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Amenity-Wage Tradeoff**

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IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Union Bargaining Power and the Amenity-Wage Tradeoff*

This paper studies the relation between the wage and amenity components of compensation under collective bargaining. Using the universe of collective bargaining agreements (CBAs) in Brazil, I augment information on workers' wages with the comprehensive set of amenities codified in the text of these contracts. I then estimate the effects of increasing union bargaining power with a difference-in-difference strategy that leverages 1) a judicial decision that prevented the expiration of existing CBA provisions—a policy known as ultractivity—and 2) gaps in CBA coverage across establishments when the policy was enacted. I find that boosting union power causes an increase in both wages and CBA clauses without a subsequent decrease in employment. A revealed preference approach to estimating the wage-equivalent value of negotiated clauses shows that amenity value also increases, comprising approximately 45% of workers' total gains in compensation. Results are consistent with collective bargaining functioning as a labor market institution that counters monopsony power, but where employers retain the right-to-manage the composition of their workforce.

JEL Classification: J52, J32, J42, K31

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Corresponding author:

Lorenzo Lagos
Brown University
Providence
Rhode Island 02912
USA

E-mail: lorenzo_lagos@brown.edu

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Growing empirical evidence on wage setting (Card et al., 2018; Dube et al., 2020a; Yeh et al., 2022; Berger et al., 2022) suggests that firms may also enjoy some discretion in setting amenities. However, the lack of comprehensive data on amenity provision across workplaces limits our ability to make headway on what pins down amenities in the labor market and analyze the tradeoffs between the wage and nonwage components of compensation. While collective bargaining makes these tradeoffs explicit by having unions and employers negotiate over the amenity-wage space, the rich information codified in the clauses of collective bargaining agreements (CBAs) has not been fully exploited to shed light on these questions.

In this paper, I study the relation between the wage and amenity components of compensation at establishments covered by CBAs. The starting point of this paper is descriptive, showcasing the rich space of amenities encoded in CBAs. I then use a shock to union bargaining power to estimate how collective bargaining translates this acquired advantage into gains in either wages or clauses, and how these changes subsequently affect employment. To interpret these results in terms of amenity-wage tradeoffs, I estimate the wage-equivalent value of CBA clauses by imposing some structure on revealed preference measures of the value of employment at an establishment. Finally, I revisit the shock to estimate its effects on the amenity value captured by CBAs. A posting model constrained by collective bargaining rationalizes the full set of results and generates novel insights on monopsony power, efficient bargaining, and labor supply responsiveness to wages versus amenity value.

The empirical setting for this study is collective bargaining in Brazil—a country where more than half of the formal workforce is covered by some CBA. The Brazilian context is well-suited to address both data limitations and identification challenges inherent to uncovering amenity-wage tradeoffs. To get comprehensive data on amenity provision across workplaces, I scrape the universe of CBAs and merge them into linked employer-employee data. An important data feature is that CBA clauses are pre-classified into subgroups which capture amenities common to all workers in an establishment.¹ For identification, I leverage a labor court decision from September 2012 mandating that CBA provisions no longer expire with the agreement, but rather remain in force until a new CBA is negotiated—a policy known as *ultractivity*.² Given that gaps in coverage are common and have an idiosyncratic component from delays in negotiations, this institutional shift exogenously raised the bargaining power of unions that happened to have an active CBA at the time the labor court’s decision was enacted, providing identifying variation for my analysis.

¹It is important to distinguish *common* amenities from *worker-specific* amenities. For example, providing transportation vouchers is a common amenity that can be negotiated in CBAs, while commute time is a worker-specific amenity over which the CBA has no direct control. This paper is concerned with the former.

²One of the main consequences of having *ultractivity* is that it allows unions to holdout, i.e., continue negotiations under an expired contract (Cramton and Tracy, 1992; Gu and Kuhn, 1998).

In the first part of the paper, I do a descriptive analysis of firm-level CBAs, which reveals that unions and employers bargain over an incredibly rich amenity-wage space. For example, while most studies on collective bargaining have focused on wage adjustments and floors, on average, these clauses comprise only 5.5% of CBA content. The most common clause subgroups are those on 1) Bargaining (18.9%), e.g., enforcement, non-compliance, and grievances; 2) Workday (12.2%), e.g., weekly rest, absences, and special shifts; and 3) Assistances (11.3%), e.g., food, childcare, and transportation. Such non-wage and non-employment provisions make up the majority of what unions negotiate with employers.³ Importantly, I document that establishments covered by specific amenities exhibit characteristics indicative of CBA clauses having real implications for the workplace. Two examples include clauses on “contracting types” and “leaves,” where the former is associated with a decrease in the share of workers with fixed-term contracts and the latter with an increase in the share of workers taking leave.

I then turn to the causal effects of shifts in bargaining power on wages and employment, as well as the comprehensive set of amenities captured by CBA clauses. Ultractivity, by keeping CBA clauses in force after expiration, precludes employers from phasing out provisions as a pressure tactic. This boosts the union’s bargaining power—as long as there was an active CBA when the policy was enacted—through their ability to holdout in negotiations. Using a difference-in-differences specification among establishments frequently covered by firm-level CBAs, I find statistically significant gains in contracted wages (1.6 log points) paired with small and statistically insignificant effects on employment (0.2 log points).

The null effects on employment despite gains in wages are not explained by downward adjustments in amenities since the effects on clauses are, in fact, positive as well (1.6 clauses).⁴ The bulk of these gains are not explained by wage clauses: only 16% comes from *wage-related* amenities (like wage rules), whereas *employment-related* amenities (like job protections) and *other* amenities (like leaves) account for 48% and 35%, respectively.⁵ However, more clauses need not imply more amenities. Hence, I extract authority measures from the text of the CBAs (Ash et al., 2020) and show that these contracts tend to impose obligations on employers and grant entitlements to workers. Importantly, the increase in union bargaining power causes an improvement in the authority of workers relative to employers.

³There is also rich heterogeneity across industries. For example, wage- and employment-related clauses make up only 10% of all clauses in CBAs covering workers in banking/finance, whereas the overall average is 24%.

⁴Effects are driven by establishments scheduled to negotiate a few months prior to the change to ultractivity, for whom having CBA coverage when the policy is enacted (i.e., treatment assignment) is directly linked to idiosyncratic delays in negotiations. Additional robustness comes from a complementary strategy that instruments treatment with the speed of CBA renewal in previous negotiations.

⁵Aligned with the notion that a stronger CBA while holding out improves the union’s bargaining position, I find larger effects at establishments covered by CBAs with an above-median clause count at baseline.

While the results show that unions use their bargaining power to increase wages and improve workplace amenities, quantifying the relation between these two components of compensation requires additional structure—namely, a framework to measure the amenity value embodied in each CBA.

I start by defining the wage-equivalent value of a CBA clause to be the change in wages required to keep the value of employment at an establishment constant after removing said clause. To calculate these values, I assume that workers’ value of employment at an establishment—captured by its PageRank value (Sorkin, 2018)—is a linearly additive function of 1) a wage component, provided by its AKM wage premium (Abowd et al., 1999); and 2) amenity components, provided by clauses in its sectoral CBA of coverage.⁶ Using within-establishment variation between 2007-2011 and 2012-2016, I find that the most valuable clauses are those on Leaves (≈ 7.8 log pts in wages), Wage Payments (≈ 4.9 log pts in wages), and Bonuses (≈ 3.1 log pts in wages).⁷ Interestingly, the analysis also reveals that some clauses capture workplace disamenities.

Out-of-sample sense checks confirm that the derived amenity values in firm-level CBAs are reasonable. First, both wage premiums and amenities are linearly increasing with PageRank values as predicted by the underlying framework. Second, amenity values are increasing with wage premiums in the cross-section, which adds to existing evidence that inequality across workplaces is exacerbated once amenities are accounted for (Maestas et al., 2023; Sockin, 2022). Third, consistent with a relatively stable job ladder, within-establishment increases in wage premiums over time are associated with decreases in amenity value. Fourth, the implied value of CBAs by industry is positively associated with union density. Finally, amenity values tend to be higher when workers are benefiting more than employers, as per the authority measures extracted from each CBA’s text.

To uncover how wages and amenities are traded off under collective bargaining, I estimate the effects of boosting union bargaining power on the amenity value of a CBA, i.e., the value-weighted sum of clauses in a CBA. Results indicate that amenity value increased by 1.3 log points, which paired with the effects on wages implies that amenity value comprises 45% of the gains made by unions. These effects are primarily driven by increases in two clause subgroups: 1) Assistances, e.g., food, childcare, and transportation; and 2) Wage Payments, e.g., pay advancements, proof of payment, and pay discounts. Interestingly, the overall

⁶Sectoral CBAs are used for the wage-equivalent estimates both to avoid a mechanical link with the main results (which focus on firm-level CBAs) and to have within-establishment variation in amenities that is plausibly exogenous due to the limited contribution of any single establishment to sectoral-level negotiations.

⁷Similar to the common job ladder assumption implied in the underlying AKM and PageRank models, the values for these CBA clauses abstract from worker-specific heterogeneity in preferences over amenities. See Morchio and Moser (2020) and Corradini et al. (2022) for analyses focused on gender-specific amenities.

effects are also the result of tradeoffs among amenity types. For example, these gains occur despite reductions in some valuable clauses, such as the Leaves subgroup.

Using a posting model under collective bargaining, the reduced form effects generate novel insights about the labor markets being studied. First, the null effect on employment as compensation increases suggests that the market is moving up an *effective* labor supply curve since employers upgrade to higher quality workers, i.e., college educated professionals. Hence, unions can counter monopsony power but employers retain the right-to-manage the composition of their workforce.⁸ Second, differences in amenity-wage tradeoffs by industry suggest efficient bargaining in the most prominent sectors, implying that workers’ labor supply is more responsive to wages than amenities. Nonetheless, the implied elasticities of labor supply with respect to amenity value (e_a^L) are non-negligible, meaning that markdown estimates where the identifying variation also impacts amenities are likely biased. Lastly, estimates from the manufacturing sector imply that $e_a^L = 2.66$, which means that—under reasonable assumptions—the markdown on amenity-inclusive compensation is 0.86.

This paper makes several distinct contributions to the literature. First, it adds to the literature on the impact of unions on the labor market. Numerous papers associate the weakening of unions to higher wage inequality (DiNardo et al., 1996; Card, 2001; Firpo et al., 2009; Farber et al., 2021). However, studies exploiting quasi-experimental variation in unionization find negligible effects on wages (Freeman and Kleiner, 1990; Lalonde et al., 1996; DiNardo and Lee, 2004; Lee and Mas, 2012; Frandsen, 2021). Nonetheless, studies have documented positive effects of non-wage channels emphasized by unions—as per Freeman and Medoff (1984). Some examples include productivity (Barth et al., 2020), workplace safety (Johnson, 2020; Boudreau, 2024), and worker voice (Harju et al., 2021). This paper is among the first to use quasi-experimental variation in union bargaining power to document causal effects on a comprehensive set of outcomes related to wages, amenities, and employment.⁹ The contrasting results I obtain relative to papers studying unionization highlight that bargaining power conditional on unionization is a very distinct margin of interest.

Second, this paper contributes to our understanding of nonwage compensation. The importance of workplace amenities has long been recognized in the theory of equalizing differences (Rosen, 1986) and in work on inter-industry wage differences (Dickens and Katz, 1987; Katz et al., 1989; Krueger and Summers, 1988). On one hand, work on compensating

⁸Employers may also “manage” the existing workforce by improving their skills through training as in Dustmann and Schönberg (2009). Unfortunately, I have no data to track on-the-job training.

⁹Dodini et al. (2023) exploit quasi-experimental variation in union density in Norway, which is a potential source of union bargaining power different from ultraactivity. While that paper is able to study effects on a vast set of outcomes not available in Brazilian administrative data (e.g., firm profits and product market prices), it does not directly analyze effects on amenities through CBAs.

differentials with longitudinal employer-employee data has relied on revealed preference assumptions without being able to specify what workers value about a given firm (e.g., Lavetti and Schmutte, 2018; Sorokin, 2018; Taber and Vejlin, 2020; Lamadon et al., 2022). On the other hand, variation in specific workplace amenities—both through survey data (Hamermesh, 1999; Pierce, 2001; Maestas et al., 2023) and experimental studies (Flory et al., 2014; Wiswall and Zafar, 2017; Mas and Pallais, 2017; Drake et al., 2021; Dube et al., 2022)—has been exploited for calculating individuals’ willingness to pay for a restricted set of amenities. The approach proposed in this paper obtains revealed preference values for a comprehensive set of amenities, i.e., those secured by unions through CBAs. This novel measure of amenity value can go beyond testing for compensating differentials, for example, by identifying specific amenities that contribute to changes in compensation to workers.¹⁰

Lastly, this study contributes to the literature on imperfect market competition. Stemming from the work of Robinson (1933), models where employers have market power in wage setting have received renewed interest in economics (Manning, 2003; Ashenfelter et al., 2010). 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., 2020a,b; Goolsbee and Syverson, 2023)—some of these focusing on Brazil (Gerard et al., 2021; Haanwinckel, 2023; Sharma, 2023). The results in this paper are consistent with monopsony power that results in both wage setting and amenity setting. Crucially, this paper documents that union bargaining power can counter monopsony power, but where employers’ right-to-manage the composition of their workforce can dampen gains for low-skill workers.¹¹

The paper is structured as follows. Section 1 describes the relevant features of collective bargaining in Brazil and the role of ultractivity. Section 2 explains the data used in the analyses and provides rich descriptives for the CBAs in my setting. Section 3 presents the effects from boosting unions’ bargaining power on wages, clauses, and employment. Section 4 estimates the wage-equivalent value of CBA clauses and provides out-of-sample sense checks. Section 5 revisits the main results with my measure of amenity values to uncover amenity-wage tradeoffs and presents a model to rationalize the results. Section 6 concludes.

¹⁰A notable exception in this respect is Sockin (2022), who uses topic models on Glassdoor reviews to identify fifty distinct amenities and shows that nonwage amenities (e.g., respect/abuse, culture, coworkers) have a more pronounced effect on job satisfaction than pay. Unlike job reviews and job adverts, the text in CBAs is unique for studying amenities because neither workers nor employers can omit items from the text.

¹¹Dodini et al. (2021) also explore the role of unions in countering monopsony power, but focus mainly on wages. These models create a valuable link between posting and bargaining explanations for wage setting by focusing on *collective* rather than *individual* bargaining. The former can constrain posting since it is a labor market institution, while the latter cannot since it only takes place after workers match to firms.

1 Background on collective bargaining in Brazil

I start by giving an overview of the union landscape in Brazil to provide context on the empirical setting. I then highlight two features of the setting that are central to the analysis. First, I discuss collective bargaining agreements (CBAs) which are the source for my information on workplace amenities. Second, I delve into the role of ultractivity, i.e., the policy that prevents CBA provisions from expiring which I use for identifying the effects of increasing union bargaining power.

1.1 The union landscape

Unions are organizations that represent the collective interests of workers in negotiations with employers. To have a union, therefore, one must define: a) the set of workers whose interests could be represented in negotiations; and b) the process by which an organization obtains the right to represent these workers. In Brazil, how these two items are determined generates a widespread but fragmented union presence.

The fragmented union landscape stems from the fact that narrow sets of workers can comprise a bargaining unit. Specifically, a category-geography cell constitutes a set of workers whose interests could be represented in negotiations. A category often refers to an industry, but can sometimes be an occupation.¹² In terms of geography, the most granular level of representation is the municipality but a bargaining unit can integrate vertically, i.e., lump multiple municipalities into a single unit, as long as representation is for the same category.

The widespread presence of unions in Brazil comes from the fact that each bargaining unit is essentially guaranteed a union. In fact, the first union to obtain the right to represent workers of a category-geography cell enjoys a lifetime monopoly.¹³ Given this collectively exhaustive set of cells, one could say that every formal worker in Brazil should be represented by a union. Even when no local union for a category exists in a workers' municipality, the corresponding state-level and national-level bodies (known as federations and confederations, respectively) are the residual claimants to those rights. Despite all this, new unions have formed even in recent years as they have successfully argued that no existing union already controls the representation rights over a given cell.¹⁴

¹²The categories are specified in the federal labor law (*Consolidação da Leis do Trabalho* or CLT). Industries and occupations are vaguely defined, i.e., they do not correspond to any official industry or occupation classification. Therefore, it is common to find bargaining units that span establishments (workers) of various industry (occupation) codes—even after coarsening these codes.

¹³While the union monopoly rule (known as *unicidade sindical*) limits competition among unions, some competition arises from the ambiguity in category boundaries. That is, disputes can arise between unions as to whether workers at specific establishments belong to the bargaining unit each union represents.

¹⁴An important incentive driving union expansion is that unions get mandatory contributions from the

The end result is 6,631 labor unions operating in Brazil (Table A1). Examples include the metalworkers’ union of Osasco and Região, the lawyers’ union in the state of São Paulo, and the confederation of financial sector workers. Most unions (94%) operate at the local level, i.e., they are not federations or confederations. However, there is a significant amount of vertical integration since a smaller share (69%) are municipal-level unions. Finally, the vast majority of unions (78%) are industry-based as opposed to occupation-based.

While being represented by one of these unions is a necessary condition for collective bargaining, it is not sufficient. In fact, 21% of unions in Brazil did not negotiate a CBA between 2009 and 2016.¹⁵ Since this paper is about collective bargaining as an institution through which unions affect working conditions, I now provide details on CBAs.

1.2 Collective bargaining agreements (CBAs)

Unions negotiate CBAs on behalf of the workers they represent, providing coverage to those working at the establishments represented in the negotiations. Coverage rules and the broad reach of these CBAs enable unions to affect a large portion of the Brazilian labor market.

There are two types of agreements: firm-level and sectoral CBAs. In firm-level CBAs, the union negotiates directly with the employer. In sectoral CBAs, the union negotiates with an employer association that represents multiple firms. These employer associations are essentially unions for firms, i.e., they have a monopoly over the collective representation rights of establishments in a category-geography cell.¹⁶ Hence, sectoral CBAs have broader reach and contain clauses that set general floors, while firm-level CBAs delve into workplace-specific issues and include augmenting provisions (Horn, 2009).

Coverage from CBAs is universal, i.e., union membership is not required. This means that the provisions negotiated in the agreement apply to all workers in the union’s bargaining unit who are employed in establishments represented by the employer counterpart. For example, a firm-level CBA between a metalworkers’ union and Volkswagen would cover all workers of the bargaining unit at that employer. Similarly, a sectoral CBA between a union of workers in the financial sector and the employers’ confederation of banks would cover all workers of the bargaining unit employed at a bank.¹⁷

Given universal coverage and the broad reach of these agreements, a majority of the

workers they represent. This system of mandatory contributions was eliminated in 2017 (*Lei 13,467/2017*).

¹⁵These statistics are based on whether the union signed any CBA between 2009 and 2016 (Table A1). Technically, negotiations may have occurred without an agreement being reached.

¹⁶See Table A1 for descriptive statistics on employer associations.

¹⁷While CBAs can specify a geographic coverage that is narrower than that of the bargaining unit, they cannot restrict coverage to some subset of the category. Unlike the case of Portugal, in Brazil there are no extensions of sectoral CBAs to establishments outside the bargaining unit.

private formal workforce in Brazil has a CBA negotiated in any given year. Table 1 shows that the share of workers with a negotiated CBA was 55% in 2009. Most of this is driven by the sectoral CBAs, which apply to 26% of establishments and account for 48% of workers (over 14 million individuals). Although firm-level CBAs only apply to 2% of establishments, these are negotiated with very large employers as evidenced by the 16% of workers covered by these agreements (over 4.5 million individuals). The most active industries in terms of CBA negotiations are communications, utilities, and manufacturing. Regionally, the richer and more developed Southeastern part of the country has higher negotiation rates.

These agreements can have a significant influence on the conditions of employment. First, CBAs are binding contracts where unions and employers negotiate clauses related to wages, working hours, health and safety measures, among other work conditions. In Section 2.2, I provide more details on the content of these agreements. Second, CBAs have a legal force that supersedes individual employment contracts. As such, negotiated clauses cannot be derogated and can only build on top of guarantees already encoded in federal labor law. Finally, the terms of the CBA apply collectively. That is, CBAs specify *common* amenities that cannot exclude workers in the bargaining unit.

I now shift focus to the process by which these agreements are negotiated and rules governing the expiration of CBA provisions. This discussion sets the stage for understanding the importance of ultractivity, which I leverage for identification purposes in Section 3.1.

1.3 The negotiation process and the role of ultractivity

Collective bargaining is usually a lengthy process that can sometimes reach an impasse. As a result, unions often find themselves in situations where the existing CBA has expired. Ultractivity dictates whether expired provisions remain in force during these lapses, thereby having profound implications on bargaining conditions.

Without ultractivity, the Brazilian setting entails frequent negotiations to maintain coverage. In terms of duration, most CBAs are valid for just 12 months, giving rise to annual negotiations.¹⁸ On top of that, starting a new round of negotiations can be costly since unions have to draft a list of demands (or *pauta de reivindicações*) and obtain a majority of votes in a General Assembly, in order to get employers to come to the bargaining table. Finally, although provisions in a new CBA apply retroactively to the expiration date of the previous contract, there is no guarantee that any agreement will be reached.¹⁹

Figure 1 highlights the relevance of periods under an expired CBA. First, renewal rates are around 80%, implying that 1/5 of establishments covered by a firm-level CBA in a given

¹⁸In some cases negotiations occur every two years—the maximum possible duration for a CBA.

¹⁹Even when an agreement is reached, reclaiming benefits from previous states of the world is often infeasible.

year allow their contract to expire without ever securing a new CBA in the subsequent two years. Second, among those that renew, 1/4 do so with a coverage gap, i.e., the renewed CBA starts coverage on a later date than the original CBA's expiration. The average length of these coverage gaps is 12 months. Third, while 3/4 of renewing establishments have no coverage gap (i.e., the renewed CBA starts coverage on the same date as the original CBA's expiration) the average time spent negotiating under the expired CBA is nearly 5 months. As such, even in this best case scenario, the length of a potential holdout is significant.

Bargaining conditions during these lapses in coverage changed drastically when ultractivity was introduced on September 2012.²⁰ 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*. Ultractivity applied to all existing CBAs that had not already expired. Importantly, all workers—including those hired after the agreement expired—are covered by the same provisions.²¹

The introduction of ultractivity came as a shock. *Súmula 277* was modified during an ordinary TST session. Comparing quotes 1 and 2 in Table 2 confirms that the new version was a complete reversal of the court's initial consensus interpretation. 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. Defenders of the policy cite the security that ultractivity provides to workers during negotiations, preventing employers from reducing acquired benefits as a bargaining chip (see quotes 5 and 6).²² All this amounts to an unexpected improvement in the bargaining power of some unions—which I discuss in Section 3.1.

This section has presented the most important aspects of the Brazilian setting for my analysis: the widespread presence of unions, their influence on working conditions through CBAs, and the relevance of ultractivity in the bargaining process. I now turn to explaining the data used and providing rich descriptives on the content of CBAs.

²⁰CBA ultractivity can be found in countries such as France, Germany, Ireland, and Mexico. Interestingly, removing ultractivity was the target of reforms to the collective bargaining framework of countries hit hardest by the European debt crisis. Under pressure from the European troika, Estonia, Greece, Portugal, and Spain restricted the ultractivity of CBAs (Marginson and Welz, 2014). More recently, the Milei government in Argentina is proposing to remove ultractivity in its attempt to weaken labor unions.

²¹On November 2013, TST clarified that provisions continue to apply to all employees, without distinction (*ARR 960-96.2012.5.08.0127*).

²²Anecdotally, there is some support for this claim. The union of journalists in São Paulo experienced a negotiation period that lasted almost 8 months without ultractivity. During that period, employers stopped paying the travel bonus, i.e., a doubling of wages for journalists on work-related travel (*abono de viagem*). These tactics were successful, resulting in a new CBA that did not include a travel bonus.

2 Data and descriptives

My analysis relies on high quality data from Brazil. After describing these data sources, I produce descriptive statistics on the content of CBAs, as well as the text of clauses negotiated in these agreements. I then provide evidence that the number of clauses by subgroup classification is a reasonable measure for variation in workplace amenities and introduce alternate “authority measures” that rely solely on CBA text for robustness.

2.1 Data sources

This project draws from two main data sources. These data allow me to track workers across establishments over time and observe (i) their wage compensation at each job and (ii) the common amenities provided in the CBA covering each job. Additional details on sample construction can be found in Appendix C.

Relação Anual de Informações Sociais (RAIS) Information on labor market outcomes come from administrative linked employer-employee data, known as RAIS. I primarily use the 2007-2016 files of this annual survey covering the universe of formal sector establishments. The key variables for the analyses include: 1) the unique CNPJ identifier of the establishment; 2) the unique identifier of the worker; 3) establishment characteristics such as industry and municipality; 4) worker characteristics such as age and education; and 5) the worker’s contracted wage for each job-year.

Sistema Mediador Information on amenities comes from *Sistema Mediador*—an online registry where all CBAs in Brazil since 2009 are written and filed.²³ I scraped all CBAs available in the registry as of September 2018, focusing on agreements from 2009 to 2016. These CBAs are conveniently saved as structured HTML files, simplifying the extraction of useful information. Central to this paper are: 1) the unique CNPJ identifiers of all the negotiating counterparts; 2) the filing and start dates of the CBA; 3) the geographic coverage of the CBA; and 4) the negotiated clauses classified by predetermined types—e.g., wage floors, maternity leaves, work shifts, vacations—along with the full text of each clause.

Other data sources Information on unions and employer associations operating in Brazil comes from the *Cadastro Nacional de Entidades Sindicais* (CNES). These data allow me to produce statistics on the composition of unions and the share that negotiate CBAs—reported in Section 1.1. To link sectoral CBAs to establishments of coverage, I obtained data through

²³For a detailed account of how *Sistema Mediador* is used in practice, refer to Appendix D.

a public information request that allow me to determine the firms affiliated to each employer association. Specifically, these data contain the CNPJ identifiers of establishments that pay mandatory dues to each employer association.

Baseline panel I construct an establishment-year panel with information on wage, amenity, and employment outcomes. Creating this panel requires determining who in RAIS is covered by which CBA from *Sistema Mediador*. In the case of firm-level CBAs, I consider all establishments in the municipalities of coverage that belong to the signing firms.²⁴ In the case of sectoral CBAs, I consider all establishments in the municipalities of coverage that belong to firms affiliated to the signing employer associations. This approach assumes that all workers in an establishment are covered by the assigned CBA—as dictated by universal coverage.²⁵ The years of CBA coverage in the panel are based on whether the agreement’s provisions are active at end-of-year. Table A2 reports descriptive statistics for this panel.

2.2 What is in a CBA?

There are thousands of CBAs negotiated in Brazil on any given year—the average during the sample period is 32K firm-level and 5.7K sectoral agreements. The clauses in these CBAs provide ample variation in the common amenities offered across establishments. In this section, I explain how CBA clauses are classified for my analysis and provide descriptive statistics that reveal significant variation in CBA content.

Clause classification enables a simple but comprehensive measure of CBA content, which I use for my amenity analysis. *Sistema Mediador* already provides a classification of clauses that the negotiating counterparts use when writing CBAs on its portal. Specifically, there are 137 clause types that are lumped into 24 broader categories, denoted as subgroups (Table A3). For example, the Leaves subgroup includes clause types like adoption leave, maternity leave, unpaid leave, etc. I also categorize subgroups into three amenity groups for exposition purposes. First, *wage-related* amenities include 4 subgroups, i.e., Wage Adjustments, Payments, Other Wages, and Rules. Second, *employment-related* amenities focus on Staffing, Contract Types, Separations, and Hiring—among other subgroups (7 in total). Lastly, *other* amenities comprise the remaining 13 subgroups that are not directly linked to

²⁴The CNPJ is a 16-digit unique identifier for establishments where the first 8 digits correspond to the firm.

²⁵The assigned CBA is the one negotiated by the modal union across establishment-CBA-union observations. This abstracts from the possibility that some workers within an establishment may be covered by another CBA, i.e., when industry- and occupation-based unions overlap. Although this introduces some noise to the analysis, only 3% of employer counterparts negotiate with both industry- and occupation-based unions throughout the entire sample period.

wages or employment, e.g., Assistances, Injuries, Vacations, Union-Firm Relations.²⁶

To showcase the richness of CBA content, I focus on establishments with firm-level agreements negotiated in 2009. I find that CBAs primarily focus on amenities not directly linked to wages or employment, i.e., *other* amenities make up 76% of clauses on average. Only 14% and 10% of clauses are *employment-related* and *wage-related* amenities, respectively (Figure 2a).²⁷ Among the *other* amenities, the most prominent bucket is that of “incentives” which includes the subgroups on Bonuses, Pays, Assistances, and Other Incentives (Figure 2d).²⁸ Highlighting workers’ concerns over job security, the most common subgroups among *employment-related* amenities are Employment Protections and Separations (Figure 2c). Among *wage-related* amenities, the dominant subgroup is Wage Adjustments, which include clause types such as wage deductions, isonomy, and floors (Figure 2b).^{29,30}

There is stark heterogeneity in the content of firm-level CBAs across industries. Table A5 presents statistics for 4 broad industries (or sectors) which constitute more than 2/3 of my analysis sample. It shows that CBAs in the banking/finance sector stand out in terms of average length (49 clauses) and content (90% are amenities not directly linked to wages or employment). While the other sectors appear more similar in this regard, differences emerge in terms of overrepresented clauses by subgroup. In manufacturing, subgroups concerning workplace safety (i.e., Prevention and Injuries) are unusually common. In trade/commerce, where nonstandard shifts are widespread, clauses on Pays appear more than usual.

Amenities change over time as well. Table A6 presents statistics for changes in the clause count by subgroup between 2009 and 2010. Among establishments covered by clauses on Bargaining (e.g., CBA enforcement, non-compliance, and grievances) there was an average gain of 4.8 such clauses between the two years. In terms of Assistances, there was an average loss of 1.5 clauses, which masks interesting heterogeneity since the bottom 10th percentile of establishments lost 12 such clauses while the top 90th percentile gained 2. Even the subgroups with the lowest variation in clause changes have establishments in the 90th (10th) percentile gaining (losing) one such clause.

²⁶For clarity, I lump these 13 subgroups into 6 buckets given by *Sistema Mediador*—for example, the Vacations, Leaves, and Other Time-Off Provisions subgroups are referred to as simply “time-off.”

²⁷For sectoral CBAs, the breakdown is 61% on *other* amenities, 22% on *employment-related* amenities, and 17% on *wage-related* amenities. They also contain more clauses on average, i.e., 46 versus 29 (Figure B1).

²⁸While some of these clauses are clearly monetary, they are separate from contracted wages. Moreover, these monetary payments tend to depend on some nonstandard form of work (e.g., overtime pay), are restricted in their use (e.g., transportation assistance), or are linked to performance (e.g., profit-sharing).

²⁹The direct link between the clauses in the Wage Adjustment subgroup and wages levels makes the term *wage-related* amenities seem less fitting. I keep this terminology since other subgroups under *wage-related* amenities pertain to issues like advance payments and proof-of-payment, which are not about wage levels.

³⁰Table A4 shows the top clause subgroups based on average counts across CBAs in 2009.

2.3 What is in a clause?

My analysis relies on the subgroup classification as a meaningful concept for common amenities in the workplace. Thus far, I have not shown anything that speaks to whether the text in the clauses matches to the concepts conveyed by the subgroups. Nor have I provided evidence that changes in clauses by subgroup correlate with real changes in the workplace. In this section, I address these points and introduce an additional metric (used in robustness checks) that relies solely on the CBA text, i.e., authority measures.

Clauses by subgroup The text of the clauses in each subgroup match the types of amenities expected. Table 3 shows three bi-grams that are among the top ranked for each subgroup based on TF-IDF.³¹ This statistic captures how important a term is within a subgroup relative to all subgroups. Hence, it’s not surprising that under Wage Adjustments one finds bi-grams such as wage-floor, wage-increase, and wage-equalization. Or that under Employment Protections one observes guarantee-employment, job-guarantee, and provisional-stability.

Changes in the clauses—as classified by subgroup—are correlated with actual changes in the workplace. The evidence for this is reported in Table A7. I first choose workplace outcomes from RAIS that intuitively match to clause subgroups, e.g., the share of workers taking leaves is an outcome that matches to Vacations, Leaves, and Other Time-Off Provisions. I then run regressions (in first-differences) of the outcome on the clause count, separately for each subgroup. I also run an adaptive lasso (in first differences) of the outcome on mean log hourly earnings and the clause counts by subgroup to understand which subgroups have predictive power on the outcome conditional on earnings.

These estimates are merely correlational, but results for the proposed outcome-to-clause matches—which are shown in the framed sections of the table—tell a consistent story. For example, additional Contract Type clauses are negatively associated and predict decreases in the share of workers with fixed-term contracts. I also find that retention rates are positively associated with subgroups about incentives, e.g., Bonuses, Pay, Assistance, etc. Moreover, the subgroups concerned with workplace safety (i.e., Injuries and Prevention) have predictive power on the share of workers experiencing adverse safety events.³² Finally, additional Leaves clauses are positive associated and predict increases in the share of workers taking leave.

³¹TF-IDF = $TF \times IDF$ stands for “term frequency - inverse document frequency”. TF is the number of times the term appears in a subgroup compared to the total. IDF is the log of the number of subgroups in the collection divided by the number of subgroups that contain the term.

³²The direction of the predictions on the workplace safety events suggest reverse causality—highlighting the emphasis on the correlational interpretation of these results. That is, it is more likely that an increase in safety events caused the inclusion of prevention clauses in CBAs (and not the other way around).

Authority measures The main limitation with any measure of amenities based on a classification of CBA clauses is that it ignores heterogeneity in the text. Nevertheless, there are other metrics of CBA content that rely solely on the text. With this in mind, I implement the authority measures developed by Ash et al. (2020) for robustness.³³

Authority measures capture the authority of agents in a legal document where 1) *obligations* and *constraints* reduce authority; and 2) *entitlements* and *permissions* expand authority. These measures rely on an unsupervised extraction of the rights and duties among agents of capital (firms and managers) and labor (workers and unions) in the CBA. The pipeline for generating these measures relies on a dependency parser to extract subject-verb prefixes, focusing on deontic modal verb structures, i.e., where an action is prescribed to one of the agents of interest. Leveraging deontic-logic rules, I classify these subject-verb prefixes as: (i) obligations, e.g., “employer must pay overtime”; (ii) constraints, e.g., “managers cannot deduct expenses from wages”; (iii) entitlements, e.g., “workers will receive travel vouchers”; or (iv) permissions, e.g., “union leaders can access the workplace.”

The authority measures reveal that CBAs reduce the authority of capital and expand the authority of labor (Figure 3). Among establishments negotiating firm-level CBAs in 2009, 38% of provisions are reducing the authority of firms and managers, mostly through obligations rather than constraints. Only 5% of the provisions are expanding the authority of these agents of capital, mostly through permissions rather than entitlements. Meanwhile, workers and unions gain entitlements and permissions—accounting for 25% and 6%, respectively. However, labor’s authority does not go completely unrestricted: 22% and 3% of provisions put obligations and constraints (respectively) on these agents. Summing across provision shares, CBAs reduce the authority of capital (-0.33) and expand the authority of labor (0.06), thereby granting more authority to labor relative to capital (0.06+0.33=0.39).

3 Impact of union bargaining power

This paper estimates the causal effects of improved union bargaining power on wages, employment, and the amenities codified in CBAs. In this section I present my empirical strategy, which relies on a difference-in-differences approach comparing sets of establishments before and after ultractivity is introduced. I then walk through my reduced form results: boosting union bargaining power increases wages and amenities without reducing employment. I also show that the resulting changes in CBAs expand the authority of labor over capital.

³³Details on the implementation of the authority measures are in Appendix E.

3.1 Empirical strategy

Shock to bargaining power The introduction of ultractivity due to *Súmula 277* provides an opportunity to study an unexpected improvement in the bargaining power of unions. As discussed in Section 1.3, the change meant that ultractivity applied to all existing CBAs that had not already expired. As such, bargaining units with a CBA negotiated prior to September 2012 that expired after that date suddenly entered the next round of negotiations knowing that existing provisions could not be unilaterally removed once the CBA expired. While all other bargaining units enjoyed the same guarantee on future CBAs, they entered the next round of negotiations without the ability to holdout under the existing provisions.

Formally, the implications of ultractivity on bargaining units whose CBA provisions unexpectedly remain in force are twofold. First, unions are less impatient to reach an agreement relative to the counterfactual. Second, inside options shift in favor of workers, i.e., the pay-offs under a negotiation impasse are more (less) favorable to workers (employers) than in the counterfactual. Both factors put unions in a better bargaining position, which is the justification for interpreting this as an improvement in the bargaining power of unions.³⁴

As such, I consider establishments with firm-level CBAs that are filed prior to (but expire after) *Súmula 277* to be treated. All other establishments in my analysis sample comprise the control group, which—as explained below—have similar attachment to firm-level collective bargaining as the treated, but simply did not enjoy coverage on September 2012.

Analysis sample The sample used for my analysis imposes restrictions to make the control establishments a credible counterfactual for the treated.³⁵ In doing so, it is worth highlighting that I am interested in the impact of improving union bargaining power, not the effects of ultractivity policies. My setting is not well-suited for the latter since *Súmula 277* affected all existing (and potential) bargaining units. Nonetheless, among bargaining units engaging in frequent negotiations, ultractivity creates a wedge in bargaining power that hinges on the existence of a CBA that was filed before (but expires after) September 2012.

The analysis sample imposes two sets of restrictions: one is innocuous while the other carries additional assumptions for identification. The first set of restrictions is that establishments must have negotiated a CBA in 2009 (the first year of the sample period) and at least another one prior to 2012 (the year ultractivity is enacted). The intention of these restrictions is to focus on bargaining units engaged in frequent negotiations. More practically,

³⁴Using the time-preference model from Binmore et al. (1986) as the strategic foundation for the generalized Nash bargaining solution, each of these factors exerts influence on the outcome through different channels. Less impatient unions increase their relative bargaining power parameter, while shifting the inside options in favor of workers raises (lowers) the union’s (employer’s) threat point.

³⁵Appendix C provides more details on the construction of the analysis sample.

having a minimum of two negotiations prior to treatment implies that analyzing pre-trends in CBA content will always be feasible. Since these are restrictions on pre-treatment outcomes, no additional assumptions are required for identification.

The second set of restriction nets out the fact that ultractivity can lead to differential exit from the market and/or negotiations since employers can no longer terminate a CBA.³⁶ Hence, I rely on the data to determine the post-treatment years by when this differential exit disappears. In terms of market exit, I restrict the sample to establishments that are open 2009-2014 (Figure C1a). In terms of negotiation exit, I restrict to establishments covered by at least one CBA negotiated in or after 2012 (Figure C1b).³⁷

This second set of restrictions conditions on post-treatment outcomes and therefore carries additional assumptions for identification. The assumption is that the boost in union bargaining power brought by ultractivity does not cause differential exit. In other words, conditioning on the outcomes does not generate selection in terms of the variation of interest. This assumption is reasonable to the extent that unions do not leverage their bargaining power to drive the employer out of business or end up without a CBA.

As such, my analysis sample simply focuses on the wedge in bargaining power among stable bargaining units with strong attachment to collective bargaining. Table C1 shows that there are roughly 23.6K establishments that satisfy these restrictions and they tend to be larger (130 workers on average) even compared to those signing a firm-level CBA in 2009.

Specification I use a difference-in-differences (DID) strategy to make causal inference on the impact of union bargaining power. Intuitively, I compare outcomes at establishments that experienced an improvement in bargaining power to those that did not, before and after ultractivity was enacted. In practice, I use the following two-way fixed effects specification

$$Y_{jt} = \sum_{k=2009}^{2016} \beta^{t-k} (D_j \times \delta_{t=k}) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt} \quad (1)$$

where Y_{jt} is an outcome of interest for establishment j at year t . The specification includes establishment fixed effects α_j and year fixed effects δ_t to account for time-invariant confounders at the establishment level and time-varying confounders common across establishments.

The treatment indicator D_j equals one for establishments with firm-level CBAs that are filed prior to (but expire after) *Súmula 277*. The X_{jt} term refers to time-varying fixed effects by detailed industry, microregion, and negotiation month to ensure results are not

³⁶The dampening in renewal rates for CBAs negotiated after 2011 supports this claim (Figure 1).

³⁷Both treated and control establishments can have a CBA negotiated in 2012 because treatment requires the filing date (rather than the start date) to be before September. The filing date captures when the agreement is reached which, due to negotiation delays, usually occurs after the start date.

driven by differential trends across these factors, in which balance by treatment status is not ensured—see Figure B2. Finally, I cluster standard errors at the establishment level.³⁸

The coefficients of interest are β^t for $t \in [2009, 2016]$ corresponding to the interaction between the treatment indicator and year fixed effects. Since labor market outcomes are measured at end-of-year, the omitted year in those specifications is 2011. For outcomes related to CBAs, the pre-treatment agreements include the one negotiated in 2009 and its earliest renewal. The post-treatment agreements are those negotiated after 2012 to ensure that ultraactivity was in force during negotiations. As such, the omitted agreement for CBA-related outcomes is the renewal of the 2009 CBA—denoted as $t = 2010\text{-}2012$ for simplicity.

Identification The identifying assumption is that the outcomes at the treated establishments would have evolved similarly to that of the control group had ultraactivity not been enacted. In my setting, this means that reasons for which some establishments had firm-level CBAs filed prior to (but expiring after) *Súmula 277* are independent from the outcomes of interest. The traditional falsification exercise for this assumption is to test for parallel trends in outcomes during the pre-treatment period. But even if parallel trends are not rejected, it is important to clarify the source of identifying variation.

The targeted source of variation in this setting is idiosyncratic delays in negotiations, which the empirical strategy approximates reasonably well. That is, an ideal control establishment is one that simply was not able to reach an agreement by September during its 2012 CBA negotiations. Unfortunately, since length of negotiations is observed only if an agreement is reached (i.e., $negotiation = file_date - start_date$) and ultraactivity can impact negotiation length, this ideal variation in delays is unobservable.³⁹

I rely on the analysis sample and specification to exploit this underlying variation. First, the analysis sample ensures negotiations are taking place by focusing on establishments with strong attachment to collective bargaining. Second, the specification includes time-varying fixed effects by negotiation month to make comparisons in which similar negotiation delays have similar implications for treatment status. For example, a treated establishment with a CBA expiring in August 2012 is compared to bargaining units scheduled to start negotiations in that same month but who experienced at least a one month delay in reaching an agreement.

Finally, additional analyses provide further support for the identification strategy. For example, I show that effects on CBA clauses are driven by establishments scheduled to

³⁸Establishment clusters guarantee that clustering corresponds to the level at which treatment is assigned. Since CBAs specify geographic coverage, establishments in the same firm or even the same bargaining unit can have different CBAs at any point in time. Results are robust to union-level clustering (Table A8).

³⁹Another potential identification strategy would be to use expiration date of CBAs relative to September 2012 as an instrument for treatment. Unfortunately, this IV is weak once one controls for industry since negotiation months and industries are highly correlated.

negotiate in months prior to ultractivity enactment, for which treatment assignment is clearly coming from negotiation delays. In addition, I implement an IV strategy that instruments treatment with the speed of CBA renewal in previous negotiations and find similar results.

3.2 Reduced form results

Effects on wages and employment Improving the bargaining power of unions increases contracted wages at affected establishments by 1.6 log points, on average. Figure 4a shows convincing evidence of parallel trends in wages from 2009 to 2011, followed by a jump in 2012.⁴⁰ Panel A in Table 4 reveals similar increases in hourly wages and earnings, i.e., contracted hourly wages (1.9 log points), average hourly earnings (1.1 log points), December hourly earnings (1.0 log points). Aligned with existing work on what unions do, this increase in wages comes with compression from the bottom and middle of the distribution, i.e., both the 90-10 and the 90-50 log wage ratios are decreasing by 1.2 and 1.5 log points, respectively.

The higher wages that unions obtain for workers do not generate disemployment effects. Figure 4b shows small and statistically insignificant point estimates around zero for all $\hat{\beta}^t$ with a DID point estimate of 0.2 log points. Panel B in Table 4 reveals that employment remains stable because higher retention rates along with lower quit rates are dampened by a decrease in hiring rates. Hence, there may be underlying changes to the workforce composition, which I'll discuss in Section 5.3 for exposition purposes.

While studies on other labor market institutions have shown wage increases paired with null employment effects, an often unobserved margin of adjustment is nonwage compensation. In other words, the unresponsiveness of employment to higher wages may be the result of decreases in amenities that leave overall compensation unchanged at these establishments. I now turn to explore this margin of adjustment through the impact of bargaining power on the common amenities negotiated in CBAs.

Effects on negotiated clauses I find that unions successfully increase the number of clauses negotiated in CBAs when their bargaining position improves. The DID estimates reveal a 1.6 clause increase, on average (equivalent to 5% increase relative to the baseline mean)—see Panel C in Table 4. Estimates suggest a similar 5% increase when considering the sum of unique clause types. That is, CBAs are not simply adding clauses to address the ultractivity of a existing amenity, they are increasing the space of amenities negotiated.

The bulk of these gains are not explained by wage clauses: only 16% comes from *wage-related* amenities, whereas *employment-related* amenities and *other* amenities account

⁴⁰The large standard errors in 2016 are due to a reporting issue in the contracted wage variable in RAIS-2016, which I adjust for (as detailed in Appendix C).

for 48% and 35%, respectively. The different dynamics in the effects are shown in Figures 4c through 4f. The plots provide additional evidence that the control group is a reasonable counterfactual since trends in clauses appear similar from the 2009 CBA to its pre-treatment renewal. Interestingly, the jump in the number of clauses occurs until the second year of treatment (2014) because in the first year (2013) increases in both *wage-* and *employment-related* amenities are muted by a decrease in *other* amenities. This interpretation relies on the notion that more clauses imply more amenities, but analyses on authority measures (upcoming) and amenity value (Section 5.1) corroborate the narrative that amenities increased.

The effects on clauses are driven by units scheduled to negotiate right before September, where variation from idiosyncratic delays in negotiations is stronger (Figure B3). In addition, the effects are larger at establishments whose pre-period CBA renewal had above-median clauses. In other words, if a union had a large number of provisions extended by ultractivity, it was able to negotiate more favorable terms. Table A9 shows that that the differential effect amounts to 2.3 additional clauses, where the effects is broken down by 25% in *wage-related*, 41% in *employment-related*, and 34% in *other* amenities.

Finally, instrumenting treatment with fast CBA renewals in previous negotiations produces similar results (Table A10). Specifically, the instrument is a dummy for whether the negotiation of the CBA renewal in the pre-period lasted less than 1 month. Panel A shows a strong first stage, i.e., fast renewals in prior negotiations are associated with a 13.3% higher likelihood of being treated. The 2SLS estimates of the main outcomes—in first differences relative to the omitted period—are reported in Panel B (pre-period) and Panel C (post-period). The estimates in Panel B are statistically insignificant, implying parallel pre-trends in the IV. Panel C shows effects consistent with the main results: null effects on employment, 4.8 log point increase in contracted wages, and 3.6 more CBA clauses.

Effects on authority measures The impact of bargaining power on authority measures shows that the increase in CBA clauses is favorable to workers. Table 5 shows that the relative authority of labor to capital increased by 11% relative to baseline. These effects are driven by expanding the authority of workers (by 46% relative to baseline), without reductions in the authority of firms and managers.⁴¹ A similar story arises when using the number of provisions by type (Table A11).⁴² In short, stronger unions increase the authority of labor relative to capital through collective bargaining.

⁴¹Figure B4 shows that most of the action is occurring for labor’s authority, where entitlements and permissions grow while obligations and constraints shrink.

⁴²On the labor side, entitlements and permissions increase, while obligation and constraints do not experience a statistically significant change. On the capital side, both entitlements and permissions as well as obligations and constraints increase.

4 Wage-equivalent value of clauses

To quantify the relation between the wage and amenity components of compensation under collective bargaining, I need a measure of the amenity value in CBAs. In this section, I provide a definition for the wage-equivalent value of CBA clauses and outline an estimation approach. To do this, I impose additional structure and simplifying assumptions outlined in Section 4.1. I then estimate values for the 24 clause subgroups using within-establishment variation over time, and provide numerous out-of-sample sense checks indicating that the resulting estimates of amenity value in CBAs are reasonable.

4.1 Definitions and approach

Definition I define the wage-equivalent value of a CBA clause as the change in wages required to keep the value of employment at an establishment constant once said clause is omitted. In other words, assume that workers get V_j utility from working at establishment j that pays a wage premium ψ_j and is covered by some CBA. Imagine a counterfactual where the CBA omits a clause from grouping z —denote this as $\Delta A(z)_j = -1$. The wage-equivalent value of clause z is the $\Delta\psi_j$ needed to make workers value this firm equally, i.e., $\Delta V_j = 0$.

Formally, assume a labor market with a common job ladder ranked by V_j . The components that provide utility from employment are wage premiums ψ_j and common amenities $A(z)_j$ for $z \in \{1, 2, \dots, Z\}$, such that $V_j = f(\psi_j, A(1)_j, A(2)_j, \dots, A(Z)_j)$.⁴³ I impose linear additivity of the arguments in $f(\cdot)$ to write

$$V_j = \alpha\psi_j + \sum_{z=1}^Z \beta^z A(z)_j \quad (2)$$

which assumes away complementarities, e.g., between wages and amenities. Based on this relation, the wage equivalent value for $A(z)$ is β^z/α . Intuitively, the more wages contribute to V_j —i.e., a larger α —the cheaper it is to compensate a foregone amenity.

An implicit assumption in this framework is that, just like workers agree on the job ladder they face, they also agree on the contributions that wage premiums (α) and each amenity component (β^z) bring to the value of employment. This would be satisfied easily under the strong assumption of homogeneous preferences over wages and amenities. More realistically, following the common job ladder assumption, this is merely a simplified representation of an aggregation of preferences among workers in Brazil.

⁴³Just like wage premiums are enjoyed by all workers, *common* amenities are those that apply to all workers. CBAs have direct influence on a comprehensive set of *common* amenities (e.g., transportation vouchers), but have no direct control over *worker-specific* amenities (e.g., commute time).

Approach The first requirement to get at the wage-equivalent value of a CBA clause is to have estimates for the objects in Equation (2). For workers’ utility of employment V_j , I estimate PageRank values (Sorkin, 2018). This is a revealed preference measure of the value of working at an establishment that leverages employer-to-employer worker flows to obtain information about the job ladder workers face.⁴⁴ For wages ψ_j , I use the establishment fixed effects in an AKM model.⁴⁵ For amenities $A(z)_j$, I use the cross-year maximum count of clauses by some grouping (e.g., 24 clause subgroups) in j ’s CBAs of coverage.

I use within-establishment variation over time to estimate β^z/α for each clause grouping z .⁴⁶ Specifically, I obtain estimates of $\{V_{jt}, \psi_{jt}, A(z)_{jt}\}_{j \in \mathcal{J}}$ for two 5-year periods $t \in [2007-2011, 2012-2016]$ and run the following regression in first differences

$$\Delta \widehat{V}_j = \alpha \Delta \widehat{\psi}_j + \sum_{z=1}^Z \beta^z \Delta \widehat{A}(z)_j + \varepsilon_j \quad (3)$$

where the error term includes changes in common amenities that are not in the purview of CBAs—like dignity at work, workplace culture, or coworkers (Dube et al., 2022; Sockin, 2022). The sample includes establishments from an analysis sample constructed as in Section 3.1 that uses sectoral CBA coverage, rather than firm-level CBA coverage.⁴⁷ Moreover, establishments must have PageRank values and AKM wage premiums in both periods, i.e., they are in the strongly connected set of establishments linked by worker flows for each t .

Validity Identification of the regression coefficients in Equation (3) relies on the conditional expectation of the error term being zero. Taking the linear relation in Equation (2) at face value, this would require that the common amenities *not* captured by CBAs that are correlated with either wage premiums or CBA clauses are constant between the two periods. Since CBAs cover a comprehensive set of common amenities, this assumption seems plausible. Importantly, other time-varying unobserved factors that generate correlations between the independent variables do not threaten identification.

The fact that all variables in the regression are estimated with noise introduces additional complications. First, noise in $\Delta \widehat{\psi}_j$ and $\Delta \widehat{A}(z)_j$ implies attenuation bias in $\widehat{\alpha}$ and $\widehat{\beta}^z$. Since

⁴⁴The intuition for the fixed point problem that pins down the PageRank values (see Appendix F) is that good employers have many worker inflows—especially from other good employers—and few worker outflows.

⁴⁵The underlying AKM model also assumes a common job ladder among workers and requires worker flows across establishments for identification (Abowd et al., 1999). See Appendix F for details on AKMs.

⁴⁶As in contingent valuation, this revealed preference approach regresses choices made by workers (V_j) on a priced item (ψ_j) and non-priced items ($A(z)$) that affect these choices. As such, the ratio of the regression coefficients β^z/α assigns a price to each $A(z)$.

⁴⁷I use sectoral CBAs both to avoid a mechanical link with the main results (which focus on firm-level CBAs) and to have within establishment variation in amenities that is plausibly exogenous due to the limited contribution of any single establishment to sectoral-level negotiations.

we are interested in β^z/α , the severity of attenuation on each coefficient could bias the wage-equivalent point estimates upward or downward. Even though taking first differences may dampen some of this bias, I vary the grouping level of CBA clauses and select the case that delivers the most reasonable point estimates as the least affected by such bias. Second, concerning noise in $\Delta\widehat{V}_j$, identification would fail if it is correlated with the noise in $\Delta\widehat{\psi}_j$ or $\Delta\widehat{A}(z)_j$. This is unlikely to be a concern since PageRank values are estimated in a separate procedure from the independent variables.

Lastly, my framework suggests that workers value establishments with higher wages and more clauses. Both in the cross-section of establishments and within-establishment over time, I find that wage premiums and CBA clauses are positively associated with PageRank values (Table A12). Furthermore, I assume that both wages and clauses are additively separable and linear in the PageRank values.⁴⁸ To that end, Figure B5 shows that both the AKM wage premiums and total CBA clauses are approximately linear in \widehat{V}_j .

4.2 Estimates of clause value

The estimates for the wage-equivalent values using the 24 clause subgroups in *Sistema Mediator* are shown in Table 6. Column 1 reports $\widehat{\alpha}$ and the set of $\widehat{\beta}^z$ for which the p-values are below 0.10. This p-value cutoff was chosen to include as many clauses as possible—considering inflated standard errors from noise in the dependent variable—while acknowledging that some CBA clauses may simply not be relevant components of V_j .⁴⁹ Column 2 reports the point estimates for the wage-equivalent values (i.e., $\widehat{\beta}^z/\widehat{\alpha}$) and Column 3 provides some clause examples for illustration.

To interpret the estimates, it’s important to specify the units of each variable in Equation (3). The dependent variable is in levels, where PageRank values \widehat{V}_j capture workers value of employment at a firm up to a unique multiplicative constant. Wage premiums are in logs, where $\widehat{\psi}_j$ is the establishment fixed effect from an AKM model in log wages after normalizing the average premium at the restaurant sector to zero. Finally, CBA clauses are in levels and are always integers since $\widehat{A}(z)_j$ is the cross-year maximum count of clauses by subgroups in j ’s sectoral CBA of coverage.

Hence, $\widehat{\alpha} = 0.214$ means that a log point increase in wage premiums is associated with a 0.214×0.01 change in V_j . Similarly, $\widehat{\beta}^z = 0.017$ for the Leaves subgroup means that having an additional clause on leaves is associated with a 0.017 change in V_j . Going back to the definition for wage-equivalent values, $\Delta A(z)_j = -1$ decreases V_j by 0.017 units, so that

⁴⁸Note that results are robust to running separate regressions as in Equation (3) for each $A(z)$.

⁴⁹The cutoff at p-values below 0.10 is not excluding any marginal cases since, among the excluded z , the one with the lowest p-value is double the cutoff at 0.20.

maintaining $\Delta V_j = 0$ requires a log point change in wages that is equal to $0.017/(0.214 \times 0.01) \approx 7.8$. Therefore, a leave clause is equivalent to a 7.8 log point increase in wages.

Table 6 shows that there are 10 clause subgroups capturing variation in common amenities that contribute to the value of employment at an establishment.⁵⁰ Among *wage-related* amenities, two subgroups are selected with positive value, i.e., Wage Payments (4.9 log pts) and Other Wage Rules (1.9 log pts).⁵¹ Among the *employment-related* amenities, only the Hiring subgroup is selected, valued at a 2.2 log point increase in wages. The remaining 7 subgroups selected fall under the broad group of *other* amenities.

Among the *other* amenities, there are both positively and negatively valued clauses. The positive subgroups include: Leaves (7.8 log pts), Bonuses (3.1 log pts), Assistances (1.9 log pts), and Union Organization (1.8 log pts). The negative subgroups include: Injuries (-6.4 log pts), Other Time-Off Provisions (-5.1 log pts), and Bargaining (-0.5 log pts). A negative wage-equivalent value implies that these CBA clause are capturing disamenities. Importantly, the presence of both amenities and disamenities guarantees that the value of a CBA is not necessarily monotonic in the number of clauses.

While the wage-equivalent values are causal, there is nuance to their interpretation since they may reflect 1) an amenity codified in the clause itself; or 2) an underlying condition that results in negotiating the clause. For example, the fact that clauses on Injuries imply a 6.4 log point decrease in wages is unlikely driven by disamenities codified in these clauses, e.g., imposing additional requirements for making injury claims. Instead, it's more likely that these clauses are negotiated once workplace injuries occur but they are ineffective at fully addressing the issue.⁵² That is, a clause could be an ineffective device whose presence merely reflect an underlying disamenity.

On a final note, aggregating CBA clauses at the subgroup level provides sufficient variation in amenities while avoiding enlarged estimates. Tables A13 and A14 show the wage-equivalent values for broad groups and clause types, respectively.⁵³ At the broad group level, the wage-equivalent values have reasonable magnitude—ranging from 0.3 to 1.0 log pts—but there is very limited room for variation with only 3 distinct z 's. At the clause type level, there is plenty of variation from 34 different z 's but the magnitudes of the wage-equivalent

⁵⁰This implies that there is valuable information in the CBA clauses. Given the p-value cutoff at 0.10, if the 24 subgroups were mostly noise, one would only expect 2.4 to be selected.

⁵¹It is encouraging that the subgroup more directly connected to wage levels (i.e., Wage Adjustments) is not selected, since the wage premiums should be capturing most of the relevant variation.

⁵²Recall from Table A7 that clauses from the Injuries subgroup predict an increase in the share of workers experiencing adverse safety events. See footnote 32.

⁵³The adjusted R-squared across grouping levels is quite stable, implying that neither is considerably better at capturing variation in $\Delta \widehat{V}_j$. Estimates for α are also stable, suggesting that the level of aggregation does not generate bias for the wage premium component.

values are unreasonable—ranging from -36.2 to 83.5 log pts. While this is an ad-hoc approach to determining the the desired level of z , any attempt of mapping CBA clauses to amenities requires some degree of clause aggregation. An advantage of my setting is that *Sistema Mediador* provides three ready-made levels of aggregation to test.

4.3 Out-of-sample sense checks

I use firm-level CBAs to provide out-of-sample sense checks for the estimates in Section 4.2. Specifically, I take the point estimates of wage-equivalent value for the 10 selected subgroups and assign them to the clauses negotiated in firm-level CBAs to obtain a measure of amenity value.⁵⁴ Through various exercises, I show that the inferred amenity value is reasonable.

First, both wage premiums and amenity values are increasing with PageRank values as predicted by the underlying framework for the estimation approach. Figures 5a and 5b shows that linearity of V_j with respect to both the wage and amenity components of compensation is a reasonable assumption. Specifically, in the cross-section of establishments covered by a firm-level CBA between 2007 and 2011, a one unit increase in the value of employment is associated with a 4.3 and 0.7 log point increase in wages and amenity value, respectively.

Second, amenity values are increasing with wage premiums in the cross-section. Figure 5c shows a linear and positive association between wages and amenities, resulting in a cross-sectional elasticity of amenities with respect to wages of 0.059—which is attenuated due to noise in $\hat{\psi}_j$. That is, establishments that offer higher wage premiums tend to provide more amenity value, which aligns with evidence in the existing literature (Maestas et al., 2023; Sockin, 2022). These results stand in contrast to Rosen (1986), where differentiation in pay across establishments represent compensating differentials, and imply that the inequality generated by worker sorting across firms is exacerbated once amenities are taken into account.

Third, consistent with a relatively stable job ladder, within-establishment increases in wage premiums over time are associated with decreases in amenity value. Figure 5d shows that the positive association between wages and amenities is reversed after taking first-differences. Generally speaking, there is no free lunch: given relatively constant value to workers, a firm that pays higher wages has to reduce amenities.

Fourth, the implied value of CBAs by industry is positively associated with union density. To set the stage, using firm-level CBAs signed in 2009, the mean amenity value is equivalent to 8.8 log points in wages—the median is 2.6 with an inter-quartile range of 0.0 to 15.4 log points. Figure B6a shows estimates of the mean amenity value by broad industry groups, where the highest value comes from CBAs in the public sector (20.0 log pts) and the lowest

⁵⁴The amenity value of a CBA is given by $Amenity_{cba} = \sum_{clause} 1\{clause = z\} \times (\hat{\beta}^z / \hat{\alpha})$.

value comes from CBAs in hospitality services (2.3 log pts). Figure B6b shows that this heterogeneity by industry positively aligns with union density, suggesting that sectors with higher union membership tend to negotiate more valuable CBAs.⁵⁵

Finally, amenity values tend to be higher when the text from the CBA expands the authority of labor and reduces the authority of capital. Table A15 shows that a 1 ppt increase in the relative authority of labor to capital is associated with a 0.029-0.033 log point increase in amenity value. Amenity value improves with greater authority to labor and deteriorates with greater authority to capital. In the case of labor, workers’ authority drives the association with amenity values. In the case of capital, limiting the authority of both firms and managers contributes to improving amenity value.

5 The amenity-wage tradeoff

Incorporating amenity value from CBAs into the analysis allows me to quantify how collective bargaining shapes compensation. To interpret these results in terms of the amenity-wage tradeoff, I rely on a posting model under collective bargaining. The model allows me to infer the slope of the contract curve on the amenity-wage space from the DID estimates, as well as establish this slope’s implications for efficient bargaining and workers’ labor supply responsiveness to wages versus amenity value. In the model, compensation gains need not generate negative employment effects, which provides the foundations for discussing whether collective bargaining constrains employers’ monopsony in the labor market.

5.1 Revisiting the impact of union bargaining power

To uncover how wages and amenities are traded off under collective bargaining, I revisit the effects of boosting union bargaining power with my estimates of the amenity value contained in CBAs. The results indicate that amenity value increased by 1.3 log points on average—about 0.3 log points lower than the effect on wages. In other words, 45% of the gains in compensation come from amenities.

Figure 6a shows the estimates for the β^k coefficients from Equation (1) where the dependent variable is amenity value. The dynamics fail to reject parallel trends and show that most of the effects on amenities are driven by 2013, i.e., the first year after unions in treated units experience a boost in bargaining power. While effects remain positive thereafter, their

⁵⁵On a related note, I run an AKM-style regression of amenity value from CBAs on union fixed effects and microregion-industry cell fixed effects. About 59% of the variation in amenities is driven by unions, suggesting that union-specific heterogeneity plays an important role in determining workplace amenities.

lower magnitude suggests some catch-up among the unions in control units who are able to holdout once they negotiate their first CBA under ultractivity.

These amenity improvements are primarily driven by gains in two clause subgroups: 1) Assistances, e.g., food, childcare, housing, and transportation; and 2) Wage Payments, e.g., pay advancements, proof of payment, time frames, and pay discounts. Figure 6b shows that Assistance and Wage Payments contribute to 46% and 48% of the overall effect, respectively. Interestingly, the improvement in amenity value is also the result of tradeoffs across amenity types. For example, these gains occur despite the reduction of some clause subgroups (e.g., Leaves) which overall imply a 1.0 log point loss in amenity value.

It is encouraging that the subgroups contributing to amenity value are reflected in outcomes associated to them, as per the descriptive analysis in Table A7. For example, the Hiring subgroup—accounting for 23% of the increase in amenity value—is part of the contracting clauses (Panel A) that are linked to lower hiring and turnover rates, which Table 4 shows are causally decreasing with an increase in union bargaining power.⁵⁶ In addition, the Bonuses and Assistances subgroups—accounting for 14% and 46% of the increase in amenity value, respectively—are part of the incentive clauses (Panel B) that are linked to higher retention, which is corroborated by the DID estimates.⁵⁷

Panel A in Table 7 summarizes the results for the main outcomes: employment, wages, clauses, and amenity value. As in Section 3.2, I estimate heterogeneous effects by establishments whose pre-period CBA renewal had above-median clauses to test whether the corresponding unions are in a better bargaining position. Panel B shows that employment and wage effects are rather stable, while the additional 2.3 clauses secured by the above-median unions translates into 2.7 additional log points in amenity value. More precisely, with the boost in bargaining power, a below-median union is able to raise amenity value by 0.5 log points while an above-median union negotiates 3.2 log points in amenity value.

Panel C presents the results for 4 sectors that constitute more than 2/3 of the analysis sample. Results for the transportation and trade/commerce sectors are close to those of the main results, with amenities corresponding to 44-47% of the increase in compensation. The largest wage and amenity effects occur in the banking/finance sector: 6.0 and 2.4 log points, respectively. This means that amenities only account for 29% of the total increase in compensation to workers. In manufacturing, however, there are null effects on wages paired with a 1.3 and 3.5 log point increase in amenity value and employment, respectively. Hence, treated manufacturing unions produce small gains in compensation that are 100% amenity-

⁵⁶DID estimates also show a decrease in the share of workers with a fixed-term contract.

⁵⁷DID estimates show no impact on the share of workers experiencing safety events (Panel C) and the share of workers taking leave (Panel D). The latter makes sense since Leaves and Other Time-Off Provisions are negatively contributing to the increase in amenity value (Figure 6b).

based, yet experience a positive response on the employment margin. Section 5.3 explains this heterogeneity in light of the model below.

5.2 Posting model under collective bargaining

The increase in compensation caused by the boost in union bargaining power occurs without a reduction in employment. To explain this, I formalize a collective bargaining model that allows for imperfect competition in the labor market. The initial building block is a posting model where asymmetric information about workers' heterogeneous preferences over workplaces enables firms to post compensation bundles made up of wages and amenity values (Card et al., 2018). Firm posting is then constrained by collective bargaining in a right-to-manage framework. i.e., Nash bargaining between firms and unions pins down the compensation bundle, taking employment as given by the binding curve in the labor market (Nickell and Andrews, 1983). For additional details and derivations, refer to Appendix G.

Posting wages and amenity values Suppose there are \mathcal{J} firms in a market, where each firm $j \in \{1, \dots, \mathcal{J}\}$ posts a pair (w_j, a_j) of wages and amenity values that workers observe at no cost.⁵⁸ The market has workers with heterogeneous preferences over the work environment offered by firms. For each worker i , the indirect utility of working at firm j is

$$u_{ij} = \beta \log(w_j - b) + \eta \log(a_j - q) + \varepsilon_{i,j} \quad (4)$$

where b and q are the workers' reference wage and amenity value levels from their outside option, and $\varepsilon_{i,j}$ refers to the idiosyncratic preferences from working at firm j arising from match factors such as commute time and coworker collegiality, among others.

Assuming that the $\{\varepsilon_{i,j}\}$ are independent draws from a Type I Extreme Value distribution and the number of firms \mathcal{J} is very large (McFadden, 1973), workers' choice probabilities are closely approximated by exponential probabilities.⁵⁹ Hence, the firm-specific labor supply functions are approximated by

$$\log(L_j) = \log(\lambda) + \beta \log(w_j - b) + \eta \log(a_j - q). \quad (5)$$

Hence, the key difference between wages and amenity values in this model (and the reason they are not perfect substitutes) is that labor supply responds differently to changes in these two forms of compensation.

⁵⁸Since my objective is to characterize labor supply, I assume (for now) that labor demand is never binding.

⁵⁹The exponential probabilities are $p_j \approx \lambda \exp(\beta \log(w_j - b) + \eta \log(a_j - q))$, where λ is a constant common across all firms in the market.

Firms generate revenue in a perfectly competitive product market (whose price is used as the numeraire) by producing output $Y_j = T_j f(L_j)$, where T_j represents a firm-specific productivity shifter and $f(\cdot)$ is the production function—assumed to be a twice continuously differentiable and homogeneous of degree $\alpha \in (0, 1)$. The market is further simplified by ignoring capital and intermediate inputs.

The firm’s problem is to post the wages and amenity values that minimize production costs given labor supply in Equation (5). The posted bundles are common to all workers since firms cannot discriminate on the basis of their idiosyncratic preferences $\{\varepsilon_{i,j}\}$. This asymmetry in information, rather than labor market concentration, is the source of monopsony power. The optimal choice is given by the following cost-minimization problem

$$\min_{w,a} (w_j + \xi_j a_j) L(w_j, a_j) \quad \text{s.t.} \quad T_j f(L(w_j, a_j)) \geq \bar{Y} \quad (6)$$

where ξ_j captures heterogeneity in the marginal cost of amenity provision across firms, which could be due to differences in HR capabilities for implementing new benefits, for example.

The first order conditions imply that the optimal compensation package of the “monopsonistic” firm (w_j^M, a_j^M) is given by

$$w_j^M = T_j f'(L_j) \mu_j \left(\frac{e_{w_j}^L}{1 + e_{w_j}^L + e_{a_j}^L} \right) \quad (7)$$

$$a_j^M = T_j f'(L_j) \mu_j \left(\frac{e_{a_j}^L}{\xi_j (1 + e_{w_j}^L + e_{a_j}^L)} \right) \quad (8)$$

where $e_{w_j}^L = \frac{\beta w_j}{w_j - b}$ and $e_{a_j}^L = \frac{\eta a_j}{a_j - q}$ represent the firm-specific labor supply elasticities with respect to wages and amenities, respectively. The μ_j term captures the marginal cost of production, which the firm will equate to marginal revenue at its optimal choice for Y_j .

To guide the discussion of the posting model, it is helpful to compare the monopsonistic compensation bundle to that in a perfectly competitive market

$$w_j^* = T_j f'(L_j) \mu_j \left(\frac{e_{w_j}^L}{e_{w_j}^L + e_{a_j}^L} \right) \quad (9)$$

$$a_j^* = T_j f'(L_j) \mu_j \left(\frac{e_{a_j}^L}{\xi_j (e_{w_j}^L + e_{a_j}^L)} \right). \quad (10)$$

The solution (w_j^*, a_j^*) is pinned down by two conditions: 1) marginal cost equals marginal revenue; and 2) marginal rate of substitution equals marginal rate of transformation. I now discuss the monopsonistic solution in light of these two conditions.

In the monopsonistic case, the first condition does not hold since compensation is marked down from the marginal revenue product of labor by $\frac{e_{wj}^L + e_{aj}^L}{1 + e_{wj}^L + e_{aj}^L}$.⁶⁰ Hence, if e_{aj}^L is non-negligible, markdown estimates that ignore amenity value may be biased.⁶¹ Interestingly, wages are below marginal product not only because of employer market power, but also simply because amenity compensation exists. In general, the more inelastic workers are to a given type of compensation, the more it will be marked down from their marginal product.

The second condition, surprisingly, holds under monopsony since MRS equals MRT is implied by the ratio of wages-to-amenities under monopsony.⁶² Therefore, although compensation has a markdown, the composition of the wage and amenity value bundle is optimal for the marginal worker. Lastly, the ratio of wages-to-amenities equals $\xi_j (e_{wj}^L / e_{aj}^L)$, implying that compensation tilts toward the type of compensation that labor supply is more responsive to, as well as the type which is less costly to provide. For example, if amenities are prohibitively expensive ($\xi_j \rightarrow \infty$) or do not influence workers decisions ($e_{aj}^L \rightarrow 0$) compensation will solely be in the form of wages.

Bargaining over wages and amenity values I now introduce collective bargaining into the model as a labor market institution that constrains firm posting. This follows a right-to-manage framework, i.e., firms and unions negotiate the compensation bundle through Nash bargaining considering employment as given by either the labor supply or the labor demand curve—whichever is binding at the resulting bundle. By seeking to improve on-the-job returns for workers, unions can push compensation above the monopsonistic bundle but can also exceed the efficient bundle under perfect competition.

The Nash bargaining problem

$$\max_{w,a} [\pi(w, a) - \pi(g_w, g_a)]^{1-\gamma} [(v(w) - v(g_w)) L(w, a)]^{\epsilon\gamma} [(v(a) - v(g_a)) L(w, a)]^{(1-\epsilon)\gamma} \quad (11)$$

maximizes wages and amenity values over the weighted product of the firm's objective and the union's objective.⁶³ The firm is maximizing profits $\pi(w, a)$ —relative to the inside option $\pi(g_w, g_a)$ —with bargaining power $1 - \gamma$. The union is modeled as being split into two

⁶⁰Total posted compensation is $w_j^M + \xi_j a_j^M = T_j f'(L_j) \mu_j \left(\frac{e_{wj}^L + e_{aj}^L}{1 + e_{wj}^L + e_{aj}^L} \right)$, where the term in parentheses is the traditional Lerner markdown modified to incorporate amenities.

⁶¹Specifically, if $e_{aj}^L > 0$ and the variation used to estimate markdowns implies changes in amenities in the opposite (same) direction as wages, the markdown will be biased upward (downward).

⁶²MRS equals MRT means that $\frac{e_{wj}^L a_j}{e_{aj}^L w_j} = \frac{1}{\xi_j}$ which implies $\frac{w_j}{a_j} = \frac{\xi_j e_{wj}^L}{e_{aj}^L}$. The MRS also implies homotheticity and hence linear Engel curves for both wages and amenities. Homotheticity and constant provision costs of amenities are key assumptions to this optimality result—also shown in Dube et al. (2022).

⁶³The maximization problem's constraints are: $\pi(w, a) \geq 0$, $L(w, a) \geq 0$, $w \geq g_w$, and $a \geq g_a$. The subscript j is dropped since the model is now focusing on negotiations between a given firm and its union.

committees: one maximizing wage gains and the other maximizing amenity gains among the employed $L(w, a)$ using some increasing and concave preference function $v(\cdot)$. The union's bargaining power $\gamma \in [0, 1]$ is allocated to each committee based on $\epsilon \in [0, 1]$.

The contract curve tracing the Nash bargaining solution (w^{NB}, a^{NB}) for all values of γ can be characterized using the problem's first order conditions. Assuming $v(\cdot) = \log(\cdot)$, $f(L) = L^\alpha$, and constant elasticities, the slope of the contract curve is given by

$$\frac{da}{dw} = \left(\frac{1 - \epsilon}{\epsilon} \right) \left(\frac{e_w^\pi}{e_a^\pi} \right) \left(\frac{a}{w} \right) \quad (12)$$

which is always positive, i.e., compensation increases with the union's bargaining power.⁶⁴ The steepness of this slope captures the amenity-wage tradeoff occurring in CBA negotiations. The union's choice affecting this tradeoff is ϵ , where higher values tilt compensation toward wages by flattening the slope.

I define efficient bargaining to be when the negotiated bundles along the contract curve are optimal for the marginal worker. If one requires that (w^{NB}, a^{NB}) imply MRS equals MRT for any γ , this means that $\epsilon = \frac{e_w^L}{e_w^L + e_a^L}$. Intuitively, under efficient bargaining, unions set their effort to bargain over wages relative to amenities according to workers' labor supply responsiveness to wages relative to amenity values. Hence, assuming efficient bargaining implies that the union's collective bargaining objectives are aligned with workers' preferences over the wage and amenity components.⁶⁵

Characterization The Nash bargaining solution (w^{NB}, a^{NB}) can be either supply constrained or demand constrained. Figure 7 provides an example characterizing the set of solutions on the amenity-wage space. Any bundle below the curve where marginal cost equals marginal revenue is supply constrained and any bundle above this curve is demand constrained. Naturally, the outcome under perfect competition is at the boundary where MC equals MR, while the monopsony outcome is supply constrained, i.e., $MC < MR$.

At $\gamma = 0$, the solution is given by the inside option (g_w, g_a) . Assuming efficient bargaining, the contract curve starts at the inside option traveling toward (w^*, a^*) maintaining a slope that guarantees $MRS = MRT$. (Equivalently, the contract curve falls on a line that crosses the origin and maintains a ratio of amenities-to-wages of $\frac{e_{aj}^L}{\xi_j e_{wj}^L}$). Employment is increasing with compensation in this initial segment of the contract curve. However, once bargaining power is such that the Nash bargaining solution becomes demand constrained—that is, above the

⁶⁴ $e_w^\pi < 0$ and $e_a^\pi < 0$ are the elasticities of profits with respect to wages and amenity value, respectively.

⁶⁵ To distinguish between optimality for the *marginal* worker as opposed to the *average* worker (or any subset of workers) would require knowing the different elasticities for these groups of workers. Since nothing in $e_{wj}^L = \frac{\beta w_j}{w_j - b}$ and $e_{aj}^L = \frac{\eta a_j}{a_j - q}$ is worker-specific, the model abstracts from this distinction.

perfectly competitive outcome—employment will then decrease with compensation.

In summary, the model provides three insights to interpret the results from Section 5.1. First, unions can increase compensation without decreasing employment if employers are not demand constrained. Second, if employers are supply constrained, both compensation and employment can increase when unions are strengthened. And third, to the extent unions are bargaining efficiently, the slope of the contract curve sheds light on the relative responsiveness of labor supply to wages versus amenity value among workers.

5.3 Discussion

In light of the model, the results from Section 5.1 highlight two implications about the Brazilian labor market. First, labor markets where firm-level collective bargaining occurs are generally not demand constrained. In fact, evidence suggests that the norm is supply-constrained (or monopsonistic) labor markets but in *effective* units of labor. Second, heterogeneity in industry-specific contract curves aligns with efficient bargaining, indicating that workers tend to be more responsive to changes in wages than amenity values.

Monopsony power The direction of employment effects reveal whether employers exercise monopsony power. Increasing compensation implies that bargaining units are moving up along the contract curve. The absence of negative employment effects—i.e., the predominant result—rules out a world where labor markets are demand constrained at baseline (unless labor demand is extremely inelastic). Positive employment effects—as in manufacturing—indicate that these labor markets are supply constrained at baseline.⁶⁶

Considering physical units of labor, null employment effects occur in two cases. The first is under extremely inelastic labor supply to firms. The second is the knife-edge case where the increase in bargaining power pushes compensation from some supply constrained bundle to the demand constrained bundle directly above it (see Figure 7b).⁶⁷ The fact that the former relies on improbable labor supply elasticities and the latter is a knife-edge case make these explanations unlikely. Moreover, Figure B7 shows that workers with a college degree are disproportionately retained by treated establishments. This suggests that employers exercise their right-to-manage the composition of their workforce, making an explanation based on *effective* units of labor more natural.

⁶⁶Manufacturing is the only case where the identifying variation generates changes in only one of the components of compensation. As such, I can estimate the elasticity of labor supply with respect to the affected component. Specifically, $e_a^L = 0.035/0.013$ which gives an elasticity with respect to amenity value of 2.66.

⁶⁷A third case is where employment increases informally, which is not observed in RAIS. This is unlikely since our sample is comprised of very large firms (130 workers on average) with a local union presence.

If the binding constraint is an effective labor supply curve, increasing compensation would make firms shift to more productive labor. That is, higher compensation would allow treated establishments to retain or attract higher quality workers. This is supported by the data. Table A16 shows that employers upgrade to higher quality workers (i.e., college educated professionals) in response to increased compensation.^{68,69} As such, results are consistent with unions countering monopsony power in the labor markets where they negotiate CBAs. However, while rank-and-file workers gain from the improvements in compensation, the benefits from moving up the supply curve are borne by high-skill workers as employers shift to more effective units of labor.

Elasticities Under efficient bargaining, the amenity-wage tradeoffs imply that workers are more responsive to changes in wages than amenities. In the overall estimates, the slope of the contract curve is 0.82. Assuming efficient bargaining, the slope estimates imply that $\frac{e_a^L}{\xi e_w^L} = 0.82$. Therefore, if the provision cost of amenity value is no greater than that of wages ($\xi \leq 1$), the elasticity of labor supply with respect to amenities is at most 4/5 of that with respect to wages.⁷⁰ The implied non-negligible values of e_a^L mean that markdown estimates in setting where the identifying variation also impacts amenity value are likely biased. In fact, my estimates imply that $e_a^L = 2.66$ (see footnote 66), which given the slope of the contract curve and assuming $\xi = 1$ gives $e_w^L = 3.26$ and an amenity-inclusive markdown of 0.86. That is, workers are compensated 14% below their marginal revenue product.

The data supports the efficient bargaining hypothesis in the most prominent sectors. Figure 8 depicts the portions of the contract curve traced by the DID estimates for the four broad industries that comprise more than 2/3 of my sample. The transportation and trade/commerce sectors exhibit similar amenity-wage tradeoffs as the overall sample, i.e., contract curve slopes of 0.79-0.86. Importantly, the contract curves nearly cross the origin, which suggest that efficient bargaining is a reasonable assumption for these sectors. The two contrasting sectors are banking/finance and manufacturing, where the slopes are 0.40 and ∞ , respectively. The model provides potential explanations for these differences.

Unions in the banking/finance sector put even more focus on wages than amenities, resulting a a flatter contract curve. Since compensation at baseline is also more oriented towards wages in this industry, the flatter contract curve makes sense from an efficient

⁶⁸Changes in workforce composition do not account for the wage increase since the gains in wages generate compression from the bottom of the distribution (Panel A, Table 4).

⁶⁹The workforce composition in terms of gender, race, and age remains unchanged (Panel B, Table A16). This may be because the shift towards college degree professionals comes at the expense of managers rather than rank-and-file workers (Panel A, Table A16).

⁷⁰In fact, one would need the provision cost of amenities to be at least 22% greater than that of wages ($\xi > 1.22$) to reverse the sign of the inequality—that is, for $e_a^L > e_w^L$.

bargaining perspective. If bargaining is efficient, a flatter contract curve could be explained by 1) higher provision costs for amenity value ξ ; or 2) a larger gap between $e_w^L > e_a^L$ (or alternatively $\frac{\beta w}{w-b} > \frac{\eta a}{a-q}$) than in other industries. For the latter explanation, if preference parameters β and η are constant across workers, the flatter contract curve would be the result of a stronger relative bite of outside options in terms of wages than amenity value.⁷¹

The sole focus on amenity value by unions in the manufacturing sector likely reflects an adjustment for inefficiently low amenities at baseline. First, efficiency at baseline in this sector is implausible since the vertical contract curve would imply that manufacturing workers are compensated entirely with amenities, which is clearly not the case. Second, the possibility that the union is acting contrary to workers' preferences is unlikely since there is a positive employment response to the increase in amenities negotiated. Finally, if one takes the contract curves of the transportation and trade/commerce sectors as reference, the compensation in the manufacturing sector appears to have unusually low amenity compensation. Hence, it seems plausible that the baseline compensation bundle is such that the amenity outside option has strong bite (i.e., $a - q$ is close to zero), pushing the union to adjust for this inefficiently low level of amenities through collective bargaining.

6 Conclusion

Evidence on firm-specific wage setting has often overlooked amenity setting. This paper focused on collective bargaining—a labor market institution that directly affects about one-third of workers in OECD countries—because it provides a unique window into studying the relation between wage and amenity setting. On one hand, collective bargaining involves explicit (and observable) tradeoffs between wages and a comprehensive set of amenities since unions and employers directly negotiate over the amenity-wage space. On the other hand, to the extent that employers use monopsony power to set compensation, collective bargaining could function as a constraint on employers' discretion in setting wages and amenities.

This paper explored the relation between the wage and amenity components of compensation under collective bargaining. It did so descriptively, using rich micro-data from Brazil and extracting information from the text in CBAs. It did so causally, leveraging a shock to union bargaining power to study its impact on wages, amenities, and employment. It did so theoretically, imposing additional structure to deliver insights on which CBA clauses workers value and the underlying labor market conditions that rationalize the empirical results.

The central finding is that unions use their bargaining power to increase wages as well as

⁷¹That is, a larger $\frac{w}{w-b}$ than $\frac{a}{a-q}$ relative to other industries could be the result of better outside options in wages and/or worse outside options in amenity value, relative to equilibrium compensation bundle (w, a) .

negotiate amenities that workers value, resulting in better compensation without a decrease in employment. The most novel part of these results is the increase in amenities, which are typically not observed in such a comprehensive and systematic way outside of collective bargaining. I documented amenity improvements by looking at changes to CBA clauses and authority measures extracted from the CBA text.

To delve deeper into the amenity-wage tradeoffs, I proposed a method for quantifying the amenity value in CBAs. Doing so required simplifying assumptions but the results tell a convincing story. For example, the average CBA has a value equivalent to a 8.8 log points increase in wages, with Leaves being the amenity that workers value the most. As documented in other studies, high paying establishments offer better amenities, exacerbating inequality in compensation across workplaces. Furthermore, the impact of bargaining power on amenity value is lower than that on wages, meaning that unions prioritize wages over amenities but still negotiate about 45% of gains as amenity compensation.

To generate insights about the underlying labor market conditions, the paper proposed a posting model constrained by collective bargaining that rationalizes the empirical findings. In light of the model, the increase in compensation paired with null employment effects is consistent with unions countering employer monopsony power along an *effective* labor supply curve. The results also indicate that efficient bargaining is likely occurring in the most prominent sectors, implying that unions are responsive to workers preferences over wage and amenity compensation. While workers' labor supply is more responsive to changes in wages than in amenity value, the elasticity with respect to amenities is non-negligible, implying that markdown estimates that ignore amenities may be biased.

The paper highlights numerous open questions for future research. I expand on two avenues of particular interest. First, while stronger unions can constrain monopsony power, spillover effects to outsiders—which are critical for claims about welfare—are not well understood. Since this paper documents that the gains from moving up the labor supply curve are borne by high-skill workers, it is likely that some outsiders (such as informal workers) are worse off. Second, while the paper studies amenity-wage tradeoffs, its focus is specific to common amenities in the purview of collective bargaining, abstracting from heterogeneity in workers' preferences over amenities and potential amenity-wage complementarities. These restrictions made my analysis tractable given observational data, but there is ample room for experimental work to study tradeoffs involving worker-specific amenities, heterogeneous preferences over amenities, and/or complementarities between wages and amenities.

References

- Abowd, J. M., Kramarz, F., and Margolis, D. N. (1999). High Wage Workers and High Wage Firms. *Econometrica*, 67(2):251–333.
- Ash, E., Jacobs, J., MacLeod, B., Naidu, S., and Stammbach, D. (2020). Unsupervised Extraction of Workplace Rights and Duties from Collective Bargaining Agreements. In *2020 International Conference on Data Mining Workshops (ICDMW)*, pages 766–774.
- Ashenfelter, O. C., Farber, H. S., and Ransom, M. R. (2010). Labor Market Monopsony. *Journal of Labor Economics*, 28(2):203–210.
- Barth, E., Bryson, A., and Dale-Olsen, H. (2020). Union Density Effects on Productivity and Wages. *The Economic Journal*, 130(631):1898–1936.
- Berger, D., Herkenhoff, K., and Mongey, S. (2022). Labor Market Power. *American Economic Review*, 112(4):1147–93.
- Binmore, K., Rubinstein, A., and Wolinsky, A. (1986). The Nash Bargaining Solution in Economic Modelling. *The RAND Journal of Economics*, pages 176–188.
- Boudreau, L. (2024). Multinational enforcement of labor law: Experimental evidence on strengthening occupational safety and health (OSH) committees. *Econometrica*.
- Card, D. (2001). The Effect of Unions on Wage Inequality in the U.S. Labor Market. *ILR Review*, 54(2):296–315.
- Card, D., Cardoso, A. R., Heining, J., and Kline, P. (2018). Firms and Labor Market Inequality: Evidence and Some Theory. *Journal of Labor Economics*, 36(S1):S13–S70.
- Corradini, V., Lagos, L., and Sharma, G. (2022). Collective Bargaining for Women: How Unions Can Create Female-Friendly Jobs.
- Cramton, P. C. and Tracy, J. S. (1992). Strikes and Holdouts in Wage Bargaining: Theory and Data. *The American Economic Review*, pages 100–121.
- Depew, B. and Sørensen, T. A. (2013). The Elasticity of Labor Supply to the Firm Over the Business Cycle. *Labour Economics*, 24:196–204.
- Dickens, W. and Katz, L. F. (1987). Inter-Industry Wage Differences and Theories of Wage Determination. NBER Working Paper.
- DiNardo, J., Fortin, N., and Lemieux, T. (1996). Labor Market Institutions and the Distribution of Wages, 1973-1992: A Semiparametric Approach. *Econometrica*, 64(5):1001–44.
- DiNardo, J. and Lee, D. S. (2004). Economic Impacts of New Unionization on Private Sector Employers: 1984–2001. *The Quarterly Journal of Economics*, 119(4):1383–1441.

- Dodini, S., Salvanes, K., and Willén, A. (2021). The Dynamics of Power in Labor Markets: Monopolistic Unions versus Monopsonistic Employers. *CESifo Working Paper No. 9495*.
- Dodini, S., Stansbury, A., and Willén, A. (2023). How Do Firms Respond to Unions? *IZA Working Paper No. 16697*.
- Drake, M. H., Thô, L. T., and Thakral, N. (2021). Wage Differentials and the Distribution of Job Amenity Values.
- Dube, A., Jacobs, J., Naidu, S., and Suri, S. (2020a). Monopsony in Online Labor Markets. *American Economic Review: Insights*, 2(1):33–46.
- Dube, A., Manning, A., and Naidu, S. (2020b). Monopsony and Employer Mis-optimization Explain Why Wages Bunch at Round Numbers. NBER Working Paper No 24991.
- Dube, A., Naidu, S., and Reich, A. (2022). Power and Dignity in the Low-wage Labor Market: Theory and Evidence from Wal-Mart Workers. NBER Working Paper No 30441.
- Dustmann, C. and Schönberg, U. (2009). Training and Union Wages. *The Review of Economics and Statistics*, 91(2):363–376.
- Falch, T. (2010). The Elasticity of Labor Supply at the Establishment Level. *Journal of Labor Economics*, 28(2):237–266.
- Farber, H. S., Herbst, D., Kuziemko, I., and Naidu, S. (2021). Unions and Inequality over the Twentieth Century: New Evidence from Survey Data. *The Quarterly Journal of Economics*, 136(3):1325–1385.
- Firpo, S., Fortin, N. M., and Lemieux, T. (2009). Unconditional Quantile Regressions. *Econometrica*, 77(3):953–973.
- Flory, J. A., Leibbrandt, A., and List, J. A. (2014). Do Competitive Workplaces Deter Female Workers? A Large-Scale Natural Field Experiment on Job Entry Decisions. *The Review of Economic Studies*, 82(1):122–155.
- Frandsen, B. R. (2021). The Surprising Impacts of Unionization: Evidence from Matched Employer-Employee Data. *Journal of Labor Economics*, 39(4):861–894.
- Freeman, R. B. and Kleiner, M. M. (1990). The Impact of New Unionization on Wages and Working Conditions. *Journal of Labor Economics*, 8(1, Part 2):S8–S25.
- Freeman, R. B. and Medoff, J. L. (1984). What Do Unions Do? *ILR Review*, 38:244.
- Gerard, F., Lagos, L., Severnini, E., and Card, D. (2021). Assortative Matching or Exclusionary Hiring? The Impact of Employment and Pay Policies on Racial Wage Differences in Brazil. *American Economic Review*, 111(10):3418–57.
- Goolsbee, A. and Syverson, C. (2023). Monopsony power in higher education: A tale of two tracks. *Journal of Labor Economics*, 41(S1):S257–S290.

- Gu, W. and Kuhn, P. (1998). A Theory of Holdouts in Wage Bargaining. *The American Economic Review*, 88(3):428–449.
- Haanwinckel, D. (2023). Supply, Demand, Institutions, and Firms: A Theory of Labor Market Sorting and the Wage Distribution. NBER Working Paper No. 31318.
- Hamermesh, D. S. (1999). Changing Inequality in Markets for Workplace Amenities. *The Quarterly Journal of Economics*, 114(4):1085–1123.
- Harju, J., Jäger, S., and Schoefer, B. (2021). Voice at Work. NBER Working Paper.
- Hirsch, B., Schank, T., and Schnabel, C. (2010). Differences in Labor Supply to Monopsonistic Firms and the Gender Pay Gap: An Empirical Analysis Using Linked Employer-Employee Data from Germany. *Journal of Labor Economics*, 28(2):291–330.
- Horn, C. H. (2009). *Collective Bargaining in Brazil: A Study on Joint Regulation of the Employment Relationship in Manufacturing*. VDM Verlag.
- Johnson, M. S. (2020). Regulation by shaming: Deterrence effects of publicizing violations of workplace safety and health laws. *American Economic Review*, 110(6):1866–1904.
- Katz, L. F., Summers, L. H., Hall, R. E., Schultze, C. L., and Topel, R. H. (1989). Industry Rents: Evidence and Implications. *Brookings Papers on Economic Activity: Microeconomics*, 1989:209–290.
- Krueger, A. B. and Summers, L. H. (1988). Efficiency Wages and the Inter-Industry Wage Structure. *Econometrica*, pages 259–293.
- Lalonde, R. J., Marschke, G., and Troske, K. (1996). Using Longitudinal Data on Establishments to Analyse the Effects of Union Organizing Campaigns in the United States. *Annales D'Économie et de Statistique*, pages 155–186.
- Lamadon, T., Mogstad, M., and Setzler, B. (2022). Imperfect Competition, Compensating Differentials, and Rent Sharing in the US Labor Market. *American Economic Review*, 112(1):169–212.
- Lavetti, K. and Schmutte, I. M. (2018). Estimating Compensating Wage Differentials with Endogenous Job Mobility. Working Paper.
- Lee, D. S. and Mas, A. (2012). Long-Run Impacts of Unions on Firms: New Evidence from Financial Markets, 1961–1999. *The Quarterly Journal of Economics*, 127(1):333–378.
- Maestas, N., Mullen, K. J., Powell, D., von Wachter, T., and Wenger, J. B. (2023). The Value of Working Conditions in the United States and the Implications for the Structure of Wages. *American Economic Review*, 113(7):2007–47.
- Manning, A. (2003). *Monopsony in Motion: Imperfect Competition in Labor Markets*. Princeton University Press.
- Marginson, P. and Welz, C. (2014). Changes to Wage-Setting Mechanisms in the Context of the Crisis and the EU's New Economic Governance Regime. Technical report, Eurofound, Dublin.

- Mas, A. and Pallais, A. (2017). Valuing Alternative Work Arrangements. *The American Economic Review*, 107(12):3722–59.
- McFadden, D. (1973). Conditional Logit Analysis of Qualitative Choice Behavior. *Frontiers in Econometrics*, 105:142.
- Morchio, I. and Moser, C. (2020). The Gender Pay Gap: Micro Sources and Macro Consequences. CEPR Discussion Paper.
- Nickell, S. J. and Andrews, M. (1983). Unions, Real Wages and Employment in Britain 1951-79. *Oxford Economic Papers*, 35:183–206.
- Pierce, B. (2001). Compensation Inequality. *The Quarterly Journal of Economics*, 116(4):1493–1525.
- Ransom, M. R. and Oaxaca, R. L. (2010). New Market Power Models and Sex Differences in Pay. *Journal of Labor Economics*, 28(2):267–289.
- Ransom, M. R. and Sims, D. P. (2010). Estimating the Firm’s Labor Supply Curve in a “New Monopsony” Framework: Schoolteachers in Missouri. *Journal of Labor Economics*, 28(2):331–355.
- Robinson, J. (1933). *The Economics of Imperfect Competition*. Springer.
- Rosen, S. (1986). The Theory of Equalizing Differences. In *Handbook of Labor Economics*, volume 1, pages 641–692. Elsevier.
- Sharma, G. (2023). Monopsony and Gender. Unpublished manuscript.
- Sockin, J. (2022). Show Me the Amenity: Are Higher-Paying Firms Better All Around?
- Sorkin, I. (2018). Ranking Firms Using Revealed Preference. *The Quarterly Journal of Economics*, 133(3):1331–1393.
- Staiger, D. O., Spetz, J., and Phibbs, C. S. (2010). Is There Monopsony in the Labor Market? Evidence from a Natural Experiment. *Journal of Labor Economics*, 28(2):211–236.
- Taber, C. and Vejlin, R. (2020). Estimation of a Roy/Search/Compensating Differential Model of the Labor Market. *Econometrica*, 88(3):1031–1069.
- Webber, D. A. (2015). Firm Market Power and the Earnings Distribution. *Labour Economics*, 35:123–134.
- Wiswall, M. and Zafar, B. (2017). Preference for the Workplace, Investment in Human Capital, and Gender. *The Quarterly Journal of Economics*, 133(1):457–507.
- Yeh, C., Macaluso, C., and Hershbein, B. (2022). Monopsony in the US Labor Market. *American Economic Review*, 112(7):2099–2138.

Tables

Table 1: Reach of Collective Bargaining Agreements

	Share of establishments negotiating a CBA			Share of workers with a negotiated CBA		
	All (1)	Sectoral (2)	Firm-level (3)	All (4)	Sectoral (5)	Firm-level (6)
Panel A: Start year						
2009	0.27	0.26	0.02	0.55	0.48	0.16
2010	0.27	0.27	0.02	0.56	0.51	0.16
2011	0.28	0.27	0.02	0.58	0.51	0.16
2012	0.27	0.26	0.02	0.58	0.51	0.17
2013	0.26	0.25	0.02	0.57	0.50	0.17
2014	0.24	0.24	0.02	0.55	0.48	0.16
2015	0.23	0.22	0.01	0.52	0.45	0.15
2016	0.23	0.23	0.02	0.53	0.46	0.15
Panel B: Region (in 2009)						
North	0.17	0.16	0.03	0.48	0.38	0.20
Northeast	0.13	0.12	0.01	0.40	0.32	0.14
Southeast	0.34	0.33	0.02	0.60	0.54	0.16
South	0.22	0.21	0.02	0.53	0.48	0.15
Midwest	0.23	0.23	0.01	0.51	0.44	0.13
Panel C: Industry (in 2009)						
Farming/fishing	0.05	0.04	0.01	0.31	0.16	0.21
Extractive ind.	0.25	0.22	0.04	0.62	0.22	0.44
Manufacturing	0.28	0.26	0.04	0.65	0.54	0.31
Utilities	0.47	0.36	0.20	0.71	0.45	0.45
Construction	0.25	0.24	0.01	0.56	0.52	0.09
Trade/commerce	0.24	0.24	0.01	0.48	0.46	0.05
Transportation	0.26	0.25	0.02	0.54	0.48	0.16
Hospitality	0.23	0.23	0.01	0.44	0.43	0.05
Communication	0.35	0.33	0.04	0.72	0.61	0.22
Banking/finance	0.46	0.31	0.20	0.62	0.38	0.34
Real estate	0.44	0.44	0.00	0.62	0.61	0.04
Professional act.	0.33	0.32	0.01	0.60	0.55	0.11
Administrative act.	0.38	0.38	0.01	0.62	0.58	0.09
Public admin.	0.15	0.11	0.05	0.52	0.32	0.43
Education	0.21	0.19	0.03	0.40	0.31	0.12
Health	0.32	0.31	0.02	0.51	0.42	0.16
Culture/sports	0.21	0.21	0.01	0.44	0.39	0.08
Other	0.24	0.24	0.02	0.36	0.30	0.08

Notes: Table shows the share of establishments and workers in the private formal sector that negotiate a CBA by (A) start year; (B) region; and (C) industry. The shares for both establishments and workers are shown when including all CBAs, as well as for sectoral and firm-level CBAs separately. Each CBA is assigned to establishments within the geographic coverage of the agreement that belong to the firms involved in the negotiations (directly in the case of firm-level CBAs; through employer associations in the case of sectoral CBAs). The workers at these establishments are then assigned to the corresponding CBA.

Table 2: Statements Regarding Ultractivity (*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 vigoraram 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 ^o , 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 ^o 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. Bargaining power</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.

Notes: Table shows original statements in Portuguese (along with their translations in English) that pertain to the change in *Súmula 277* that introduced ultractivity to the collective bargaining framework on September 2012. Legally, the way provisions are extended under ultractivity despite the expiration of a CBA is by incorporating them into individual labor contracts. These quotes are extracted from the *Tribunal Superior do Trabalho* and multiple media sources in Brazil.

Table 3: Prominent Bigrams by TF-IDF in the Text of Clause Subgroups

Wage adjustments	Wage payment	Other wages	Other wage rules
wage-floor	wage-advance	earn-commission	normative-salary
wage-increase	proof-payment	weekly-remunerate	equal-salary
wage-equalization	pay-discount	weekly-commission	function-salary
Separations	Contract types	Hiring	Other contracting
prior-notice	probation-contract	same-function	work-contract
severance-pay	renewal-period	readmission-case	social-security
dismissal-approval	end-apprenticeship	work-card	provide-fair
Staffing	Working conditions	Employment protections	Workday
promote-training	instrument-tool	guarantee-employment	working-hours
automation-means	damage-caused	job-guarantee	hours-bank
good-qualification	be-reimbursed	provisional-stability	day-shift
Bonuses	Pays	Assistances	Other incentives
be-promote	overtime	basic-basket	profit-sharing
cashier-allowance	pay-additional	transport-voucher	life-insurance
company-pay	night-work	funeral-assistance	reason-retirement
Injuries	Prevention	Union organization	Union-firm relations
medical-certificate	protection-equipment	assistance-due	notify-union
absence-allow	first-aid	opposition-right	bulletin-board
dental-issue	drinking-water	approve-assembly	union-leader
Vacations	Leaves	Other time off provisons	Bargaining
start-vacation	pay-leave	wedding-day	labor-justice
days-advance	maternity-leave	remunerate-days	any-divergence
period-enjoyment	adoption-case	collective-coincide	settle-any

Notes: Table shows three prominent bigrams for each of the 24 clause subgroups provided by *Sistema Mediator*. The clause subgroups in blue refer to *wage-related* amenities, in green to *employment-related* amenities, and in gray to *other* amenities. The bigrams displayed are selected based on TF-IDF measures using the text of all 2009 firm-level CBAs, where the text of each subgroup across CBAs constitutes a document. $TF-IDF = TF \times IDF$ stands for “term frequency - inverse document frequency”. TF is the number of times the bigram appears in a subgroup compared to the total. IDF is the log of the number of subgroups in the collection divided by the number of subgroups that contain the bigram.

Table 4: Impact of Union Bargaining Power

Panel A: Impact on wages						
	Log contracted wage (1a)	Log contracted wage (hourly) (2a)	Log average earnings (hourly) (3a)	Log December earnings (hourly) (4a)	90-10 log wage ratio (5a)	90-50 log wage ratio (6a)
$D_i \times \delta_{t \geq 2012}$	0.016 (0.004)	0.019 (0.004)	0.011 (0.003)	0.010 (0.003)	-0.012 (0.007)	-0.015 (0.005)
Baseline mean	12.283	7.142	7.367	7.421	0.947	0.610
Observations	183,828	183,828	183,532	183,259	183,828	183,828

Panel B: Impact on employment						
	Log employment (1b)	Hiring rate (2b)	Retention rate (3b)	Turnover rate (4b)	Turnover rate: layoffs (5b)	Turnover rate: quits (6b)
$D_i \times \delta_{t \geq 2012}$	0.002 (0.009)	-0.025 (0.012)	0.009 (0.002)	-0.019 (0.012)	-0.006 (0.007)	-0.004 (0.002)
Baseline mean	3.286	0.623	0.797	0.396	0.185	0.078
Observations	183,854	185,895	183,673	185,859	185,895	185,895

Panel C: Impact on CBAs					
	Clause count (1c)	Clause count: unique types (2c)	Wage clauses (3c)	Employment clauses (4c)	Other clauses (5c)
$D_i \times \delta_{t \geq 2012}$	1.556 (0.223)	0.954 (0.149)	0.256 (0.034)	0.750 (0.055)	0.548 (0.161)
Baseline mean	31.056	19.385	2.780	4.085	24.189
Observations	136,912	136,912	136,912	136,912	136,912

Notes: Table reports the pooled DID estimates based on Equation (1) for outcomes related to (A) wages; (B) employment; and (C) collective bargaining agreements. In other words, it reports the estimates for β in the following specification $Y_{jt} = \beta(D_i \times \delta_{t \geq 2012}) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt}$ along with standard errors clustered at the establishment-level in parentheses. Refer to Appendix C for definitions of the outcomes. The unit of observation is the establishment-year restricted to establishments in the analysis sample. The baseline mean refers to the average outcome in 2009.

Table 5: Impact of Union Bargaining Power on Authority Expansion

Panel A: Overall				
	Labor–Capital (1a)	Labor (2a)	Capital (3a)	
$D_i \times \delta_{t \geq 2012}$	0.040 (0.005)	0.044 (0.005)	0.003 (0.003)	
Baseline mean	0.353	0.060	-0.293	
Observations	110,067	110,067	110,067	

Panel B: Individual agents				
	Workers (1b)	Unions (2b)	Firms (3b)	Managers (4b)
$D_i \times \delta_{t \geq 2012}$	0.038 (0.004)	0.005 (0.002)	0.004 (0.003)	-0.001 (0.001)
Baseline mean	0.082	-0.022	-0.292	-0.001
Observations	110,067	110,067	110,067	110,067

Notes: Table reports the pooled DID estimates based on Equation (1) for outcomes measuring the authority of agents of interest, i.e., capital (firms and managers) and labor (workers and unions). Specifically, the table reports the estimates for β in the following specification $Y_{jt} = \beta(D_i \times \delta_{t \geq 2012}) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt}$ along with standard errors clustered at the establishment-level in parentheses. Authority measures capture the authority of agents in a legal document where 1) *obligations* and *constraints* reduce authority; and 2) *entitlements* and *permissions* expand authority. The dependent variable in these regressions is the share of provisions in the CBA that expand authority minus those that reduce authority for a given agent. Refer to Appendix E for more details on extracting the provisions of authority from the text of CBAs. The unit of observation is the establishment-year restricted to establishments in the analysis sample. The baseline mean refers to the average outcome in 2009.

Table 6: Wage-equivalent Value of CBA Clauses

	Estimate (1)	Value (2)	Clause examples (3)
Wage clauses			
Wage payment	0.010 (0.003)	0.049	Mandatory and automatic advances of 40% the monthly wage
Other wage rules	0.004 (0.002)	0.019	Availability of magnetic cards to withdraw advance payments
Employment clauses			
Hiring	0.005 (0.003)	0.022	Restrict duration of probations (60 days) and temporary contracts (90 days)
Other clauses			
Bonuses	0.007 (0.004)	0.031	50% of year-end bonus can be paid in advance for vacation purposes
Assistances	0.004 (0.002)	0.019	Reimburse up to R\$282 per child under 6 for childcare expenses
Injuries	-0.014 (0.005)	-0.064	Work-related accidents involving leave must be reported to the union within 24 hours
Leaves	0.017 (0.006)	0.078	Paid leaves: death (4 days), blood donation (1 day), voting (2 days); marriage (3 days); paternity (5 days)
Other time off provisions	-0.011 (0.005)	-0.051	Employers must inform workers about vacation periods at least 30 days in advance
Union organization	0.004 (0.002)	0.018	Workers can request not to pay assistance dues to the union (1% annual salary)
Bargaining	-0.001 (0.001)	-0.005	Impose fines on employers that fail to comply with clauses in the CBA
Wage premium	0.214 (0.024)	1.000	
Adjusted R2	0.047		
Observations	55,898		

Notes: Table displays the estimates wage-equivalent value for the 10 (out of 24) clause subgroups that have an impact on workers' value of employment at an establishment. Column (1) reports the point estimates—along with their standard errors in parentheses—of α and β^z from the specification in first-differences given by Equation (3). Clause subgroups whose $\widehat{\beta}^z$ has a p-value greater than 0.10 are not included in this table. Column (2) reports the wage-equivalent value, which is defined as the impact of the subgroup divided by that of the wage premium, i.e., $\widehat{\beta}^z/\widehat{\alpha}$. Column (3) provides excerpts from representative clauses in each subgroup. Clause representativeness is based on the share of bigrams contained that belong to the top-20 bigrams for that subgroup based on TF-IDF. The sample includes establishments from an analysis sample constructed as in Section 3.1 that uses sectoral CBA coverage, rather than firm-level CBA coverage. Moreover, establishments must have PageRank values and AKM wage premiums in both periods, i.e., they are in the strongly connected set of establishments linked by worker flows for each $t \in [2007-2011, 2012-2016]$.

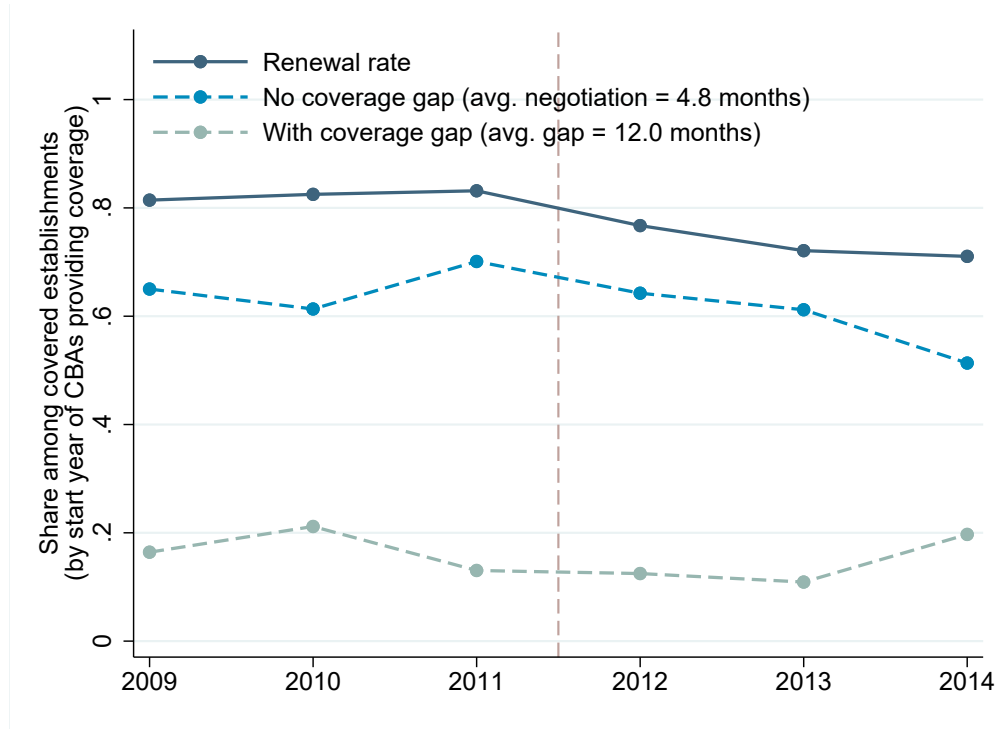
Table 7: Amenity-Wage Tradeoffs

	Log employment	Log contracted wage	Amenity value
	(1)	(2)	(3)
Panel A: Overall effects			
$D_i \times \delta_{t \geq 2012}$	0.002 (0.009)	0.016 (0.004)	0.013 (0.002)
Baseline mean	3.286	12.283	0.130
Observations	183,854	183,828	136,883
Panel B: Heterogeneous effects by clause count in pre-period renewal			
$D_i \times \delta_{t \geq 2012}$	-0.011 (0.012)	0.018 (0.006)	0.005 (0.002)
$D_i \times \delta_{t \geq 2012} \times HighClause_i$	0.038 (0.020)	-0.003 (0.009)	0.027 (0.004)
Panel C: Overall effects by industry			
Manufacturing	0.035 (0.020)	-0.003 (0.013)	0.013 (0.003)
Trade/commerce	0.015 (0.023)	0.019 (0.008)	0.017 (0.004)
Banking/finance	-0.002 (0.019)	0.060 (0.006)	0.024 (0.003)
Transportation	-0.048 (0.039)	0.020 (0.012)	0.015 (0.007)

Notes: Table summarizes the effects of an increase in union bargaining power on (1) employment; (2) wages; and (3) amenity value. The slope of the contract curve (defined in Section 5.2) is given by dividing the effect on amenity value by that on wages. Panel A reports the estimates for β in the following specification $Y_{jt} = \beta(D_i \times \delta_{t \geq 2012}) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt}$ along with standard errors clustered at the establishment-level in parentheses. Panel C reports these same estimates after splitting the sample by the 4 largest industries in the analysis sample, accounting for over two-thirds of observations. Panel B reports the estimates for β_1 and β_3 in the following fully interacted specification $Y_{jt} = \beta_1(D_i \times \delta_{t \geq 2012}) + \beta_2(H_i \times \delta_{t \geq 2012}) + \beta_3(D_i \times \delta_{t \geq 2012} \times H_i) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt}$, where $H_i = HighClause_i$ is an indicator for having above median clauses in the CBA renewal prior to the shock. The unit of observation is the establishment-year restricted to establishments in the analysis sample. The baseline mean refers to the average outcome in 2009.

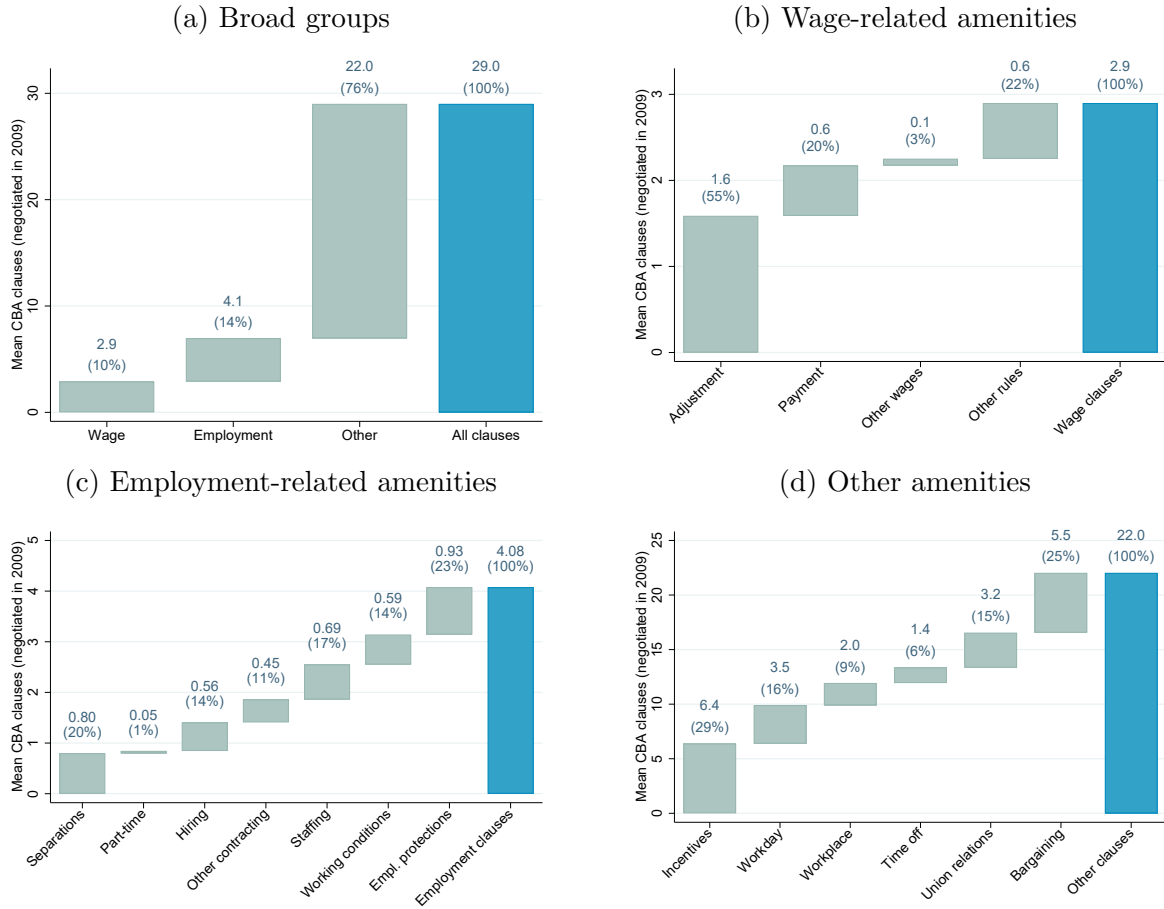
Figures

Figure 1: Renewal Rates and Coverage Gaps



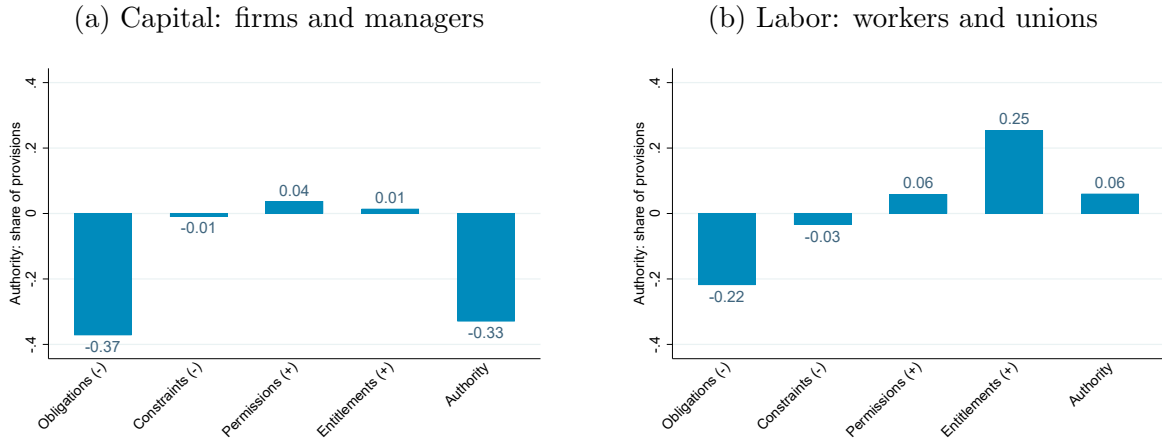
Notes: The figure depicts changes in renewal rates and coverage gaps from firm-level CBAs over time. Specifically, it shows the share of establishments covered by a CBA in a given start year that negotiate another CBA within two years, i.e., the renewal rate. Among those who renew, the dashed lines distinguish between renewal CBAs that start on or before the initial CBA expires (i.e., no coverage gap) versus those that start after the initial CBA expires (i.e., with coverage gap). The legend for these dashed lines reports the average months of negotiation across renewals without a coverage gap—that is, the difference between the new CBA’s filing and start date—as well as the average months without coverage across renewals with a coverage gap—that is, the difference between the start dates of the new and initial CBAs.

Figure 2: Content of Firm-level CBAs



Notes: Figures show different breakdowns of the content in firm-level CBAs negotiated in 2009. The bars in each figure report the number of clauses in a given clause group averaged across establishments covered by these CBAs (percentages are reported in parentheses). Figure 2a focuses on the breakdown by broad groups, i.e., wage-related, employment-related, and other amenities. Figure 2b zooms into the wage-related amenities, showing the breakdown by clause subgroup. Figure 2c and Figure 2d do the same for the employment-related amenities and other amenities, respectively. For exposition purposes, the 13 subgroups that comprise other amenities are grouped into 6 buckets. Refer to Table 3 for the list of 24 clause subgroups.

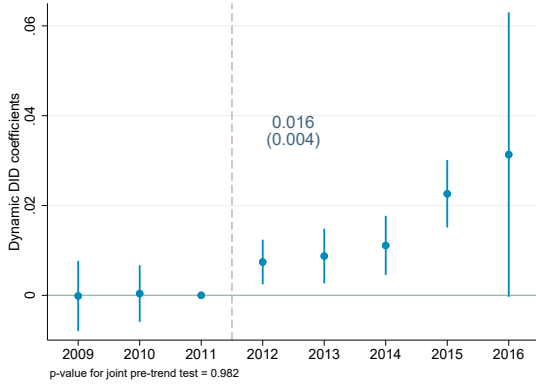
Figure 3: Authority Measures in the Text of Firm-level CBAs



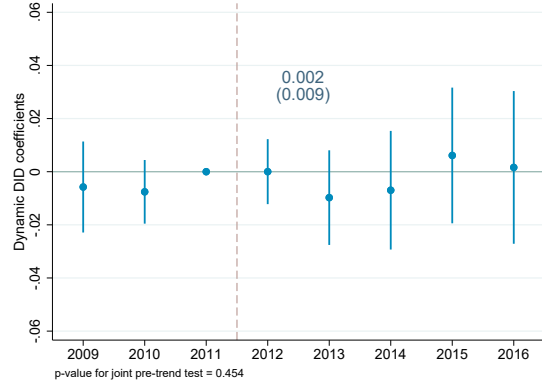
Notes: Figures show the components expanding and reducing the authority of capital (firms and managers) and labor (workers and unions) from firm-level CBAs negotiated in 2009. Refer to Appendix E for more details on extracting the provisions of authority from the text of CBAs. The bars report the share of provisions in the CBA that pertain to capital (Figure 3a) and labor (Figure 3b), averaged across the establishments covered by these agreements. Obligations and constraints reduce authority, so their shares are reported as negative. Entitlements and permissions expand authority, so their shares are reported as positive. The last bar corresponds to the sum of these shares, which provides a summary measure of authority.

Figure 4: Event Studies for Wages, Employment, and CBA Clauses

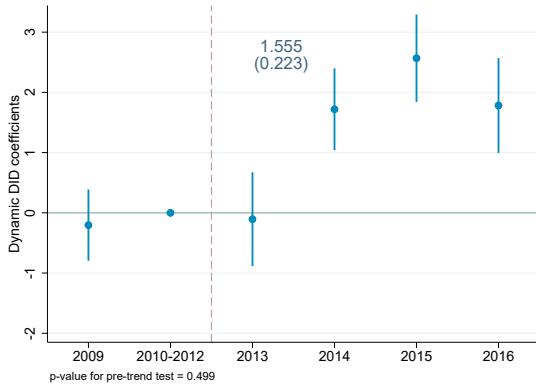
(a) Log contracted wage



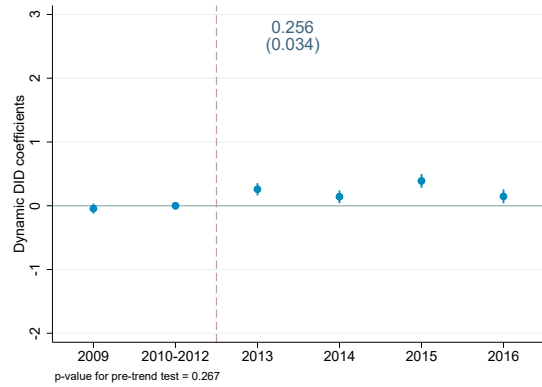
(b) Log employment



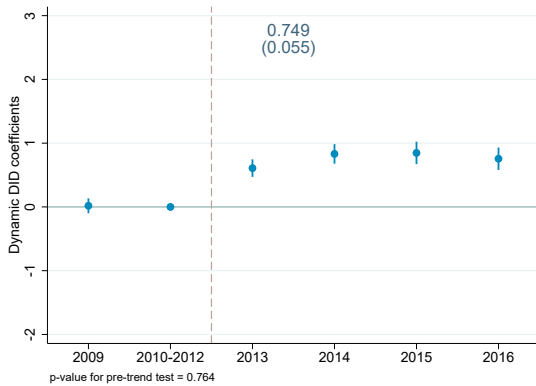
(c) Number of clauses



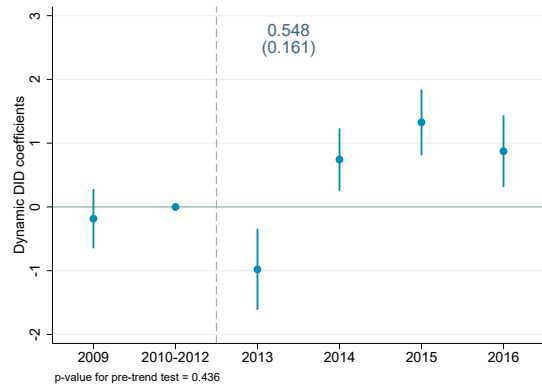
(d) Wage clauses



(e) Employment clauses

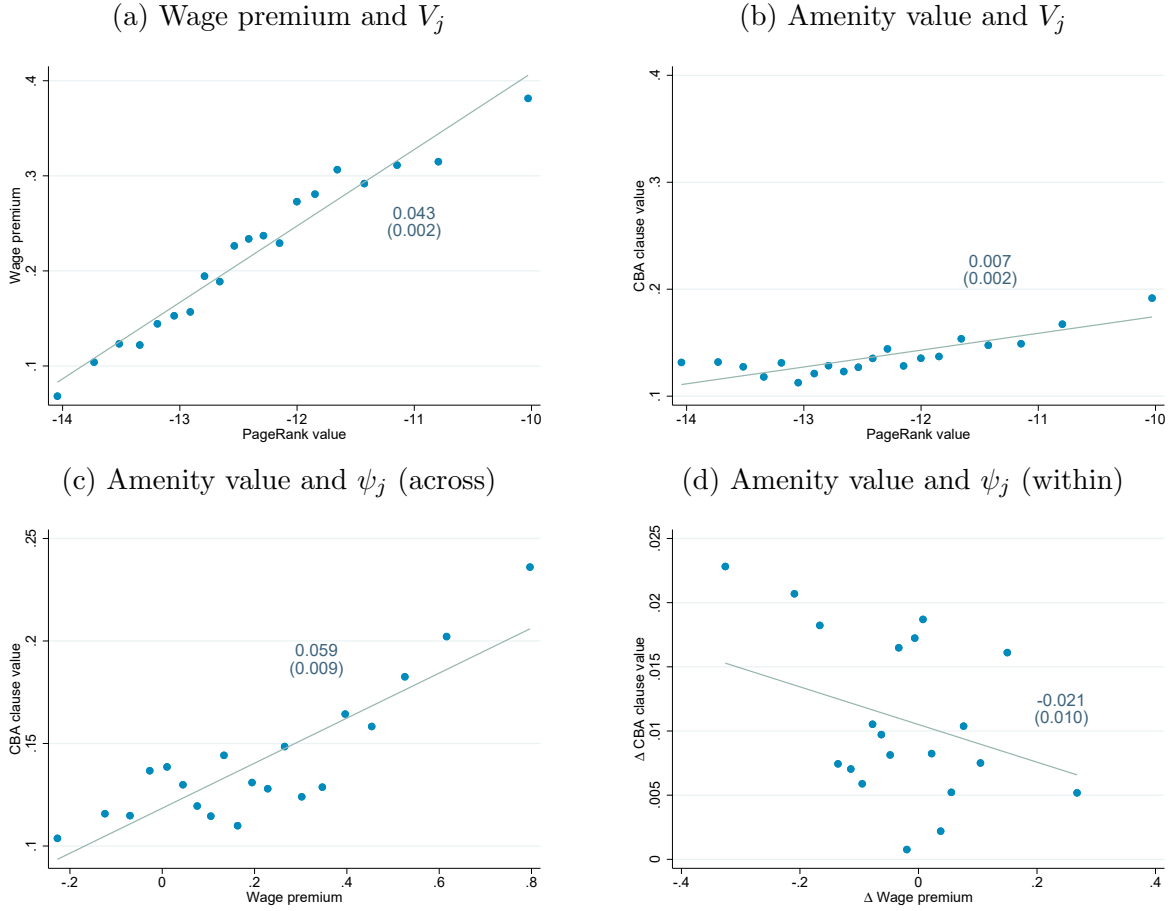


(f) Other clauses



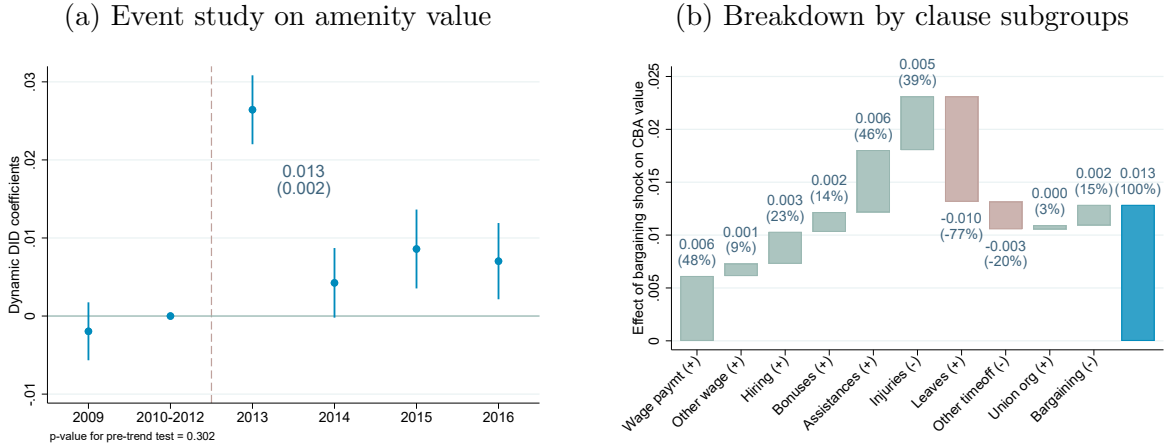
Notes: Figures show the event studies for the impact of union bargaining power using the DID specification in Equation (1). In addition to depicting the estimates of the β^t coefficients, each figure reports the pooled DID estimate—that is, the estimates for β in the following specification $Y_{jt} = \beta(D_i \times \delta_{t \geq 2012}) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt}$ along with standard errors clustered at the establishment-level in parentheses. For outcomes related to wages and employment (Figures 4a and 4b), the omitted year is 2011, i.e., the year prior to the shock to union bargaining power. For outcomes related to CBAs (Figures 4c through 4f), the omitted year pertains to the renewal of the 2009 CBA—denoted as $t = 2010-2012$ for simplicity. Refer to Section 3.1 for more details. The unit of observation is the establishment-year restricted to establishments in the analysis sample.

Figure 5: Out-of-Sample Sense Checks



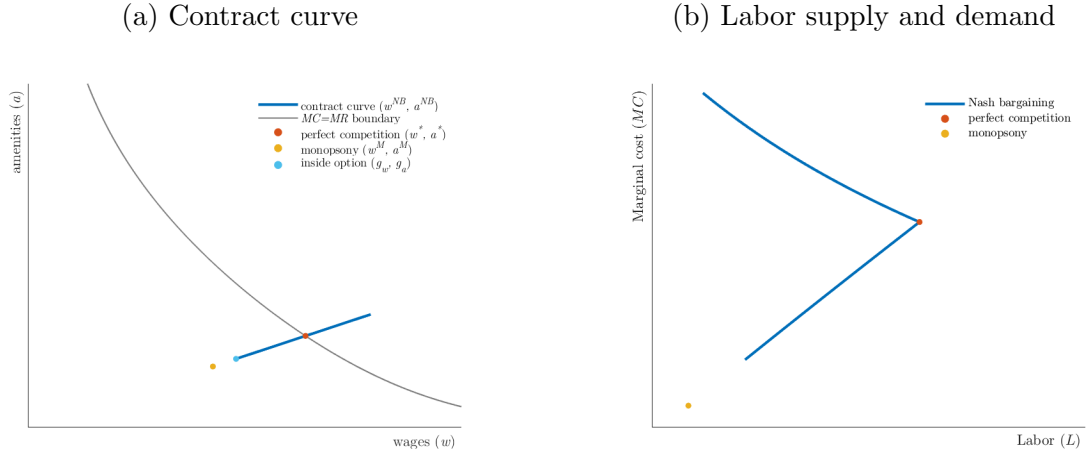
Notes: Figures provide evidence on the out-of-sample sense checks for the amenity values inferred from the specification in first-differences given by Equation (3). The amenity value of a CBA is given by $Amenity_{cba} = \sum_{clause} 1\{clause = z\} \times (\hat{\beta}^z / \hat{\alpha})$, where the estimating sample considers establishments covered by sectoral CBAs, as opposed to the firm-level CBA coverage used for the samples used in these sense checks. Refer to section 4.2 for more details. Figures 5a and 5b are binned scatter plots of wage premiums and amenity values on PageRank values (respectively) using information from 2007-2011. Figures 5c and 5d are binned scatter plots of amenity values on wage premiums across establishments (using information from 2007-2011) and within establishments (using first differences between 2007-2011 and 2012-2016), respectively. Each binned scatter plot includes fixed effects by detailed industry, microregion, and negotiation month, and reports the point estimate (and standard error) for the slope of the fitted line. The unit of observation is the establishment. Figures 5a and 5b are restricted to establishments in the analysis sample that also have PageRank values and AKM wage premiums in both periods, i.e., they are in the *strongly* connected set of establishments linked by worker flows for each $t \in [2007-2011, 2012-2016]$. Figures 5c and 5d are restricted to establishments in the analysis sample that also have AKM wage premiums in both periods, i.e., they are in the connected set of establishments linked by worker flows for each $t \in [2007-2011, 2012-2016]$.

Figure 6: Impact of Union Bargaining Power on Amenity Value



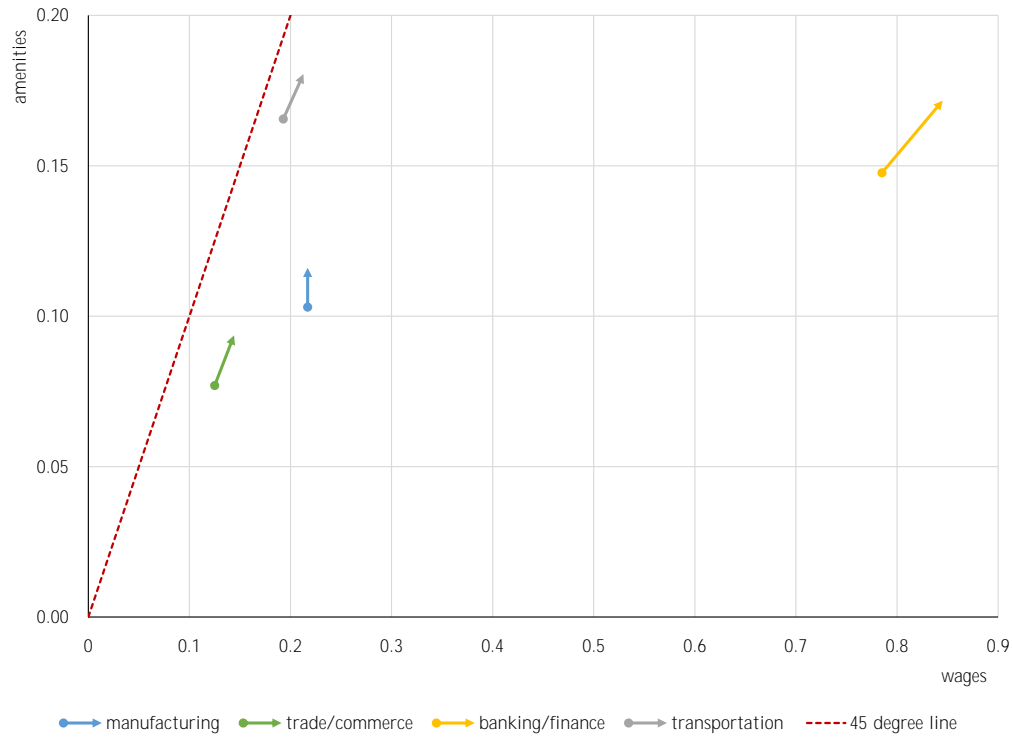
Notes: Figures show the event studies for the impact of union bargaining power on amenity value using the DID specification in Equation (1). In addition to depicting the estimates of the β^t coefficients, Figure 6a reports the pooled DID estimate—that is, the estimates for β in the following specification $Y_{jt} = \beta(D_i \times \delta_{t \geq 2012}) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt}$ along with standard errors clustered at the establishment-level in parentheses. Figure 6b shows the breakdown of the effect on amenity value by the clause subgroups that contribute to the value of a CBA. Subgroups capturing amenities are labeled with (+), while those considered disamenities are labeled with (-). The amenity value of a CBA is given by $Amenity_{cba} = \sum_{clause} 1\{clause = z\} \times (\hat{\beta}^z / \hat{\alpha})$. Refer to section 4.2 for more details. The unit of observation is the establishment-year restricted to establishments in the analysis sample.

Figure 7: Illustration of Posting Model under Collective Bargaining



Notes: Figure 7a shows the Nash bargaining solution as traced by the bargaining power parameter γ . The figure depicts how the two forms of compensation—i.e., wages and amenity value—evolve from the inside option (where $\gamma = 0$) and move along the contract curve as $\gamma \rightarrow 1$. The compensation bundles under full monopsony and a perfectly competitive labor market are provided as reference. The fact that the contract curve aligns with these bundles and the origin implies efficient bargaining. As the contract curve crosses the competitive boundary—i.e., the locus of (w, a) pairs at which marginal cost equals marginal revenue—the employment effect switches from positive to negative. This is shown explicitly in Figure 7b. The figures are generated with $f(L) = L^\alpha$, $v(w) = \ln(w)$, $T = 40$, $\alpha = 0.5$, $\xi = 1.2$, $\beta = 0.750$, $\eta = 0.375$, and inside options at the first fourth of the segment from the monopsonistic to the perfectly competitive outcome.

Figure 8: Empirical Contract Curves by Industry



Notes: The figure displays contract curves for the main industries in the analysis sample. Each arrow represents an empirical analogue of the portion of the contract curve traced by the shock to union bargaining power (see Figure 7a). The slope of each contract curve is based on the pooled DID estimates reported in Panel C of Table 7. The baseline amenity-wage bundles (shown with circular markers) are based on the mean amenity value from 2009 CBAs and the average AKM wage premium from the 2007-2011 period for each industry. The dashed line represents the 45 degree line.

Appendices for Online Publication

A. Appendix Tables

B. Appendix Figures

C. Data Appendix

D. Understanding *Sistema Mediador*

E. Authority Measures

F. PageRank and AKM Models

G. Bargaining Model

A Appendix Tables

Table A1: Characteristics of Unions and Employer Associations

	Unions				Employer associations			
	Count (Share) (1)	Share signing CBAs (2)	Count if signing (Share) (3)	Median CBAs signed: per year (4)	Count (Share) (5)	Share signing CBAs (6)	Count if signing (Share) (7)	Median CBAs signed: per year (8)
Local union	6,249 (0.94)	0.80	4,976 (0.95)	3.1	3,463 (0.95)	0.81	2,804 (0.97)	1.0
(Con)federation	382 (0.06)	0.69	263 (0.05)	3.3	171 (0.05)	0.58	99 (0.03)	2.4
Municipal-level	4,582 (0.69)	0.83	3,782 (0.72)	3.4	1,884 (0.52)	0.83	1,555 (0.54)	1.0
State-level	2,049 (0.31)	0.71	1,457 (0.28)	2.8	1,750 (0.48)	0.77	1,348 (0.46)	1.1
Industry-based	5,164 (0.78)	0.86	4,460 (0.85)	3.5	3,326 (0.92)	0.84	2,803 (0.97)	1.0
Occupation-based	1,467 (0.22)	0.53	779 (0.15)	1.6	308 (0.08)	0.32	100 (0.03)	1.7
North	522 (0.08)	0.75	389 (0.07)	2.4	346 (0.10)	0.74	257 (0.09)	1.0
Northeast	1,329 (0.20)	0.71	937 (0.18)	2.1	735 (0.20)	0.72	528 (0.18)	1.0
Southeast	2,576 (0.39)	0.82	2,117 (0.40)	3.9	1,269 (0.35)	0.80	1,018 (0.35)	1.3
South	1,619 (0.24)	0.86	1,387 (0.26)	3.6	984 (0.27)	0.87	854 (0.29)	1.4
Midwest	640 (0.10)	0.75	481 (0.09)	3.0	388 (0.11)	0.82	318 (0.11)	1.0
Total	6,631	0.79	5,239	3.1	3,634	0.80	2,903	1.0

Notes: Table shows descriptive statistics for labor unions (columns 1-4) and employer associations (columns 5-6) registered in the *Cadastro Nacional de Entidades Sindicais* (CNES). Each section of the table reports statistics for a mutually exclusive and collectively exhaustive characterization of union types. Hence, the shares reported in parentheses add to one within each section. Columns (1) and (5) consider all unions and employer associations, while the rest restrict to the entities that signed at least one CBA in 2009-2016 based on *Sistema Mediador* data. Unions can be involved in the negotiation of either sectoral or firm-level CBAs, while employer association only participate in sectoral negotiations. The sample excludes rural unions and public servants' unions.

Table A2: Baseline Panel of Negotiations

	Count (unique observations)				Average over unique CBAs			
	CBAs (1)	Workers covered (2)	Establishments covered (3)	Main unions (4)	Clause count (5)	Clause type count (6)	Duration: months (7)	Negotiation: months (8)
Panel A: Firm-level CBAs								
2009	26,807	4,509,503	45,500	2,792	21.7	15.1	13.9	4.3
2010	28,987	5,144,924	53,025	2,896	22.5	15.8	13.9	4.1
2011	31,549	5,546,271	58,770	3,068	22.1	15.5	13.9	3.8
2012	33,977	6,011,904	69,348	3,168	22.5	15.4	13.7	3.9
2013	34,267	6,124,469	68,327	3,196	22.3	15.5	13.8	4.0
2014	34,396	6,031,869	70,509	3,187	22.6	15.7	13.6	4.1
2015	33,064	5,475,811	55,250	3,093	22.8	15.9	13.6	4.2
2016	33,364	5,374,480	65,228	3,047	24.4	17.0	13.8	4.2
Panel B: Sectoral CBAs								
2009	4,976	9,691,834	429,231	2,287	42.5	28.4	13.4	3.8
2010	5,554	11,231,217	479,922	2,465	42.3	28.2	13.4	3.7
2011	5,996	12,247,152	524,207	2,587	43.3	28.6	13.6	3.4
2012	6,257	12,761,485	540,760	2,685	42.7	28.3	13.4	3.3
2013	6,095	12,995,819	542,883	2,594	43.8	29.0	13.3	3.8
2014	5,819	12,105,854	497,810	2,570	44.2	29.2	13.3	4.0
2015	5,653	11,287,985	494,380	2,529	44.3	29.4	13.5	4.1
2016	5,831	10,810,918	482,538	2,561	43.8	29.0	13.1	4.0

Notes: Table provides year-specific descriptive statistics for establishment-year panels that track negotiations from firm-level CBAs (Panel A) and sectoral CBAs (panel B). Columns (1)-(4) provide counts of the unique CBAs, workers, establishments, and unions in the panel. Coverage is based on end-of-year coverage status. Columns (5)-(8) are average over unique CBA observations. “Clause count” is the number of clauses, while “clause type count” is the number of unique clause types (out of 137). “Duration” refers to the difference between the start and end date of a CBA, while “negotiation” refers to the difference between the start and the filing date of a CBA. Creating this panel requires determining who in RAIS is covered by which CBA from *Sistema Mediador*. In the case of firm-level CBAs, I consider all establishments in the municipalities of coverage that belong to the signing firms. The assigned CBA is the one negotiated by the “main union”, i.e., the modal union across establishment-CBA-union observations. In the case of sectoral CBAs, I consider all establishments in the municipalities of coverage that contribute to the signing employer association. The assigned CBA is the one negotiated by the “main union”, i.e., the modal union across establishment-CBA-union observations among those negotiating CBAs with binding wage floors. Refer to Appendix C for more details.

Table A3: Clause Subgroups and Caluse Types (continued in next page)

Wage adjustments	Wage payment	Other wages	Other wage rules
Wage deductions	Wage payment	Weekly rest wage	Other wage rules
Wage isonomy		Intern wage	
Wage floors		Production wage	
Wage increases			
Separations	Contract types	Hiring	Other contracting
Advance notice	Part-time	Female workforce	Other contracting
Separations	Internships	Youth workforce	
Suspensions		Outsourcing	
		Advanced-age workforce	
		Hiring rules	
		Other workforces	
		Special needs workforce	
Staffing	Working conditions	Employment protections	Workday
Work functions adaptation	Moral harassment	Abortion protections	Sundays and holidays
Work function assignment	Sexual harassment	Injury protections (work-related)	Workday compensation
Performance evaluation	Tools and equipment	Adoption protections	Workday controls
Other staffing rules	Equal opportunity	Retirement protections	Weekly rest
Worker participation in management	Disciplinary norms	Apprenticeship protections	Duration and schedule
Task-and-wage schedule	Other rules on working conditions	Employment protections	Absences
Vocational training		Maternity protections	Break intervals
Transfers		Paternity protections	Special shifts
		Injury protections (nonwork-related)	Other workday provisions
		Military service protections	Workday extension/reduction
		Other employment protections	On-call shifts
		Policy for dependents	Uninterrupted shifts
		Policies for maintaining employment	
		Employment protection program	

Notes: Table shows the clause types that belong to each of the 24 clause subgroups provided by *Sistema Mediador*. The clause subgroups in blue refer to *wage-related* amenities, in green to *employment-related* amenities, and in gray to *other* amenities. There are a total of 137 clause types, unevenly distributed across the subgroups.

Clause Subgroups and Caluse Types (continued from previous page)

Bonuses	Pays	Assistances	Other incentives
13th month bonus	Night pay	Food assistance	Retirement
Work function bonus	Overtime pay	Childcare assistance	Fees
Other bonuses	Hazard pay (health)	Illness assistance	Loans
	Shift pay	Education assistance	Profit sharing
	Hazard pay (danger)	Housing assistance	Awards
	On-call pay	Maternity assistance	Family salary
	Seniority pay	Funeral assistance	Life insurance
	Other pays	Health assistance	
		Transportation assistance	
		Subsistence allowance	
		Other assistances	
Injuries	Prevention	Union organization	Union-firm relations
Medical certificates	Accident prevention committee	Factory commission	Union access to information
Work-related injuries	Health education campaigns	Union dues	Union access to workplace
Nonwork-related injuries	Working environment conditions	Opposition to union dues	Guarantees to union officers
Other injury provisions	Equipments for individual safety	Other union provisions	Union activities leave
Rehabilitation of the injured	Safety equipment	Union representatives	Other union-firm provisions
	Medical exams	Unionization campaigns	Strikes
	Insalubrity		
	Machine and equipment maintenance		
	Other injury prevention standards		
	Hazards		
	First aid		
	Health and safety professionals		
	Training for injury prevention		
	Uniforms		
Vacations	Leaves	Other time off provisions	Bargaining
Vacation days and duration	Abortion leave	Other time off provisions	CBA enforcement
Collective vacations	Adoption leave		CBA non-compliance
Vacation remuneration	Maternity leave		Conflict resolution
	Paid leave		Other bargaining provisions
	Unpaid leave		CBA negotiation rules
			CBA renewal/termination

Table A4: Top Clause Subgroups in Firm-level CBAs

Rank	Broad group	Clause subgroup	Mean clause	
			Count	Share
1	Other	Bargaining	5.5	18.9%
2	Other	Workday	3.5	12.2%
3	Other	Assistances	3.3	11.3%
4	Other	Union-firm relations	1.6	5.7%
5	Wage	Wage adjustments	1.6	5.5%
6	Other	Union organization	1.6	5.4%
7	Other	Prevention	1.5	5.1%
8	Other	Pay	1.3	4.6%
9	Other	Other incentives	1.2	4.0%
10	Employment	Employment protections	0.9	3.2%
11	Employment	Separations	0.8	2.7%
12	Employment	Staffing	0.7	2.4%
13	Wage	Other wage rules	0.6	2.2%
14	Other	Bonuses	0.6	2.1%
15	Employment	Working conditions	0.6	2.0%
16	Wage	Wage payment	0.6	2.0%
17	Employment	Hiring	0.6	1.9%
18	Other	Vacations	0.6	1.9%
19	Other	Injuries	0.5	1.9%
20	Other	Leaves	0.5	1.7%

Notes: Table ranks the top twenty clause subgroups based on the mean count of clauses across establishments in the baseline panel that negotiated firm-level CBAs in 2009. Each subgroup is shown with its assigned a rank and corresponding broad group, i.e., wage-related, employment-related, or other amenity. In addition to the mean count of the subgroup, the table also reports the mean count as a share of all clauses in a CBA.

Table A5: Differences in Firm-level CBAs by Industry

	Mean CBA clause count	Mean share of clauses: broad groups			Top 5 overrepresented subgroups (by rank gain: industry vs. overall)
		Wage	Employment	Other	
Manufacturing	24.3	13.9%	18.6%	67.5%	Hiring Other contracting Prevention Other incentives Injuries
Trade/commerce	20.1	13.3%	17.1%	69.6%	Other contracting Pay Separations Wage payment Other incentives
Banking/finance	48.8	3.4%	6.5%	90.2%	Leaves Vacations Injuries Other time off provisions Bonuses
Transportation	31.8	13.5%	20.5%	66.0%	Wage payment Other contracting Prevention Workday Employment protections

Notes: Table shows differences in CBA content by four broad industries using establishments-level observations among those in the baseline panel that negotiated a firm-level CBA in 2009. These industries are the most represented and account for more than two-thirds of the analysis sample. For each industry, the table reports the mean number of CBA clauses, the share of clauses by broad groups (i.e., wage-related, employment-related, and other amenities), and the five most overrepresented clause subgroups in the industry. Overrepresented subgroups are defined by creating industry-specific and overall rankings based on mean clause count, calculating the rank gain by comparing the industry-specific to the overall ranking, and choosing the five subgroups experiencing the largest rank gains.

Table A6: Top Clause Subgroup Changes in Firm-level CBAs

Rank	Clause subgroup	Change in clause count (2009-2010)			
		Mean	Std dev	10th perc	90th perc
1	Bargaining	4.83	17.54	-1	10
2	Assistances	-1.46	4.76	-12	2
3	Workday	-0.51	3.42	-7	2
4	Wage adjustments	0.08	2.52	-1	1
5	Prevention	-0.39	2.23	-4	1
6	Union organization	-0.84	2.19	-6	1
7	Other incentives	0.28	2.05	-1	2
8	Pay	-0.51	1.83	-4	1
9	Working conditions	-0.36	1.77	-2	1
10	Union-firm relations	0.05	1.76	-1	1

Notes: Table reports statistics for the change in clause count by subgroup using establishments in the baseline panel that negotiated a firm-level CBA in 2009 and 2010. For each clause subgroup, the sample is restricted to the establishments where the corresponding CBA has a nonzero clause count in either year. The reported statistics are the mean, standard deviation, 10th percentile, and 90th percentile. The subgroups are ranked by standard deviation (descending order) and the table reports results for the top ten subgroups.

Table A7: Relation between Changes in Subgroup Clauses and Workplace Outcomes

	Hiring rate (1)	Turnover rate (2)	Share with fixed contract (3)	Retention rate (4)	Share with safety events (5)	Share taking leave (6)
Panel A: Contracting clauses						
Separations	-4.37% [0.000]	-1.99% [0.018]	0.81% [0.435]	0.35% [0.044]	1.04% [0.638]	1.50% [0.057]
Contract types	16.28% [0.007]	12.88% [0.073]	-13.74% [0.017]	0.32% [0.721]	6.08% [0.508]	0.13% [0.965]
Hiring	-4.30% [0.002]	-1.84% [0.075]	-0.09% [0.951]	0.61% [0.003]	0.89% [0.671]	-0.07% [0.931]
Other contracting	-1.57% [0.431]	2.47% [0.331]	0.36% [0.863]	0.05% [0.792]	4.51% [0.137]	0.50% [0.273]
Panel B: Incentives clauses						
Bonuses	-8.30% [0.000]	-3.84% [0.000]	2.24% [0.061]	0.79% [0.000]	2.00% [0.267]	1.07% [0.003]
Pays	-6.36% [0.000]	-1.36% [0.137]	0.47% [0.513]	0.79% [0.000]	0.69% [0.650]	0.79% [0.018]
Assistances	-1.79% [0.000]	-0.95% [0.000]	0.86% [0.000]	0.28% [0.000]	0.74% [0.153]	0.48% [0.001]
Other incentives	0.92% [0.414]	-0.47% [0.495]	-1.45% [0.014]	0.18% [0.080]	-2.25% [0.213]	-0.58% [0.057]
Panel C: Workplace safety clauses						
Injuries	-4.30% [0.000]	-3.13% [0.003]	1.57% [0.539]	0.99% [0.000]	-3.86% [0.276]	-0.97% [0.169]
Prevention	-3.53% [0.000]	-2.01% [0.002]	-0.15% [0.843]	0.53% [0.000]	2.68% [0.124]	0.38% [0.217]
Panel D: Time off clauses						
Vacations	-14.77% [0.000]	-6.23% [0.000]	5.83% [0.000]	1.30% [0.000]	1.64% [0.623]	1.16% [0.058]
Leaves	-12.12% [0.000]	-5.38% [0.004]	-5.14% [0.249]	1.45% [0.000]	10.80% [0.020]	2.20% [0.007]
Other time off provisions	-11.25% [0.000]	-5.98% [0.000]	1.31% [0.513]	1.41% [0.000]	-2.70% [0.427]	0.43% [0.430]

Notes: Table reports the association between changes in labor market statistics and changes in CBA clauses between 2009 and 2010. The sample is restricted to establishments in the baseline panel that negotiated firm-level CBAs in both 2009 and 2010. The estimated associations are reported in percentage terms relative to the 2009 mean (corresponding p-values are reported in brackets). Each estimate comes from a separate regression restricted to establishments that negotiated at least one of the corresponding clauses in either year. Highlighted cells are those selected from an adaptive lasso of the change in the labor market statistic on changes in mean log hourly earnings and changes in CBA clauses (for all 24 subgroups) regardless of whether any specific clause was negotiated in either year. Cell highlighted in green are those where the lasso coefficient is positive, whereas gray correspond to negative lasso coefficients. Each panel focuses on similar clause subgroups that are matched to outcomes of relevance (demarcated by partially enclosed columns). That is, Panel A contains subgroups linked to outcomes in columns (1)-(3); Panel B to column (4); Panel C to column (5); and Panel D to column (6).

Table A8: Impact of Union Bargaining Power (Union-level Clustering)

Panel A: Impact on wages						
	Log contracted wage (1a)	Log contracted wage (hourly) (2a)	Log average earnings (hourly) (3a)	Log December earnings (hourly) (4a)	90-10 log wage ratio (5a)	90-50 log wage ratio (6a)
$D_i \times \delta_{t \geq 2012}$	0.016 (0.007)	0.019 (0.008)	0.011 (0.005)	0.010 (0.005)	-0.012 (0.012)	-0.015 (0.010)
Baseline mean	12.283	7.142	7.367	7.421	0.947	0.610
Observations	183,828	183,828	183,532	183,259	183,828	183,828

Panel B: Impact on employment						
	Log employment (1b)	Hiring rate (2b)	Retention rate (3b)	Turnover rate (4b)	Turnover rate: layoffs (5b)	Turnover rate: quits (6b)
$D_i \times \delta_{t \geq 2012}$	0.002 (0.017)	-0.025 (0.019)	0.009 (0.005)	-0.019 (0.014)	-0.006 (0.006)	-0.004 (0.003)
Baseline mean	3.286	0.623	0.797	0.396	0.185	0.078
Observations	183,854	185,895	183,673	185,895	185,895	185,895

Panel C: Impact on CBAs					
	Clause count (1c)	Clause count: unique types (2c)	Wage clauses (3c)	Employment clauses (4c)	Other clauses (5c)
$D_i \times \delta_{t \geq 2012}$	1.556 (0.755)	0.954 (0.537)	0.256 (0.114)	0.750 (0.159)	0.548 (0.655)
Baseline mean	31.056	19.385	2.780	4.085	24.189
Observations	136,912	136,912	136,912	136,912	136,912

Notes: Table reports the pooled DID estimates based on Equation (1) for outcomes related to (A) wages; (B) employment; and (C) collective bargaining agreements. In other words, it reports the estimates for β in the following specification $Y_{jt} = \beta(D_i \times \delta_{t \geq 2012}) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt}$ along with standard errors clustered at the union-level in parentheses. Refer to Appendix C for definitions of the outcomes. The unit of observation is the establishment-year restricted to establishments in the analysis sample. The baseline mean refers to the average outcome in 2009.

Table A9: Impact of Union Bargaining Power by Clause Count in Pre-period Renewal

	Log contracted			Employment		
	Log employment (1)	wage (2)	Clause count (3)	Wage clauses (4)	clauses (5)	Other clauses (6)
$D_i \times \delta_{t \geq 2012}$	-0.011 (0.012)	0.018 (0.006)	1.216 (0.207)	0.123 (0.035)	0.503 (0.052)	0.591 (0.156)
$D_i \times \delta_{t \geq 2012} \times HighClause_i$	0.038 (0.020)	-0.003 (0.009)	2.289 (0.487)	0.566 (0.082)	0.951 (0.124)	0.767 (0.342)
Baseline mean	3.286	12.283	31.056	2.780	4.085	24.189
Observations	183,854	183,828	136,912	136,912	136,912	136,912

Notes: Table summarizes the heterogeneous effects of an increase in union bargaining power on (1) employment; (2) wages; and (3) CBA clauses. Specifically, the table reports the estimates for β_1 and β_3 in the following fully interacted specification $Y_{jt} = \beta_1(D_i \times \delta_{t \geq 2012}) + \beta_2(H_i \times \delta_{t \geq 2012}) + \beta_3(D_i \times \delta_{t \geq 2012} \times H_i) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt}$, where $H_i = HighClause_i$ is an indicator for having above median clauses in the CBA renewal prior to the shock. The unit of observation is the establishment-year restricted to establishments in the analysis sample. The baseline mean refers to the average outcome in 2009.

Table A10: Impact of Union Bargaining Power (IV Strategy)

	Treat	Log employment	Log contracted wage	Clause count
	(1)	(2)	(3)	(4)
Panel A: First stage				
Fast pre-period renewal	0.133 (0.010)	- -	- -	- -
Panel B: Second stage (pre-period)				
Treat	- -	-0.075 (0.062)	0.027 (0.031)	2.161 (1.689)
Panel C: Second stage (post-period)				
Treat	- -	-0.037 (0.055)	0.048 (0.025)	3.580 (1.559)
F-statistic	179.7	-	-	-
Cragg-Donald F-stat	-	201.0	200.8	196.6
Kleibergen-Paap F-stat	-	184.5	184.3	179.8
Observations	23,528	23,445	23,442	23,527

Notes: Table presents results for the complementary instrumental variable strategy to identify the effects of increased union bargaining power on employment, wages, and CBA clauses. The instrument for treatment is a dummy for “fast pre-period renewal”, i.e., whether the negotiation of the 2009 CBA’s renewal in the pre-period lasted less than 1 month. Panel A reveals a strong first stage. Panel B reports the 2SLS estimates from regressing the first differenced outcome (using pre-period observations) on treatment. Panel C reports the 2SLS estimates from regressing the first differenced outcome (using post-period observations) on treatment. The F-statistics for weak identification tests correspond to the estimates in Panel C. For columns (2) and (3), the pre-period first differences are from 2010 to 2011 and the post-period first differences are from 2011 to 2012. For column (4), the pre-period first difference is from the 2009 CBA to its renewal and the post-period first difference is from the 2009 CBA renewal to the CBA negotiated in 2013. All regressions include time-varying fixed effects for detailed industry, microregion, and negotiation month. Standard errors are clustered at the establishment level.

Table A11: Impact of Union Bargaining Power on Authority Measures

Panel A: Overall					
	Provisions (1a)	Labor: entitlements and permissions (2a)	Labor: obligations and constraints (3a)	Capital: entitlements and permissions (4a)	Capital: obligations and constraints (5a)
$D_i \times \delta_{t \geq 2012}$	1.649 (0.184)	0.436 (0.043) [26%]	0.036 (0.041) [2%]	0.140 (0.023) [8%]	1.037 (0.115) [63%]
Baseline mean	17.690	5.030	4.071	0.910	7.680
Observations	136,912	136,912	136,912	136,912	136,912
Panel B: Labor (workers and unions)					
	Provisions (1b)	Entitlements (2b)	Permissions (3b)	Obligations (4b)	Constraints (5b)
$D_i \times \delta_{t \geq 2012}$	0.472 (0.075)	0.204 (0.032) [43%]	0.232 (0.019) [49%]	0.046 (0.038) [10%]	-0.010 (0.009) -[2%]
Baseline mean	9.100	3.880	1.149	3.472	0.599
Observations	136,912	136,912	136,912	136,912	136,912
Panel C: Capital (firms and managers)					
	Provisions (1c)	Entitlements (2c)	Permissions (3c)	Obligations (4c)	Constraints (5c)
$D_i \times \delta_{t \geq 2012}$	1.177 (0.129)	0.045 (0.007) [4%]	0.094 (0.019) [8%]	1.005 (0.111) [85%]	0.032 (0.007) [3%]
Baseline mean	8.590	0.215	0.695	7.473	0.207
Observations	136,912	136,912	136,912	136,912	136,912

Notes: Table reports the pooled DID estimates based on Equation (1) for the authority measures extracted from the text of CBAs. In other words, it reports the estimates for β in the following specification $Y_{jt} = \beta(D_i \times \delta_{t \geq 2012}) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt}$ along with standard errors clustered at the establishment-level in parentheses. Authority measures capture the authority of agents in a legal document where 1) *obligations* and *constraints* reduce authority; and 2) *entitlements* and *permissions* expand authority. These measures rely on an unsupervised extraction of these provisions among agents of capital (firms and managers; Panel C) and labor (workers and unions; Panel B) in the CBA. Refer to Appendix E for more details. The unit of observation is the establishment-year restricted to establishments in the analysis sample. The baseline mean refers to the average outcome in 2009.

Table A12: Relation of PageRank Values to Wage Premiums and CBA Clause Count

	Pre-period			First differences		
	(1)	(2)	(3)	(4)	(5)	(6)
Wage premium	1.3296 (0.0218)		1.3291 (0.0218)	0.2164 (0.0243)		0.2153 (0.0243)
CBA clause count		0.0006 (0.0002)	0.0005 (0.0002)		0.0009 (0.0003)	0.0008 (0.0003)
Adjusted R2	0.266	0.206	0.267	0.046	0.045	0.046
Observations	55,898	55,898	55,898	55,898	55,898	55,898

Notes: Table shows estimates of coefficients from regressing PageRank values on AKM wage premiums and CBA clause counts. The unit of observation is the establishment-period with $t \in [2007-2011, 2012-2016]$. Columns (1)-(3) focus on the pre-period and columns (4)-(5) use first-differences, i.e., changes between the two periods. Regressions include detailed industry, microregion, and negotiation month fixed effects. Standard errors are clustered at the establishment-level. The sample is restricted to the analysis sample constructed with coverage from sectoral CBAs, where the establishments also have PageRank values and AKM wage premiums in each t , i.e., they are in the *strongly* connected set of establishments linked by worker flows.

Table A13: Wage-equivalent Value of CBA Clauses (Broad Groups)

	Estimate	Std. error	Value
	(1)	(2)	(3)
Wage clauses	0.002	(0.001)	0.010
Employment clauses	0.002	(0.001)	0.010
Other clauses	0.001	(0.000)	0.003
Wage premium	0.214	(0.024)	1.000
Adjusted R2	0.047		
Observations	55,898		

Notes: Table displays the estimates wage-equivalent value for the 3 broad groups of clauses. Column (1) reports the point estimates of α and β^z from the specification in first-differences given by Equation (3). Column (2) report the standard error of the estimates. Column (3) reports the wage-equivalent value, which is defined as the impact of the clause type divided by that of the wage premium, i.e., $\hat{\beta}^z/\hat{\alpha}$. The sample includes establishments from an analysis sample constructed as in Section 3.1 that uses sectoral CBA coverage, rather than firm-level CBA coverage. Moreover, establishments must have PageRank values and AKM wage premiums in both periods, i.e., they are in the strongly connected set of establishments linked by worker flows for each $t \in [2007-2011, 2012-2016]$.

Table A14: Wage-equivalent Value of CBA Clauses (Clause Types)

	Estimate	Std. error	Value
	(1)	(2)	(3)
Wage clauses			
Wage floors	0.005	(0.002)	0.026
Intern wage	-0.039	(0.019)	-0.184
Employment clauses			
Internships	0.029	(0.016)	0.138
Hiring rules	0.009	(0.004)	0.041
Worker participation in management	0.178	(0.074)	0.835
Equal opportunity	-0.028	(0.015)	-0.132
Retirement protections	0.030	(0.012)	0.139
Apprenticeship protections	0.166	(0.088)	0.778
Paternity protections	0.055	(0.033)	0.258
Other clauses			
Overtime pay	-0.014	(0.008)	-0.066
Night pay	0.028	(0.014)	0.130
Illness assistance	-0.029	(0.014)	-0.136
Funeral assistance	-0.024	(0.014)	-0.111
Retirement	-0.021	(0.012)	-0.099
Workday compensation	0.008	(0.005)	0.039
Absences	0.011	(0.005)	0.050
Special shifts	0.015	(0.007)	0.071
Work-related injuries	-0.032	(0.016)	-0.149
Rehabilitation of the injured	-0.077	(0.029)	-0.362
Working environment conditions	0.008	(0.004)	0.035
Safety equipment	0.034	(0.013)	0.158
Medical exams	-0.020	(0.010)	-0.096
Other injury prevention standards	0.023	(0.008)	0.107
Uniforms	-0.029	(0.013)	-0.136
Collective vacations	-0.045	(0.019)	-0.210
Unpaid leave	0.070	(0.018)	0.330
Paid leave	0.024	(0.008)	0.114
Guarantees to union officers	-0.021	(0.012)	-0.098
Union dues	0.013	(0.003)	0.059
Opposition to union dues	0.032	(0.009)	0.152
Union representatives	-0.018	(0.009)	-0.083
Unionization campaigns	0.031	(0.012)	0.147
CBA enforcement	-0.011	(0.004)	-0.053
CBA renewal/termination	-0.008	(0.004)	-0.036
Wage premium	0.213	(0.024)	
Adjusted R2	0.050		
Observations	55,898		

Notes: Table displays the estimates wage-equivalent value for the 34 (out of 137) clause types that have an impact on workers' value of employment at an establishment. Column (1) reports the point estimates of α and β^z from the specification in first-differences given by Equation (3). Column (2) report the standard error of the estimates. Column (3) reports the wage-equivalent value, which is defined as the impact of the clause type divided by that of the wage premium, i.e., $\hat{\beta}^z/\hat{\alpha}$. Sample restrictions are the same as in Table 6.

Table A15: Relation of Amenity Value with Authority Expansion

	Baseline panel			Analysis sample		
	(1)	(2)	(3)	(4)	(5)	(6)
Labor–Capital	0.029 (0.001)			0.033 (0.001)		
<u>Labor</u>		0.004 (0.001)			0.007 (0.002)	
Workers			0.005 (0.001)			0.007 (0.002)
Union			-0.004 (0.003)			0.014 (0.006)
<u>Capital</u>		-0.059 (0.001)			-0.062 (0.002)	
Firms			-0.058 (0.001)			-0.060 (0.002)
Managers			-0.164 (0.012)			-0.216 (0.020)
Observations (K)	130.158	130.158	130.158	46.697	46.697	46.697

Notes: Table shows the association between the amenity value in firm-level CBAs and measures of authority extracted from the text of these CBAs. The amenity value of a CBA is given by $Amenity_{cba} = \sum_{clause} 1\{clause = z\} \times (\hat{\beta}^z / \hat{\alpha})$. Refer to section 4.2 for more details. Authority measures capture the authority of agents in a legal document where 1) *obligations* and *constraints* reduce authority; and 2) *entitlements* and *permissions* expand authority. The independent variables in these regressions refer to the share of provisions in the CBA that expand authority minus those that reduce authority for agents of capital (firms and managers) and of labor (workers and unions). Refer to Appendix E for more details on extracting the provisions of authority from the text of CBAs. Columns (1)-(3) focus on the baseline panel, while columns (4)-(5) focus on the analysis sample. Observations are unique CBAs from the sample period: 2009-2016.

Table A16: Impact of Union Bargaining Power on Workforce Composition

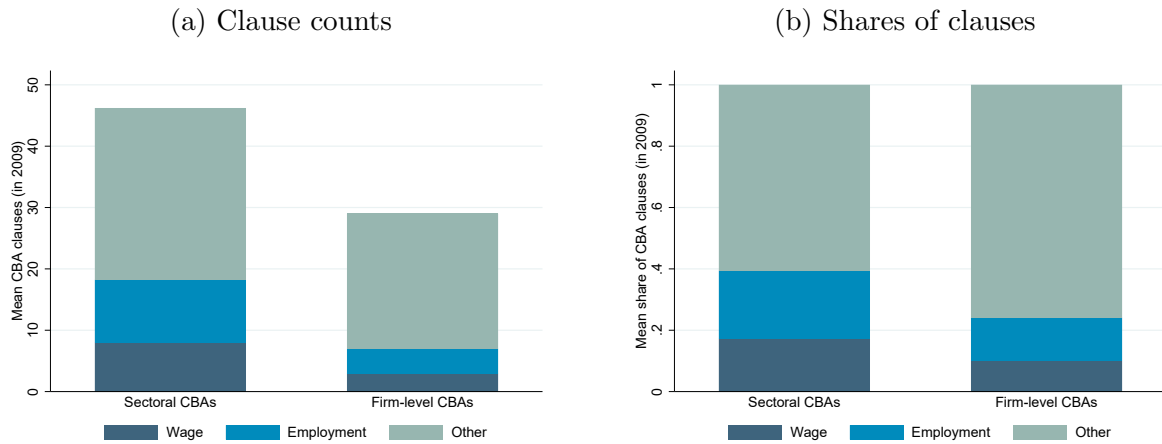
Panel A: Education and occupation						
	No high school degree (1a)	High school degree only (2a)	College degree (3a)	Managers (4a)	Professionals (5a)	Rank-and-file workers (6a)
$D_i \times \delta_{t \geq 2012}$	-0.005 (0.002)	-0.005 (0.002)	0.010 (0.002)	-0.008 (0.001)	0.008 (0.002)	0.000 (0.002)
Baseline mean	0.272	0.462	0.266	0.075	0.170	0.755
Observations	183,854	183,854	183,854	183,854	183,854	183,854

Panel B: Gender, race, and age					
	Male workers (1b)	White workers (2b)	Age: below 30 (3b)	Age: 30-40 (4b)	Age: above 40 (5b)
$D_i \times \delta_{t \geq 2012}$	0.000 (0.002)	0.002 (0.003)	-0.003 (0.002)	0.003 (0.002)	0.000 (0.002)
Baseline mean	0.620	0.693	0.345	0.310	0.354
Observations	183,854	183,854	183,854	183,854	183,854

Notes: Table reports the pooled DID estimates based on Equation (1) for outcomes related to the composition of the workforce. In other words, it reports the estimates for β in the following specification $Y_{jt} = \beta(D_i \times \delta_{t \geq 2012}) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt}$ along with standard errors clustered at the establishment-level in parentheses. Refer to Appendix C for definitions of the outcomes. The unit of observation is the establishment-year restricted to establishments in the analysis sample. The baseline mean refers to the average outcome in 2009.

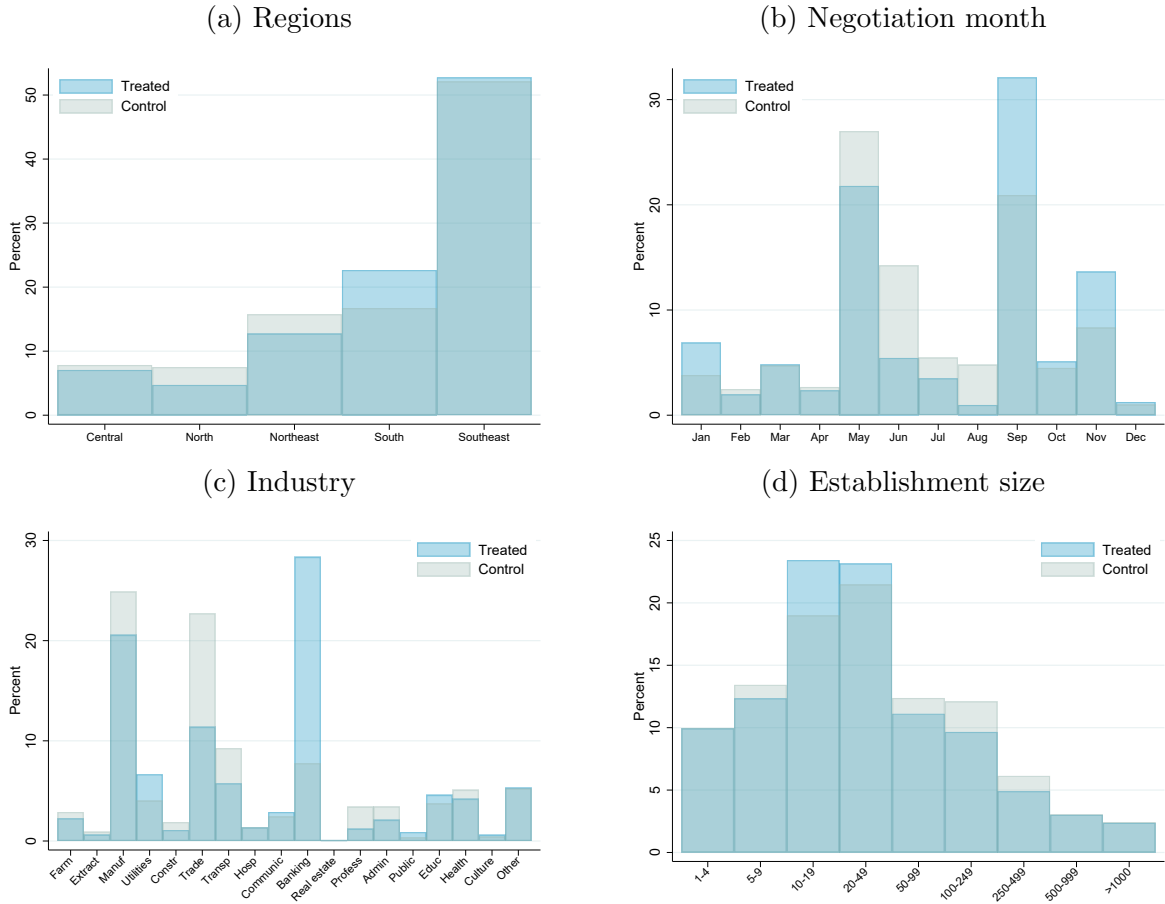
B Appendix Figures

Figure B1: Content of CBAs by Broad Groups



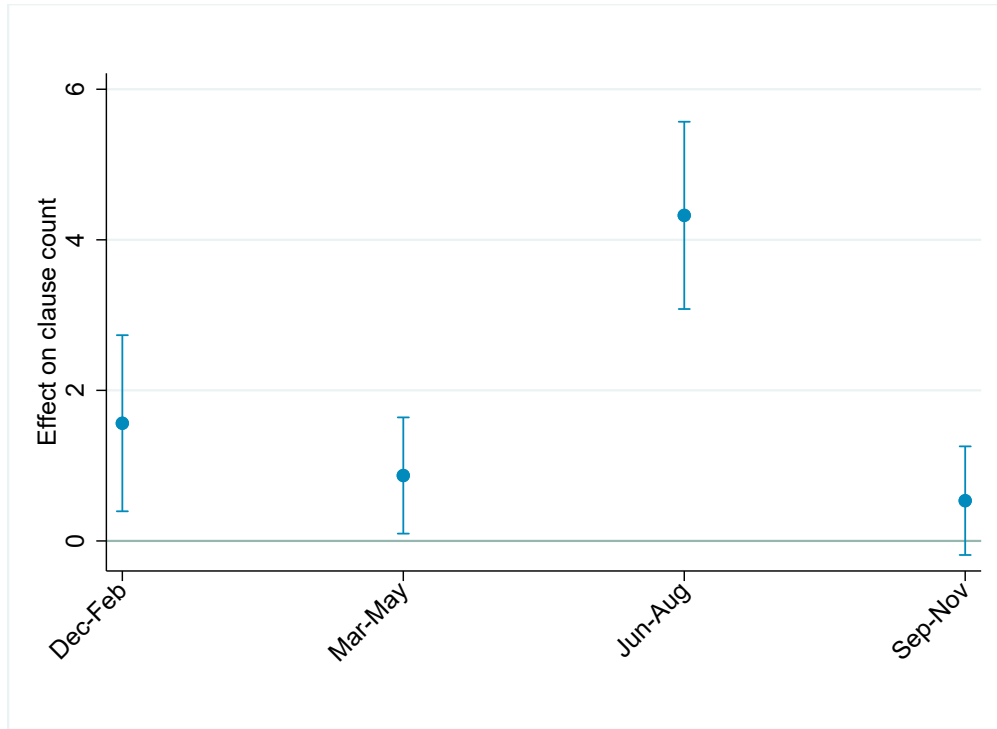
Notes: Figures display the content of sectoral and firm-level CBAs negotiated in 2009 in terms of clauses by broad groups, i.e., wage-related amenities, employment-related amenities, and other amenities. Figure B1a shows the mean clauses by broad groups across establishments covered by these CBAs. The mean total clauses for sectoral and firm-level CBAs is 46 and 29, respectively. Figure B1b shows the mean clauses by broad groups as a share of total clauses across establishments covered by these CBAs. Refer to Tables 3 and A3 for more details on the clause subgroups and clause types included in each broad group.

Figure B2: Establishment Characteristics by Assignment of Treatment



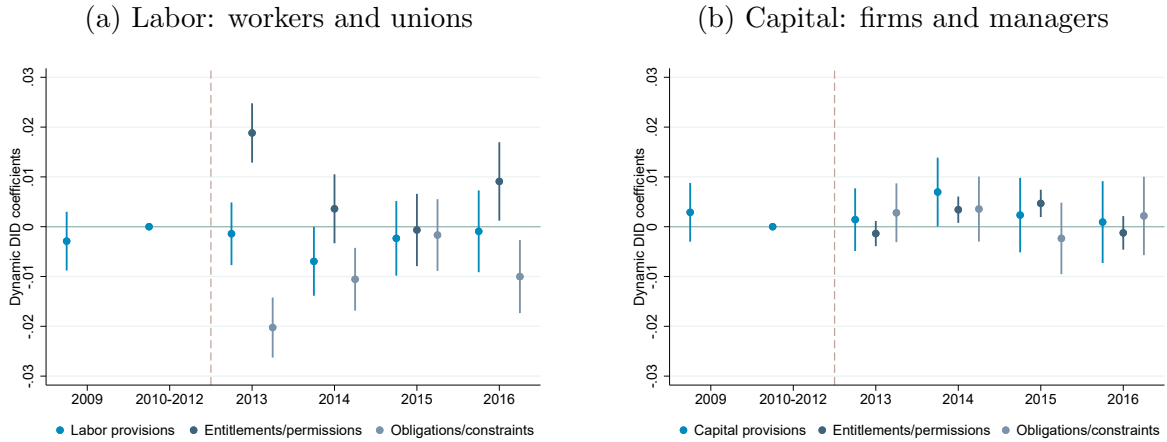
Notes: Figures show the distribution of the treated and control establishments in the analysis sample by different characteristics. Figure B2a focuses on the distribution across the 5 broad geographical regions in Brazil. Figure B2b concerns the month in which each establishment is due to negotiate with its union. Figure B2c depicts the distribution by broad industries. Figure B2d pertains to establishment size—the difference in average size between treated and control establishments is small, i.e., 129 versus 133, respectively (Table C1). The imbalances between treated and control motivate the inclusion of time-varying controls for micro-region, negotiation month, and detailed industry in Equation (1).

Figure B3: Impact on Clauses by Negotiation Month



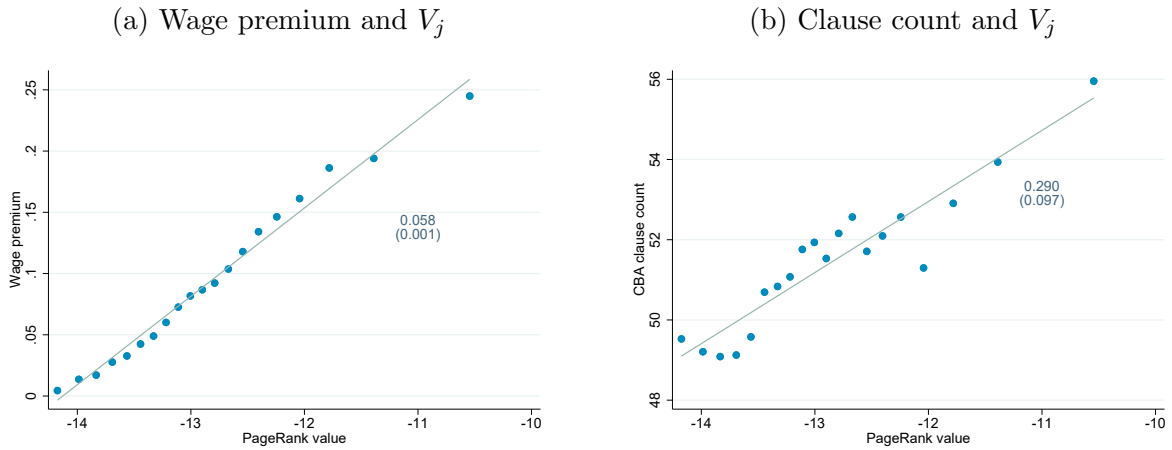
Notes: Figure shows the impact of union bargaining power on CBA clauses by negotiation month, i.e., the calendar month when each establishment is due to negotiate with its union. Each marker represents the pooled DID estimate based on Equation (1)—that is, the estimate for the β coefficient in the following specification $Y_{jt} = \beta(D_i \times \delta_{t \geq 2012}) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt}$, with standard errors clustered at the establishment-level. Each estimate is calculated on the subset of establishments in the analysis sample with negotiation months falling in December-February, March-May, June-August, or September-November. Since ultractivity was introduced in September 2012, those with negotiation months in June-August were allowed at most 3 months of negotiation delays to be considered treated.

Figure B4: Event Studies for Share of Provisions with Authority



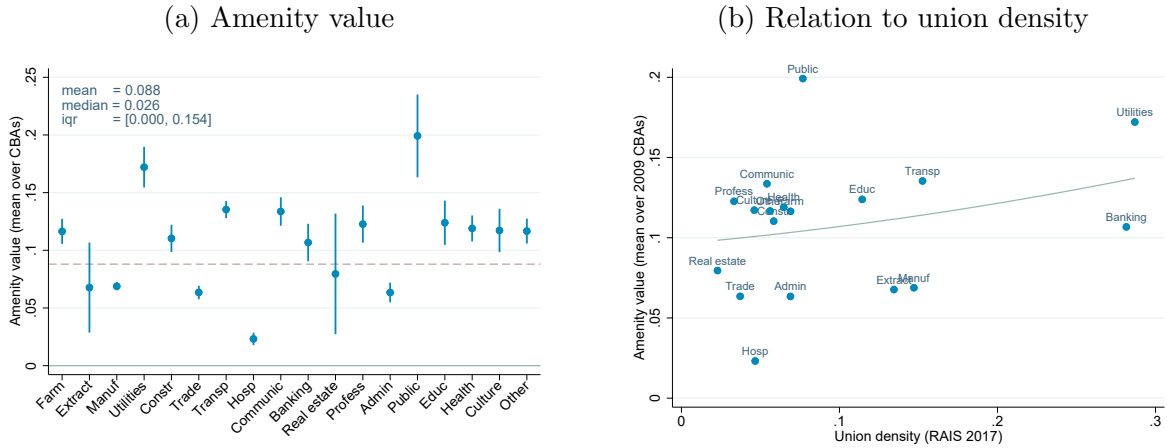
Notes: Figures show event studies for the impact of union bargaining power on authority measures using the DID specification in Equation (1). That is, each marker depicts the estimates of the β^t coefficients with standard errors clustered at the establishment-level. Authority measures capture the authority of agents in a legal document where 1) *obligations* and *constraints* reduce authority; and 2) *entitlements* and *permissions* expand authority. These measures rely on an unsupervised extraction of these provisions among agents of capital (firms and managers; Figure B4b) and labor (workers and unions; Figure B4a) in the CBA. Refer to Appendix E for more details. Each figure reports event studies for 3 outcomes measured as a share of provisions in the CBA: 1) provisions corresponding to either capital or labor; 2) their respective entitlements and permissions; and 3) their respective obligations and constraints. The unit of observation is the establishment-year restricted to establishments in the analysis sample.

Figure B5: Relation of Wage Premiums and CBA Clauses with PageRank Values



Notes: Figures provide motivation for the linear relation in Equation (2). Figures B5a and B5b are binned scatter plots of wage premiums and number of CBA clauses on PageRank values (respectively) using information from 2007-2011. Each binned scatter plot includes fixed effects by detailed industry, microregion, and negotiation month, and reports the point estimate (and standard error) for the slope of the fitted line. The unit of observation is the establishment. The sample is restricted to the analysis sample constructed with coverage from sectoral CBAs, where the establishments also have PageRank values and AKM wage premiums in $t \in [2007-2011, 2012-2016]$, i.e., they are in the *strongly* connected set of establishments linked by worker flows for each t .

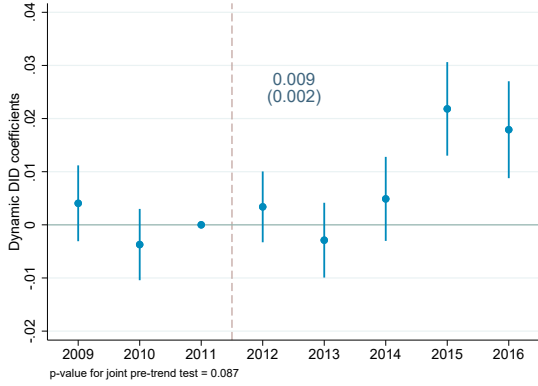
Figure B6: Mean Amenity Value of Firm-level CBAs by Industry



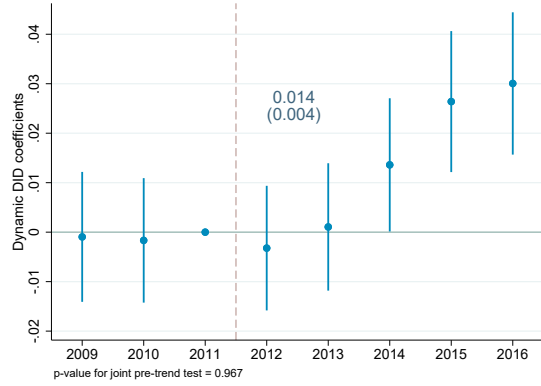
Notes: Figures show descriptive statistics of the amenity value of firm-level CBAs negotiated in 2009. The amenity value of a CBA is given by $Amenity_{cba} = \sum_{clause} 1\{clause = z\} \times (\hat{\beta}^z / \hat{\alpha})$. Refer to section 4.2 for more details. Figure B6a displays the estimate of the mean amenity value by broad industry groups. The dashed horizontal line corresponds to the overall mean, which is reported on the figure along with the median and the inter-quartile range. Figure B6b shows the relationship between the mean amenity value by industry and the industry-specific union density. Union density is calculated as the share of workers who are union members and is only reported in RAIS starting 2017. Since coverage is universal in Brazil, union membership consists of workers willing to pay dues in exchange for additional benefits that are not in CBAs, e.g., recreational facilities and private health insurance plans.

Figure B7: Event Studies on Workforce Composition

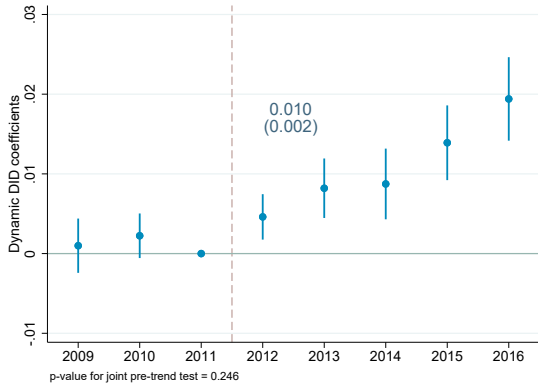
(a) Retention rate



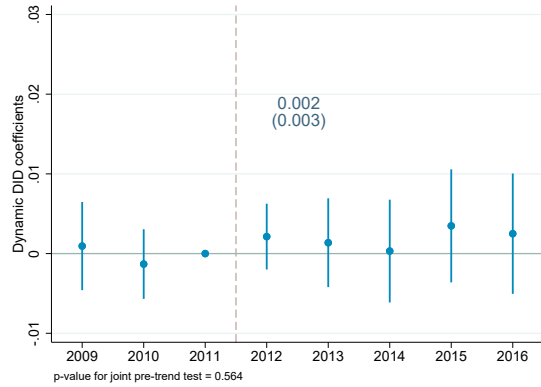
(b) Retention rate: college



(c) Share workers: college



(d) Share workers: white



Notes: Figures show the event studies for the impact of union bargaining power on outcomes related to workforce composition using the DID specification in Equation (1). In addition to depicting the estimates of the β^t coefficients, each figure reports the pooled DID estimate—that is, the estimates for β in the following specification $Y_{jt} = \beta(D_i \times \delta_{t \geq 2012}) + \alpha_j + \delta_t + \gamma X_{jt} + \varepsilon_{jt}$ along with standard errors clustered at the establishment-level in parentheses. Refer to Section 3.1 for more details. The unit of observation is the establishment-year restricted to establishments in the analysis sample.

C Data Appendix

C.1 Sample construction

To study the relation between the wage and amenity components of compensation under collective bargaining, I construct three main samples: 1) initial sample; 2) baseline panel; and 3) analysis sample. The first is a sample at the establishment-CBA level intended to provide general statistics on collective bargaining coverage (mainly in Section 1.2). The second is a panel at the establishment-year level that allows me to track CBA negotiations over time in order to provide descriptives on the negotiation process, the role of ultractivity, and changes to the content of CBAs (mainly in Sections 1.3 to 2.3). The third is a subset of the baseline panel focusing on bargaining units with strong attachment to collective bargaining where ultractivity introduced a wedge in union bargaining power (mainly from Section 3 onward).

Initial sample This sample focuses on providing general statistics on CBA coverage and the starting point for subsequent samples used in the paper. To do so, I need to assign each CBA in *Sistema Mediador* to an establishment in RAIS. I first extract the CNPJ identifiers of the employer counterparts as well as the municipalities of coverage in each CBA. Assignment is different for firm-level CBAs and sectoral CBAs. For firm-level CBAs, I use the first 8 digits of the CNPJ identifiers to find all establishments in RAIS that are part of the signing firms in the CBA, have nonzero employment by end-of-year in the start year of the CBA, and are located in one of the municipalities of coverage of the CBA.⁷² For sectoral CBAs, I implement the same procedure but I first match the employer associations signing the CBA to the firms being represented in the agreement. The crosswalk that allows me to create these links was secured through a public information request, from which I obtained the CNPJ identifiers of firms contributing to individual employer associations.⁷³ Through this procedure, each establishment is assigned to its CBAs such that in a given year there can be multiple, unique, or no CBAs negotiated. The statistics in Table 1 report the share of establishments and workers that negotiated at least one CBA in the private sector.

Baseline panel This sample focuses on tracking firm-level CBA negotiations over time for a given establishment. Although workers in an establishment are almost always represented

⁷²The CNPJ is a 16-digit unique identifier for establishments where the first 8 digits correspond to the firm.

⁷³These data corroborate an important aspect of the union context: that workers in an establishment are generally represented by a single union and that establishments are generally represented by a single employer association. Specifically, 92% of firms contributing to an employer association are 1-to-1 matches, and 95% of firms sending union contributions on behalf of workers are 1-to-1 matches. One-to-many matches are possible when industry-based and occupation-based categories overlap.

by a single union, exceptions occur when industry-based and occupation-based categories overlap. Hence, each establishment is assigned a “main union” which corresponds to the modal union across establishment-CBA-union observations in the initial sample. As such, the goal is for each establishment-year observation to only include information on the CBAs negotiated by the main union in a given year.

An establishment is treated if any CBA was filed before and expired after ultractivity. When multiple CBAs by the main union exist for a given establishment-year, the following rules are applied. I use the minimum start date and the maximum end date, keeping the maximum CBA duration. To avoid double counting from multiple entries of the same CBA or amendments, I also take the maximum of the clause counts and provisions of authority. For the months of negotiation (i.e., the difference between the start and filing dates), I use the mean across the CBAs in a given establishment-year.

The resulting panel only contains establishment-year observations for years when a CBA was negotiated. Using this panel, I calculate CBA renewals for each establishment and gaps in coverage (see Figure 1). I then create a balanced panel for the years 2009 to 2016. Coverage by year for each establishment is given if at end-of-year there was an active CBA and the establishment had nonzero workers.

I repeat this same procedure using sectoral CBAs.⁷⁴ Hence, there are two baseline panels. The one tracking firm-level CBA negotiations over time, which is used for the descriptives in Section 2 and is the starting point for the analysis sample. And the one tracking sectoral CBA negotiations over time, which is used to construct the sample for estimating the wage-equivalent value of clauses.

Analysis sample This sample focuses on restricting the baseline panel for firm-level CBAs to bargaining units with strong attachment to collective bargaining where ultractivity introduced a wedge in union bargaining power. The idea is to restrict the nontreated establishments to those that provide a credible counterfactual, i.e., where the lack of coverage in September 2012 is due to idiosyncratic reasons (see Section 3.1).

The analysis sample imposes two sets of restrictions. The first set of restrictions is that establishments must have negotiated a CBA in 2009 (the first year of the sample period) and at least another one prior to 2012 (the year ultractivity is enacted). The intention of these restrictions is to focus on bargaining units engaged in frequent negotiations. More practically, having a minimum of two negotiations prior to treatment implies that analyzing pre-trends in CBA content will always be feasible.

⁷⁴The only difference relative to the firm-level CBA procedure is that the “main union” is the modal union across establishment-CBA-union observations where at least one worker in the establishment is paid the wage floor negotiated in the CBA.

The second set of restriction nets out the fact that ultractivity can lead to differential exit from the market and/or negotiations since employers can no longer terminate a CBA. Hence, I rely on the data to determine the post-treatment years by when this differential exit disappears. In terms of market exit, I restrict the sample to establishments that are open 2009-2014 (Figure C1a). This provides balance in the 3 pre-treatment years and guarantees labor market outcomes are observable in at least 3 post-treatment years. In terms of negotiation exit, I restrict to establishments covered by at least one CBA negotiated in or after 2012. (Figure C1b). This essentially guarantees that there is some CBA content to analyze under ultractivity. Note that both treated and control establishments can have a CBA negotiated in 2012 because treatment requires the filing date (rather than the start date) to be before September.⁷⁵

There are roughly 23.6K establishments that satisfy these restrictions and they tend to be larger (130 workers on average) even compared to those signing a firm-level CBA in 2009 (104 workers)—see Table C1.

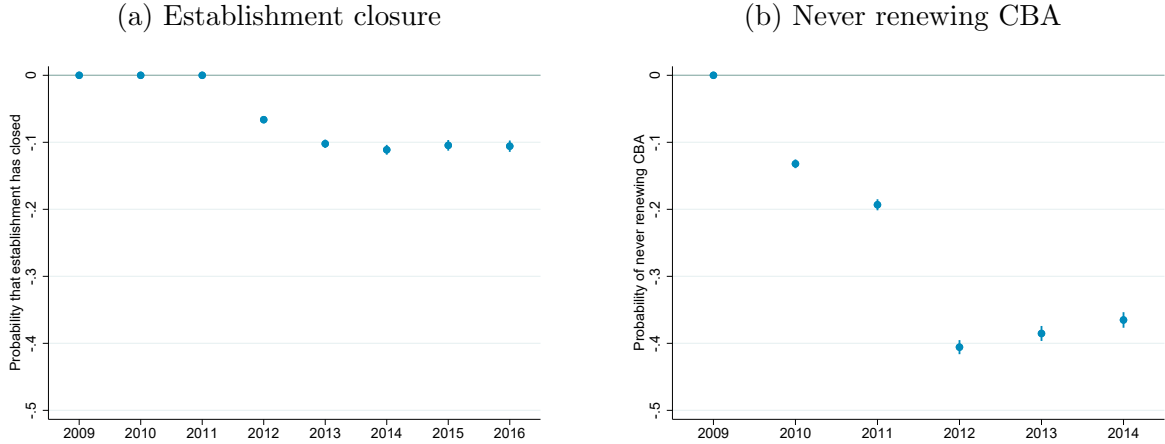
Table C1: Establishments, Workers, and Unions Across Samples

	Has 2009 CBA (1)	Analysis sample (2)	Treat (3)	Control (4)
Establishments	43,209	23,565	17,726	5,839
(share treated)	(0.49)	(0.75)	(1.00)	(0.00)
Workers	4,500,553	3,055,484	2,281,443	774,041
(mean estab size)	(104)	(130)	(129)	(133)
Unions	2,734	2,100	1,724	1,156

Notes: Table reports the number of unique establishments, workers, and unions across samples. The sample in column (1) includes establishments in the baseline panel that negotiated a firm-level CBA in 2009. Column (2) restricts to the analysis sample, while columns (3) and (4) focus on the treated and control units, respectively. The share of treated establishments and the mean establishment size are reported in parentheses.

⁷⁵The filing date captures when the agreement is reached, which due to negotiation delays usually occurs after the start date.

Figure C1: Motivation for Analysis Sample Restrictions



Notes: Figures provide evidence motivating the restrictions for the analysis sample. In these analyses, the sample includes establishments open throughout the pre-period (2009-2011) that negotiate a firm-level CBA in 2009 which is renewed prior to 2012. Each figure plots the estimates of the dynamic DID coefficients from specifications of the following form $Y_{jt} = \sum_{k=2009}^T \beta^{t=k} (D_j \times \delta_{t=k}) + \alpha_j + \delta_t + \varepsilon_{jt}$ with standard errors clustered at the establishment-level. The unit of observation is the establishment-year and D_j is an indicator for being treated. In Figure C1a the outcomes is an indicator for whether the establishment has closed, i.e., it no longer appears in RAIS. The omitted year is 2011 given that all establishments are open from 2009 to 2011. In Figure C1b the outcomes is an indicator for whether the establishment never renews its CBA. The omitted year is 2009 given that all establishments renew their CBA from 2009.

For estimating the wage-equivalent value of clauses (Section 4.2), an analogous version of the analysis sample is constructed but using the baseline panel for sectoral CBAs. This sample is further restricted to establishments with PageRank values and AKM wage premium estimates for both $t \in [2007 - 20011, 2012 - 2016]$. For several of the out-of-sample sense checks (Section 4.3), the analysis sample is restricted to establishments with PageRank values and AKM wage premium estimates.

C.2 Construction of variables

The following is a comprehensive list of the variables used in my analyses along with a description of how they were constructed. I categorize these variables as 1) wage outcomes; 2) employment outcomes; 3) CBA outcomes; and 4) other variables.

Wage outcomes

- Log contracted wage: For every spell-year recorded in RAIS, employers report the contracted wage of the worker. Based on the type of wage contract (e.g., monthly, biweekly, daily, etc.) I ensure that the contracted wage reflects a monthly contracted wage, which

is the most common form of wage contract.⁷⁶ I then convert the contracted wage to real terms using Brazil's CPI with base year 2015 and take logs. Using workers employed at end-of-year and with tenure greater than one month (i.e., employed throughout the month of December), I take the mean of log contracted wage by establishment-year. When this outcome is reported as "hourly," I divide the real contracted wage by monthly contracted hours before taking logs and calculating the mean.

- 90-10 and 50-10 wage ratio: Using workers employed at end-of-year and with tenure greater than one month (i.e., employed throughout the month of December), I calculate the 90th, 50th, and 10th percentile of the log contracted wage by establishment-year. The 90-10 ratio is simply the difference between the 90th and the 10th percentile, while the 50-10 ratio is the difference between the 50th and the 10th percentile.
- Log average earnings: For every spell-year recorded in RAIS, employers report the mean monthly earnings across months in which the worker was employed. I convert these earnings to real terms using Brazil's CPI with base year 2015 and take logs. Using workers employed at end-of-year and with tenure greater than one month (i.e., employed throughout the month of December), I take the mean of log average earnings by establishment-year. When this outcome is reported as "hourly," I divide the average earnings by monthly contracted hours before taking logs and calculating the mean.
- Log December earnings: For every spell-year recorded in RAIS, employers report the total earnings in the month of December. I convert these earnings to real terms using Brazil's CPI with base year 2015 and take logs. Using workers employed at end-of-year and with tenure greater than one month (i.e., employed throughout the month of December), I take the mean of log December earnings by establishment-year. When this outcome is reported as "hourly", I divide the average earnings by monthly contracted hours before taking logs and calculating the mean.

Employment outcomes

- Log employment: For each establishment-year, I calculate total employment as the total workers employed at end-of-year with tenure greater than 1 month, i.e., worker employed at the establishment for the entirety of December. I then simply take logs of total employment.

⁷⁶An additional adjustment is needed for 2016 since the decimal on the contracted wage for a non-negligible portion of employers was incorrect, such that the reported value is the correct one divided by 100. Hence, I multiply by 100 any contracted wage in this year that is below the minimum wage.

- Hiring rate: For each establishment-year, I calculate the total number of workers who were hired by the establishment throughout the year. I then divide the hires by the average between the total employment at end-of-year for the current and previous year.
- Retention rate: For each establishment-year, I take the share of workers employed throughout the month of December among those who were employed throughout the month of January. When this outcome is reported for workers with a college education, I restrict to workers that have that level of education.
- Turnover rate: For each establishment-year, I calculate the total number of workers who separated from the establishment throughout the year. I then divide the separated workers by the average between the total employment at end-of-year for the current and previous year. When this statistic refers to layoffs (or quits), I restrict to separations that are classified as layoffs (or quits).
- Fixed contract: These are workers whose employment contracts have a fixed duration. I calculate the share of workers with such contracts in each establishment-year.
- Safety events: These are occurrences that reflect a lack of safety in the work environment. They include work-related deaths, separations due to injuries and disabilities, as well as leaves motivated by injuries. I can then calculate the share of workers with such events in each establishment-year.
- Taking leave: These are instances where workers take leave regardless of the motivation. I calculate the share of workers with such events in each establishment-year.
- Education groups: I generate three groups based on the worker-level education variable provided in RAIS, i.e., no high school degree, high school degree only, and college degree. I calculate the share of workers belonging to each group in each establishment-year.
- Occupation groups: I generate three groups based on the worker-level occupation variable provided in RAIS (*Classificação Brasileira de Ocupações*), i.e., managers, professionals, and rank-and-file. I calculate the share of workers belonging to each group in each establishment-year.

CBA outcomes

- Clause count: For each establishment-year, I take the assigned CBA of coverage and calculate the number of clauses in the CBA. When multiple CBAs exist for a given

establishment year, I use the maximum for each clause type and then sum across clause types to get the total number of clauses. When this outcome refers to “unique types”, I simply create an indicator for each clause type negotiated in the CBA and sum across these binary variables.

- Wage/employment/other clauses: For each establishment-year, I take the assigned CBA of coverage and calculate the number of clauses in the CBA that are classified as wage-related, employment-related or other. When multiple CBAs exist for a given establishment year, I use the maximum for each clause type and then sum across clause types that are classified as either wage-related, employment-related, or other. Table A3 details the clause types and subgroups that belong to each of these three classifications provided by *Sistema Mediador*.
- Provisions: For each establishment-year, I take the assigned CBA of coverage and calculate the number of subject-verb prefixes in the text of the CBA that use deontic modal verbs and concern agents of capital (firms and managers) or labor (workers and unions). I then classify these provisions as obligations, constraints, permissions, or entitlements (see Appendix E for more details). When multiple CBAs exist for a given establishment year, I use the maximum for each provision type and then sum across these types to get the total number of provisions.
- Authority measures: For each establishment-year, I calculate the share of provision types (i.e., obligations, constraints, permissions, or entitlements) by agent of interest (i.e., firms, managers, workers, or unions) among all provisions. The shares corresponding to obligations and constraints reduce authority, while the shares corresponding to permissions and entitlements expand authority. Hence, a summary measure of authority for a given agent is the sum of the respective share of provisions expanding authority minus the share of provisions reducing authority. Finally, the relative authority of labor to capital is calculated by taking the authority measure for agents of labor and subtracting the authority measure for agents of capital.
- Amenity value: For each establishment-year, I take the assigned CBA of coverage and calculate the weighted sum of clauses in the CBA, where the weights are the wage-equivalent amenity values assigned to clause subgroups in Table 6. That is, the amenity value of a CBA is given by $Amenity_{cba} = \sum_{clause} 1\{clause = z\} \times (\hat{\beta}^z / \hat{\alpha})$. When multiple CBAs exist for a given establishment year, I use the maximum for each clause type and then take the weighted sum to get the amenity value.

Other variables

- Wage premium: To estimate the establishment fixed effect from AKM we take job spells of full-time workers, ages 18-54, on open-ended contracts, and earning monthly wages in private sector establishments from RAIS in two periods (2007-2011 and 2012-2016). For each period, we find the largest strongly connected set of establishments based on worker flows, i.e., a link between two establishments is defined as having at least one inflow and one outflow. We restrict to establishments that have at least 10 workers (on average across years) and are observed at least 4 years in RAIS. Following Gerard et al. (2021), the model includes dummies for individual workers (α_i) and individual establishments (ψ_j), year dummies interacted with five education dummies, and quadratic and cubic terms in age interacted with the education dummies (X_{it})—see Appendix F. For the baseline year, the worker effects are measured as of age 40 to correspond to the approximate peaks of experience profiles. The establishment fixed effects for each period are normalized relative to the restaurant industry, where rents are assumed to be negligible.
- PageRank value: To estimate PageRank values we take job spells of full-time workers, ages 18-54, on open-ended contracts, and earning monthly wages in private sector establishments from RAIS in two periods (2007-2011 and 2012-2016). For each period, we find the largest strongly connected set of establishments based on worker flows, i.e., a link between two establishments is defined as having at least one inflow and one outflow. We restrict to establishments that have at least 10 hires overall, with at least one of these coming from non-employment. To solve for the vector of PageRank values (see Appendix F), we follow Morchio and Moser (2020) and only consider employment-to-employment flows to be month-to-month job transitions. In addition, we set the damping factor used in finding the fixed point in the linear system of normalized flows to 0.8—one of the standard values in computer science. That is, the “random surfer” moving through the labor market restarts his search at a new establishment with 80% probability. As shown in Sorkin (2018), PageRank values are unique up to an unknown multiplicative factor. Results are robust to (i) assuming the multiplicative factor is the same for both periods; (ii) choosing the establishment with the smallest wage premium gap as the normalizing establishment, and then assume it maintained a time invariant PageRank value of 1; and (iii) choosing the establishment with the smallest wage premium gap as the normalizing establishment, and then assume it maintained a time invariant PageRank value and that the multiplicative factor in 2011-2016 equals 1.
- Industry: Each establishment in RAIS has an industry classification code based on

Classificação Nacional de Atividades Econômicas (CNAE). The broad industries—used in the heterogeneity analyses, for example—consist of 18 groupings created from the sectoral classification of CNAE (*seção*) provided by provided by the Brazilian statistical agency IBGE. The detailed industries—used as time-varying fixed effects in Equation (1), for example—consist of 285 groupings that consist of the first three digits of the CNAE code (referred to as *grupo* by IBGE). While broad industries distinguish between manufacturing and transportation, the detailed industries distinguish between steel and non-steel metalwork (or between train and track transportation).

- Region: Each establishment in RAIS reports the municipality where it is located. In my descriptives, I assign each municipality to one of the five major regions provided by the Brazilian statistical agency IBGE. In my analyses, however, I use time-varying fixed effects by microregion. These microregions are neighboring municipalities grouped into 543 units by IBGE that capture local labor markets.
- Negotiation month: Each bargaining unit has an assigned negotiation month (or *data-base*). This corresponds to the calendar month in which CBAs for the bargaining unit tend to start and end, and it marks the time when negotiations for the unit should be taking place. Each CBA in *Sistema Mediador* reports the negotiation month, which I then assign to each establishment using the mode across establishment-year observations with CBA information.
- Union density: The 2017 files for RAIS include indicators for whether a workers is a union member. I calculate union density as the share of workers that are union members—restricted to workers employed at end-of-year with tenure greater than 1 month, i.e., worker employed at the establishment for the entirety of December.

D Understanding *Sistema Mediador*

In 2007, Brazil's Ministry of Labor (MTE) launched a website for writing, filing, and registering 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.⁷⁷ 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. There are three general steps needed to register a CBA: 1) origination, 2) submission, and 3) revision.

D.1 Origination

The process starts when one of the counterparts in the negotiation of a CBA creates a new entry for the agreement, i.e., originate the CBA through *Sistema Mediador*. The applicant must provide the following information to complete this part of the process:

- Group represented by the applicant: workers or employers
- Applicant's unique identifier: CNPJ—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 origination number that can be used to edit information about the CBA before submitting the agreement. The applicant can share this number with the negotiating counterpart, allowing either party to make online edits to the CBA.

D.2 Submission

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

- Identifier of the counterpart (CNPJ)

⁷⁷Specifically, *Instrução Normativa SRT n^o 11/2009* revoked *n^o 6/2007* which had mandated submissions on paper. Although a 2012 decision removed the ban on paper submissions (*Processo n^o RR - 3895000-45.2009.5.09.0003*), virtually all agreements are registered online through *Sistema Mediador*.

- Identifier of any additional entity signing the CBA (CNPJ)
- Name and title of the representatives for 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 date for negotiations
- Category of coverage, i.e., free text describing the workers covered
- Geographic coverage, i.e., the municipalities in which the CBA is binding

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

Once the additional information is validated, one can start writing the clauses of the CBA. Before writing each clause, one must classify it into one of 137 different clause types chosen from a predetermined list that is broken down by broad groups and subgroups (see Table A3). 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 origination number.

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. *Sistema Mediador* keeps track of the exact date when a CBA is submitted, which I refer to as the filing date. Once the agreement is submitted, it cannot be edited. This implies that negotiations should have finalized by the filing date, so that the difference between filing date and start date capture the duration of the negotiation process. If the submission is successful, a registration form becomes available. This form must be signed by all parties involved and sent to the regional offices of the MTE. A filing number is provided to track the registration status of the CBA.

D.3 Revision

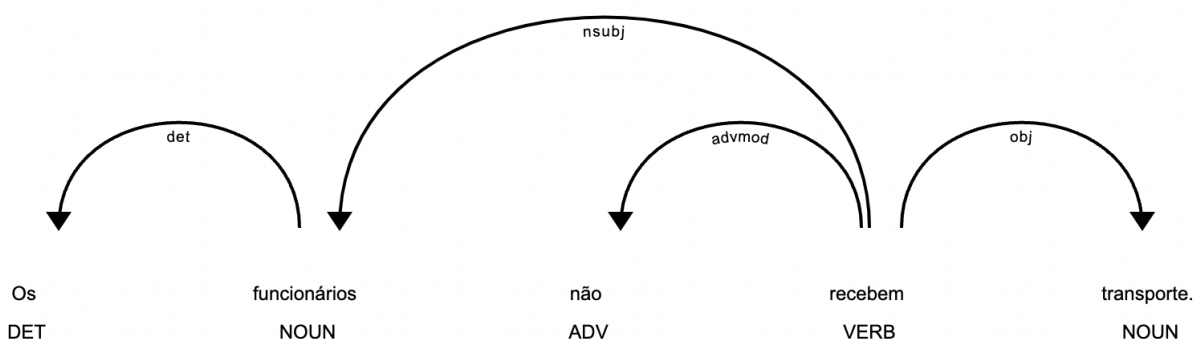
After submitting the registration form, it is possible that MTE notifies the parties that some corrections are required before formalizing the registration of the CBA. When that is the case, the applicant can access the CBA through *Sistema Mediador* and make the corrections. There are two modalities 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. A registration number is provided as proof of the legally binding agreement.

E Authority Measures

My analysis uses authority measures extracted from the text of the CBAs to characterize whether provisions in the agreement are expanding or reducing the authority of capital (firms and managers) and labor (workers and unions). I obtain these authority measures by following the documentation in Ash et al. (2020), introducing modification that are specific to Portuguese. This appendix details how I extract these authority measures.

E.1 Subject-verb prefix identification

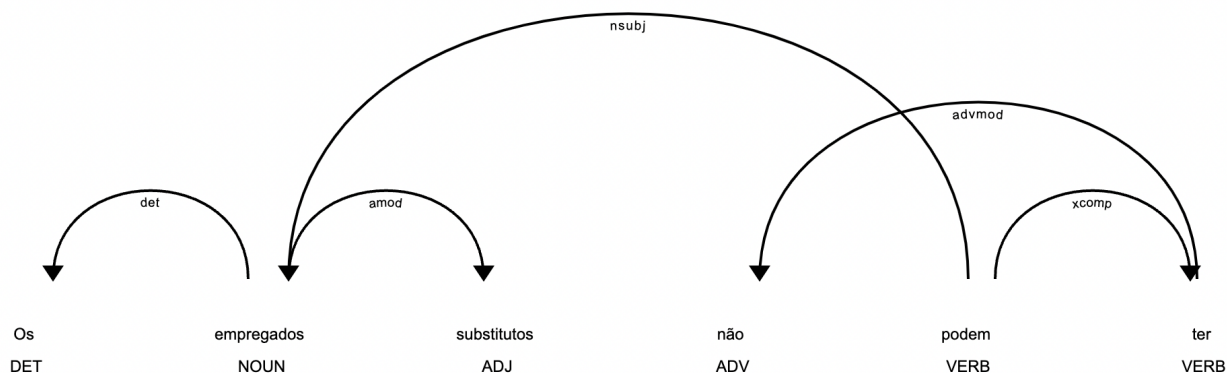
I build an NLP pipeline to parse sentences in each CBA into parts-of-speech using spaCy’s Portuguese parser.⁷⁸ As a starting example, consider the following sentence: “Os funcionários não recebem transporte” (i.e., employees do not get transportation). Once processed by the NLP pipeline, spaCy provides attributes for each word describing its part-of-speech.



In the above parse tree, spaCy identifies “funcionários” as the subject of the sentence (nsubj), and the syntactic parent of “funcionários” is the verb “recebem.” The arrows in the parse tree indicate the children of a given word. The syntactic relationships of the words can be accessed through the `token.dep_` attribute, while the part-of-speech can be accessed through the `token.pos_` or `token.tag_` attributes. In order to access the parent of a word, tokens are assigned an attribute `token.head`.

When a modal verb is present, subject-verb prefix identification is slightly more complex. For instance, consider the following sentence: “Os empregados substitutos não podem ter direito à pensão” (i.e., substitute employees do not have the right to a pension).

⁷⁸The spaCy model used in the pipeline is “pt_core_news_sm” (see [documentation](#)). Though spaCy has larger models potentially offering improved accuracy, they suffer from decreased efficiency. The largest spaCy model, “pt_core_news_lg,” has a 0.97 accuracy for both lemmatization and part-of-speech tags, and the model used in the pipeline has a 0.97 accuracy for lemmatization and 0.96 for part-of-speech tags.



The parser correctly identifies “empregados” as the subject (nsubj) of the sentence. However, the syntactic parent of “empregados” is the modal verb “podem,” rather than the verb of interest “ter.” Hence, I iterate through the syntactic children of the verb “podem” in order to determine whether an open clausal complement (xcomp), in this case, “ter,” is present.

Differences in dependency parsing There is one key difference between the spaCy Portuguese and English dependency parsers. The English parser has a more descriptive tag schema, providing “fine-grained” part-of-speech tags alongside “coarse-grained” part-of-speech tags from the [Universal POS tag set](#), where the former can be obtained through the `token.tag_` attribute and the latter from the `token.pos_` attribute. The Portuguese dependency parser only provides “coarse-grained” part-of-speech tags, which are less descriptive.

In extracting subject-verb prefixes in Portuguese, modal verbs are not explicitly marked, and the syntactic parent of parsed subjects may not be the intended verb. This issue is resolved with an algorithmic determination of subject-verb prefixes, as explained above, which is more complicated than the original implementation in Ash et al. (2020). For instance, verbs are checked to see whether “ter que” is present in their children. In the example from the section above, the English spaCy dependency parser would identify the English equivalent “can” as a modal verb (MD) in the `tag_` attribute.

The original implementation uses Hugging Faces NeuralCoref 4.0, a pipeline extension for spaCy that resolves coreference clusters using a neural network. No easily accessible and integrative alternative exists for Portuguese, so our implementation is unable to resolve coreferences. Nonetheless, the 2009 firm-level CBAs only contains 5.05% pronoun subjects, of which some reference already identified agents and other reference no agent at all.

Portuguese Parsing of the Sentence “Eu devo ler este livro.”

token.text	token.head	token.dep_	token.tag_	token.pos_	token.children	token.ancestors
Eu	devo	nsubj	PRON	PRON	[]	[devo]
devo	devo	ROOT	VERB	VERB	[Eu, ler]	[]
ler	devo	xcomp	VERB	VERB	[livro, .]	[devo]
este	livro	det	DET	DET	[]	[livro, ler, devo]
livro	ler	obj	NOUN	NOUN	[este]	[ler, devo]
.	ler	punct	PUNCT	PUNCT	[]	[ler, devo]

English Parsing of the Sentence “I must read this book.”

token.text	token.head	token.dep_	token.tag_	token.pos_	token.children	token.ancestors
I	read	nsubj	PRP	PRON	[]	[read]
must	read	aux	MD	AUX	[]	[read]
read	read	ROOT	VB	VERB	[I, must, book, .]	[]
this	book	det	DT	DET	[]	[book, read]
book	read	dobj	NN	NOUN	[this]	[read]
.	read	punct	.	PUNCT	[]	[read]

Language differences There is no one-to-one translation of modal verbs from English to Portuguese, though strict and permissive modals are mutually exclusive in both languages. The English “will” expresses the future tense and expectations, but Portuguese does not possess an equivalent modal verb. Rather, Portuguese utilizes future tense conjugations and the modal verb “dever.” As a result, verbs must be systematically inspected for their tense by checking for endings “-rá” and “-rão.”

Whereas the passive voice in English only requires the auxiliary verb “to be” followed by the past participle of the main verb, Portuguese employs two distinct structures to convey the passive voice. In Portuguese, the passive voice is formed by using the auxiliary verb “ser” (to be) followed by the past participle of the main verb. The passive voice can also be formed using the reflexive pronoun “se” in combination with a verb conjugated in the third person. Provided these alternatives, the dependency parser is not able to identify all passive subjects, so the code checks for the passive voice in addition to the parser’s analysis. This

is done so by determining whether the pronoun “se” is present in the syntactic children of a verb and by determining whether a verb is preceded by “ser.” As such, errors may arise with the parsing and labeling of reflexive verbs, as the program makes use of active verbs, i.e., non-passive and not special verbs.

Moreover, the usage of verb forms ending in “-se-á” and “-se-ão” are unique to Portuguese to express, for example, the future tense in a passive voice construction. In addition to checking for the future tense and the pronoun “se” individually, the code also identifies this structure, which is denoted as a strict modal and passive. As the parser is unable to properly lemmatize verbs with “-se,” “-se-á,” and “-se-ão” endings, the code removes such endings in all cases and then re-lemmatizes the verb in the case of “-se.”

Shared limitations The pipeline is unable to distinguish between independent and dependent clauses. Take for example the sentence “Se os empregados, na citada semana, trabalharem no horário estabelecido na cláusula, deverá a empresa pagar-lhes com os adicionais de horas extras” (i.e., if employees, in the reference week, work the shifts established in the clause, the employer must pay them overtime for additional hours). In this case, the parser identifies two subject-verb prefixes: “empresa deverá pagar-lhes” and “empregados trabalharem”. The annotation scheme also fails with exterior framing clauses or contingencies, as described in the original implementation.

Sentences written with indirect objects are not identified by the parser. Consider the sentence “Fica garantida ao aposentado a inscrição de novos beneficiários” (i.e., it is guaranteed to retirees the registration of new beneficiaries). The parser identifies “inscrição” as the subject of the sentence despite “aposentado” being the intended subject. Run through the pipeline, the above sentence would output “inscrição fica garantida” as the subject-verb prefix. This is a limitation also present in the original English implementation.

One of the most significant changes required for the pipeline to function similarly to the English implementation is the marking of verbs with “se” as passive, whether they are used in a reflexive or passive manner. The passive construction is more common; however, verbs such as “comprometer-se” (i.e., commit oneself to) are still prevalent in the agreements. Due to this difference, the provision verb dictionaries include some reflexive verbs in the passive category, and the provision assignment patterns are modified to accommodate reflexive verbs.

Another limitation in both the original implementation and this one is that the pipeline does not examine predicate adjectives. The sentence “Employees will be responsible...” is broken down into the subject-verb prefix “employees will be” since responsible is an adjective rather than a verb. In this example, the subject-verb prefix is marked as an obligation, which is correct. However, consider the sentence “Employees will be free to...,” which is

an entitlement. Since the pipeline does not use the predicate adjective “free,” this clause is recorded as an obligation as well.

Both implementations also fail to account for multiple subjects within one provision. For instance, in the sentence “Employees, employers, and unions are subject to the following agreement,” the parser can only identify one of the subjects instead of capturing all three subjects. Ideally, the parser should be able to identify and count all three subjects, increasing the count for each agent by one, but the current parser is limited to working with one subject at a time for each provision.

E.2 Subjects

Agent dictionaries are used to identify whether the subject in a provision is an agent of capital (firms and managers) or an agent of labor (workers and unions). The agent dictionaries are derived from the list of 1,000 most common lemmatized subjects in the 2009 corpus of firm-level CBAs, which is approximately equivalent to all agents that appear more than 100 times in these agreements. Feminine and plural forms of nouns are included within dictionaries to accommodate possible lemmatization errors. Below are the dictionaries used for each agent (in Portuguese).

Firms companhia, companhias, concessionária, concessionárias, concessionário, concessionários, contratante, contratantes, corporação, corporações, corporativa, corporativas, corporativo, corporativos, empregador, empregadora, empregadoras, empregadores, empresa, empresar, empresária, empresárias, empresário, empresários, empresas, escola, escolas, estabelecimento, estabelecimentos, firma, firmas, hospital, hospitais, patrão, patroa, patroas, patrões, proprietária, proprietárias, proprietário, proprietários

Managers chefe, chefes, conselho, conselhos, diretor, diretora, diretoras, diretores, diretoria, diretorias, gerência, gerências, gerenciador, gerenciadora, gerenciadoras, gerenciadores, gerente, gerentes, manager, managers, superintendência, superintendente, superintendentes, supervisor, supervisora, supervisoras, supervisores

Workers acidentada, acidentadas, acidentado, acidentados, admitida, admitidas, admitido, admitidos, aposentada, aposentadas, aposentado, aposentados, aposentado, aposentados, aprendiz, aprendizes, auxiliar, auxiliares, beneficiário, beneficiários, cobrador, cobradores, colaborador, colaboradora, colaboradoras, colaboradores, comissionista, comissionistas, contratada, contratadas, contratado, contratados, dependente,

dependentes, dimitida, dimitidas, dimitido, dimitidos, docente, docentes, empregada, empregadas, empregado, empregados, empregar, estagiária, estagiárias, estagiário, estagiários, estudante, estudantes, funcionária, funcionárias, funcionário, funcionários, gestante, gestantes, jornalista, jornalistas, mãe, mães, motorista, motoristas, operador, operadora, operadoras, operadores, operária, operárias, operário, operários, pai, pais, participante, participantes, pessoal, professor, professora, professoras, professores, servidor, servidora, servidoras, servidores, substituta, substitutas, substituto, substitutos, suplente, suplentes, trabalhador, trabalhadora, trabalhadoras, trabalhadores, vendedor, vendedora, vendedoras, vendedores

Unions assembleia, assembleias, confederação, confederações, cooperativa, cooperativas, delegado, delegados, dirigente, dirigentes, federação, federações, grêmio, líder, líderes, representante, representantes, sindicato, sindicatos, cipa, cipeiro, sindicalizado, sindicalizados, sindicalizada, sindicalizadas

E.3 Verbs

Verb dictionaries are used to create a comprehensive list of verbs to be considered for classifying into provision types. The provision verb dictionaries are derived from the list of 1,000 most common lemmatized verbs in 2009 corpus of firm-level CBAs, which is approximately equivalent to all verbs that appear more than 100 times in these agreements. Verb conjugations are included within dictionaries to accommodate possible lemmatization errors. Adding all verb forms to dictionaries is excessive, so only commonly mis-lemmatized verbs within the 1,000 most common lemmatized verbs are included.

Relative to the original implementation, there is one improvement that involves an additional provision type, i.e., negative provisions. This provision type is included to solve an issue described by Ash et al. (2020) in their code for entitlement patterns. Some of the most common examples of non-negative, passive clauses with a strict modal include “employees will be fired.” In addition, clauses such as “employees will not lose” and “employees will not work” are marked as constraints but should be labeled as entitlements. The negative provision type provides a simple way to search for these clauses to be properly labeled.⁷⁹ The original implementation attempts to solve this problem with an extension of entitlement verbs, but this method results in an extended list of verbs with some false positive for entitlements, e.g., “select” and “train”.

⁷⁹There are only a few “negative verbs” used in the CBAs, making it a small addition to the code.

PROVISION DICTIONARIES

Provision Verb Dictionaries

Provision Type	Passive or Reflexive Verbs	Non-Passive Verbs
Obligation	exigir, esperar, coagir, compelir, obrigar, obrigado, forçar, requerer, comprometer, comprometer, responsabilizar	garantir, assegurar
Constraint	proibir, vedar, banir, impedir, impedir, restringir, proscrever, limitar, impossibilitar, negar, abster	
Permission	permitir, autorizar, aprovar, habilitar	
Entitlement	conceder, dar, outorgar, fornecer, garantir, garantido, proteger, cobrir, informar, notificar, assegurar, facultar, proporcionar, prestar, propiciar, providenciar, fornecer, avisar	ter, receber, ganhar, obter, gozar, beneficiar, repousar
Promise		reconhecer, consentir, afirmar, segurar, estipular, assumir, concordar, prometer, aquiescer
Negative	despedir, despedir, dispensar, dispensado, dispensados	trabalhar, sofrer, perder

Verb Categories and Sample Verbs

Category	Verbs
Obligation	garantir, assegurar, ser exigido, ser obrigado, ser requerido, comprometer-se
Constraint	ser proibido, ser impedido, ser negado
Permission	poder, ser permitido, ser autorizado, ser aprovado, ser habilitado
Entitlement	ter, gozar, receber, ser concedido, ser dado, ser garantido, ser fornecido
Promise	concordar, prometer, consentir, aquiescer, reconhecer, segurar, assumir
Negative	trabalhar, sofrer, perder, ser dispensado

The table above shows the verb dictionary by provision type, as well as some examples. The table below provides the deontic logic rules used to categorize a subject-verb prefixes

as obligations, constraints, permissions, or entitlements.

PROVISION TYPE ASSIGNMENT

Pseudocode for Provision Type Assignment

Provision	Pattern
Obligation	not negative + strict modal + active verb not negative + not permissive modal + obligation or promise verb
Constraint	negative + modal + not obligation, not negative, and not constraint verb not negative + strict modal + constraint verb negative + permission verb
Permission	not negative + permissive modal + not special verb not negative + permission verb negative + constraint verb
Entitlement	not negative + entitlement verb not negative + strict modal + passive + not special and not negative verb negative + obligation or negative verb

Provision Type Assignment Examples

Provision	Pattern
Obligation	empresa fornecerá, sindicato obriga-se
Constraint	empresa não poderá impedir, empresa se absterá
Permission	empregado poderá deixar, empregados serão autorizados
Entitlement	empregados receberão, supervisores serão custeados, empresa não será responsabilizada

F PageRank and AKM Models

The underlying models for PageRank values and AKM wage premiums have a direct connection to the posting model. Specifically, they all rely on assumptions about u_{ij} , i.e., the indirect utility of worker i from working at firm j . In this appendix, I walk through the PageRank and AKM models and then discuss assumptions in light of the posting model (Section 5.2) and valuing CBA clauses (Section 4.1).

F.1 PageRank values

This is an abridged exposition of the model in Sorkin (2018). The starting point is $u_{ij} = V_j + \varepsilon_{ij}$, where $\varepsilon_{i,j}$ refers to the idiosyncratic preferences of worker i from working at establishment j . In a market with only two firms and independently distributed type I Extreme Value ε_{ij} across workers, the probability that a worker prefers firm j over k is given by $\frac{\exp(V_j)}{\exp(V_j) + \exp(V_k)}$. With N workers and letting M_{jk} denote the number of workers choosing firm j over k , the following relation between employment decisions and valuations of firm-specific employment is simply $M_{kj}/M_{jk} = \exp(V_k)/\exp(V_j)$.

In a labor market with multiple firms $j \in \mathcal{J}$, the above condition imposes a restriction on each pair of firms, i.e.,

$$M_{kj} \exp(V_j) = M_{jk} \exp(V_k), \forall j \in \mathcal{J}. \quad (13)$$

One can relax this condition by imposing a single restriction per firm that guarantees a consistent valuation of employers (e.g., no Condorcet cycles), as well as a unique set of firm-level values that best explains worker flows across establishments. Summing equation (13) across all employers and rearranging terms gives

$$\frac{\overbrace{\sum_{j \in \mathcal{J}} M_{kj} \exp(V_j)}^{\text{value-weighted entry}}}{\underbrace{\sum_{j \in \mathcal{J}} M_{jk}}_{\text{exits}}} = \underbrace{\exp(V_k)}_{\text{value}}, \quad (14)$$

which implies a single linear restriction per establishment.

The intuition behind equation (14) is that a valuable firm tends to be chosen over other valuable firms and has fewer workers leave it. This recursive definition of $\exp(V_j)$ is closely linked to Google's PageRank algorithm for ranking web-pages in a search. Along these lines,

one can solve for $\exp(V_j)$ as a fixed point in a linear system. Moreover, a unique solution exists if the set of employers are strongly connected, i.e., an establishment has to both hire a worker from and have a worker hired by another establishment in the set.

F.2 AKM wage premiums

This is a version of the model in Card et al. (2018) extended to account for common amenity value. The starting point is $u_{ij} = \beta \log(w_j - b) + \eta \log(a_j - q) + \varepsilon_{i,j}$, which is the same as the posting model, i.e., Equation (4). Hence, imposing the same set of assumptions as in Section 5.2, one can derive the compensation bundles under monopsony provided in Equations (7) and (8).⁸⁰

Rearranging equations (7) and (8), one can write the posted wage and amenity value as weighted averages of the marginal revenue product of labor and their respective reference values b and q , i.e.,

$$w_j = \left(\frac{\beta}{1 + \beta + e_{aj}^L} \right) T_j f'(L_j) \mu_j + \left(\frac{1 + e_{aj}^L}{1 + \beta + e_{aj}^L} \right) b \quad (15)$$

$$a_j = \left(\frac{\eta}{\xi_j(1 + \eta + e_{wj}^L)} \right) T_j f'(L_j) \mu_j + \left(\frac{1 + e_{wj}^L}{1 + \eta + e_{wj}^L} \right) q. \quad (16)$$

Assume a linear technology $f(L_j) = \theta L_j$ and price-taking employers in the output market to specify the marginal revenue product of labor: $T_j f'(L_j) \mu_j = T_j P_j \theta$. To simplify further, assume that reference wages and amenities are proportional to productivity ($b = \bar{b}\theta$ and $q = \bar{q}\theta$). Rearranging terms and taking logs results in

$$\log(w_j) = \log \left(\frac{\theta \bar{b}(1 + e_{aj}^L)}{1 + \beta + e_{aj}^L} \right) + \log(1 + \beta R_j^w) \quad (17)$$

$$\log(a_j) = \log \left(\frac{\theta \bar{q}(1 + e_{wj}^L)}{1 + \eta + e_{wj}^L} \right) + \log(1 + \eta R_j^a), \quad (18)$$

where $R_j^w = T_j P_j / [(1 + e_{aj}^L) \bar{b}]$ and $R_j^a = T_j P_j / [\xi_j (1 + e_{wj}^L) \bar{q}]$. With relatively small values of βR_j^w and ηR_j^a , compensation in the form of wages and amenity value are functions of a fixed worker component and a fixed establishment component as in Abowd et al. (1999).

⁸⁰In this model, monopsony power stems from information asymmetries, i.e., employers cannot discriminate on the basis of workers' idiosyncratic preferences $\{\varepsilon_{i,j}\}$. The model also abstracts from strategic complementarities by assuming a large number of firms \mathcal{J} .

Specifically,

$$\log(w_j) = \log\left(\frac{\bar{b}(1 + e_{a_j}^L)}{1 + \beta + e_{a_j}^L}\theta\right) + \beta R_j^w \quad (19)$$

$$\log(a_j) = \log\left(\frac{\bar{q}(1 + e_{w_j}^L)}{1 + \eta + e_{w_j}^L}\theta\right) + \eta R_j^a. \quad (20)$$

Therefore, Equation (19) implies that workers' compensation in wages can be written as $\log(w_j) = \alpha^w + \psi_j^w$, where $\psi^w = \beta R_j^w$ is an establishment-specific wage premium. Similarly, Equation (20) implies that workers' compensation in amenity value can be written as $\log(a_j) = \alpha^a + \psi_j^a$, where $\psi^a = \eta R_j^a$ is an establishment-specific amenity premium. To separately identify these premiums from the worker fixed effects, one must focus on a set of firms that are connected through worker flows.^{81,82}

F.3 Reconciling modeling assumptions

The previous sections specify the models and assumptions underlying PageRank values and AKM wage premiums. I now highlight differences in these assumptions relative to those made in the paper, specifically with regards to the posting model and valuing CBA clauses.

I start with the case of AKM since it is the most similar to the posting model. Both models set $u_{ij} = \beta \log(w_j - b) + \eta \log(a_j - q) + \varepsilon_{i,j}$ and make the same assumptions to get closed-form solutions for the compensation bundles in Equations (7) and (8). After this point, the AKM model relies on additional simplifying assumptions to write these expressions in a way that separates worker and firm components. Hence, the posting model nests an AKM model that accounts for amenity value.

In the case of the PageRank values, there are two modeling assumptions that seem at odds. First, setting $u_{ij} = V_j + \varepsilon_{ij}$ along with the same distributional assumptions about ε_{ij} as the posting model, implies a direct mapping between V_j and $\beta \log(w_j - b) + \eta \log(a_j - q)$. Second, by assuming $V_j = \alpha \psi_j + \sum_{z=1}^Z \beta^z A(z)_j$ for the estimation of the wage-equivalent value of clauses, V_j is now linked to a completely different expression. If the models are internally consistent, both $\alpha \psi_j + \sum_{z=1}^Z \beta^z A(z)_j$ and $\beta \log(w_j - b) + \eta \log(a_j - q)$ should equal each other. While I never observe either object to confirm this claim, I now turn my

⁸¹Unbiased estimates rely on an exogenous mobility condition. Gerard et al. (2021) provides falsification tests in the Brazilian setting. The implicit assumptions from linear additivity of the wage and amenity value components in Equation (4) imply no changes to the typical estimation of AKM wage premiums.

⁸²In theory, if one could observe variation in amenity value at the worker level across firms, estimating AKM-style amenity premiums would be feasible. As a sidenote, assuming CBA clauses encompass all common amenities offered by firms, the amenity value in CBAs would capture these AKM-style amenity premiums.

attention to explain how this is conceptually possible.

On one hand, the expression $\alpha\psi_j + \sum_{z=1}^Z \beta^z A(z)_j$ concerns the objects that generate value to all workers in a firm, rather than the values themselves. That is, it breaks down V_j into the wage premium and multiple common amenities (e.g., CBA clauses), each of which carry some weight—i.e., α and β^z for $z \in \{1, 2, \dots, Z\}$ —in determining how much workers value working at a specific firm. In a way, this expression is like an accounting assumption rather than an economic one. As such, workers' labor supply is responsive to changes in these objects (allowing for identification from worker flows), but meaningful expressions for elasticities are not possible without a common metric for value.

On the other hand, the expression $\beta \log(w_j - b) + \eta \log(a_j - q)$ concerns the values themselves as offered by firms, adding the assumption that workers' labor supply decisions are different depending on the form this compensation takes, i.e., wages versus amenities. By being explicit about how workers react to changes in compensation, this expression is about the underlying economic model rather than an accounting identity. Hence, CBA clauses have a wage-equivalent amenity value coming from their relative weight in determining V_j —that is, β^z/α —but the economic model bundles all those clauses into a single amenity value metric, allowing workers to differentially respond to wages and amenity value. By having amenity value in the same metric as wages, it is possible to meaningfully speak about elasticities.

G Bargaining Model

The labor market institution at the center of this paper is collective bargaining. As such, this paper considers a posting model where firms are constrained by collective bargaining in a right-to-manage framework. That is, Nash bargaining between firms and unions pins down wage and amenity compensation bundles, taking employment as given by the binding labor curve (Nickell and Andrews, 1983). This appendix show the derivations of the bargaining model excluded from the discussion in Section 5.2.

G.1 First order conditions

The Nash bargaining problem is

$$\max_{w,a} [\pi(w, a) - \pi(g_w, g_a)]^{1-\gamma} [(v(w) - v(g_w)) L(w, a)]^{\epsilon\gamma} [(v(a) - v(g_a)) L(w, a)]^{(1-\epsilon)\gamma}$$

Taking logs of the expression above, compute the derivative with respect to w and a to get

$$\begin{aligned} \frac{v(w) - v(g_w)}{wv'(w)} &= \frac{\epsilon\gamma}{(1-\gamma)(-e_w^\pi) + \gamma(-e_w^L)} \\ \frac{v(a) - v(g_a)}{av'(a)} &= \frac{(1-\epsilon)\gamma}{(1-\gamma)(-e_a^\pi) + \gamma(-e_a^L)} \end{aligned}$$

The left hand-side of both equations will always be greater than zero since the union would never agree to anything below its inside option (g_w, g_a) . This condition places some bounds on the elasticities of labor to ensure that the right-hand side is also positive, i.e., $e_w^L < \left(-\frac{1-\gamma}{\gamma}\right) e_w^\pi$ and $e_a^L < \left(-\frac{1-\gamma}{\gamma}\right) e_a^\pi$.

The signs of the elasticities depend on whether the labor supply or the labor demand curve are binding. When the labor supply curve is binding, the labor elasticities are positive, i.e., $e_w^L = \frac{\beta w}{w-b}$ and $e_a^L = \frac{\eta a}{a-q}$. When the labor demand curve is binding, the labor elasticities are negative, i.e., $e_w^L = \sigma \left(-\frac{1}{1-\alpha}\right)$ and $e_a^L = (1-\sigma) \left(-\frac{1}{1-\alpha}\right)$ where $\sigma \equiv \frac{w}{w+\xi a}$ denotes the proportion of marginal costs of labor accounted for by the wage component. Plugging in these conditions, the profit elasticities expressions change but remain negative. In the demand constrained case, they are $e_w^\pi = -\frac{\sigma\alpha}{1-\alpha}$ and $e_a^\pi = -\frac{(1-\sigma)\alpha}{1-\alpha}$. In the supply constrained case, they are $e_w^\pi = \alpha \left(\frac{\beta-x(\beta+\sigma)}{1-\alpha x}\right)$ and $e_a^\pi = \alpha \left(\frac{\eta-x(\eta+(1-\sigma))}{1-\alpha x}\right)$ where x represent the markdown on the marginal revenue product of labor. As $x \rightarrow 1$, the profit elasticities approach the solution from the demand constrained case.

G.2 Contract curve

Take the first order condition with respect to wages—assuming that $v(\cdot) = \log(\cdot)$ —to obtain

$$\gamma = \frac{e_w^\pi (\log(w) - \log(g_w))}{(e_e^\pi - e_w^L)(\log(w) - \log(g_w)) - \epsilon}$$

Plug this into the first order condition with respect to amenities to get

$$(e_w^L e_a^\pi - e_w^\pi e_a^L)(\log(a) - \log(g_a))(\log(w) - \log(g_w)) + \epsilon e_a^\pi (\log(a) - \log(g_a)) - (1 - \epsilon) e_w^\pi (\log(w) - \log(g_w)) = 0$$

This is a function $F(w, a) = 0$ for which implicit differentiation implies $\frac{da}{dw} = -\frac{dF/dw}{dF/da}$.

Taking these derivatives while holding σ and the elasticities constant gives

$$\frac{da}{dw} = \left(-\frac{a}{w}\right) \left(\frac{(e_w^L e_a^\pi - e_w^\pi e_a^L)(\log(a) - \log(g_a)) - (1 - \epsilon) e_w^\pi}{(e_w^L e_a^\pi - e_w^\pi e_a^L)(\log(w) - \log(g_w)) + \epsilon e_a^\pi}\right)$$

One can show that $(e_w^L e_a^\pi - e_w^\pi e_a^L) = 0$ under both the demand constrained and the supply constrained cases. Hence, the slope of the contract curve can be simplified to

$$\frac{da}{dw} = \left(\frac{1 - \epsilon}{\epsilon}\right) \left(\frac{e_w^\pi}{e_a^\pi}\right) \left(\frac{a}{w}\right)$$

which is always positive.

G.3 Negotiation effort on wages

Assume bargaining only occurs over efficient combinations of (w, a) so that $\frac{w}{a} = \frac{\xi e_w^{LS}}{e_a^{LS}}$. This implies that the chosen ϵ would be such that the slope of the contract curve satisfies this condition. In other words, $\frac{da}{dw} = \frac{e_a^{LS}}{\xi e_w^{LS}}$ which implies

$$\epsilon^{NB} = \frac{\xi e_w^{LS} e_w^\pi a}{\xi e_w^{LS} e_w^\pi a + e_a^{LS} e_a^\pi w}$$

Plugging in the demand constrained profit elasticities simplifies to $\epsilon^{NB} = \sigma$, while plugging in the supply constrained profit elasticities simplifies to $\epsilon^{NB} = e_w^{LS} / (e_w^{LS} + e_a^{LS})$. Under the efficient bargaining assumption, it turns out that σ is also equal to $e_w^{LS} / (e_w^{LS} + e_a^{LS})$. Hence, the same negotiation effort on wages holds in both supply and demand constrained labor market conditions.