction and from the publication of the revised Súmula 277 they will be in a diametrically opposed direction.
<i>Panel C. Supportive views</i>		
5. Graça Costa, Secretary of Labor Relations at CUT (national union center)	Todos os anos, ao fazer as negociações, tínhamos que, primeiro, nos preocupar em garantir os avanços da campanha anterior. Com essa alteração, o foco central é avançar nos direitos, um grande alívio para nossas atividades.	Each year, when negotiating, we were concerned primarily with securing the progress achieved in previous campaigns. With this change, the central focus is to advance worker rights, a great relief to our activities.
6. Jonas Valente, General Secretary at SJADE (labor union)	Em muitas negociações, há patrões que usam a possibilidade do fim da vigência da convenção coletiva... Há um impasse na negociação da data-base como ameaças para que os sindicatos fechem acordos ruins. Agora, essa arma não poderá mais ser usada.	In many negotiations, there are employers who use the possibility of ending the collective bargaining agreement... deadlocks in negotiations are used as threats for unions to agree to givebacks. Now this weapon can no longer be used.
<i>Panel D. Dissenting views</i>		
7. Juliana da Penha Thomaz, Vice-Director of Labor Relations at SINEP-MG (employer association)	A negociação coletiva acabou sendo desestimulada, seja porque os trabalhadores já partem de certa situação de conforto, seja porque os empregadores não se arriscam a novas concessões, ainda que momentaneamente possíveis, temendo perpetuá-las.	Collective bargaining has been discouraged, either because workers are already starting from a comfortable position, or because employers do not risk making new concessions, even if momentarily possible, due to fear of them becoming perpetual.
8. Júlio Bernardo do Carmo, Deputy Justice at TRT-MG (regional labor court)	Longe de otimizar, pode, sim, emperrar o surgimento de novas cláusulas favoráveis aos trabalhadores em instrumentos coletivos, já que, aderindo inapelavelmente os contratos individuais de trabalho, amargaria ainda mais o oneroso encargo social do patronato, incutindo um medo generalizado de outorgar tais benesses.	Far from optimizing, it may obstruct the emergence of new clauses favorable to workers in collective bargaining agreements, since, by integrating into individual labor contracts, it would further embitter the onerous social burden of employers, instituting a generalized fear of granting such benefits.

*Note:* Quotes extracted from the *Tribunal Superior do Trabalho* as well as da Penha Thomaz (2016).

Table 2: Characteristics of CBAs Over Filing Periods

	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b><i>Panel A: Firm-level agreements</i></b>							
<i>CBA level</i>							
Clause count (mean)	17.1	17.1	17.2	17.4	18.0	17.7	17.8
Duration (mean)	13.1	13.2	13.2	13.3	13.3	13.2	13.1
Negotiation length (mean)	3.5	3.7	3.6	3.6	3.7	3.8	3.9
Start month (mode)	May	May	May	May	May	Jan	Jan
Negotiation month (mode)	May	May	May	May	May	May	May
Total CBAs	15,300	18,408	18,198	17,539	17,036	15,969	14,915
<i>Establishment level</i>							
Employees (mean)	141.5	147.8	142.8	147.6	153.4	148.0	146.4
CBAs signed (mean)	1.7	1.7	1.6	1.6	1.6	1.6	1.5
Establishments under CBA (proportion of estab.)	15,822 (0.01)	18,162 (0.01)	18,929 (0.01)	18,187 (0.01)	17,058 (0.01)	16,260 (0.01)	14,657 (0.01)
Workers covered (proportion of workforce)	2,239,234 (0.11)	2,683,920 (0.13)	2,703,272 (0.13)	2,684,448 (0.13)	2,616,735 (0.13)	2,407,247 (0.12)	2,145,123 (0.12)
<b><i>Panel B: Sectoral agreements</i></b>							
<i>CBA level</i>							
Clause count (mean)	41.3	41.2	42.7	42.7	44.3	43.9	44.8
Duration (mean)	13.0	13.1	13.0	12.8	13.0	13.0	13.0
Negotiation length (mean)	3.6	3.5	3.3	3.4	3.8	3.9	4.2
Start month (mode)	May	May	May	May	May	May	May
Negotiation month (mode)	May	May	May	May	May	May	May
Total CBAs	4,111	5,016	4,953	4,966	4,546	4,803	4,664
<i>Category + geography level</i>							
Employees (mean)	-	-	-	-	-	-	-
CBAs signed (mean)	1.3	1.4	1.3	1.4	1.4	1.4	1.3
Establishments under CBA (proportion of estab.)	1,154,008 (0.94)	1,162,184 (0.95)	1,156,221 (0.95)	1,106,756 (0.95)	1,027,689 (0.93)	986,322 (0.94)	919,268 (0.92)
Workers covered (proportion of workforce)	17,879,660 (0.91)	18,833,298 (0.92)	18,796,656 (0.92)	18,087,776 (0.92)	16,961,290 (0.89)	16,404,630 (0.91)	14,669,110 (0.88)

*Note:* Table shows descriptive statistics for firm-level and sectoral agreements in *Sistema Mediador* by the period in which the CBAs were filed at the Ministry of Labor. Filing periods start in September 26th and end in September 25th so that 2011-2012 marks the last period prior to the policy change. All CBAs are original, legally binding, neither retroactive nor prospective, have valid geographic coverage, and have a union counterpart representing (as well as coverage for) workers in private sector industries. Additional restrictions from establishment-level information apply to firm-level CBAs. Namely, the employer appears in RAIS, belongs to the private sector, and is in the largest connected set of establishments due to worker mobility 2007-2016. In sectoral agreements, coverage is assigned to an entire pair: the CBA's category (as determined by the text classifier) and geographic unit (municipality, state, or national) of coverage. Establishment and worker information for sectoral agreements rely on the assumption of extending coverage to all establishment within a pair—relying on a mapping between categories and industry codes. In addition to potential noise in the category-to-industry code mapping, this assumption creates an overestimate of sectoral coverage rates.

Table 3: Content of Extended Firm-Level CBAs

Clause type	Proportion of CBAs w/clause
Workday	0.79
<i>weekly rest, breaks, uninterrupted shifts, absences, workday controls</i>	
Collective bargaining	0.69
<i>non-compliance, conflict resolution, renewal/termination of CBA</i>	
Wage supplements	0.50
<i>overtime pay, 13th month bonus, food allowance, profit sharing</i>	
Wages	0.42
<i>wage floors, wage adjustments, payment schedule, wage deductions</i>	
Union relations	0.39
<i>access to firm information, union dues, unionization campaigns</i>	
Employment	0.38
<i>probationary periods, advance notice, part-time contracts, outsourcing</i>	
Labor relations	0.32
<i>employment protections, modified work functions, sexual harassment</i>	
Occupational health and safety	0.29
<i>accident prevention committee, rehabilitation, safety equipment</i>	
Holidays and leaves	0.26
<i>vacation duration, common holidays, paid leave, maternity leave</i>	

*Note:* Table shows the proportion of extended firm-level CBAs—i.e., filed prior and expiring after the introduction of automatic extensions—that contain at least one clause of the corresponding clause type. Clause types are the most general grouping of clauses according to the predetermined list in *Sistema Mediador*. The clause types are sorted from most to least common across CBAs. Below each clause type (in italics) are some examples of the amenities encompassed by said group.

Table 4: Selection Models for Sample Adjustments

	Basic (1)	Few controls (2)	All controls (3)	Lasso (4)	Elastic net (5)
<i>Panel A. Standardized differences in matched sample (2011)</i>					
Micro-region (0.819)	0.228	0.202	0.204	0.207	0.215
Industry (0.928)	0.316	0.301	0.304	0.318	0.326
Firm size bin (0.886)	0.313	0.292	0.292	0.303	0.321
Mean wage (0.528)	0.403	0.388	0.390	0.403	0.396
Mean estab effect (0.461)	0.365	0.363	0.352	0.367	0.361
Mean worker effect (0.495)	0.382	0.363	0.370	0.381	0.373
<i>Panel B. Model statistics and parameters</i>					
Degrees of freedom	844	852	872	751	675
Log-likelihood (K)	-36.677	-36.536	-36.460	-36.617	-36.716
R-square	0.249	0.252	0.254	0.251	0.249
$\alpha$ parameter	-	-	-	1.0000	1.0000
$\lambda$ parameter	-	-	-	0.0002	0.0006
<i>Panel C. Correlation of log-odds</i>					
Basic	1.000	-	-	-	-
Few controls	0.992	1.000	-	-	-
All controls	0.987	0.996	1.000	-	-
Lasso	0.982	0.990	0.994	1.000	-
Elastic net	0.979	0.986	0.990	0.996	1.000

*Note:* Table shows the results from making sample adjustments across different selection models. Specifically, column (1) runs the logit regression in Equation 1 without growth rates, column (2) includes the growth rates in mean worker effects and in/outflow rates, column (3) includes all growth rates, and columns (4) and (5) select among all possible covariates using lasso and elastic net, respectively. Panel A displays the standardized differences between treated and control establishments of select 2011 outcomes after trimming the set of potential controls. The improvement in covariate imbalance is observed by comparing these values to those of the standardized differences prior to the Imbens (2015) procedure—shown next to the outcome variable in parentheses. Panel B includes model statistics from each selection model. Although the elastic net chooses  $\alpha = 1$ , so that only L1 regularization is used (as in lasso), the penalty parameter  $\lambda$  differs from that in column (4) because column (5) selects the largest  $\lambda$  within a standard error of the one that minimizes cross-validation MSE. Panel C shows the correlation in log-odds across the different selection models. High correlation values suggest similar sample adjustments despite the varying degrees of freedom across models.

Table 5: Addressing Challenges to Identification Strategy (Wage Outcomes)

	Baseline Ind×Reg×Yr (1)	Balanced Panel (2)	No Sectoral Agreement (3)	Strongest Unions (4)	Lowest Informality (5)	Improved Expectations (6)
<i>Panel A. Mean wage</i>						
Reference group	-0.019*** (0.003)	-0.016*** (0.003)	-0.020*** (0.004)	-0.020*** (0.004)	-0.018*** (0.004)	-0.027*** (0.007)
Column group	. (.)	. (.)	-0.016** (0.008)	-0.017*** (0.005)	-0.024*** (0.007)	-0.027*** (0.007)
<i>Panel B. Median wage</i>						
Reference group	-0.018*** (0.004)	-0.015*** (0.004)	-0.019*** (0.004)	-0.018*** (0.004)	-0.018*** (0.004)	-0.030*** (0.008)
Column group	. (.)	. (.)	-0.016 (0.010)	-0.019*** (0.007)	-0.022*** (0.008)	-0.024*** (0.008)
<i>Panel C. Mean wage (core occupation)</i>						
Reference group	-0.017*** (0.004)	-0.018*** (0.004)	-0.016*** (0.004)	-0.018*** (0.004)	-0.016*** (0.004)	-0.024*** (0.009)
Column group	. (.)	. (.)	-0.021* (0.011)	-0.013* (0.007)	-0.019** (0.009)	-0.025** (0.010)
<i>Panel D. Mean wage (rank-and-file)</i>						
Reference group	-0.017*** (0.003)	-0.015*** (0.004)	-0.017*** (0.004)	-0.018*** (0.004)	-0.016*** (0.004)	-0.023*** (0.007)
Column group	. (.)	. (.)	-0.017** (0.008)	-0.014** (0.006)	-0.020*** (0.007)	-0.026*** (0.007)
<i>Panel E. Mean wage (incumbents)</i>						
Reference group	-0.012*** (0.004)	-0.010*** (0.004)	-0.012*** (0.004)	-0.010** (0.004)	-0.009** (0.004)	-0.011 (0.008)
Column group	. (.)	. (.)	-0.017** (0.008)	-0.020*** (0.006)	-0.025*** (0.007)	-0.029*** (0.008)
<i>Panel F. Establishment effects</i>						
Reference group	-0.008*** (0.002)	-0.007*** (0.003)	-0.008*** (0.003)	-0.008*** (0.003)	-0.008*** (0.003)	-0.020*** (0.006)
Column group	. (.)	. (.)	-0.011* (0.006)	-0.009* (0.005)	-0.009 (0.006)	-0.011* (0.006)
Establishments (reference)	32,142	27,190	27,944	24,114	26,865	6,570
Establishments (column)	.	.	4,198	8,028	5,277	4,716

*Note:* Table reports the coefficients for several DID regressions addressing challenges to identification. Column (1) runs the baseline specification in Equation 2 using time-varying micro-region×industry fixed effects instead of separate interactions for micro-regions and industries (this baseline is used throughout the table to enable comparison across columns). Column (2) considers a balanced panel of establishments, where balance is imposed on the treated and potential controls prior to the selection adjustments. All subsequent columns test for heterogeneity along some indicator variable, reporting the effects among establishments with an inactive heterogeneity indicator (Reference group), as well as those with an active heterogeneity indicator (Column group). Column (3) tests whether establishments in cells not covered by an extended sectoral CBA experience similar effects. Column (4) explores whether establishments with the strongest unions—proxied by the micro-region×category cells in the top quartile of union density (based on RAIS 2017)—experience heterogeneous effects. Column (5) tests whether low informality categories—that is, those in the first quartile of informality rates (based on PNAD 2011)—experience similar effects, i.e., metalwork, paper, chemical and pharmaceutical, and air transportation. Column (6) focuses on a subsample of industries where information from the business expectation survey (IESE) is available. The results explore whether establishments in industries whose growth expectations improved from 11/12 to 12/13 experience similar effects.

Table 6: Optimal Union Allocation of Surplus for Collective Bargaining

	Stronger union $\beta\sigma > \phi(1 - p(1 - \sigma))$	Weaker union $\beta\sigma < \phi(1 - p(1 - \sigma))$
Amenities are stickier than wages ( $\delta < \iota$ )	Focus on amenities $e_1^* = 0$	Focus on wages $e_1^* = 1$
Wages are stickier than amenities ( $\delta > \iota$ )	Focus on wages $e_1^* = 1$	Focus on amenities $e_1^* = 0$

*Note:* Table shows the parameter conditions dictating the bang-bang solution of the two-period model in Sections 5.1 where  $u(\cdot)$  is an identity function. The threshold condition providing this two-by-two characterization is derived in Appendix F. The solution  $e_1^*$  is the optimal allocation of surplus that the union assigns to wage bargaining  $eS$ , as opposed to amenity bargaining  $(1 - e)S$  where  $e \in [0, 1]$ . Wage- and amenity-specific stickiness are determined by  $\iota$  and  $\delta$ , where lower values imply increased stickiness. Union strength is determined by several exogenous parameters: union discounting  $\beta$ , firm discounting  $\phi$ , strike probability  $\sigma$ , and probability of CBA renewal  $p$ . When either of the condition in the table hold with equality, the union is indifferent so that the solution is  $e_1^* \in [0, 1]$ .

Table 7: Top Clauses Valued by Poached Workers

Positive clauses	Value	Negative clauses	Value
1. Employment protections	0.041 [0.004]	1. Unspecified staffing rules	-0.104 [-0.011]
2. Renewal/termination of CBA	0.027 [0.003]	2. Wage corrections	-0.043 [-0.004]
3. Union relations	0.025 [0.003]	3. Wage adjustments	-0.039 [-0.004]
4. Hiring	0.018 [0.002]	4. Allowances	-0.013 [-0.001]
5. Other enforcement provisions	0.014 [0.001]	5. Unspecified workday provisions	-0.013 [-0.001]
6. Unspecified working conditions	0.011 [0.001]	6. Workday compensation	-0.003 [-0.000]
7. Workday controls	0.001 [0.000]	7. Disciplinary norms	-0.000 [-0.000]
Mean wage change (poached workers)			1.000 [0.102]
Establishments with 09/10-10/11 coverage			6,825
$\alpha$ parameter			1.000
$\lambda$ parameter			0.001
Out-of-sample RMSE (elastic net)			0.210
Out-of-sample RMSE (random forest)			0.212

*Note:* Table shows the top positively and negatively valued clauses as measured by their impact on the Poaching Index after accounting for wage changes among poached workers. The coefficient on each clause is divided by the coefficient on mean wage change among poached workers and can therefore be interpreted as a wage-equivalent measure. Values in brackets represent the coefficients from the elastic net regression prior to converting into the wage-equivalent measure. Sample restricted to establishments covered by firm-level CBAs in the 09/10 and 10/11 filing periods. The elastic net on the 90% random sample chooses  $\alpha = 1$ , so that only L1 regularization is used (as in lasso) with penalty parameter  $\lambda$ . The out-of-sample RMSE are obtained by predicting the poaching index with the trained models on the randomly excluded 10% sample. To provide more context, below are examples of the text included in some of these clause groups. 1. Employment protections: workers returning from sick leave are guaranteed employment for 30 days. 2. Renewal/termination of CBA: this agreement can be extended provided there is interest of one of the parties in writing. 3. Union relations: break rooms are accessible to union leaders for promoting union activities. 4. Hiring: the firm will provide orientation and training upon hiring. 1. Unspecified staffing rules: the firm will try to keep employees over 40 years of age. 2. Wage corrections: the firm reserves the right to deduct items allowed by CLT (e.g., medical plans) from workers' wages. 3. Wage adjustments: base wages will increase by 10.58% on December 1st, 2012. 4. Allowances: the firm will provide each employee a monthly food allowance of R\$220.00.

Table 8: Impact of Automatic Extensions on Amenity Inclusion/Exclusion

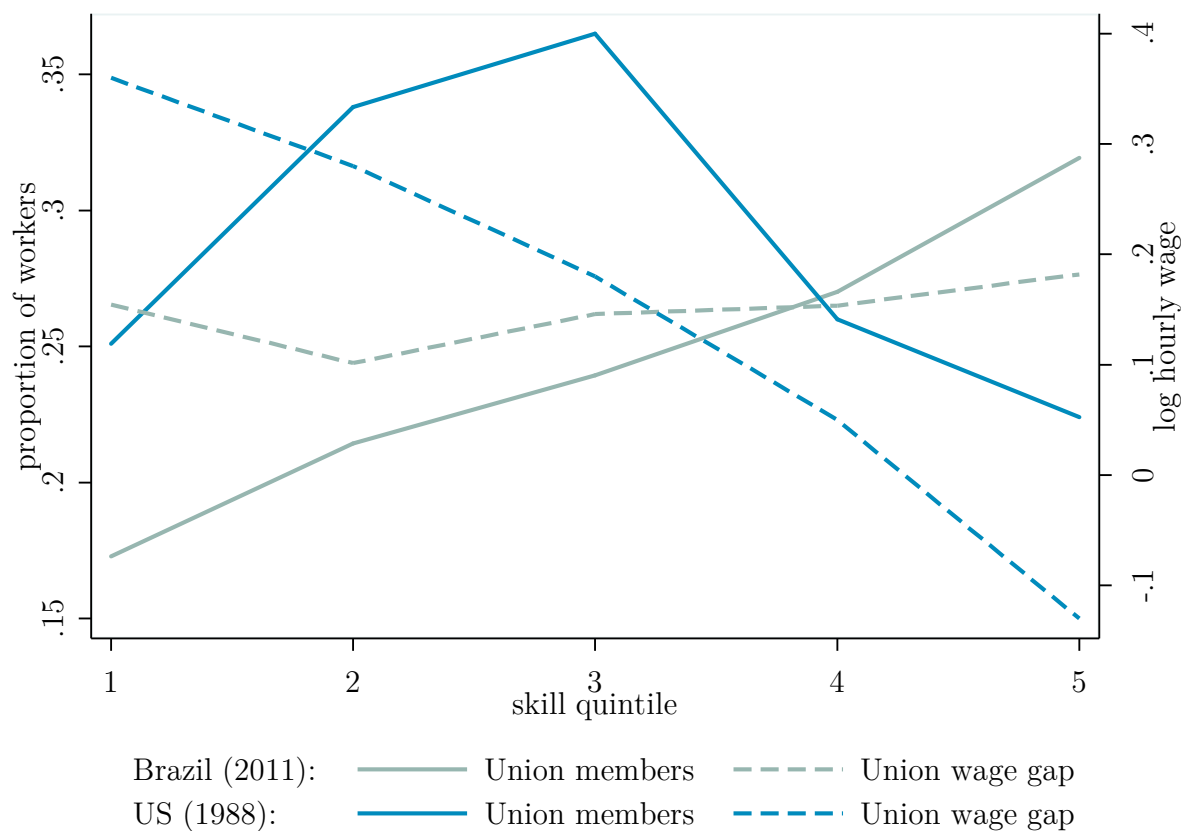
Strong unions		Weak unions	
Clause	Prob.	Clause	Prob.
<i>Panel A: Broad clauses</i>		<i>Panel A: Broad clauses</i>	
Pay	0.015***	Wage supplements	0.012**
Labor relations	0.009*	Hiring	0.012**
Employment protections	0.009*	Other employment contracts	-0.009*
Union relations	0.013**	Other enforcement provisions	0.018**
<i>Panel B: Specific clauses</i>		<i>Panel B: Specific clauses</i>	
Overtime pay	0.010**	Salary deductions	0.009**
Night pay	0.011***	Hazard pay	-0.003*
Seniority pay	0.007**	Separation/dismissal	-0.009*
Food allowance	0.013***	Female workforce	0.001*
Housing allowance	0.002*	Other rules on employment contracts	-0.009*
Maternity allowance	0.004*	Transfers	-0.006**
Fees	0.003*	Paternity protections	-0.004**
Life insurance	0.007**	Policies for dependents	-0.003**
Part-time contracts	-0.006***	Workday compensation	0.014**
Internship/apprenticeship	0.006**	Workday duration and schedule	-0.011*
Schedule of tasks and wages	0.006**	Extension/reduction of workday	-0.010*
Moral harassment	-0.002**	Uninterrupted shifts	0.009**
Sexual harassment	-0.001*	Machine and equipment maintenance	0.003**
Adoption protections	0.005***	Hazard (danger risk)	0.001*
Apprenticeship protections	0.003*	Adoption leave	0.004*
Extension/reduction of workday	0.010*	Paid leave	0.005*
First aid	0.005*	Factory commission	-0.005***
Training for work-related injury prevention	0.004*		
Abortion leave	-0.003***		
Guarantees to union officers	0.008***		
Other provisions for union relation	0.013**		
Union dues	-0.008*		
Non-compliance with CBA	0.017***		
Bargaining units	2,630	Bargaining units	2,634

*Note:* Table shows all the clauses whose probability of being included in a firm-level CBA changed significantly after the introduction of automatic extensions for bargaining units with strong versus weak unions. Clauses highlighted in blue (red) are those carrying positive (negative) value as per the predictive model of the Poaching Index. The sample considers bargaining units with extended CBAs that renegotiate an agreement after the policy intervention and compares the change in probabilities between the extended CBA and its renewal. Bargaining units with strong (weak) unions are those whose micro-region and category are in the top (bottom) two quartiles of union density across micro-region×category cells. Coefficients are obtained by running a linear probability model of an indicator variable for the clause group on a dummy for the renewed CBA applying bargaining unit fixed effects, micro-region fixed effects, and category fixed effects. Standard errors are clustered at the bargaining unit level.

# Appendices

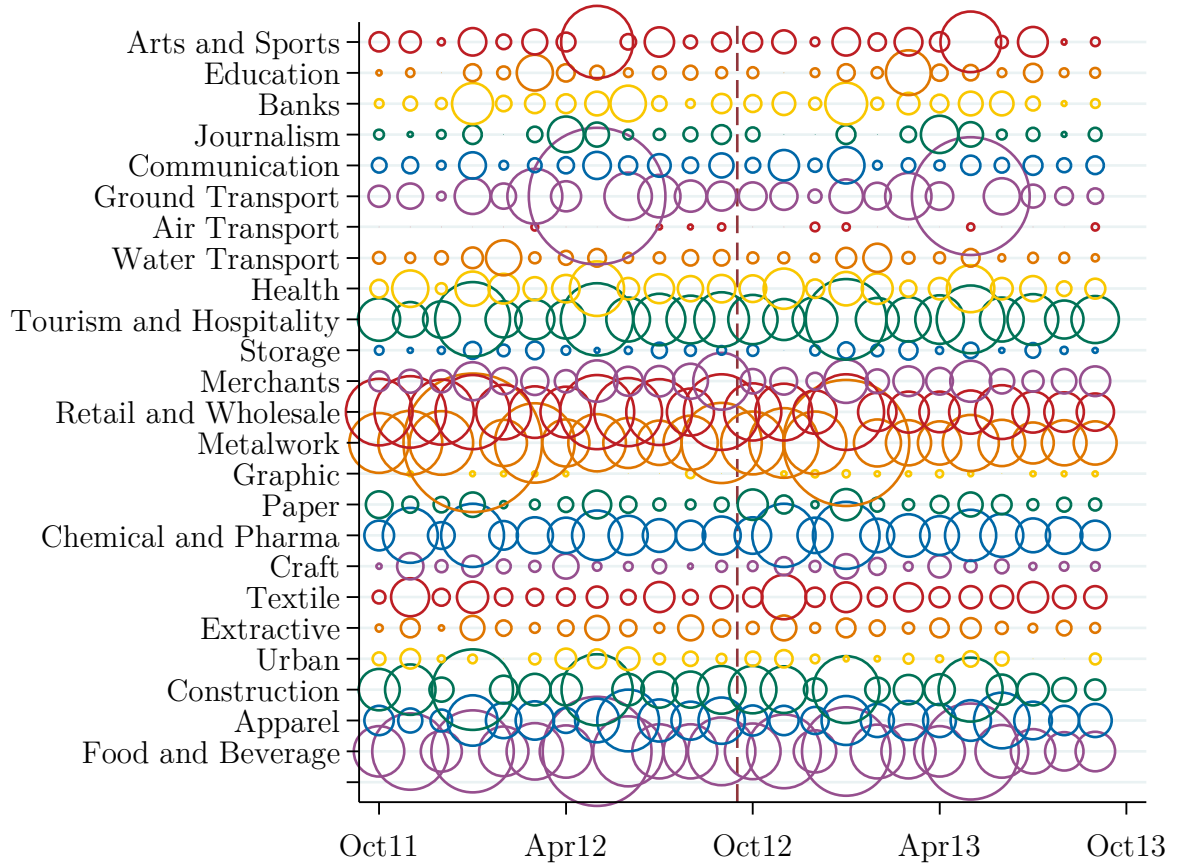
## A Additional Figures

Figure A1: Union Density and Membership Wage Gap in Brazil and the U.S.



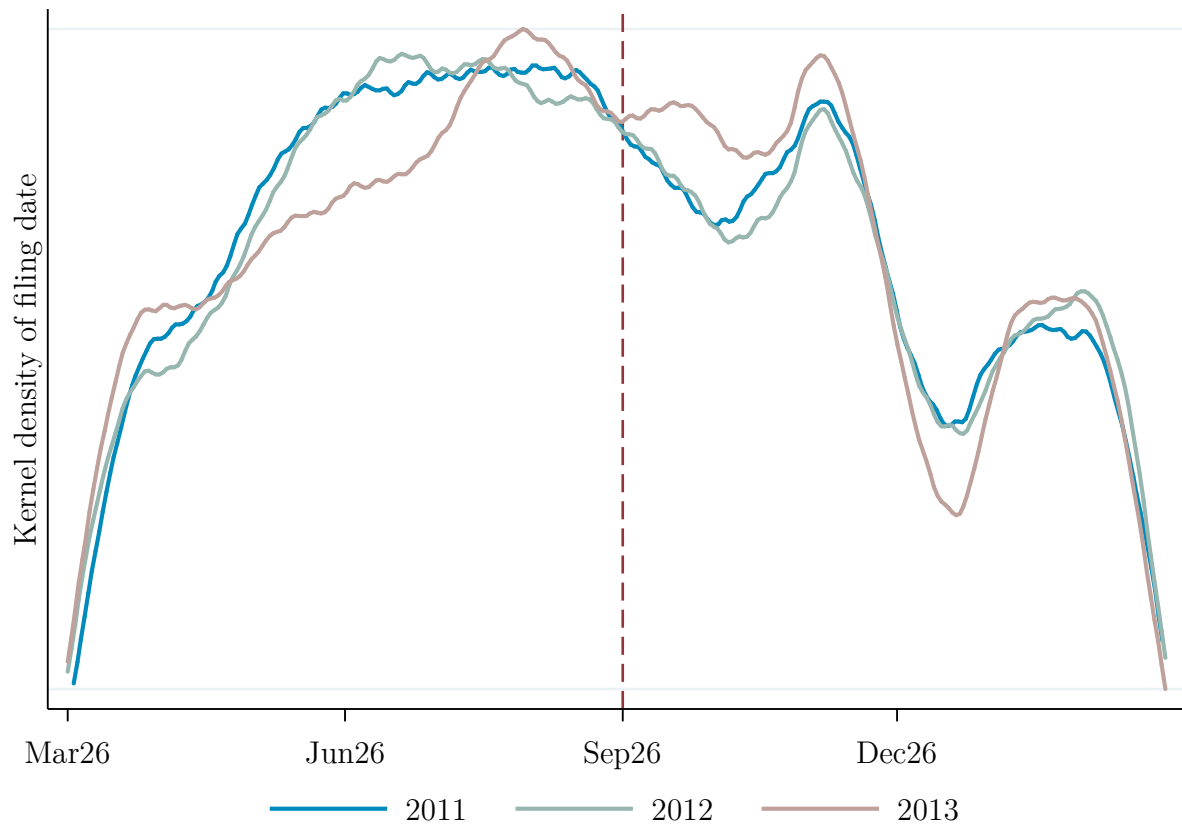
*Note:* Figure shows the proportion of workers that are union members (i.e., union density) and their wage advantages (i.e., union wage gap) by “skill” quintiles in the U.S. and Brazil. Results of the U.S. analysis are taken from Card (1996) who uses CPS data from 1988. Data for the Brazil analysis uses the annual household survey data (PNAD) for the year 2011. In an effort to mimic the U.S. analysis, the Brazilian sample is restricted to male, formal, private sector worker between 22 and 66 year of age. “Skill” is based on quintiles of predicted wages based on a wage regression estimated on non-union members. Covariates in the regression include a gender dummy, years of schooling, job market experience and its square. The idea is that this predicted wage is an index of unobserved skill that is unaffected by any distortionary effect of unions on the pay structure of union members.

Figure A2: Distribution of CBA Expiration Months by Category



*Note:* Figure shows the relative number of firm-level CBAs by expiration month and category among those agreements filed in the two filing periods prior to the introduction of automatic extensions, i.e., from 09/26/2010 to 09/25/2012 (marked by the vertical line). The size of a bubble is comparable across categories and the vertical dotted line denotes the introduction of automatic extensions. Categories are defined as per the OvA logit classifier. The lack of mass points at specific months within categories suggest that industry alignment of negotiations is week. This analysis is carried out using the 132,113 unique CBA level observations used to construct the panel at the bargaining unit level.

Figure A3: Densities of CBA Filing Dates (2011-2013)



*Note:* Figure plots kernel densities of CBA filing dates for three years centered at the policy change (marked by the vertical line). The year 2011 is prior to the introduction of automatic extensions; 2012 includes the policy change; and 2013 is after the introduction of automatic extensions. Densities are estimated with Epanechnikov kernels. This analysis is carried out using the 132,113 unique CBA level observations used to construct the panel at the bargaining unit level.

Figure A4: Extract from a CBA in *Sistema Mediador*

**ACORDO COLETIVO DE TRABALHO 2013/2013**

NÚMERO DE REGISTRO NO MTE: SP006649/2013  
**DATA DE REGISTRO NO MTE:** 28/06/2013  
NÚMERO DA SOLICITAÇÃO: MR031458/2013  
NÚMERO DO PROCESSO: 47999.005332/2013-81  
**DATA DO PROTOCOLO:** 27/06/2013

Confira a autenticidade no endereço <http://www3.mte.gov.br/sistemas/mediador/>.

SIND TRAB COM MIN DER PETROLEO (IPM) SJCAMPOS VP REGIAO, **CNPJ n. 96.486.634/0001-75**, neste ato representado(a) por seu Presidente, Sr(a). MARIA ANTONIETA DE LIMA;

E

BRASQUIMICA PRODUTOS ASFALTICOS LTDA, **CNPJ n. 13.829.957/0015-92**, neste ato representado(a) por seu Diretor, Sr(a). JOSE ALBERTO PINON GONZALEZ;

celebram o presente ACORDO COLETIVO DE TRABALHO, estipulando as condições de trabalho previstas nas cláusulas seguintes:

**CLÁUSULA PRIMEIRA - VIGÊNCIA E DATA-BASE**

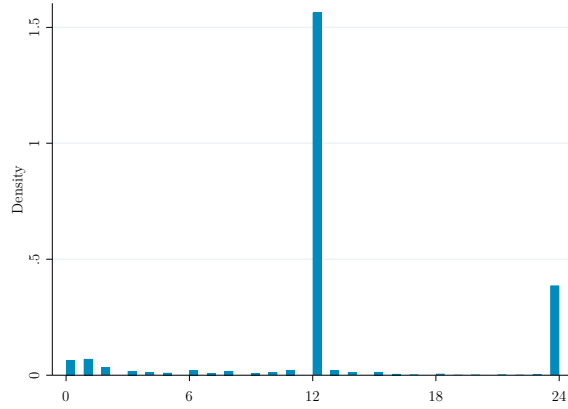
As partes fixam a **vigência** do presente Acordo Coletivo de Trabalho no período de 1º de janeiro de 2013 a 31 de dezembro de 2013 e a **data-base** da categoria em 1º de janeiro.

**CLÁUSULA SEGUNDA - ABRANGÊNCIA**

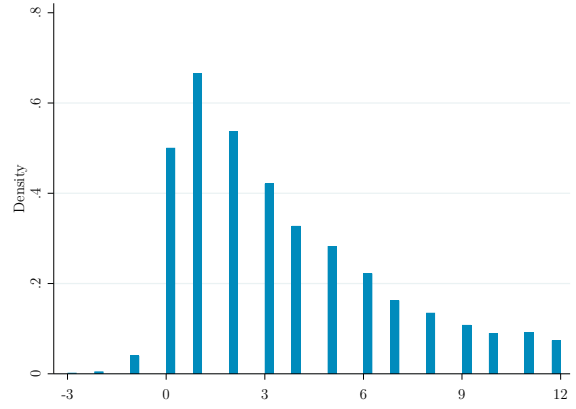
O presente Acordo Coletivo de Trabalho, aplicável no âmbito da(s) empresa(s) acordante(s), abrangerá a(s) **categoria(s) trabalhadores no comercio de minerios inclusive pesquisa de minerios e derivados de petroleo**, com **abrangência territorial** em **Caçapava/SP**.

*Note:* Figure shows an extract of a typical CBA found in *Sistema Mediador*, highlighting the standardized features in the underlying HTML. The title indicates whether the agreement is at the firm-level (*acordo*) or sectoral (*convenção*). The small table following the title contains the registration and filing dates. Afterwards are the two counterparts with their respective CNPJ identifiers. The initial two clauses are standardized. The first one contains the CBA validity (i.e., start and expiration date) as well as the reference negotiation date (*data-base*). The second clause includes the worker category in free text as well as the list of municipalities comprising the geographic coverage. All subsequent clauses are categorized into their selected groups from predetermined lists, contain a title and body where both are written as free text.

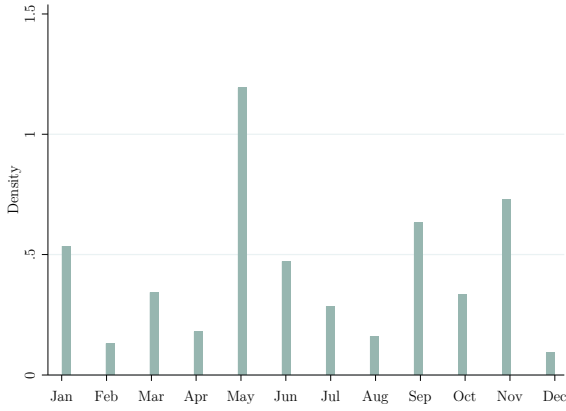
Figure A5: Histograms of Firm-Level CBA Characteristics



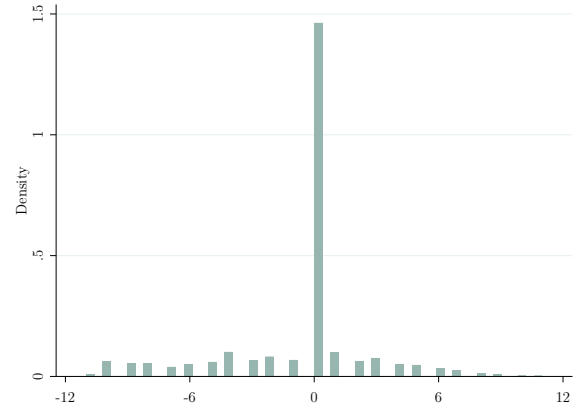
(a) Duration (months)



(b) Negotiation length (months)



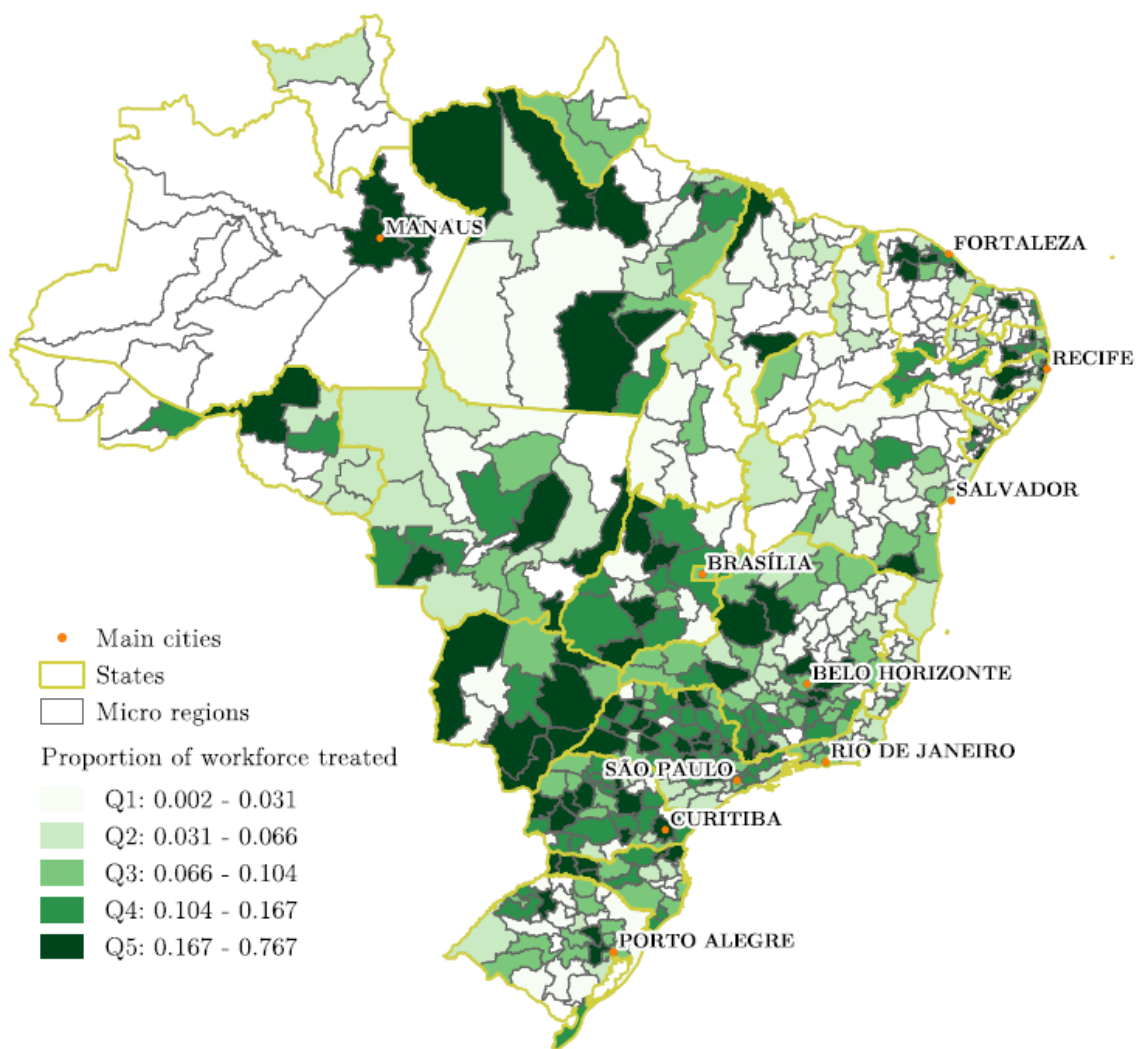
(c) Negotiation month



(d) Difference: start - negotiation month

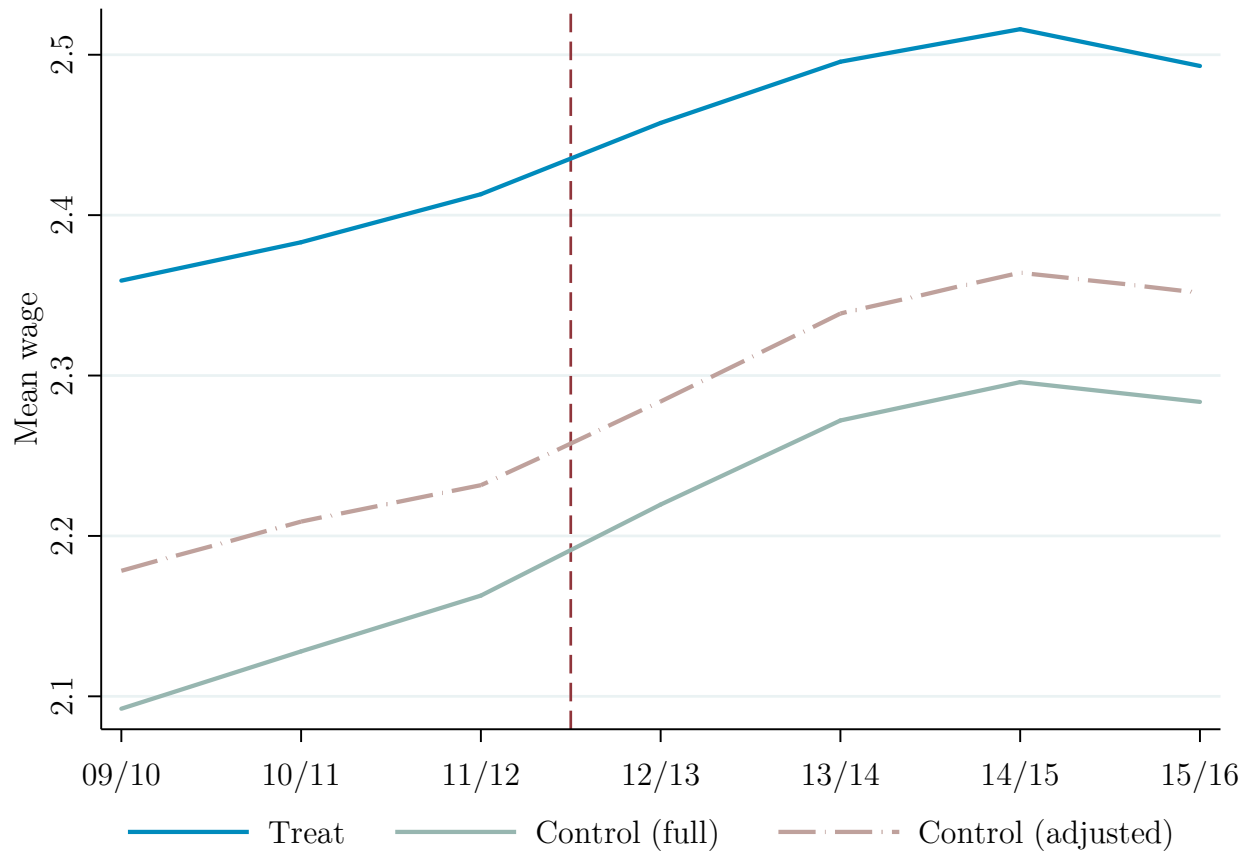
*Note:* Figures show histograms of characteristics from firm-level CBAs in Table 2. Duration is measured by rounding up the difference between the expiration and start dates divided by 30. Negotiation length is measured by rounding up the difference between the filing and start dates divided by 30—this histogram is restricted to lengths of -3 to 12 months. Negotiation month refers to the month specified in the reference date of negotiations (*data-base*) in the CBA. The difference between start and negotiation months is again measured within a given CBA.

Figure A6: Proportion of Workforce Treated by Micro-Region



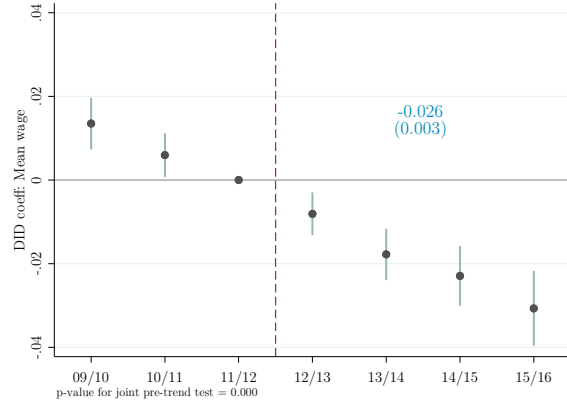
*Note:* Figure shows the proportion of the workforce in a given micro-region that are covered by a firm-level CBA that was filed prior and expired after the introduction of automatic extensions. The scale is determined by quintiles in the proportion of workforce treated across micro-regions.

Figure A7: Wage Trends by Establishment Group

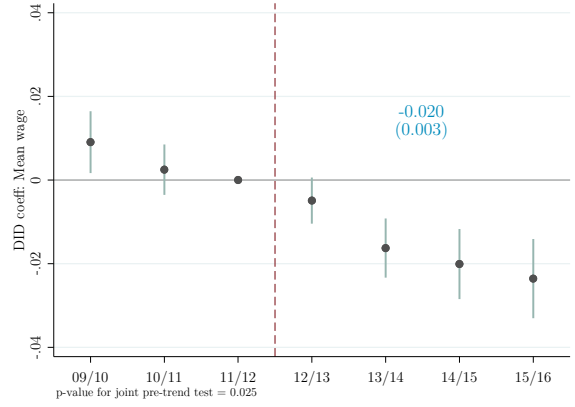


*Note:* Figure show the raw trends in establishment-level mean wages for the treated group, the full set of potential controls, and the adjusted set of controls based on the elastic net selection model. The vertical reference line marks the introduction of automatic extensions. The trends suggests that the selection procedure provides a set of establishments that are closer to the treated in levels and that experience a similar evolution of wages as the treated prior to the introduction of automatic extensions. Interestingly, the policy change coincides with a boost in wages across groups but the treated establishments seem to incur slower wage growth.

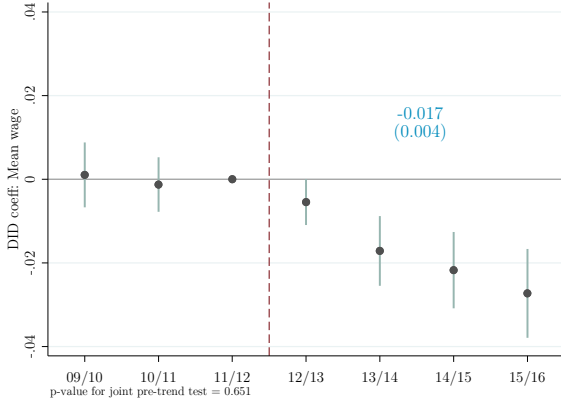
Figure A8: Impact of Automatic Extensions on Wages (Selection Models)



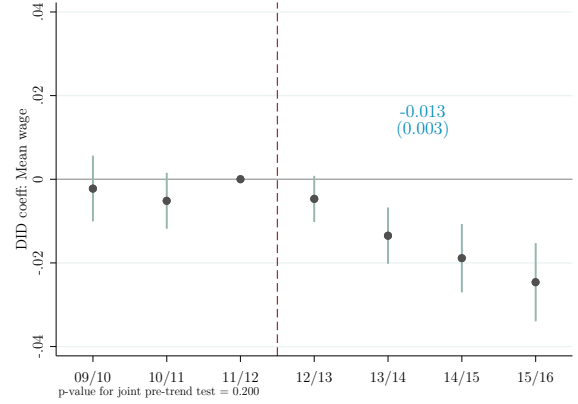
(a) No adjustment



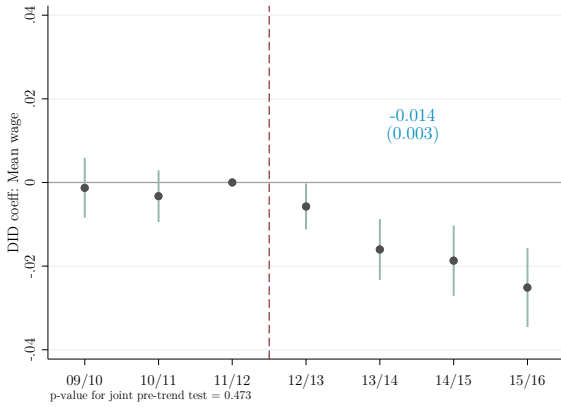
(b) Basic



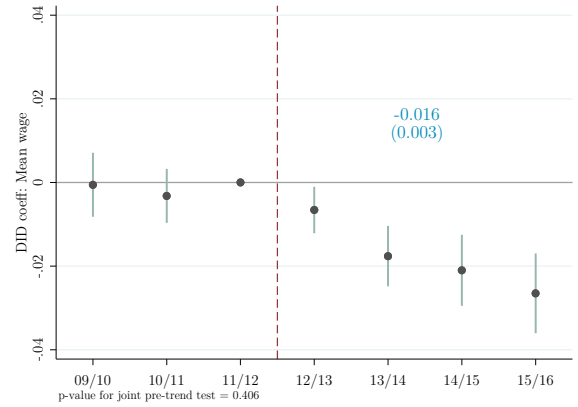
(c) Few controls



(d) All controls



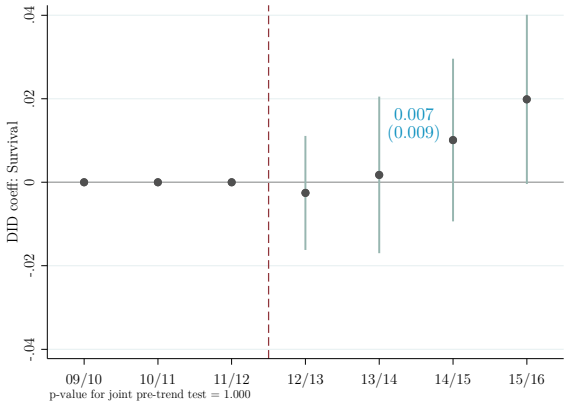
(e) Lasso



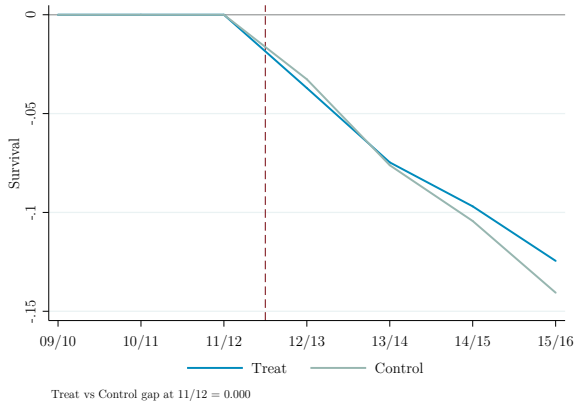
(f) Elastic net

*Note:* Figures show estimates of the  $\beta_j$  coefficients for  $j \in [09/10, 15/16]$  (with 11/12 omitted) from the DID specification in Equation 2 on mean wages for the analysis samples resulting from the different selection models in Table 4. Confidence intervals at a 95% level are provided for each coefficient. Below each figure are the p-value for a joint test of the null hypothesis that both pre-period coefficients are equal to zero. The overall DID estimates (i.e., the interaction of treatment and post-intervention dummies) with standard errors in parentheses are also reported. Regressions include establishment and filing period fixed effects, as well as separate time-varying fixed effects for industries and micro-regions. Each establishment is weighted by its average employment in the pre-policy period. Standard errors are clustered at the firm level. Interestingly, effects are dampened as the adjustment procedure provides more a reliable counterfactual.

Figure A9: Impact of Automatic Extensions on Survival



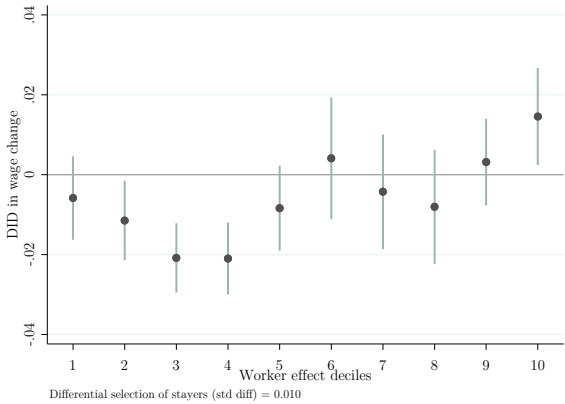
(a) DID coefficients



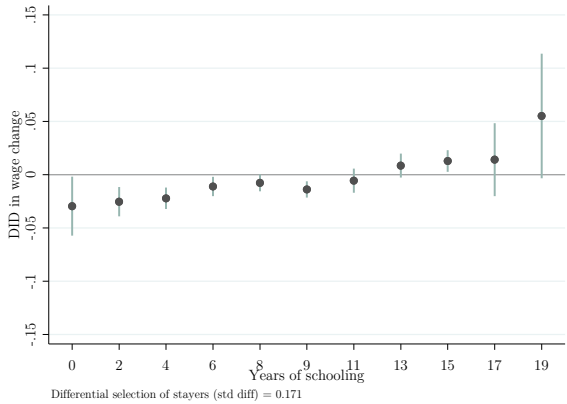
(b) Trends

*Note:* Figures show estimates of the  $\beta_j$  coefficients for  $j \in [09/10, 15/16]$  (with 11/12 omitted) from the DID specification in Equation 2 on establishment survival as well as the residualized trends in this outcome for both treated and control establishments. Confidence intervals at a 95% level are provided for each coefficient. Pre-intervention coefficients are all zero because of the balanced sample in the first three filing periods. The overall DID estimates (i.e., the interaction of treatment and post-intervention dummies) with standard errors in parentheses are also reported. Regressions include establishment and filing period fixed effects, as well as separate time-varying fixed effects for industries and micro-regions. Each establishment is weighted by its average employment in the pre-policy period. Standard errors are clustered at the firm level. The analysis sample is based on the elastic net selection model.

Figure A10: Wage Change of Stayers by Skill and Education



(a) Worker effect deciles



(b) Years of schooling

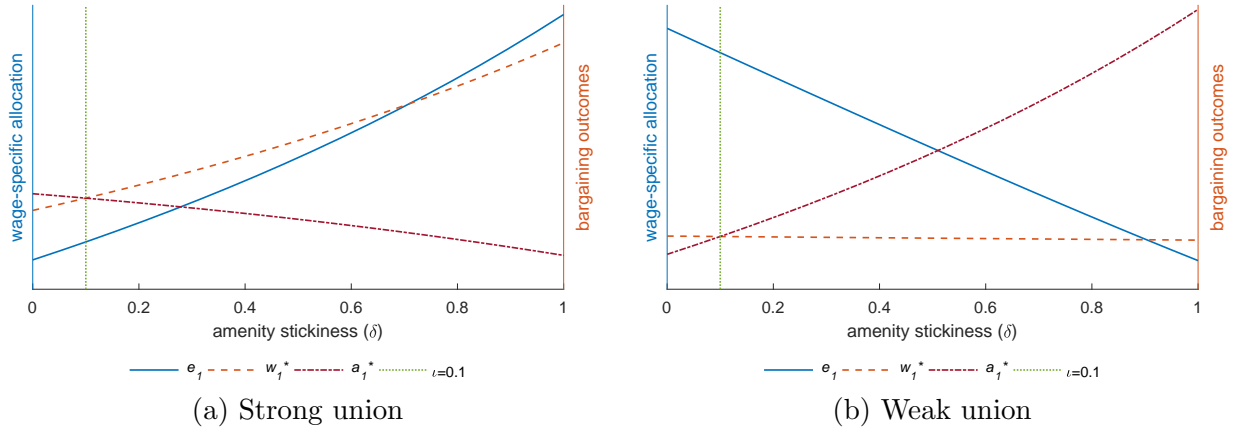
*Note:* Figures show the coefficients representing the difference in two-year wage changes among stayers in treated establishments relative to control establishments by worker effect deciles, on the left-hand side, and by years of schooling, on the right-hand side. The figures summarize the difference in these differences between 2009-2011 and 2011-2013. Confidence intervals at the 95% level are provided for each coefficient, as well as the standardized difference between treated and control of workers selecting into being stayers along the  $x$ -axis values. All regressions include time-varying industry and micro-region fixed effects. Standard errors are clustered at the establishment level. The analysis sample is based on the elastic net selection model.

Figure A11: Cross-Category Correlation of Union Density and Informality Rates



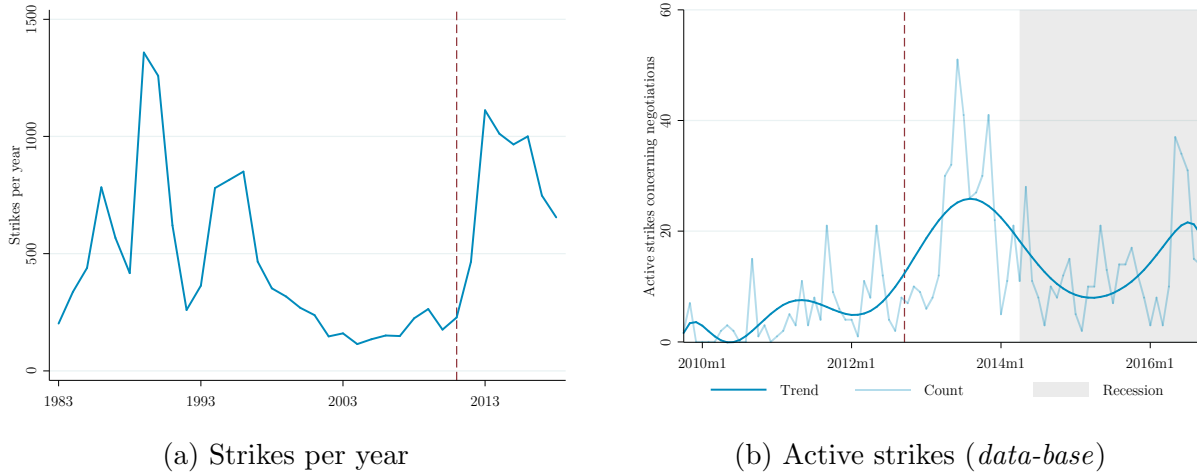
*Note:* Figure shows the relationship between union density and informality rates at the category level based on Brazilian household survey data (PNAD). Each dot corresponds to the union density and informality rate of a given category. The correlation coefficient  $\rho$  is then calculated across categories without applying any weights. The sample is restricted to private sector workers ages 22 to 66 in 2011, i.e., prior to the introduction of automatic extensions. Category groups are determined according to article 577 of CLT which details the union representation framework. I assign these categories to workers in PNAD based on the industry (CNAE) where they are employed using an industry-to-category crosswalk. Union density is the proportion of workers in the category who claim to be affiliated to a union. Informality rate is the proportion of workers in the category who admit to not being legally employed. These data are used to classifying metalwork, paper, chemical and pharmaceutical, and air transportation as the categories with the lowest informality rates in the robustness checks.

Figure A12: Model Simulations Assuming Log Utility



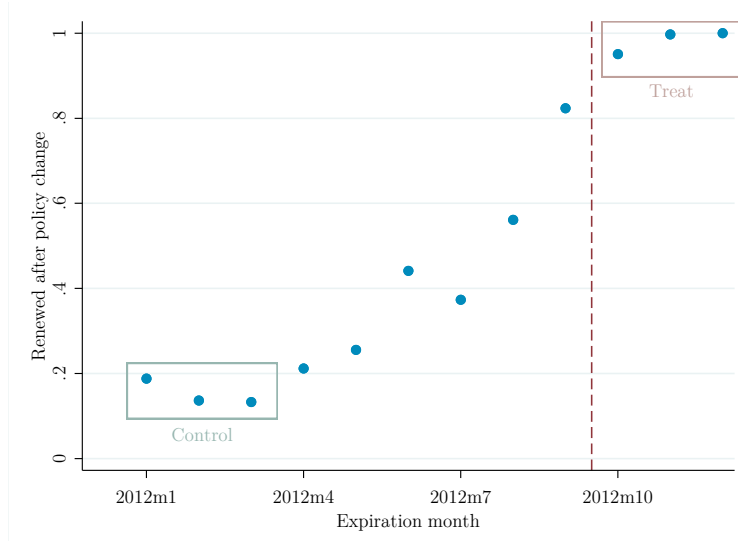
*Note:* Figures show the optimal union allocation during negotiations and the resulting bargaining outcomes for both wages and amenities as the amenity stickiness parameter  $\delta \in [0, 1]$  changes based on simulations of the model assuming  $u(\cdot) = \log(\cdot)$ . Figure A12a concerns a situation where unions are strong by setting  $\beta = 0.95$  and  $\phi = 0.01$ . Figure A12b concerns a situation where unions are weak by setting  $\beta = 0.01$  and  $\phi = 0.95$ . Other parameters are set to the following fixed values:  $\iota = 0.1$ ,  $p = 0.7$ ,  $\sigma = 0.2$ ,  $\gamma = 0.5$ ,  $e_2 = 0.5$ ,  $p = 0.7$ ,  $w_1^F = 50$ ,  $a_1^F = 50$ ,  $S_1 = 500$ , and  $S_2 = 500$ . The grid space for simulations uses 20 equally spaced values of  $\delta$  within  $[0, 1]$ . Two separate  $y$ -axis scales are used in these figures: optimal allocation on the left and bargaining outcomes on the right.

Figure A13: Trends in Private Sector Strikes



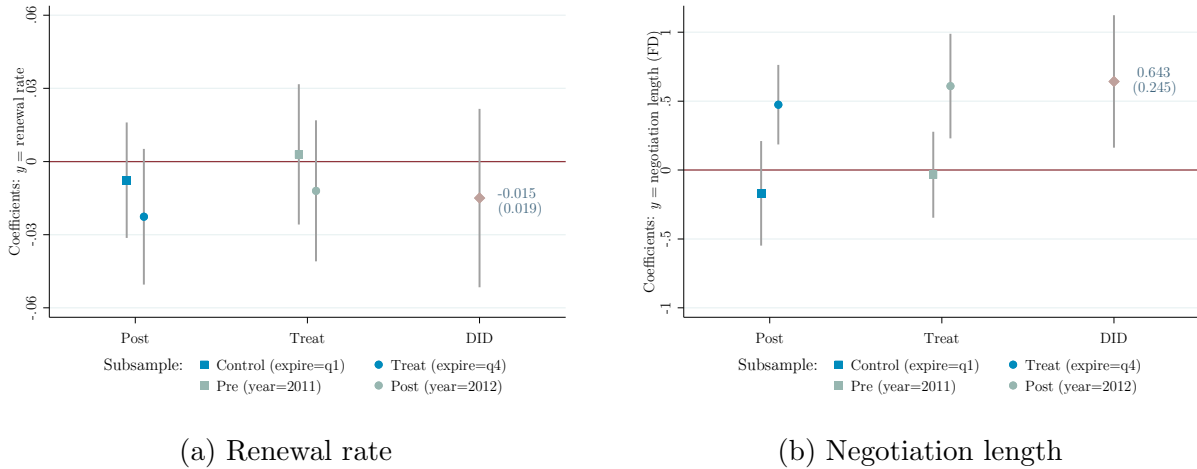
*Note:* Figures show trends in private sector strikes demarcating the introduction of automatic extensions with a vertical dotted line. Figure A13a displays the yearly count of strikes from 1983 to 2018. The level of strikes experienced after the introduction of automatic extensions compare to those occurring between the end of the military dictatorship (1985) to the stabilization programs of the *Plano Real* (1994). Figure A13b focuses on the monthly evolution of active strikes resulting from the collective bargaining process (*data-base*) during the sample period used in the main analysis. Due to high-periodicity stochastic cycles, a Butterworth filter is used on the time-series for monthly strikes in order to obtain underlying trends. The 2014 recession is marked by the gray area to highlight that the increase in strikes precedes this event. Strikes data obtained from SAG-DIEESE.

Figure A14: Probability of Negotiating Under Extensions (Conditional on Renewing)



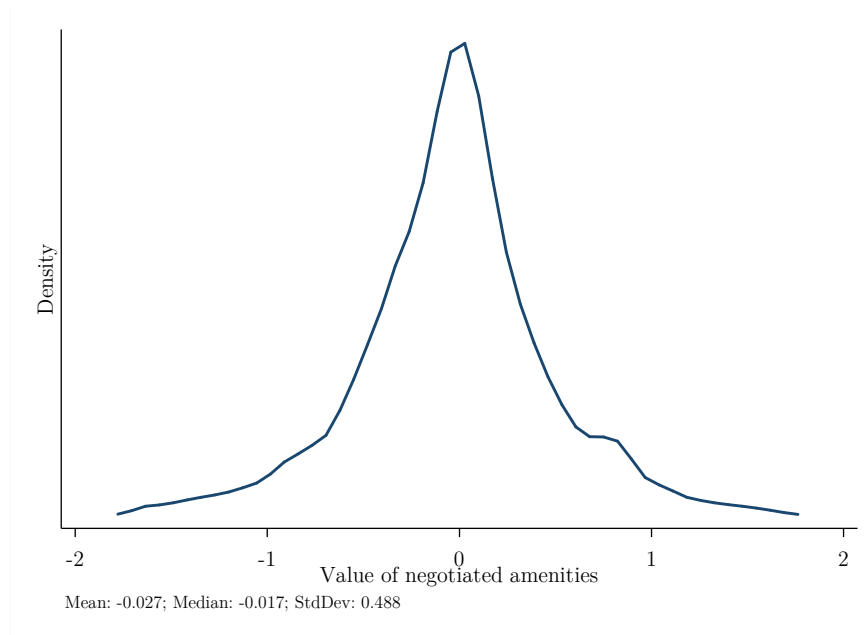
*Note:* Figure shows the proportion of bargaining units with CBAs expiring around the introduction of automatic extensions that renew after the policy intervention. The figure reveals prolonged negotiation periods, with nearly 20% filing after September 26th despite having their CBA expire in the first quarter of 2012. In contrast, virtually all renewals from bargaining units with CBAs expiring in the fourth quarter do so under automatic extensions. Exploiting these differences in likelihood of negotiating under the new policy, I take agreements expiring in Q1 as control units and those expiring in Q4 as treated units with 2011 as a pre-policy period for 2012 (see Appendix Figure A15). Note that estimates from this exercise are likely dampened since at least 20% of the control group is treated. Unfortunately, a regression discontinuity design is infeasible because I do not observe the running variable (i.e., active negotiations) unless the bargaining unit renews its CBA. This analysis is carried out using the 132,113 unique CBA level observations used to construct the panel at the bargaining unit level.

Figure A15: Impact of Automatic Extensions on Renewal Rates and Holdout



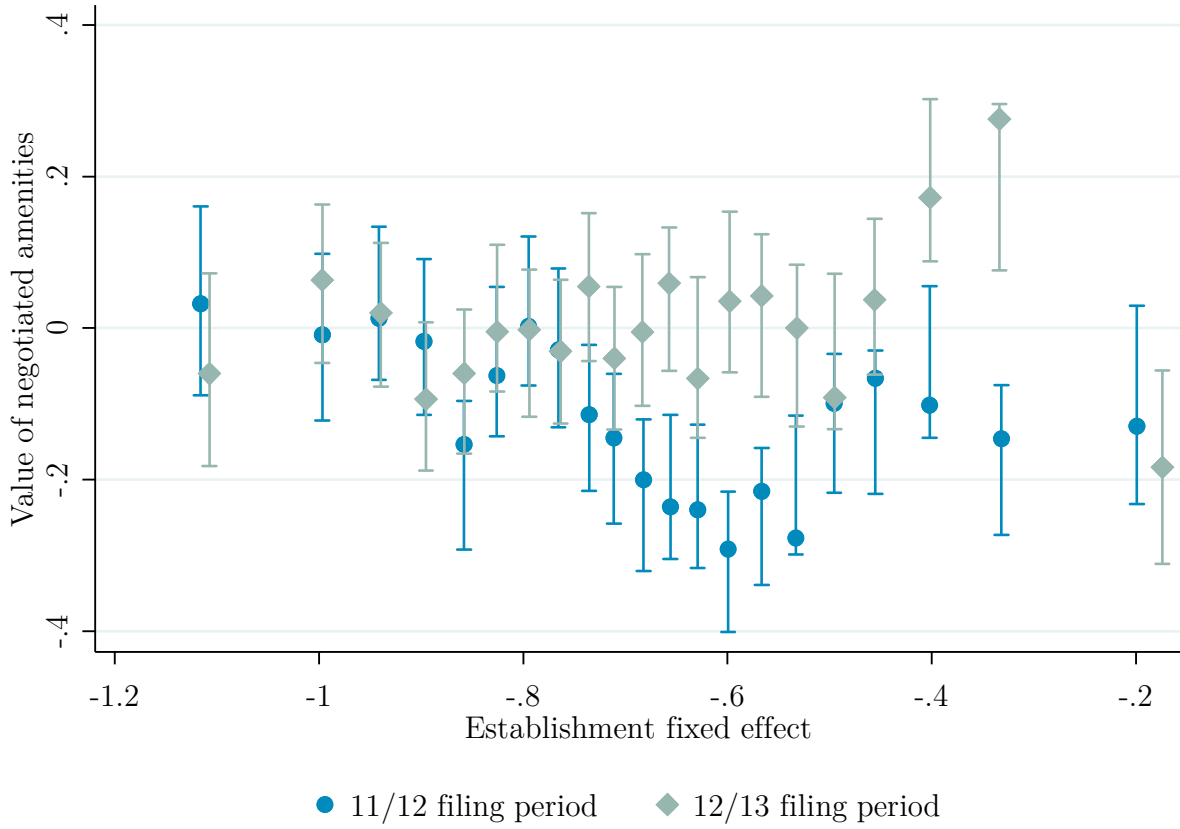
*Note:* Figures show the results of the simple DID described in Appendix Figure A14. Renewals are the proportion of bargaining units that file a subsequent CBA starting within one month of the original CBA's expiration date. Figure A15a shows a negative but statistically insignificant effect on renewal rates. Taking the difference in negotiation length between the renewal and the original CBA, Figure A15b shows a statistically significant increase in negotiation periods of nearly 2/3 of a month. The figure shows that this effect is driven by longer negotiations among the Q4 expiring CBAs in 2012.

Figure A16: Density of Amenity Value Among Extended CBAs



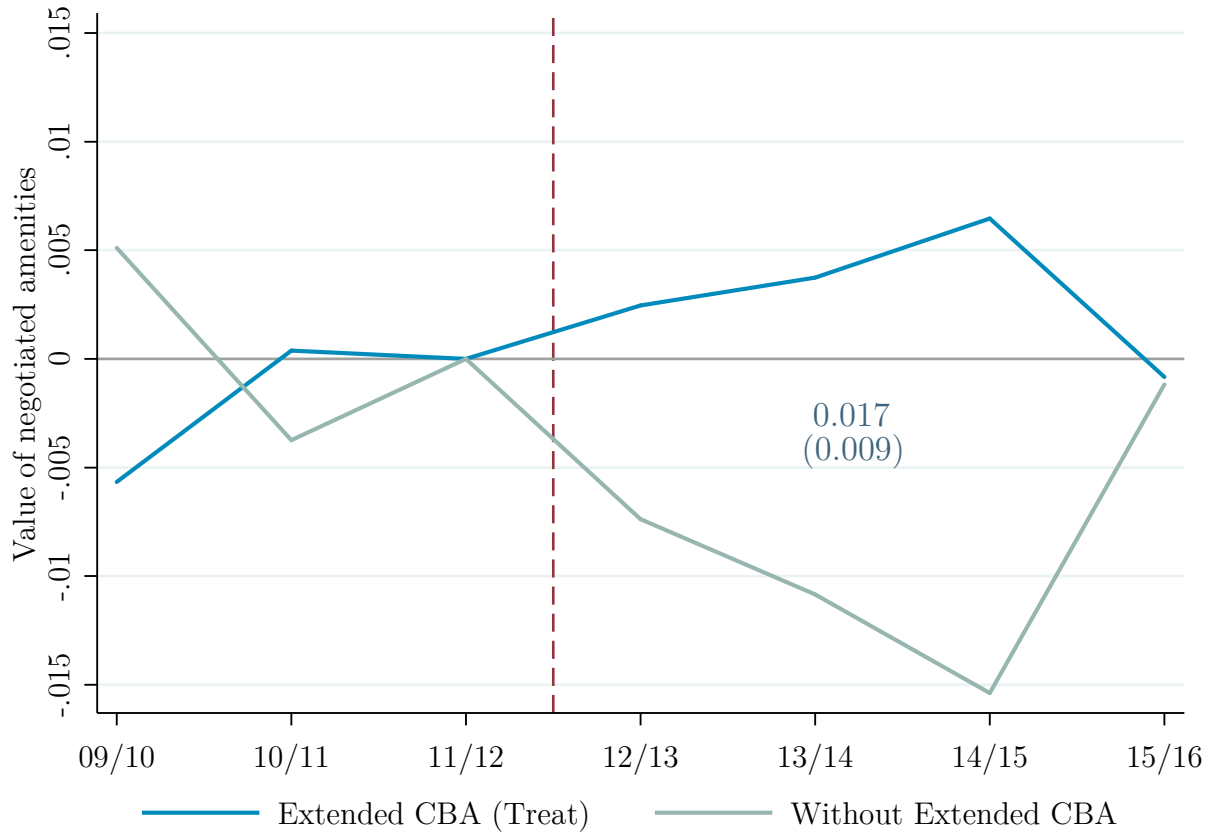
*Note:* Figure shows kernel density of the wage-equivalent value of negotiated amenities based on the set of unique firm-level CBAs from the analysis sample filed in 11/12. The density is estimated with an Epanechnikov kernel.

Figure A17: Are Wage Premiums Simply Compensating for (Dis)amenities?



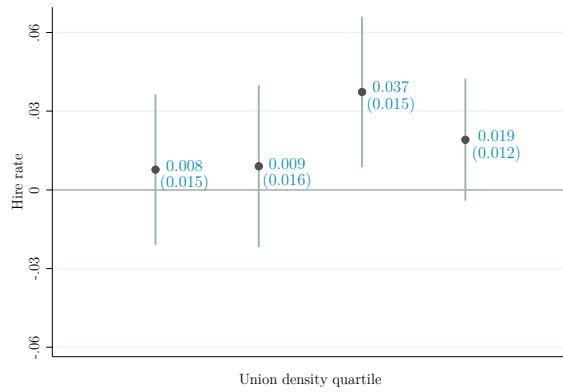
*Note:* Figure shows the scatterplots of average amenity value by establishment fixed effect bins across establishments covered by firm-level CBAs from the 11/12 and 12/13 filing periods. In other words, this figure displays the relationship between the wage premiums (based on an AKM model estimated on 2007-2016 worker flows) and the wage-equivalent measure of negotiated amenities (based on the predictive model of the Poaching Index estimated on 2010-2011 worker flows) in the cross-section of establishments prior and after the introduction of automatic extensions. The number of bins is chosen as per Cattaneo et al. (2019), imposing the same number of bins on both scatterplots. Confidence intervals at a 95% level are constructed based on a piecewise polynomial of degree 3 with 3 smoothness constraints.

Figure A18: Residualized Trends in Amenity Value: Bargaining Unit Panel

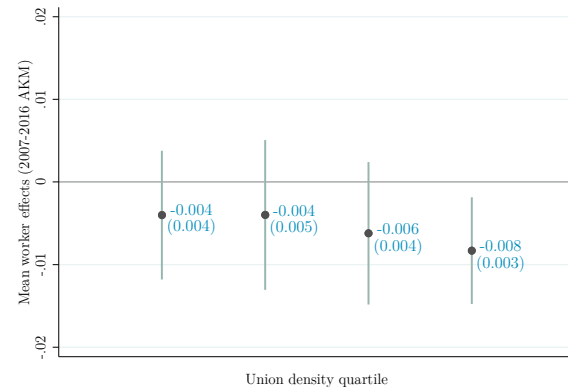


*Note:* Figure shows the residualized trends in amenity value based on the DID specification in Equation 2 at the bargaining unit level using units with extended CBAs as the treated group and those without as the control group. The sample is restricted to the bargaining unit panel described in Appendix D. The overall DID estimate (i.e., the interaction of treatment and post-intervention dummies) with standard errors is also reported. This coefficient is not interpreted as causal since the collective bargaining process in bargaining units without extended CBAs were also affected by automatic extensions. At the very least, the Figure reveals whether there are common year effects across groups in terms of changes to the value of negotiated amenities.

Figure A19: Impact of Automatic Extensions on Hire Rates and Worker Effects



(a) Hire rates



(b) Worker effects

*Note:* Figures show the impact of automatic extensions on hire rates and mean worker effects using the DIFD empirical strategy. Sample is restricted to establishments belonging to bargaining units with an extended CBA, at least two CBAs filed between 09/10 and 11/12, and at least one CBA filed between 12/13 and 13/14. The sample also includes the control establishments matched to the aforementioned treated establishments. The coefficients represent the treatment versus control difference in 1) the change in outcome for the two CBAs closest to the policy change that were filed prior to automatic extensions; and 2) the change in outcome between the CBA filed just before and just after the policy intervention. Union strength is determined by union density quartiles based on the micro-region $\times$ category cell of the bargaining unit. Regressions control for micro-region fixed effects and category fixed effects. Standard errors are clustered at the establishment level.

## B Additional Tables

Table B1: Collective Bargaining Characteristics in Brazil and Select OECD Countries

	Predominant level (1)	Sectoral extensions (2)	Clause precedence (3)	Bargaining coverage (4)	Peace clauses (5)	Employer lockouts (6)	Clause backdating (7)	Extension duration (8)
Brazil	Mixed	Uncommon	Favorability principle	All workers (65%)	Not allowed	Illegal	Status quo	Replacement*
Australia	Mixed	Non-existent	No relevant overlap	All workers (59%)	Yes, common	Allowed	No obligation	Termination notice
Chile	Firm-level	Non-existent	No relevant overlap	Members, opt-in (21%)	Not allowed	Allowed	No obligation	Replacement (selective)
Estonia	Firm-level	Uncommon	Favorability principle	All workers (19%)	Yes, common	Allowed	No obligation	Termination notice*
France	Sectoral	Common	Firm-level CBA*	All workers (98%)	Not allowed	Illegal	No obligation	Replacement
Germany	Sectoral	Common*	Favorability principle	Members only (56%)	Yes, common	Allowed	No obligation	Replacement
Greece	Mixed	Uncommon*	Firm-level CBA*	All workers (40%)	Yes, but rare	Illegal	Status quo	3 months*
Ireland	Firm-level*	Uncommon*	Favorability principle	All workers (34%)	Yes, common	Allowed	No obligation	Replacement
Japan	Firm-level	Uncommon	No relevant overlap	Members only (17%)	Yes, always	Allowed	Not relevant	Termination notice
Mexico	Firm-level	Uncommon	Favorability principle	All workers (13%)	Not allowed	Illegal	No obligation	Replacement
Portugal	Sectoral	Uncommon*	Firm-level CBA*	Members, opt-in (72%)	Yes, but rare	Illegal	No obligation	12 months*
Spain	Sectoral	De-facto true	Firm-level CBA*	All workers (73%)	Yes, common	Allowed	No obligation	12 months*
Sweden	Sectoral	Common	Not defined	Members only (90%)	Yes, common	Allowed	No obligation	Negotiation impasse
UK	Firm-level	Non-existent	Not defined	All workers (16%)	Not allowed	Allowed	No obligation	No automatic extensions
US	Firm-level	Non-existent	No relevant overlap	All workers (12%)	Yes, common	Allowed	Not relevant	Negotiation impasse

*Note:* Table shows collective bargaining characteristics in Brazil and select OECD countries. Information reflects collective bargaining situation for each country as of December 2015. Asterisks (\*) refer to characteristics that were modified since 2008. Column 8 contains general information on cross-country variation in automatic extensions. In particular, extension duration indicates the time limit or event that ends an automatic extension. Predominant level denotes whether firm-level or sectoral CBAs dominate collective bargaining. Sectoral extensions refer to the ability to extend sectoral CBA to non-signing parties. Clause precedence indicates the bargaining level that has preference when both firm-level and sectoral CBAs overlap. Bargaining coverage is the share of employees to whom collective bargaining applies (both private and public sectors). Peace clauses are no-strike commitments. An employer lockout is a work stoppage initiated by the employer during a labor dispute. Clause backdating refers to the retroactivity of CBAs.

*Sources:* Marginson and Welz (2014), Visser et al. (2015), ILO (2016), and OECD (2017).

Table B2: DID Estimates by Selection Model (Wage Outcomes)

	No adjustment (1)	Basic (2)	Few controls (3)	All controls (4)	Lasso (5)	Elastic net (6)	Balanced (7)
Mean wage	-0.026*** (0.003)	-0.020*** (0.003)	-0.017*** (0.004)	-0.013*** (0.003)	-0.014*** (0.003)	-0.016*** (0.003)	-0.016*** (0.004)
Mean wage (core occupation)	-0.024*** (0.003)	-0.015*** (0.004)	-0.018*** (0.004)	-0.014*** (0.004)	-0.015*** (0.004)	-0.017*** (0.004)	-0.018*** (0.004)
Mean wage (rank-and-file)	-0.024*** (0.003)	-0.018*** (0.003)	-0.016*** (0.003)	-0.014*** (0.003)	-0.015*** (0.003)	-0.016*** (0.003)	-0.016*** (0.004)
Mean wage (professional/technicians)	-0.031*** (0.005)	-0.021*** (0.005)	-0.023*** (0.006)	-0.019*** (0.006)	-0.021*** (0.006)	-0.017*** (0.006)	-0.014** (0.006)
Mean wage (incumbents)	-0.014*** (0.003)	-0.012*** (0.004)	-0.009** (0.004)	-0.006* (0.004)	-0.007** (0.004)	-0.008** (0.004)	-0.008** (0.004)
Establishment effects	-0.014*** (0.002)	-0.010*** (0.002)	-0.010*** (0.002)	-0.009*** (0.002)	-0.009*** (0.002)	-0.009*** (0.002)	-0.009*** (0.003)
Establishments (treat)	16,244	16,060	16,063	16,066	16,066	16,071	13,595
Establishments (control)	114,887	16,060	16,063	16,066	16,066	16,071	13,595

*Note:* Table shows the overall DID estimates (i.e., the interaction of treatment and post-intervention dummies) for numerous outcomes across various analysis samples. Column (1) includes the treated establishments compared to the full set of potential controls. Columns (2)-(6) show the analysis sample resulting from the selection models in Table 4. Column (7) applies the elastic net selection model on treated and potential control establishments that survive the entire sample period.

Table B3: Top Tokens Valued by Poached Workers

Positive tokens	Value	Negative tokens	Value
1. “Norm” (standard, normal)	0.102 [0.010]	1. “Enghen” (engineer)	-0.163 [-0.017]
2. “Ativ” (active, activity)	0.099 [0.010]	2. “Condic” (condition, limit)	-0.112 [-0.011]
3. “Nacional” (national)	0.085 [0.009]	3. “Filh” (child, son, daughter)	-0.099 [-0.010]
4. “Debit” (debit, debited)	0.083 [0.009]	4. “Port” (port, door)	-0.013 [-0.010]
5. “Real” (accomplish, real)	0.081 [0.008]	5. “Folh” (payroll, sheet)	-0.091 [-0.009]
6. “Gerent” (manager, manage)	0.069 [0.007]	6. “Avos” (grandparents)	-0.082 [-0.008]
7. “Imediat” (immediate, prompt)	0.069 [0.007]	7. “Reduz” (reduce, diminish)	-0.078 [-0.008]
Mean wage change (poached workers)			1.000 [0.102]
Establishments with 09/10-10/11 coverage			6,825
$\alpha$ parameter			1.000
$\lambda$ parameter			0.001
Out-of-sample RMSE (elastic net)			0.210
Out-of-sample RMSE (random forest)			0.212

*Note:* Table shows the top positively and negatively valued tokens (or root words) as measured by their impact on the Poaching Index after accounting for wage changes among poached workers. The coefficient on each token is divided by the coefficient on mean wage change among poached workers and can therefore be interpreted as a wage-equivalent measure. Values in brackets represent the coefficients from the elastic net regression prior to converting into the wage-equivalent measure. Sample restricted to establishments covered by firm-level CBAs in the 09/10 and 10/11 filing periods. The elastic net on the 90% random sample chooses  $\alpha = 1$ , so that only L1 regularization is used (as in lasso) with penalty parameter  $\lambda$ . The out-of-sample RMSE are obtained by predicting the poaching index with the trained models on the randomly excluded 10% sample.

Table B4: DID Estimates by Selection Model (Worker Flows)

	No adjustment (1)	Basic (2)	Few controls (3)	All controls (4)	Lasso (5)	Elastic net (6)	Balanced (7)
Hire rate	0.034*** (0.004)	0.033*** (0.005)	0.023*** (0.004)	0.028*** (0.005)	0.027*** (0.005)	0.027*** (0.005)	0.018*** (0.005)
Hire rate (first employment)	0.005*** (0.002)	0.005*** (0.002)	0.004** (0.002)	0.002 (0.002)	0.003* (0.002)	0.003* (0.002)	0.003 (0.002)
Layoff rate (low tenure)	0.009*** (0.002)	0.009*** (0.002)	0.006*** (0.002)	0.006*** (0.002)	0.005*** (0.002)	0.007*** (0.002)	0.005*** (0.002)
Layoff rate (high tenure)	-0.008** (0.003)	-0.008** (0.004)	-0.008** (0.004)	-0.007* (0.004)	-0.008** (0.004)	-0.008** (0.004)	0.000 (0.003)
Quit rate (low tenure)	0.007*** (0.001)	0.006*** (0.002)	0.004*** (0.002)	0.005*** (0.002)	0.005*** (0.002)	0.005*** (0.002)	0.004** (0.002)
Quit rate (high tenure)	-0.002*** (0.001)	-0.001* (0.001)	-0.001 (0.001)	-0.001* (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Establishments (treat)	16,244	16,060	16,063	16,066	16,066	16,071	13,595
Establishments (control)	114,887	16,060	16,063	16,066	16,066	16,071	13,595

*Note:* Table shows the overall DID estimates (i.e., the interaction of treatment and post-intervention dummies) for numerous outcomes across various analysis samples. Column (1) includes the treated establishments compared to the full set of potential controls. Columns (2)-(6) show the analysis sample resulting from the selection models in Table 4. Column (7) applies the elastic net selection model on treated and potential control establishments that survive the entire sample period.

Table B5: DID Estimates by Selection Model (Worker Quality)

	No adjustment (1)	Basic (2)	Few controls (3)	All controls (4)	Lasso (5)	Elastic net (6)	Balanced (7)
Mean worker effects (2007-2016 AKM)	-0.022*** (0.002)	-0.020*** (0.002)	-0.017*** (0.003)	-0.013*** (0.002)	-0.015*** (0.002)	-0.016*** (0.002)	-0.014*** (0.002)
Mean worker effects (2007-2011 AKM)	-0.016*** (0.002)	-0.016*** (0.002)	-0.012*** (0.002)	-0.009*** (0.002)	-0.010*** (0.002)	-0.012*** (0.002)	-0.010*** (0.002)
Mean worker+covariate effects	-0.022*** (0.002)	-0.019*** (0.002)	-0.016*** (0.003)	-0.013*** (0.002)	-0.014*** (0.002)	-0.016*** (0.002)	-0.013*** (0.002)
Mean worker effect netflow	-0.003* (0.002)	-0.006** (0.002)	-0.009*** (0.002)	-0.008*** (0.002)	-0.007*** (0.002)	-0.007*** (0.002)	-0.007*** (0.003)
Prop. completed high school	-0.013*** (0.002)	-0.008*** (0.002)	-0.006*** (0.002)	-0.006*** (0.002)	-0.007*** (0.002)	-0.008*** (0.002)	-0.007*** (0.002)
Mean tenure	-0.054*** (0.007)	-0.049*** (0.008)	-0.032*** (0.008)	-0.035*** (0.008)	-0.031*** (0.008)	-0.037*** (0.008)	-0.023*** (0.008)
Establishments (treat)	16,244	16,060	16,063	16,066	16,066	16,071	13,595
Establishments (control)	114,887	16,060	16,063	16,066	16,066	16,071	13,595

*Note:* Table shows the overall DID estimates (i.e., the interaction of treatment and post-intervention dummies) for numerous outcomes across various analysis samples. Column (1) includes the treated establishments compared to the full set of potential controls. Columns (2)-(6) show the analysis sample resulting from the selection models in Table 4. Column (7) applies the elastic net selection model on treated and potential control establishments that survive the entire sample period.

Table B6: Addressing Challenges to Identification Strategy (Composition Outcomes)

	Baseline Ind×Reg×Yr (1)	Balanced Panel (2)	No Sectoral Agreement (3)	Strongest Unions (4)	Lowest Informality (5)	Improved Expectations (6)
<i>Hire rate</i>						
Reference group	0.027*** (0.005)	0.016*** (0.005)	0.025*** (0.006)	0.025*** (0.007)	0.025*** (0.006)	0.041*** (0.010)
Column group	. (.)	. (.)	0.037*** (0.009)	0.031*** (0.007)	0.032*** (0.008)	0.042*** (0.009)
<i>Quit rate (high tenure)</i>						
Reference group	-0.001** (0.001)	-0.001 (0.001)	-0.001* (0.001)	-0.001* (0.001)	-0.001* (0.001)	-0.002 (0.001)
Column group	. (.)	. (.)	-0.002 (0.001)	-0.001 (0.001)	-0.002** (0.001)	-0.001 (0.001)
<i>Mean worker effects (2007-2016 AKM)</i>						
Reference group	-0.017*** (0.002)	-0.014*** (0.003)	-0.018*** (0.003)	-0.018*** (0.003)	-0.017*** (0.003)	-0.025*** (0.004)
Column group	. (.)	. (.)	-0.013** (0.006)	-0.014*** (0.004)	-0.017*** (0.005)	-0.020*** (0.006)
<i>Proportion with completed high school</i>						
Reference group	-0.009*** (0.003)	-0.007*** (0.002)	-0.009*** (0.003)	-0.009** (0.004)	-0.008** (0.003)	-0.005 (0.005)
Column group	. (.)	. (.)	-0.005 (0.005)	-0.009*** (0.003)	-0.011*** (0.003)	-0.008** (0.004)
<i>Proportion female</i>						
Reference group	0.001 (0.002)	0.002 (0.002)	0.002 (0.002)	0.001 (0.002)	0.003 (0.002)	0.003 (0.003)
Column group	. (.)	. (.)	-0.003 (0.004)	0.000 (0.002)	-0.004 (0.003)	-0.001 (0.003)
<i>Proportion nonwhite</i>						
Reference group	0.005 (0.003)	0.001 (0.004)	0.005 (0.004)	0.005 (0.004)	0.006 (0.004)	0.000 (0.006)
Column group	. (.)	. (.)	0.007 (0.005)	0.006* (0.004)	0.001 (0.004)	0.003 (0.004)
Establishments (reference)	32,142	27,190	27,944	24,114	26,865	6,570
Establishments (column)	.	.	4,198	8,028	5,277	4,716

*Note:* Table reports the coefficients for several DID regressions addressing challenges to identification. Column (1) runs the baseline specification in Equation 2 using time-varying micro-region×industry fixed effects instead of separate interactions for micro-regions and industries (this baseline is used throughout the table to enable comparison across columns). Column (2) considers a balanced panel of establishments, where balance is imposed on the treated and potential controls prior to the selection adjustments. All subsequent columns test for heterogeneity along some indicator variable, reporting the effects among establishments with an inactive heterogeneity indicator (Reference group), as well as those with an active heterogeneity indicator (Column group). Column (3) tests whether establishments in cells not covered by an extended sectoral CBA experience similar effects. Column (4) explores whether establishments with the strongest unions—proxied by the micro-region×category cells in the top quartile of union density (based on RAIS 2017)—experience heterogeneous effects. Column (5) tests whether low informality categories—that is, those in the first quartile of informality rates (based on PNAD 2011)—experience similar effects, i.e., metalwork, paper, chemical and pharmaceutical, and air transportation. Column (6) focuses on a subsample of industries where information from the business expectation survey (IESE) is available. The results explore whether establishments in industries whose growth expectations improved from 11/12 to 12/13 experience similar effects.

Table B7: DID Estimates by Selection Model (Employment Outcomes)

	No adjustment (1)	Basic (2)	Few controls (3)	All controls (4)	Lasso (5)	Elastic net (6)	Balanced (7)
Survival	0.013* (0.008)	0.015* (0.008)	0.002 (0.008)	0.001 (0.008)	0.005 (0.009)	0.007 (0.009)	0.000 (.)
Payroll	0.042*** (0.013)	0.079*** (0.017)	0.041*** (0.015)	0.028* (0.015)	0.039** (0.015)	0.035** (0.016)	-0.022* (0.013)
Employment	0.074*** (0.014)	0.104*** (0.017)	0.064*** (0.016)	0.046*** (0.015)	0.059*** (0.016)	0.056*** (0.017)	-0.002 (0.014)
Employment (fixed-term)	0.095 (0.077)	0.111* (0.067)	-0.074 (0.082)	0.042 (0.063)	0.092 (0.066)	0.132* (0.070)	0.116 (0.073)
Prop. female	0.002 (0.001)	-0.000 (0.001)	0.001 (0.001)	0.000 (0.001)	0.000 (0.002)	0.001 (0.002)	0.001 (0.002)
Prop. nonwhite	0.004 (0.003)	0.002 (0.003)	0.000 (0.003)	0.001 (0.003)	-0.001 (0.003)	0.003 (0.003)	-0.000 (0.003)
Establishments (treat)	16,244	16,060	16,063	16,066	16,066	16,071	13,595
Establishments (control)	114,887	16,060	16,063	16,066	16,066	16,071	13,595

*Note:* Table shows the overall DID estimates (i.e., the interaction of treatment and post-intervention dummies) for numerous outcomes across various analysis samples. Column (1) includes the treated establishments compared to the full set of potential controls. Columns (2)-(6) show the analysis sample resulting from the selection models in Table 4. Column (7) applies the elastic net selection model on treated and potential control establishments that survive the entire sample period.

## C Understanding *Sistema Mediador*

In 2007, Brazil's Ministry of Labor (MTE) launched a website for writing and submitting collective bargaining agreements (CBAs) called *Sistema Mediador*. On August 2008, MTE announced that all CBAs from 2009 onward needed to be submitted electronically through this website in order to be registered by the ministry, and therefore become legally binding. I've scraped all CBAs from this website as of September 2018. The objective of this appendix is to understand how these data are produced.

### Application

An application is needed in order to submit a CBA through *Sistema Mediador*. The applicant must provide the following information to start the process:

- Applicant's representation: workers or employers
- Applicant's unique identifier: CNPJ or CEI (this information is validated by the website which is then used to automatically fill-in other fields, e.g., name, address, etc.)
- Level of bargaining: firm-level or sectoral
- Type of CBA: original or amendment to an original (in the latter case, the application number of the original CBA must be provided)

After providing this basic information, the applicant receives an application number that can be used to edit information about the CBA before submitting the agreement. In theory, the applicant can share this number with the negotiating counterpart, allowing either party to make online edits to the CBA.

### Submission

The next step in the process is to provide additional information, write the CBA, and submit it through the website. The additional information required includes:

- Identifier of the counterpart (CNPJ or CEI)
- Identifier of any additional entity signing the CBA (CNPJ or CEI)
- Name and title of the representatives of all parties involved
- Validity period of the CBA, i.e., a start and end date (cannot exceed two years)
- *Data-base* of the category, i.e., the reference calendar date for negotiations

- Category of coverage, i.e., free text describing the workers covered
- Geographic coverage, i.e., the municipalities in which the CBA will be binding

Once this information is provided, *Sistema Mediador* makes some validation checks, e.g., that the geographic coverage corresponds to the labor union's jurisdiction.

With the additional information validated, one can start writing the clauses of the CBA. Before writing each clause, the applicant must classify it into a broad group and then a specific subgroup from predetermined lists. Once the clause is classified, the applicant can write the clause title and its content. Although the title and description of the clause is free text, one can import clauses from previous CBAs registered in *Sistema Mediador* by providing the corresponding application number. In addition to the clauses, an applicant can insert appendixes to the agreement. Unlike clauses, the appendixes are not classified into groups and subgroups, but they can also be imported from previous CBAs.

The final task in this step of the process is to submit the agreement. Additional validation checks are made after clicking submit, e.g., that the CBA has at least one clause. Once the agreement is submitted, it cannot be edited, meaning that all negotiations should have taken place beforehand. If the submission is successful, a registration form becomes available. This form must be signed by all parties involved and filed in person at the regional offices of the MTE. A filing number is provided to track the registration status of the CBA.

## **Corrections**

After filing the registration form, it is possible that MTE notifies the parties that some corrections are required before formalizing the registration of the CBA. When that is the case, the applicant can access the CBA through *Sistema Mediador* and make the corrections. There are two modalities for corrections. One is for editing the CBA's category, which can be done completely online. The other is to provide additional requirements. In this last case, the applicant must print the requirement form, fulfill the request, and file the form at the regional MTE offices. Once all corrections (if any) are approved by the MTE, the CBA is registered and becomes law. A registration number is provided as proof of the legally binding agreement.

## D Data Construction

### Collective bargaining agreements

I import CBAs scraped from *Sistema Mediador* with start dates from 2008 to 2017 at the counterpart pair level. Hence, a single CBA has multiple observations when at least one of the worker or employer counterparts has more than one signing party. CBAs with invalid counterpart pair information and expiration dates are dropped. In addition to removing duplicate entries, cases where the CBA constitutes an employment protection program are also dropped.<sup>1</sup> These restrictions eliminate 357 observations out of 962,097.

I then distinguish which of the counterparts in the pair corresponds to workers versus employers. This is done by determining whether the CNPJ identifier matches to a labor union or an employer association primarily using information from the 2016 national union registry (CNES), as well as supplementary information found in union formation requests, affiliation to national union centers, and RAIS. The end result consists of counterpart pair level observations for each CBA where the worker and employer sides in each pair are identifiable. The few cases where I cannot distinguish the counterparts or where the resulting counterparts do not conform to the type of agreement (i.e., firm-level vs. sectoral) are dropped.<sup>2</sup> These restrictions keep 98% of all initial observations.

Unregistered CBAs and amendments to existing CBAs are ignored, in order to keep only registered and original agreements. Firm-level (sectoral) agreements make 83.4% (16.6%) of all unique CBAs. Out of these, 4.2% (12.4%) of observations are amendments while 31.7% (30.5%) were never registered. Exploiting information from CNES, I keep observations where the union represents regular workers, i.e., categories that align with industries. More than 90% (85%) of unique agreement $\times$ union observations correspond to unions that represent regular workers. The remainder include 4.5% (7.0%) to differentiated categories or professions and 3.1% (3.7%) to rural workers, among others. I then keep unique employer observations for each agreement, ignoring the possibility of multiple worker counterparts. All restrictions up to this point are the same for both firm-level and sectoral CBAs, but as focus turns toward employer characteristics important differences arise given data constraints on employer associations relative to establishments.

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<sup>1</sup>Employment protection programs only start appearing in *Sistema Mediador* from 2016 onward. Firms that join the *Programa de Proteção ao Emprego (PPE)* are able to temporarily reduce working hours by up to 30%, with a proportional reduction in wages. In return, the government compensates workers whose wages have been reduced 50% of the wage cut.

<sup>2</sup>In a firm-level agreement the employer counterpart must be an establishment and the worker counterpart must be a labor union. In a sectoral agreement the employer counterpart must be an employer association and the worker counterpart must be a labor union.

## Firm-level agreements

Merging in information from the agreements’ geographic coverage, I generate observations at the agreement $\times$ employer $\times$ geography level. Using the first 8-digits of the employer’s CNPJ identifier, these observations are merged into the establishments found in RAIS 2008-2017 that are 1) subsidiaries of the signing firm; and 2) inside the CBA’s geographic coverage. About 93% of unique agreement $\times$ employer observations are matched to an establishment in RAIS. Out of these matched observations, nearly 73% are from the largest connected set linked by worker flows from 2007 to 2016—this restriction is applied later on. The resulting data set has unique agreement $\times$ establishment observations for all firm-level CBAs with coverage over workers employed by establishments in RAIS.

I then drop agreements filed in 2007, with retroactive filing dates (i.e., filed after expiration), or with proactive filing dates (i.e., filed more than 3 months before start date). I also restrict attention to CBAs filed between September 26th, 2009 and September 25th, 2017 to align with filing periods  $\mathcal{J} \in [09/10, 15/16]$ .<sup>3</sup> Using the categories as defined by the classifier, I remove agreements where the category of coverage is rural workers or public servants. Leveraging information from RAIS, I focus on private sector establishments with more than 10 workers employed throughout December 2009, 2010, and 2011 that are operating from January 2009 to September 2012.<sup>4</sup> After applying this set of restrictions, the data set contains 133,361 firm-level CBAs covering 42,059 unique establishments. Restricting to the largest connected set of establishments retains 99.1% of the unique agreements and 98.0% of the establishments.

Taking the 132,113 unique firm-level CBAs matched to their respective establishments of coverage, I create a panel of covered establishments over filing periods. This panel is used to generate the descriptive statistics in Table 2. It is also the starting point for the establishment level panel used in the analysis for wages, as well as the bargaining unit level panel used in the analysis for amenities (both described in detail below).

## Sectoral agreements

Employer associations represent a subset of establishments from a given industry in a defined geographic jurisdiction. The unavailability of mapping establishments to employer associations requires that I rely on the information available in each CBA regarding geographic coverage and category covered to get a broad sense of the workers affected by these sec-

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<sup>3</sup>Any agreement $\times$ establishment observation with zero employment during the filing period of the matched CBA is dropped so as to exclude non-operating establishments at the time of the CBA’s enforcement.

<sup>4</sup>For each establishment, I only consider information for monthly wage earners with open-ended contracts working at least 30 hours a week.

toral agreements. Hence, I bundle employer associations that bargain together as a single unit and treat any change in the CBA’s geographic coverage as an expansion/reduction of the establishments covered.<sup>5</sup> Moreover, I restrict attention to those agreements whose category matches the modal category for the employer association across CBAs. The reasoning for this restriction is that employer association still bargain with unions that are not their core workforce, e.g., the association of private schools bargains with teachers as well as bus drivers. Hence, this restriction mirrors the focus on outcomes for workers in core occupations made in the firm-level CBA analysis.

Upon merging the information on geographic coverage, I obtain observations at the agreement $\times$ association $\times$ geography level where I separately consider municipal, state, and national coverage levels. Among unique sectoral CBAs, the highest level of geographic coverage is municipal for 86.7%, state for 13.1%, and national for 0.1%. Only 64 agreements have more than one level of geographic coverage, so that treating these geographic levels separately generates limited coverage repetition from a single CBA. Coverage repetition *across* CBAs is much more common since this approach relies on a classifier and a crosswalk to determine the industry covered by each sectoral CBA. Moreover, it assumes that all establishments of the selected industry are covered by the agreement. These caveats are precisely the reason why an analysis at the sector-level is not viable and why sectoral coverage ends up being much higher than official statistics (90% versus 65%). The resulting data set consists of unique agreement $\times$ association $\times$ geography observations for all sectoral CBAs with coverage over the core workforce of “potentially” represented establishments.

I then drop agreements filed in 2007, with retroactive filing dates (i.e., filed after expiration), or with proactive filing dates (i.e., filed more than 3 months before start date). I also restrict attention to CBAs filed between September 26th, 2009 and September 25th, 2017 to generate the filing periods  $\mathcal{J} \in [09/10, 15/16]$ . Using the categories determined by the classifier, I remove agreements where the category of coverage is rural workers or public servants. Unfortunately, having observations at the employer association level preclude leveraging RAIS to apply additional restriction used on firm-level CBAs. After applying this set of restrictions, the data set contains 37,881 sectoral CBAs covering 195,348 unique association-municipality pairs.

Taking the 37,881 unique sectoral CBAs matched to their respective employer association and geography of coverage, I create a panel of covered association $\times$ municipalities over filing periods. This panel is used to generate the descriptive statistics in Table 2. This panel is also

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<sup>5</sup>Given that 88% of sectoral CBAs are signed between a single employer association and a single labor union, the error introduced by bundling employer associations is likely to be small. In fact, the density of the network of co-signing associations is 0.0019.

used to determine the industry×municipalities that did not have a treatment CBA at the sector-level which are used for verifying that results are not driven by sectoral negotiations.

## Panel at the establishment level

Starting with the panel used to generate the descriptive statistics in Table 2 at the firm-level, I define a treatment CBA as one that 1) is filed prior to the policy change; 2) expires after the policy change; and 3) has a duration of at least 12 months. The first two conditions imply that an agreement that was signed as temporary was unexpectedly extended by the policy change. The third condition ensures that the agreement pertains to annual negotiations (i.e., *negociações de data-base*) rather than idiosyncratic ones.<sup>6</sup> A treated establishment is one covered by a treatment CBA. Note that whether an agreement is filed after automatic extensions does not factor into any distinction between establishments.

I then consider all establishments in the largest connected set (2007-2016) that are also in the private sector with more than 10 workers employed throughout December 2009, 2010, and 2011 that are operating from January 2009 to September 2012. I then keep treated establishments as well as those that did not engage in firm-level collective bargaining prior to the policy change. Afterwards, I restrict the latter to those that are in the same micro-region×industry as the treated so as to generate a pool of potential controls with similar sectoral coverage.<sup>7</sup> In terms of unique establishments, 16,260 are treated and 115,056 are potential controls. Therefore, the resulting data set includes all treated establishments plus a set of potential controls with similar sectoral coverage that can generate a balanced panel for the three filing periods prior to the introduction of automatic extensions.

From this data set of treated and potential control establishments, I construct the panel at the establishment level. The first step is to apply the matching procedure (if any) to select among the potential controls. The second step is to obtain the desired outcome variables by filing period for the set of establishments considered from the RAIS data files. When generating these outcomes, I only consider information for monthly wage earners with open-ended contracts working at least 30 hours a week.<sup>8</sup>

## Panel at the bargaining unit level

Starting with the panel used to generate the descriptive statistics in Table 2 at the firm-level, I keep all agreement×establishment observations in that panel. Since the goal is to

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<sup>6</sup>Only 4.4% of agreements satisfying the first two conditions have a duration below 12 months.

<sup>7</sup>There are indeed significant differences in terms of industry and location between treated and control groups as evidenced by the removal of 51.0% of the potential controls after applying this restriction.

<sup>8</sup>These same criteria were used in prior steps of the data construction involving RAIS files.

link CBAs over time, the fact that more than one establishment can sign a single agreement and that a single establishment can negotiate with different worker categories precludes the use of establishment identifiers. Consequently, I create a new employer identifier based on the set of co-signing establishments in agreements covering the same category.<sup>9</sup> The modal characteristics across establishments are then assigned to the co-signing group (e.g., municipality, industry, etc.) before collapsing to the 132,113 unique CBA level observations. This is the panel used for the motivation figures such as A2 and A3.<sup>10</sup>

Focusing on annual negotiations, I restrict attention to agreements with duration of at least 12 months. This leaves 86.6% (or 114,469) of the original CBAs considered. I then link CBAs across time for each co-signing group by repeating the following algorithm until all agreements are assigned to a bargaining unit. First, take the mode start month and expiration month across CBAs of each co-signing group. Second, assign those CBAs that share the same start and expiration month (plus or minus one month) to a new bargaining unit. Third, ignore all CBAs that have been assigned and repeat. Hence, a bargaining unit consists of an employer counterpart that engages in collective bargaining with the same category of workers while maintaining a consistent reference month for negotiations (*database*). This definition adheres to the collective bargaining structure described in Section 1.1

To generate a panel of bargaining units, I allow only a single CBA per filing period. Applying this restriction reduces the number of unique CBAs to 91,474.<sup>11</sup> The criteria for selecting among multiple CBAs are the following: 1) latest expiration date; 2) longest duration; 3) largest number of clauses; 4) earliest file date; 5) smallest difference between file and registration date; and 6) random selection.<sup>12</sup> To account for the possibility of changing the reference month for negotiations, linked CBAs for the same co-signing group are joined into a single bargaining unit as long as there are no overlaps in filing periods.

## Sample for AKM

The raw RAIS data are provided in state-year files. The variable names, labels, types, formats, and value labels are standardized across years. For each state-year file, I keep workers employed on December 31st whose tenure is greater than one month to ensure

<sup>9</sup>This step reduces the number of employer identifiers from 41,199 establishments to 29,553 co-signing groups. The main reason for this reduction is that it collapses the expansion in establishments that resulted from considering all subsidiaries within the CBA's geographic coverage. In fact, most firm-level agreements only involve one employer counterpart.

<sup>10</sup>Similar results hold in the final panel at the bargaining unit level, but having the full set of CBAs allows for better comparison to the descriptive statistics in Table 2.

<sup>11</sup>More than half of this 20% loss in unique CBAs is due to repeated entries, i.e., agreements that share the same start and expiration date within a bargaining unit.

<sup>12</sup>The ordering of these criteria ensures that treatment CBAs are not removed from the panel.

employment throughout December—the month at which wages are calculated. Workers with invalid information for individual identifiers, establishment identifiers, and December wages are dropped. Log hourly wages are constructed by taking the natural logarithm of the real value of December wages (using Brazil’s CPI for that month) divided by the monthly contracted hours (using weekly contracted hours multiplied by 4.348). When there is more than one December job for a given person-year pair, I keep the observation with the highest contracted hours. If tied in contracted hours, I keep the observation with the highest log hourly wage. If tied in contracted hours and log hourly wages, I randomly selected one observation. This ensures that person-year observations are unique within each state.

The selected unique person-year observations for each state are then stacked across 2007-2016 into a single state file. Each establishment is assigned its modal legal classification, municipality, and industry code. Each worker is assigned its modal gender, race, date of birth, and education. I then keep observations belonging to the private sector based on the legal classification of each establishment (removing observations with the Central Bank industry code as well as those with invalid industry codes), and workers who are hired on open-ended non-rural contracts that are paid on a monthly basis.

The remaining observations in each state file are then stacked across states into a single master file. The entire employment history of an individual is removed when one of the following four conditions is satisfied. First, the worker has a repeated person-year observation across states. Second, the nominal value of the reported December wage is below the federal minimum wage for that month, accounting for contracted hours. Third, the log hourly wage is in the 99th percentile of the wage distribution in the state $\times$ year. Fourth, the log hourly wage changes by more than 100 log points in adjacent years. Based on these person-year observations, the modal assignments from the previous paragraph are applied again.

The remaining person-year observations, age 25 to 54 and with at least one year of potential labor market experience, constitute the sample considered for the AKM model.<sup>13</sup> The AKM model provides a parametric way to estimate: 1) establishment-specific wage premiums paid to all workers regardless of skill; and 2) skill component that workers carry with them across establishments. The specification is

$$w_{it} = \theta_i + \psi_{J(i,t)} + X'_{it}\beta + r_{it}$$

where  $w_{it}$  denotes log real hourly wage,  $\theta_i$  is a person effect that captures any time-invariant but fully portable components of earnings capacity,  $\psi_{J(i,t)}$  represents a wage premium paid at establishment  $j$  to all workers,  $J(i,t)$  is an index function indicating the workplace for

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<sup>13</sup>The education variable is used to calculate years of schooling. I calculate the years of potential labor market experience as  $age - schooling - 6$ .

worker  $i$  in year  $t$ ,  $X'_{it}$  is a vector of time varying controls (e.g., year effects and controls for individual experience), and  $r_{it}$  is a time-varying error capturing all other factors, including any person-specific job match effects. The fixed effects are identified in the connected set of establishments linked by worker mobility. As is common practice, I use the largest connected set based on worker flows in the sample period of interest, i.e., full period (2007-2016), pre-period (2007-2011), and post-period (2012-2016). The estimates are unbiased as long as mobility is unrelated to  $r_{it}$ . Standard falsification tests suggest that endogenous mobility is not a concern in the RAIS data.

## E Category Classifier

The data to train the classifier is generated as follows. Starting with the employer  $\times$  agreement  $\times$  geography data for firm-level CBAs (prior to restricting to establishments in the largest connected set), I keep the set of unique establishment  $\times$  agreement observations. I then merge in the information pertaining to each agreement to assign them an industry based on the mode 3-digit industry code across covered establishments. Using the crosswalk from industry codes to categories, the end result is a list of unique firm-level CBAs with the mode industry of coverage as well as the category of coverage that corresponds to that industry.<sup>14</sup> I then merge into these observations the free text under “category of coverage” from each CBA.

In order to train the classifier, there must be some CBAs that are correctly classified. By applying filters on each industry-based category classification—i.e., category based on the industry-to-category crosswalk—I manually assign the correct category to a 25% random sample of CBAs. Whenever the free text inputted as “category of coverage” is ambiguous, no classification is assigned.<sup>15</sup> Although this implies that training the classifier cannot account for such ambiguous cases, I apply a boosting technique that essentially corrects this issue.

Leveraging the sample of CBAs classified according to category of coverage, I train and test a multinomial one-versus-all (OvA) logit classifier.<sup>16</sup> The processed text is transformed into a bag-of-words vector containing the number of times each word from the vocabulary appears in the text.<sup>17</sup> Using a 50% random sample, the classifier is trained using a 3-fold cross validation. The trained classifier has 98.6% precision and 96.4% recall on the out-of-sample validation set. Note that this precision and recall apply only for the CBAs that I was able to classify manually (it ignores ambiguous category text). It is thus too bright of a picture for how the classifier performs on the full set of CBAs.

To improve the performance of the classifier, I exploit the fact that unions can only represent one category. To this end, I use the trained classifier to predict the category of all valid and original CBAs, both at the firm- and sector-level. Using unique agreement  $\times$  union observations, I assign each union its mode category as assigned by the classifier. Finally, each CBA is assigned the mode of the corrected category across signing unions. Prior to this boosting technique, the classifier’s precision in a random sample of 100 CBAs is 81%. After this correction, precision improves to 94%.

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<sup>14</sup>Category groups are built from article 577 of CLT detailing the union representation framework.

<sup>15</sup>Ambiguity usually arises from category entries such as “all employees in the signing firms.”

<sup>16</sup>An OvA classifier runs a logit where the outcome is the probability of being classified as  $x$  (as opposed to not  $x$ ) based on the text tokens. I run this regression for all  $x$ , i.e., for each worker category group. Each observation is then classified according to the category group with the maximum predictive value.

<sup>17</sup>The category text is processed by converting into lower case, removing punctuation, numbers, and stop-words, and applying a Portuguese snowball stemmer.

## F Two-Period Model

### Setup

Consider a surplus  $S > 0$  resulting from the joint production of unionized workers' labor and their employers' capital. This surplus is to be split between the firm and the union through a collective bargaining process where  $eS$  is bargained as wages and  $(1 - e)S$  is bargained as amenities. The union chooses its wage allocation  $e \in [0, 1]$  in order to maximize expected payoffs in a setting with sequential negotiations, recursive fallback positions, and simultaneous but separate Nash bargaining over wages and amenities.

Assume finite periods  $t = 1, 2, \dots, T$  with each period containing a full bargaining process.<sup>18</sup> Letting  $w$  denote wages and  $a$  negotiated amenities, the union's constrained maximization problem is

$$\max_{e_t} \sum_{j=1}^T \beta^{j-1} (u(w_j^*) + u(a_j^*)) \quad \text{s.t.} \quad e_t \in [0, 1]$$

That is, the union allocates surplus to wage- and amenity-specific negotiations in each period in order to maximize the discounted payoff it obtains from the bargaining outcome in each dimension. The union's preferences over wages and amenities  $u(\cdot)$  are assumed to be additively separable and  $\beta \in [0, 1]$  refers to the union's discounting factor.

The bargaining outcomes in each compensation component and period are determined by the Nash bargaining solution. That is,

$$\begin{aligned} & \max_{w_t} [(w_t^{EB}) - \sigma(w_t^{EF})]^\gamma \left[ (e_t S_t - w_t^{EB'}) - \sigma(e_t S_t - w_t^{EF'}) \right]^{1-\gamma} \\ & \max_{a_t} [(a_t^{EB}) - \sigma(a_t^{EF})]^\gamma \left[ ((1 - e_t) S_t - a_t^{EB'}) - \sigma((1 - e_t) S_t - a_t^{EF'}) \right]^{1-\gamma} \end{aligned}$$

where the left-most bracket contains the union's effective bargained share minus the effective fallback (denoted by the superscripts  $EB$  and  $EF$ , respectively) and the right-most bracket represents the analogous outcome for the firm.<sup>19</sup> It is worth noting that the union's bargaining power  $\gamma \in [0, 1]$  is the same in both wage and amenity negotiations. Moreover, the probability of exercising the fallback position is given by  $\sigma \in [0, 1]$ , which can also be interpreted as a strike probability.

<sup>18</sup>Although the Nash bargaining solution is axiomatic, the extensive form game underlying it requires the time elapsed between offers and counteroffers approaching zero. Thus, the  $T$  periods constitute bargaining rounds (analogous to the annual negotiations in Brazil) but within each period there can be an infinity of offers and counteroffers being made.

<sup>19</sup>This maximization problem is constrained by not allowing the sharing rule to imply that effective payoffs make either agent worse off than with their effective fallback position.

The effective bargained share accounts for the fact that agents are forward-looking and CBA renewals are not guaranteed. The same applies for the effective fallback, but where no renewal can occur once the fallback position is exercised. Hence, in a two-period model, the effective shares during the first bargaining round are

$$x_1^{EB} = x_1 + \beta[p x_2^* + (1 - p)x_2^F] \quad \text{and} \quad x_1^{EF} = x_1^F + \beta x_1^F \quad \text{for} \quad x \in \{w, a\}$$

in the case of unions and

$$x_1^{EB'} = x_1 + \phi[p x_2^* + (1 - p)x_2^F] \quad \text{and} \quad x_1^{EF'} = x_1^F + \phi x_1^F \quad \text{for} \quad x \in \{w, a\}$$

in the case of firms. The parameter  $p$  denotes the CBA renewal probability and  $\{\beta, \phi\}$  are the discounting parameters for unions and firms, respectively.<sup>20</sup>

The link between current and future negotiations is captured by recursive fallback positions with wage- and amenity-specific stickiness parameters. That is,

$$w_t^F = (1 - \iota)w_{t-1}^* \quad \text{and} \quad a_t^F = (1 - \delta)a_{t-1}^*$$

where  $\iota \in [0, 1]$  represents wage stickiness (e.g., inflation) and  $\delta \in [0, 1]$  denotes amenity stickiness (e.g., benefit phase-out).<sup>21</sup> The  $\iota$  and  $\delta$  parameters are central to studying the effects of automatic extensions since they determine the duration (or stickiness) of amenities and wages. Moreover, they also determine the extent to which current bargaining outcomes affect future negotiations. For example, in the case of the two-period model, the bargained surplus share  $w_1^*$  implies an effective surplus beyond the value  $w_1^*$  since it includes 1) its influence on  $w_2^*$  through the fallback position of that bargaining round; and 2) ensuring provisions  $w_2^F$  if bargaining fails.

## Solution

To reveal the forces at work from the setup in Section 5.2, I solve the two-period model through backward induction. In the second period, the bargaining outcomes are

$$\begin{aligned} w_2^* &= \gamma(1 - \sigma)[e_2 S_2] + \sigma[(1 - \iota)w_1] \quad \text{and} \\ a_2^* &= \gamma(1 - \sigma)[(1 - e_2)S_2] + \sigma[(1 - \delta)a_1]. \end{aligned}$$

<sup>20</sup>For the second period, there is no distinction between effective and actual values since there are no subsequent periods to consider, i.e.,  $x_2^{EB} = x_2^{EB'} = x_2$  and  $x_2^{EF} = x_2^{EF'} = x_2^F$ .

<sup>21</sup>For the first period, the fallback positions  $w_0^F$  and  $a_0^F$  are given.

Hence, workers get the allotted wage- or amenity-specific surplus weighted by the product of their bargaining power and a no-strike scenario plus their fallback position weighted by the strike probability. In this last period, the union's decision has the objective function  $u(w_2^*) + u(a_2^*)$ . Given the symmetry of the solutions, it is easy to see that the optimal wage-specific allocation is  $e_2^* \in [0, 1]$ . That is, in the last period, the union is indifferent about the amount of surplus it allocates to wage bargaining relative to amenity bargaining.

Plugging in the solutions from the second period into the Nash bargaining problem of the first, the resulting bargaining outcomes are

$$\begin{aligned} w_1^* &= \omega_1 \{ \gamma(1 - \sigma)[e_1 S_1] \} + \omega_2 \{ \sigma[w_1^F] \} + \omega_3 \{ p\gamma(1 - \sigma)[e_2 S_2] \} \quad \text{and} \\ a_1^* &= \alpha_1 \{ \gamma(1 - \sigma)[(1 - e_1) S_1] \} + \alpha_2 \{ \sigma[a_1^F] \} + \alpha_3 \{ p\gamma(1 - \sigma)[(1 - e_2) S_2] \}. \end{aligned}$$

The first and second summands in each solution are analogous to those of the last period except for the inclusion of weights  $\{\omega_1, \omega_2\}$  for wages and  $\{\alpha_1, \alpha_2\}$  for negotiated amenities. The solutions also include an additional term weighted by  $\omega_3$  or  $\alpha_3$  that contains the second period's allotted wage- or amenity-specific surplus marked down by the product of 1) the probability of renewal; 2) the union's bargaining power; and 3) a no-strike scenario.<sup>22</sup> Note that if the payoffs from any of the above sharing rules implies that either of the agents get less than their fallback option, the solution is the fallback itself.

It is now possible to solve for the union's allocation for the first period, i.e.,  $\max_{e_1} u(w_1^*) + u(a_1^*) + \beta[u(w_2^*) + u(a_2^*)]$  subject to  $e_1 \in [0, 1]$ , by substituting in for the bargaining solutions. In the simplest case where  $u(\cdot)$  is an identity function, the solution takes extreme values that depend on a threshold. Specifically, the union's surplus allocation to wage negotiations is given by

$$e_1^* = \begin{cases} 0 & \text{if } \frac{1+\beta\sigma(1-\iota)}{1+\phi(1-p(1-\sigma))(1-\iota)} < \frac{1+\beta\sigma(1-\delta)}{1+\phi(1-p(1-\sigma))(1-\delta)} \\ [0, 1] & \text{if } \frac{1+\beta\sigma(1-\iota)}{1+\phi(1-p(1-\sigma))(1-\iota)} = \frac{1+\beta\sigma(1-\delta)}{1+\phi(1-p(1-\sigma))(1-\delta)} \\ 1 & \text{if } \frac{1+\beta\sigma(1-\iota)}{1+\phi(1-p(1-\sigma))(1-\iota)} > \frac{1+\beta\sigma(1-\delta)}{1+\phi(1-p(1-\sigma))(1-\delta)} \end{cases}$$

The threshold condition above implies the solutions shown in Table 6.

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<sup>22</sup>The weights  $\{x_1, x_2, x_3\}$  for  $x \in \{\omega, \alpha\}$  take the following form  $x_1 = \frac{1}{\phi'}$ ,  $x_2 = \frac{\gamma\beta'(1+\phi)+(1-\gamma)\phi'(1+\beta)}{\beta'\phi'}$ , and  $x_3 = \frac{\gamma\beta'\phi+(1-\gamma)\phi'\beta}{\beta'\phi'}$ , where for  $\mu \in \{\beta, \phi\}$  the term  $\mu'$  equals  $[1 + \mu(1 - \eta)(1 - p(1 - \sigma))]$  with  $\eta = \iota$  if  $x = \omega$  and  $\eta = \delta$  if  $x = \alpha$ .

## G Model Extension: Two-Sided Selection

Workers and employers care about how unions distribute rents. Different wage and amenity profiles affect employers' hiring and firing decisions, as well as worker quits and labor force participation choices. Since the shape of these profiles is unobserved, I leverage the canonical two-sided selection model from Abowd and Farber (1982) and Card (1996) to rationalize observed effects of automatic extensions on workforce composition with changes to the model's parameters that determine the shape of wage and amenity profiles.

The two-sided selection model has the following setup. Assume that an individual worker's payoff for working in an establishment without firm-level collective bargaining is  $w_i^n + a_i^n = \pi_i$ . That is, the worker's wages and amenities equal her productivity  $\pi_i$ , where amenities are normalized to zero when no CBA is negotiated, i.e.,  $a_i^n = 0$ ,  $\forall i$ .<sup>23</sup> In the case of employment with a CBA, the worker's payoff is  $w_i^u + a_i^u = \theta_0 + \lambda_0 + \theta_1 \lambda_1 \pi_i$ . Hence, there are wage and amenity premiums ( $\theta_0 > 0$  and  $\lambda_0 > 0$ , respectively) that are independent of productivity. Moreover, there are also dampened returns to skill mediated by wage- and amenity-specific compression parameters ( $\theta_1 \in [0, 1]$  and  $\lambda_1 \in [0, 1]$ , respectively).

Voting over the premium and compression parameters incorporates the two-sided selection model into the bargaining model from Section 5.1. That is, assume that  $\{\theta_0, \theta_1\}$  and  $\{\lambda_0, \lambda_1\}$  can be mapped into the wage- and amenity-specific rents extracted by unions, respectively. Recall that before initiating negotiations with employers, the union must call a General Assembly where workers approve the list of claims (*pauta de reivindicações*) they want to achieve in upcoming negotiations. Given perfect information, workers are essentially choosing  $\{\theta_0, \theta_1, \lambda_0, \lambda_1\}$  through a majority voting rule. Adding further assumptions implies that the median voter determines the shape of the wage and amenity profiles.<sup>24</sup>

Two-sided selection is determined by two rules, one for workers and another for employers. A worker decides to stay or apply for a job at an establishment covered by a CBA if the excess benefit exceeds some preference cost  $\rho_i$  for working at such a firm. This restriction leads to the worker-specific selection rule, i.e.,

$$(w_i^u + a_i^u) - (w_i^n + a_i^n) > \rho_i \implies \pi_i < \frac{\theta_0 + \lambda_0 - \rho_i}{1 - \theta_1 \lambda_1} \quad (7)$$

An employer that has negotiated a CBA keeps a worker or posts a new position if the sum of the individual and match-specific productivity  $m_i$  exceed the payoff that the worker receives.

<sup>23</sup>One can think of the voluntary unemployed and informal workers as having productivity below what any firm is willing to pay.

<sup>24</sup>In a multidimensional policy space, the Median Voter Theorem requires very restrictive assumptions. It suffices to assume single-peaked preferences and identical ordering of preferences along each dimension.

This restriction leads to the employer-specific selection rule, i.e.,

$$\pi_i + m_i > (w_i^u + a_i^u) \implies \pi_i > \frac{\theta_0 + \lambda_0 - m_i}{1 - \theta_1 \lambda_1} \quad (8)$$

These selection rules place upper and lower bounds on the skill (or productivity) composition of an establishment with CBA coverage. Very high skill workers will avoid employment at such establishments due to the reduced return to their skill—see Equation 7. Meanwhile, very low skill workers will be turned down because of the additional premiums they receive—see Equation 8. Therefore, an individual that both wants to work at an establishment with CBA coverage and is also desired by the employer must have  $m_i > \rho_i$ .

The shape of the productivity distribution among the potential workforce  $f(\pi_i | m_i > \rho_i)$  and the parameters  $\{\theta_0, \theta_1, \lambda_0, \lambda_1\}$  determine the establishment's skill composition. Keeping the productivity distribution fixed implies that changes in the workforce composition resulting from automatic extension must be driven by the effects of this policy on the premium and compression parameter. Given observed effects of automatic extensions on workforce composition, information on the selection rule driving these results is revealed, thereby narrowing down the potential mechanisms through which the reform affected selection.

The influx of low-skill workers implies that automatic extensions loosen the lower bound selection rule, i.e., Equation 8. Focusing on the numerator and denominator terms separately gives way to two possible explanations. One is that premiums decrease  $\downarrow (\theta_0 + \lambda_0)$ ; the other that compression increases  $\theta_1 \lambda_1 \rightarrow 0$ . The empirical evidence implies that more compression in the value of jobs covered by extended CBAs is driving the effects on workforce composition. Evidence for this is detailed in Section 7.2.