Suppressing Paper Unions: Evidence from the USMCA's Labour Provisions in Mexico

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ABSTRACT. We study the effects of a major labour reform induced by the U.S.–Mexico–Canada Trade Agreement (USMCA) on Mexico's union system, which aimed to improve workers' wages and working conditions by eliminating *paper unions*—unions that exist only on paper, do not represent workers, and allow firms to forestall real unionization. The reform required existing collective bargaining agreements (CBAs) to be legitimized by workers through secret-ballot votes and introduced stricter requirements for signing new CBAs. As a result, 78% of pre-reform CBAs were terminated, with few new CBAs created subsequently. We combine the universe of pre-reform CBAs with matched employer–employee and survey data and employ a matched difference-in-differences design to estimate the effects on union firms. We find that the reform had a null effect on average wages, but employment and the wage bill at union firms increased by 3.6% and 3.1%, respectively, by 2026. Profits at union establishments in manufacturing also increased by 5.4% following the reform. To rationalize these findings, we develop a model of optimal firm sorting in which the reform reduces firms' marginal labour costs by eliminating payments to paper unions and weakens the union threat by raising the cost of unionization for workers.

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> *"The USMCA includes the strongest, most advanced, and most comprehensive labor obligations of any U.S. trade agreement. [...] These provisions will promote better working conditions and higher wages for Mexican workers and will create the conditions for fairer competition between U.S. and Mexican workers."*
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> — Office of the U.S. Trade Representative (2020)

1. Introduction

Weak labour market institutions, such as unions that do not represent workers, are a common feature of many developing economies (Freeman, 2010; Jäger *et al.*, 2025). Beyond their domestic consequences, these institutional weaknesses can generate tensions with trading partners who may view weak enforcement of fundamental labour rights as an unfair competitive advantage that helps keep labour costs low (Ehrlich, 2018). To level the playing field and protect jobs, developed countries have opted in recent decades to include labour provisions in trade agreements with developing countries that impose higher labour standards as a condition for market access (Carrère *et al.*, 2022).[1] A prominent example is the U.S.–Mexico–Canada Trade Agreement (USMCA), which required Mexico to modify its labour law to guarantee workers' rights to freedom of association and effective collective bargaining (Office of the U.S. Trade Representative, 2020). Yet, despite the central role of labour provisions in trade negotiations, there is limited causal evidence on whether the institutional changes they induce strengthen labour market institutions, improve workers' outcomes, and raise labour costs in developing countries.

In this paper, we provide evidence on the consequences of such institutional changes by studying the effects of a major labour reform of the Mexican union system required by the USMCA. The reform sought to raise wages and improve the working conditions of Mexican workers by eliminating the widespread practice of employers signing collective bargaining agreements (CBAs) with *paper unions*—unions that existed only on paper, did not represent workers during negotiations, and allowed firms to forestall real unionization and keep control over wage setting (Bensusán *et al.*, 2007; de Buen Unna, 2013; Jäger *et al.*, 2025). Sadka (2016) estimates that up to 82.6% of CBAs in Mexico were of this type in 2016. To this end, the reform required all unions with an existing CBA (also known as historical CBAs) to call for a legitimization vote among covered workers and introduced stricter requirements to sign new CBAs. CBAs that unions did not submit to a vote by May 2023, or that workers rejected, were terminated, leaving the door open for workers to organize new representative unions.

To examine the impact of the reform on firm-level outcomes, we combine a novel web-scraped dataset covering the universe of pre-reform CBAs in Mexico with the matched employer–employee administrative records from the Mexican Social Security Institute (IMSS),

[1] According to International Labour Organization (2016), nearly half of trade agreements concluded between 2011 and 2015 included labour provisions.

covering all private-sector formal workers from 2017 to 2026. We use IMSS data corresponding to February of each year and aggregate worker-level outcomes in each period to the firm level. This dataset offers two important advantages over conventional survey data. First, it allows us to follow firms linked to a pre-reform CBA (union firms) over a nine-year time window, which is not possible with the standard National Survey of Occupation and Employment (ENOE). Second, identifying union firms through administrative records on CBAs rather than workers' self-reports avoids relying on workers' awareness of the existence of such agreements, which may be particularly limited in workplaces covered by paper unions (Fairris, 2007).

To enforce the new rules of collective bargaining, the reform established the *Centro Federal de Conciliación y Registro Laboral (CFCRL)*. This federal agency was responsible for overseeing the legitimization process and is now in charge of the registration of new CBAs. Given the scale of the institutional transformation, the CFCRL was gradually introduced across states in three stages, with the final stage taking effect in October 2022. We focus on the final stage of this rollout, which marked the implementation of the new institutional framework in Mexico's largest economic states, including Mexico City, Nuevo León, and Jalisco. To estimate the effects of the reform, we employ a matched difference-in-differences (DID) design comparing changes in firm-level outcomes between union firms (treated) and similar non-union firms (control), before and after October 2022.

We begin by documenting that the pre-reform union pay premium between treated and control firms in our sample vanishes after matching. This suggests that, once differences in observable characteristics are removed, Mexican unions do not seem very effective at obtaining higher pay for their members. This result is consistent with the widespread presence of paper unions and helps explain why wages in Mexico remained so low despite having a private-sector union membership rate similar to that of Canada (15.7% vs. 14.7%) and more than double that of the U.S. (6%). For instance, in May 2018, the average hourly wage in manufacturing, a sector with a large union presence in Mexico (23%), was $2.10 USD in Mexico compared with $21.42 USD and $19.87 USD in the U.S. and Canada, respectively (INEGI, U.S. Bureau of Labor Statistics, and Statistics Canada). The USMCA's labour provisions aimed to narrow these labour cost differentials across the North American region by strengthening collective bargaining in Mexico.

Turning to the effects of the reform, our first main finding is that it had a null effect on mean log daily wages at union firms. Similar null effects post-reform are found when examining different percentiles of the within-firm wage distribution, using the mean log wages of workers who remained at the same firm throughout (stayers), weighting firms by their pre-reform employment, and looking at the firm-specific pay premiums (measured as the dynamic firm fixed effects estimated from a Time-Varying AKM specification (Lachowska *et al.*, 2023; Engbom *et al.*, 2023; Bergolo *et al.*, 2025)). The lack of an increase in union firms' pay premium suggests that the reform did not strengthen workers' bargaining power at these firms after its implementation (Beauregard *et al.*, 2025).

We interpret the absence of wage effects in light of the substantial decline in collective bargaining following the reform. The legitimization process resulted in the termination of 78% of historical CBAs, primarily because unions never submitted them to a vote (Secretaría del Trabajo y Previsión Social, 2023). However, contrary to the intent of the USMCA's labour provisions, this reduction in the number of CBAs was not followed by a comparable increase in the creation of new CBAs. By May 2026, legitimized and newly registered CBAs accounted for only 32% of the pre-reform stock, consistent with a higher cost of unionization induced by the reform's stricter requirements.

Next, we examine the effects of the reform on employment and the wage bill at union firms. We find that employment increased by 3.6% by 2026, while the wage bill rose by 3.1% over the same period. Given the absence of wage effects, the increase in the wage bill is entirely driven by employment growth. Relative to their 2022 (untransformed) mean among treated firms in the matched sample, these estimates correspond to approximately three additional employees per firm, and a $20,400 USD increase in the annual wage bill of each firm in 2026. We find no evidence that the reform reduced union firms' survival in the formal sector, contrary to the argument that the flexibility provided by paper unions was necessary to keep firms operating in the Mexican formal labour market (Bensusán *et al.*, 2007).

A natural explanation for the employment effects builds on how the literature has described the economic role of paper unions before the reform (Bouzas Ortíz, 2009; Bensusán and Middlebrook, 2012; Sadka, 2016). According to this literature, firms hired the services of these unions to forestall workers' unionization while retaining control over wage setting as in the non-union status quo (de Buen Unna, 2013). In exchange, paper unions reportedly charged employers a fee that scaled with firm size for signing and maintaining CBAs that provided the minimum benefits for workers (Bensusán *et al.*, 2007). Under these conditions, such fees operated as a tax on labour, and their elimination after the reform lowered firms' marginal cost and allowed them to expand employment.

Unpacking the employment effects of the reform reveals that low-paid employment, defined as the number of workers at the firm earning less than twice the 2024 minimum wage (248.93 MXN per day), accounts for nearly 70% of the employment increase by 2026, with substantially smaller gains among higher-paid employment. These patterns are consistent with paper unions imposing a cost on firms that was removed after the reform. At the same time, the limited creation of new CBAs post-reform and the concentration of employment gains among low-paid workers, who tend to favour unionization (Taschereau-Dumouchel, 2020), reinforce the view that the reform also raised the cost of forming a union for workers. In addition, we find that union firms are 2.3 pp more likely than non-union firms to hire a worker not previously in formal employment by 2026, suggesting that the reform expanded formal employment rather than merely reshuffling workers across formal firms.

We then provide suggestive evidence that the employment gains post-reform are driven by firms that had relied on paper unions to forestall workers' unionization. Since we cannot

directly identify firms with paper unions, we conduct two different empirical exercises to shed light on this. First, we examine whether the effects are concentrated among firms whose CBAs and unions displayed characteristics that the literature associates with paper unions (de Buen Unna, 2013; Bensusán and Middlebrook, 2012). The results show that employment effects are larger among firms whose historical CBAs provided no extra-legal benefits (4.1% by 2026), whose unions were affiliated with one of the three largest union confederations historically linked to paper unions (4.8%), or whose unions operated across many industries (4.6%), a characteristic of the business model of paper unions (Bensusán *et al.*, 2007). Second, we estimate a logistic regression to predict the probability that a CBA was not legitimized and examine whether employment effects are larger among firms with a higher predicted probability of non-legitimization. We argue that paper unions, anticipating that workers would reject their agreements, were less likely to call for a legitimization vote and thus more likely to have their CBA terminated after May 2023. The static DID results show that employment gains increase with the predicted probability of non-legitimization, reaching 4.5% among firms in the top tercile, compared with no statistically significant effect among those in the lowest tercile. Wage effects, in contrast, remain statistically insignificant across all terciles.

To rationalize our main empirical findings, we develop a simple model of optimal firm sorting across three different arrangements: non-union, union, and paper union. Firms differ in productivity and the cost of providing amenities to workers, and face an infinite supply of identical workers. Paper-union and non-union firms choose wages and employment to maximize profits, paying workers their outside option wage and providing no amenities, whereas union firms bargain over wages and amenities in the spirit of Lagos (2026). Following Green *et al.* (2026), workers decide to unionize when the gains of having a union job exceed the cost of organizing. Then, firms facing the union threat can either accommodate the workers' union or hire a paper union to forestall the threat of unionization in exchange for a fee proportional to the wage bill. This fee acts as an ad-valorem tax on the wage bill, raising firms' marginal labour costs and reducing employment without affecting workers' wages. We model the reform as eliminating the paper-union option and increasing the cost of unionization for workers. As a result, firms that previously relied on paper unions may no longer face a credible union threat and become non-union, allowing them to expand employment without changing wages.

We generate two additional predictions from the model and examine them empirically. First, the model predicts that employment gains post-reform should be larger in areas with a higher outside option, where firms face higher labour costs and therefore pay larger fees to paper unions. Since the outside option of formal workers is positively related to the informal-sector wage, this implies larger employment gains after the reform in areas with higher wages in the informal sector. Consistent with this prediction, we find that employment effects are 2 pp larger among union firms located in states with above median average

informal-sector wages. Second, the model predicts that firms transitioning from paper-union to non-union arrangements experience an increase in profits through two channels: savings from no longer paying paper-union fees and efficiency gains from eliminating the employment distortion induced by the ad-valorem fee. To examine this prediction, we use establishment-level data from the Annual Manufacturing Survey (EAIM) and estimate a DID specification comparing manufacturing establishments with and without a historical CBA before and after the reform. Consistent with the model's prediction, we find that profits at establishments unionized before the reform increased by 5.4% relative to their pre-reform mean. We also document a 2.9% increase in employment, in line with our findings using IMSS data, and a 3.7% increase in fixed assets, suggesting that firms expanded their capital stock alongside employment.

Lastly, we use our empirical results to quantify the economic gains from the reform for firms and workers. For firms, we estimate an annual increase in profits of $4.3 billion USD among union establishments in the manufacturing sector, equivalent to $966,000 USD in additional annual profits per establishment. A back-of-the-envelope calculation combining our model and empirical estimates suggests that these establishments previously paid approximately $78,000 USD per month to paper unions, consistent with anecdotal evidence on payments in other sectors (Bensusán *et al.*, 2007). For workers, the increase in formalization generates total earnings gains of $75.9 million USD over 2023–2026, relative to a counterfactual in which workers would have remained employed in the informal sector. This corresponds to an average annualized earnings gain of $6,090 USD per additional worker entering formal employment. All in all, these findings suggest that, contrary to the objectives of the USMCA's labour provisions, the reform did not raise wages or labour costs at union firms in Mexico. Instead, it reduced firms' marginal labour costs, leading to higher profits and employment, with more limited gains for workers through increased formalization.

This paper contributes to three strands of the literature. First, it adds to the literature examining the effects of labour provisions in trade agreements (Martinez-Zarzoso and Kruse, 2019; Carrère *et al.*, 2022; Abman *et al.*, 2023), where existing work has primarily relied on cross-country variation and documented mixed results. For instance, Dewan and Ronconi (2018) find that free trade agreements with the U.S. increased labour inspections in Latin American countries, but they do not find significant effects for Mexico under the North American Free Trade Agreement (NAFTA). More recently, Bazillier and Rana (2025) find that labour provisions in trade agreements improve labour standards only when they are both legally binding and embedded in a comprehensive institutional framework. We extend this literature by documenting the consequences of a reform induced by the USMCA, using detailed information on CBAs and employer–employee administrative data that allow us to track changes in outcomes at affected firms.

Second, we contribute to the literature studying unions in developing countries (Magruder, 2012; Yao and Zhong, 2013; Corradini *et al.*, 2025; Lagos, 2026), where there is a growing body of research on collective bargaining in Latin America (Jäger *et al.*, 2025). In

particular, in the Brazilian context, Derenoncourt *et al.* (2025) document substantial heterogeneity in union wage premia and find that a right-to-work reform in 2017 reduced the average union premium by 42% (from 2.7 to 1.5 log points), while in Argentina, Hermo (2025) shows that collective bargaining propagates economic shocks across firms through negotiated wage floors. To the best of our knowledge, this is the first paper to use quasi-experimental variation to study paper unions and shed light on how they operate. We also provide the first causal estimates of the effects on firm-level outcomes of one of the most significant transformations of the Mexican union system in the country's modern labour history (Sadka, 2026).

Finally, our work relates to the literature examining how firms respond to the threat of unionization (Neumark and Wachter, 1995; Farber, 2005; Fortin *et al.*, 2021). In a recent paper, Taschereau-Dumouchel (2020) proposes a general equilibrium model with endogenous union formation in which non-union firms adjust their workforce composition to deter unionization by hiring more high-skilled workers, who are less likely to support unionization, and fewer low-skilled workers, who are more likely to support it. Closer to our theoretical framework, Green *et al.* (2026) develop a search-and-matching model in which non-union firms emulate wages at unionized firms to prevent workers from organizing. We build on this work and develop a static model of optimal firm sorting across union arrangements that incorporates an alternative response to the threat of unionization: hiring the services of a paper union. Our framework further departs from Green *et al.* (2026) by endogenizing amenity formation in union firms, which they treat as exogenous.

The rest of the paper is organized as follows. Section 2 describes the institutional background on Mexico's union system and the labour reform we study. Section 3 describes the data and Section 4 outlines our empirical strategy. Section 5 presents our empirical results, including the heterogeneity analysis and robustness checks. Section 6 develops a theoretical framework that rationalizes our main empirical findings and generates additional predictions that we test in the data. Section 7 quantifies the economic gains from the reform for firms and workers. Lastly, Section 8 concludes. Appendices A to E provide supplementary material.

2. Institutional Setting

The union system in Mexico became a central issue during the renegotiation of NAFTA in 2018. The U.S. and Canada had long argued that the weakness of collective bargaining and low wages in Mexico have created an uneven playing field for investment attraction in the region. To help raise Mexican wages and reduce labour-cost differentials among the three countries, the new USMCA included a labour chapter (Chapter 23) under which Mexico committed to guarantee the fundamental rights of freedom of association and effective

collective bargaining (Annex 23-A).[2] This intervention by the U.S. and Canada to promote a change in the union system of a partner country through a trade agreement was unprecedented and unique. The ultimate goal was to benefit American and Canadian workers by improving labour conditions in Mexico, particularly by strengthening collective bargaining in the country (Office of the U.S. Trade Representative, 2020).

To meet such commitments, Mexico enacted a major labour reform in May 2019 with a bundle of measures to eliminate the common practice of employers signing collective bargaining agreements with *paper unions*—unions that exist only on paper, do not represent workers and allow firms to forestall real unionization—, marking one of the most significant institutional transformations in the country's modern labour history (Secretaría del Trabajo y Previsión Social, 2019; Sadka, 2026). To understand the scope of this institutional change, we first review in Section 2.1 the Mexican union system before 2019, focusing on the widespread presence of paper unions and the legal loopholes that allowed them to proliferate. Then, in Section 2.2, we describe in more detail the new rules imposed by the reform.

2.1. The Pre-Reform Union System in Mexico

Similar to the U.S. and Canada, collective bargaining in Mexico is predominantly decentralized, occurring mainly at the firm level, and union membership largely coincides with collective-bargaining coverage (Jäger *et al.*, 2025).[3] Data from ENOE shows that the unionization rate in the formal sector in Mexico fell from 31% to 22.1% between 2005 and 2018 (an 8.9 pp drop), in line with the well-documented de-unionization trend around the globe (Card *et al.*, 2020; Farber *et al.*, 2021; Jäger *et al.*, 2022; Beauregard *et al.*, 2025). Also, as in the Wagner model, a single union holds exclusive representation over all union workers in the unit during negotiations of a CBA, and the employer deducts union dues directly from workers' payments. However, unlike right-to-work laws in the U.S., closed-shop arrangements, under which employers could agree to hire only union members and to dismiss workers expelled from the union, were lawful in Mexico.

Prior to 2019, the Mexican union system was characterized by the widespread presence of CBAs signed between employers and paper unions (*sindicatos de papel* in Spanish) (Fairris, 2003; Bensusán and Middlebrook, 2012; Jäger *et al.*, 2025).[4] As their name suggests, these

[2]These commitments complement earlier domestic efforts to modify the Mexican union system. For instance, in 2017 Mexico amended Article 123 of the Constitution to overhaul its labour justice system and ratified ILO Convention No. 98 in 2018 (Bensusán, 2020).

[3]Other, less common forms of union organization include craft, industrial, and national unions, as well as unions representing workers across multiple occupations (Fairris, 2007; Cámara de Diputados del H. Congreso de la Unión, 2024).

[4]We use the term "paper unions" broadly to refer to unions that lacked genuine worker representation and were used by employers to forestall real unionization. This category encompasses what the Mexican legal literature commonly refers to as *sindicatos de protección*, as well as related labels such as *sindicatos fantasma* and *sindicatos de membrete*. There are other forms of employer-aligned unions that are closely related to this phenomenon. These included company unions (*sindicatos blancos*), which are more common in the north part of Mexico and characterized by employer influence, and *sindicatos charros*, which had worker membership but were associated with undemocratic leadership and had close ties to the state.

organizations existed largely on paper with little or no presence in the workplace. They were not elected by workers and did not represent workers' interests during contractual negotiations. Instead, employers hired the services of paper unions to sign CBAs with minimum benefits for workers that were virtually impossible to replace or eliminate, allowing them to prevent real unionization and keep control over wage setting (Bensusán *et al.*, 2007; Bouzas Ortíz, 2009). Unlike unions organized around a particular firm or industry, paper unions often provided these services to employers across industries (Bensusán *et al.*, 2007). Sadka (2016) estimates that up to 82.6% of CBAs in Mexico were paper-union contracts in 2016. We provide a concrete example of this type of contract in Appendix A.

Employers and paper unions exploited a loophole in the Mexican labour law. Specifically, the law did not require any union to show that it actually represented the workers of a firm in order to obtain, hold or exercise collective bargaining rights. There was no certification election and no verification of membership by the labour authority (Bensusán *et al.*, 2007; de Buen Unna, 2013; Bensusán and Middlebrook, 2012). As a result, obtaining the legal certification as a union (known as *toma de nota* in Spanish) was straightforward.[5] Once registered, a paper union and an employer could sign an agreement without the knowledge or consent of workers, and the agreement took effect simply by being deposited with the labour authorities. With a CBA already in place, another union could not negotiate a new agreement without first displacing the incumbent one, making it extremely difficult for other unions to enter the workplace. Payments to paper unions scaled with firm size, primarily coming from firms that treat them as a recurring, budgeted cost (González, 2006; Bensusán *et al.*, 2007; de Buen Unna, 2013).[6]

Once employers had established these arrangements, displacing the incumbent paper union was almost impossible for workers. The legal process to eliminate an unrepresentative union was lengthy and exposed workers to retaliation and intimidation (Bensusán *et al.*, 2007; de Buen Unna, 2013).[7] In firms with closed-shop clauses, challenging the incumbent union was a synonym of losing the job. Political ties further contributed to the persistence of these arrangements. Many paper unions belonged to large confederations such as the *Confederación de Trabajadores de México (CTM)*, historically known for its undemocratic union practices and close ties to the *Partido Revolucionario Institucional (PRI)*,

[5] In contrast, in the U.S., workers select a bargaining representative through a secret-ballot election, where a union is certified if it receives a majority of the votes cast. To guarantee the workers' right to form or join a union, or refrain from doing so, this process is carefully supervised by the National Labor Relations Board (NLRB). See https://www.nlrb.gov/about-nlrb/rights-we-protect/the-law/employees/your-right-to-form-a-union.

[6] Bensusán *et al.* (2007) report that paper unions in the cleaning sector received monthly rents ranging from 1 to 4 million MXN.

[7] In the local news, there is plentiful anecdotal evidence of workers facing intimidation or dismissal when attempting to organize independently in workplaces covered by paper unions. For instance, at PKC Arneses, workers seeking representation by the *Sindicato Minero* reported threats of dismissal if they supported the independent union (La Jornada, 2016). Another example occurred at Goodyear in San Luis Potosí, where workers challenging an incumbent paper union alleged retaliatory dismissals following their efforts to organize independently (El Universal, 2018). The International Labour Organization (ILO) has also documented the widespread use of paper unions (see Case No. 2694).

the political party that governed Mexico continuously for more than 70 years. Senior CTM leaders also held leadership positions within the party and seats in Congress (Bensusán and Middlebrook, 2012).[8] Advocates of paper unions viewed them as providing economic stability for firms by preserving managerial control over wage setting and preventing representative unions from entering the workplace. This perceived flexibility was promoted as an advantage of the Mexican labour market, but came at the cost of weakening genuine collective bargaining and contributing to low wage growth (Bensusán, 2020).

In summary, paper unions were a common feature of the Mexican labour market and operated as a device to forestall the threat of unionization rather than as instruments of worker representation. From the firm's perspective, they provided a valuable service by blocking the entry of a worker-aligned union into the workplace, in exchange for a recurring payment to the paper union that scaled with firm size. From the workers' perspective, they provided no representation at the bargaining table, so wages under paper-union CBAs were set unilaterally by the employer, similar to a non-union setting.

2.2. The 2019 Labour Reform

The reform introduced two main changes in the Mexican union system to guarantee that workers are represented during collective bargaining. First, to eliminate the stock of CBAs signed between employers and paper unions, the reform established a one-time legitimization process under which all existing CBAs had to be ratified by a majority of the workers they covered through a secret vote within a four-year period ending in May 2023.[9] CBAs that unions did not submit to a vote by the deadline, or that workers rejected, were terminated, leaving the door open for workers to organize a new representative union.

Secondly, to close the legal loophole that allowed employers and paper unions to sign CBAs without workers' consent, the reform introduced new requirements both to form a union and to register a new CBA. Workers interested in forming a union must now hold a secret ballot to elect their representatives and submit, among other documents, a roster of members with their national identification number (CURP) and proof of employment status (e.g., payroll stubs) to obtain the legal certification as a union. More importantly, certification alone no longer confers bargaining rights. To sign a new CBA, a union must first obtain a certificate of representativeness (*constancia de representatividad*) by demonstrating the support of at least 30% of the workers to be covered by the contract. The application to obtain this new certificate involves ten different requirements, including a list of workers with their name, CURP, hiring date, and handwritten signature. The procedure itself takes between fifteen and thirty days to complete, in addition to the time required to assemble the

[8]The *Confederación Revolucionaria de Obreros y Campesinos (CROC)* and the *Confederación Regional Obrera Mexicana (CROM)* were two other major confederations embedded in Mexico's state-party labour system. The CROC was affiliated with the PRI from its creation in 1952, while the older CROM had developed close ties with post-revolutionary governments since the 1920s and later became part of the PRI-aligned official labour movement (Paczyńska, 2007).

[9]Firms that had registered their intention to hold a legitimization vote but were unable to conduct it before the May 2023 deadline were allowed to hold the vote in June or July 2023.

supporting documentation. Once issued, the certificate is valid for six months, during which the union must negotiate a CBA with the firm. The resulting CBA, as well as any subsequent revision, must then be approved by a majority of workers through a secret ballot. Together, these measures effectively targeted unrepresentative unions, but at the same time increased the cost of unionization for workers.[10]

The reform created the CFCRL to supervise the legitimization process and enforce the new rules of collective bargaining. This new institution centralized the registration of unions and is in charge of issuing certificates of representativeness.[11] Given the scale of the institutional transformation, however, CFCRL was gradually introduced across the country. The final stage took effect in October 2022 and covered Mexico's largest and most economically relevant states, including Mexico City, Nuevo León, and Jalisco.[12] Although the reform was enacted in May 2019, most of the new rules of collective bargaining became operational only until the CFCRL was introduced across states. Additionally, enforcement in the new system was complemented by the USMCA's Rapid Response Labor Mechanism (RRM), which allows the U.S. or Canada to initiate proceedings when workers at Mexican facilities report being denied freedom of association. Under RRM, violations of workers' collective-bargaining rights can lead to the suspension of preferential tariffs and denial of entry of goods to the U.S. or Canada (Sadka, 2026).[13] Importantly for our research, the universe of CBAs was digitized and made public through CFCRL's *Repositorio de Información del Registro Laboral (RIRL)*.

Figure 1 illustrates the bite of the reform in terms of legitimized and new CBAs. For the period May 2019 to July 2023, we plot the cumulative number of CBAs legitimized by workers' votes, expressed as a share of the pre-existing stock of contracts. The CFCRL estimates that approximately 139,000 historical CBAs were active before 2019. The series shows little legitimization activity between 2019 and 2022, with most voting events taking place in the last part of the four-year window, particularly after the CFCRL became operational nationwide in October 2022 (indicated by the dashed vertical line). By the end of the legitimization process, only 22% of the pre-reform stock (30,526 historical CBAs) were legitimized, 0.5%

[10]The reform also required to have proportional representation by gender in union boards and banned closed-shop arrangements that forced firms to lay off workers who stopped being union members (Secretaría del Trabajo y Previsión Social, 2019).

[11]The CFCRL also performs conciliation functions previously carried out by *Juntas de Conciliación y Arbitraje (JCA)*. And, labour disputes, previously addressed by JCA, were transferred to new labour courts to make rulings more independent and expeditious (Secretaría del Trabajo y Previsión Social, 2019)

[12]The first stage began in November 2020 and covered Campeche, Chiapas, Durango, Estado de México, Hidalgo, San Luis Potosí, Tabasco, and Zacatecas. The second stage began in November 2021 and covered Aguascalientes, Baja California, Baja California Sur, Colima, Guanajuato, Guerrero, Morelos, Oaxaca, Puebla, Querétaro, Quintana Roo, Tlaxcala, and Veracruz. The third and final stage began in October 2022 and covered Chihuahua, Ciudad de México, Coahuila, Jalisco, Michoacán, Nayarit, Nuevo León, Sinaloa, Sonora, Tamaulipas, and Yucatán.

[13]As of September 2026, the U.S. had invoked the RRM 47 times since its first use in 2021. Most cases were resolved after Mexico and the facility took corrective actions, while only five escalated to dispute settlement panels. See U.S. Trade Representative's RRM cases.

(663 CBAs) were terminated after workers explicitly voted against them, and the remaining 77.5% (more than 108,000 CBAs) expired because unions never submitted them to a vote (Secretaría del Trabajo y Previsión Social, 2023). From August 2023 onward, we add to the series the cumulative number of new CBAs deposited with the CFCRL. Notably, the expiration of non-legitimized CBAs has not been followed by a comparable increase in new contracts. By May 2026, legitimized and new CBAs account for only 32% of the pre-reform stock. This pattern is consistent with the reform increasing the cost of unionization through its new organizational requirements, an intuition we formalize in Section 6.[14]

3. Data

This section describes the three main datasets used in our empirical analysis. The first consists of confidential matched employer–employee data from IMSS, which covers the universe of private formal employment in Mexico. The second is a novel dataset on CBAs that we construct from RIRL. The third is the EAIM from INEGI, which provides detailed information on manufacturing establishments. We link the CBA data separately to IMSS and EAIM, allowing us to identify firms covered by historical CBAs and examine their outcomes before and after the reform. We describe each data source and the corresponding linkage procedures below.

Matched Employer–Employee Data. We access confidential administrative records from IMSS through Banco de México's EconLab. Upon hiring a formal worker, employers are required to register the employment relationship with IMSS, so these records provide a complete picture of the wage and employment history of the formal private sector in Mexico (Samaniego de la Parra and Fernández Bujanda, 2024).

We use worker–firm matches from IMSS in February of each year between 2017 and 2026. For firms, we observe an anonymized employer identifier, geographic location (state and municipality), and industry. For workers, we observe a unique anonymized identifier, employer, daily wage (*salario base de cotización*), age, and gender. The wage variable includes bonuses and commissions such as the annual bonus (*aguinaldo*) and vacation bonus (*prima vacacional*). It is measured before taxes and other deductions, such as union dues, and is bottom-coded at the minimum wage (MW) and capped at 25 *Unidades de Medida y Actualización (UMA)*.[15] We deflate nominal wages using the national CPI (base second half of July 2018).

To identify firms' exporter status, we link IMSS records to firm-level foreign trade data (CExt), also accessed through EconLab, which contain information on export transactions by product, trading partner, and transaction value. More importantly, EconLab has access to

[14] In line with this, recently, the CFCRL simplified the procedure for registering new CBAs by eliminating redundant documentation, including the requirement to resubmit the certificate of representativeness issued by the CFCRL itself, and reducing the maximum processing time from thirty to twenty business days (DOF, August 19, 2026).

[15] UMA is an inflation-indexed unit used in Mexico to set the monetary value of several legal and administrative thresholds. In February 2026, the share of top-coded values in our data is less than 2%.

firms' legal name (*razón social*) and tax identifier (*Registro Federal de Contribuyentes (RFC)*) since November 2018. These variables are confidential and are not available for researchers but they can be used to link IMSS data to external datasets via EconLab. One limitation of IMSS administrative records, however, is that we cannot determine whether workers who enter (exit) the dataset are coming from (moving into) unemployment, non-participation, or the informal sector.[16] IMSS data also do not contain firm balance-sheet information or workers' hours worked.

CBA Data. To measure union status at the firm level before the reform, we web-scraped the public online repository of RIRL, which contains the universe of CBAs in Mexico.[17] We draw on two sets of records from this repository. The first is the archive of historical CBAs, i.e., all agreements registered before the reform. For each historical CBA, we collect the firm's legal name (*razón social*), the name of the union that signed the agreement, and the state and date of registration. The second is the set of legitimized CBAs, that is, historical CBAs that were subsequently ratified by workers through a validation vote. For each legitimized CBA, we collect the date of the vote, the name of the union conducting it, and the firm's legal name and tax identifier (RFC). Because only pre-existing agreements could be legitimized, firms with a legitimized CBA are a subset of firms with an historical CBA. However, legitimized records complement the historical data by providing an extra piece of information: the firm's RFC. Unlike the firm's name, which is the only identifier available in historical records, the RFC allows a more accurate link to IMSS data. In both datasets, we drop records with missing or invalid employer names or RFCs and remove duplicate observations.[18] RIRL data were accessed between May and October 2024. Our contract datasets contain 423,458 historical and 29,534 legitimized CBAs.

We link each dataset to the matched employer–employee data using the available firm identifier, matching historical CBAs by firms' legal names and legitimized CBAs by RFC. We provide EconLab with the CBA data containing these identifiers, and they perform the linkage internally using the confidential data of firms. Employer identifiers are first cleaned and standardized by removing special characters and converting text to uppercase. Exact matches are then performed using RFCs (when available) and firms' legal names. For records that remain unmatched, EconLab applies the Jaro–Winkler string-similarity algorithm to legal names and retains matches that meet a 98% similarity threshold. We match 177,969 of the 423,458 historical CBAs (42%) and 28,079 of the 29,534 legitimized CBAs (95%).[19] Our number of matched CBAs associated with a firm with at least one worker registered in IMSS in February 2019 is 152,101, which is very close to CFCRL's estimate of

[16] According to ENOE, 55% of the Mexican workforce was informal in the second quarter of 2026.

[17] The archive can be accessed at https://repositorio.centrolaboral.gob.mx.

[18] Removing duplicates and observations with invalid names or RFCs of firms reduces the number of observations by 17.4% and 3.1% for historical and legitimized CBAs, respectively.

[19] The lower match rate for historical contracts reflects the longer period they cover: firms' legal names appear in IMSS records only from November 2018 onward, so firms that exited the formal sector or changed their legal name before that date cannot be linked by name. The matching strategy using RFC from legitimized CBAs helps to mitigate the latter problem.

139,000 active CBAs pre-reform (Secretaría del Trabajo y Previsión Social, 2023). We then define a union firm in IMSS data as a firm that is linked to at least one CBA, either through the historical or legitimized records, and as non-union otherwise.

Under this definition, 25.1% of all firms with at least 10 employees registered with IMSS in February 2019 are classified as union firms. These firms employed more than 10 million workers, equivalent to 54% of formal employment in that period. Because not all workers within a union firm are union members (e.g managers or directors), our estimate for the number of workers in a firm with an historical CBA in 2019 should be interpreted as an upper bound on the number of unionized workers. This view is consistent with the estimates provided by ENOE, which indicates that approximately 4.5 million workers reported being union members in the first quarter of 2019. To the best of our knowledge, there isn't any official estimate of the share of firms covered by a CBA for this period.

Although our data do not capture union membership at the worker level, they offer several advantages over survey-based measures (such as ENOE) that are commonly used to study unions in Mexico. For instance, in some cases employers sign CBAs with paper unions without workers' knowledge, so workers may be unaware that their workplace is covered by a CBA. Union membership based on self-reported information may therefore underestimate actual union coverage (Fairris, 2003). Our measure, derived from the universe of registered CBAs rather than from workers' reports, identifies union firms regardless of whether workers know they are covered or not by a CBA. In addition, our data identify union status for the full population of formal firms rather than for a sample of workers and, through its linkage to IMSS administrative records, allow us to follow workers and firms over long time spans, something that cannot be done with current survey data.

Finally, to conduct our main heterogeneity analysis, we combine contractual characteristics with IMSS data for a subset of 84,601 successfully matched historical CBAs. For these contracts, we download and process the text of the pdfs, extracting features that the literature associates with paper unions. First, because CBAs signed by these unions were often brief documents that merely reproduced the minimum benefits required by the labour law, we measure contract length and construct indicators for extra-legal benefits, including scholarships for workers' children, vacation and year-end bonuses above the statutory minimum, and food benefits (Bensusán *et al.*, 2007; de Buen Unna, 2013). Secondly, we identify closed-shop clauses, which allowed paper unions to exercise control over workers by making employment conditional on union membership (Bouzas Ortíz, 2009; Bensusán and Middlebrook, 2012). Third, we identify whether the signing union belongs to a broader union confederation and if it was present in more than five industries (the sample median), capturing the business-oriented model of paper unions whose leaders often operated across otherwise unrelated sectors (Bensusán *et al.*, 2007). Lastly, we construct an indicator for indefinite-duration CBAs, capturing agreements that could remain in force even in the absence of active negotiations, a feature exploited by employers and paper unions to prevent

real unionization (de Buen Unna, 2013). Appendix B describes the extraction and validation procedure of these characteristics in detail.

Annual Manufacturing Survey. To examine the effects of the reform on additional outcomes, we use confidential data at the establishment-level from INEGI's EAIM. The EAIM is a key source of information for tracking the evolution of Mexico's manufacturing sector, collecting annual data on employment, wage bill, revenue, intermediate input consumption, and fixed assets. Unlike IMSS, EAIM allows us to examine the effects of the reform on firms' economic performance, particularly profits. We construct a measure of profits as total revenue minus labour cost, other intermediate input consumption, and capital depreciation. We deflate all nominal variables using the national CPI (base second half of July 2018). Our baseline analysis uses a balanced panel of 7,766 manufacturing establishments observed annually between 2021 and 2024.

To identify establishments associated to firms with an historical CBA, we link the CBA data to EAIM in two steps. First, we obtain establishments' legal names and unique identifiers (*Clave Estadística Empresarial (CLEE)*) from the May 2021 edition of INEGI's National Statistical Directory of Economic Units (*Directorio Estadístico Nacional de Unidades Económicas (DENUE)*). Second, to guarantee consistency between the matching procedures, we provide EconLab with the DENUE records, which they match internally to the CBA data using the same procedure described above for the IMSS data. EconLab then returns the CLEEs of successfully matched establishments, which we provide to INEGI's Microdata Laboratory to create the CBA dummy in EAIM. We classify establishments linked to at least one historical CBA as union establishments and the remaining establishments as non-union.

4. Empirical Strategy

This section presents our matched difference-in-differences design to estimate the impact of the labour reform in Mexico. It also describes the main outcomes analyzed and discusses the main identification assumptions.

Econometric Specification. To estimate the causal effect of the reform, we exploit the introduction of CFCRL in Mexico's largest states in October 2022 and use a matched DID design, comparing changes in outcomes between pre-reform union (treated) and non-union (control) firms. Because we use IMSS data from February of each year, February 2022 is the last pre-treatment period in our sample, and February 2023 is the first post-treatment period. We thus estimate the following event-study specification:

$$y_{j,t} = \psi_j + \delta_t + \sum_{\substack{r=2017 \\ r\neq 2022}}^{2026} \beta_r \times D_j \times 1\{t = r\} + \varepsilon_{j,t}, \tag{1}$$

where j denotes firms and t calendar years, $y_{j,t}$ is one of the outcomes of interest in firm j and year t (e.g. mean log wages), D_j is a dummy variable that takes the value of one if firm j is treated (union firm), and zero otherwise (non-union firm). ψ_j and δ_t are firm

and year fixed effects, respectively. The coefficients β_r are our parameters of interest and capture the difference in $y_{j,t}$ between union and non-union firms in year r, relative to the same difference in 2022, the last pre-treatment year, which is normalized to zero. $\varepsilon_{j,t}$ is the error term, and standard errors are clustered at the firm level.

Sample and Matching. To construct firm-level measures, we aggregate the characteristics of workers aged 15–65 in the firm in each period, where workers holding multiple jobs are assigned to their highest-paid job. Multi-establishment firms are assigned the modal municipality, state, and industry of their workers. We restrict the sample to firms with at least one worker in every year from 2018 to 2022 and with at least 10 employees in both 2017 and 2022.[20] We exclude firms that legitimized a CBA on or before February 2022, our last pre-treatment period, as well as firms in the construction sector given the project-based nature of their collective agreements. To alleviate concerns about potential confounding from the 2021 outsourcing reform, we also drop those firms experiencing an absolute net flow of workers larger than 20 employees between May and August 2021 (Casco *et al.*, 2024).[21] We provide more details about this last point in the discussion of identification below.

The pool of treated firms consists of union firms (with a pre-reform CBA), as described in Section 3. To construct a comparable control group, we implement a one-to-one matching strategy without replacement, where each treated firm is paired with a firm from the pool of non-union firms (without a CBA pre-reform) (Stepner and Garland, 2017). We match exactly on state, industry, an indicator for location in the northern border free zone (ZLFN), exporter status, and firm age in 2022. We also apply caliper matching (with bandwidths equal to one-half of each variable's standard deviation) on employment growth between 2017 and 2022, log employment in 2022, and the share of workers in year t earning below the year $t+1$ minimum wage, for $t = 2018, \ldots, 2022$. For all outcomes except survival in the formal sector, we further restrict the estimation sample to matched pairs in which both treated and control firms remain in the formal sector (i.e. they have at least one worker registered in IMSS) throughout the post-reform period. As we show in Section 5, the reform has no significant effect on the extensive margin, so conditioning on survival does not affect our estimates.

Table 1 presents summary statistics for the full and matched samples as of February 2022. Columns (1) and (2) show the average characteristics of treated (union) and control (non-union) firms before matching. Union firms are, on average, more than twice as large as non-union firms and pay higher wages. They are also more likely to export to the U.S. and Canada (by 8 pp), to operate in manufacturing (13 pp) and in the Center region (14 pp), and exhibit a lower share of workers earning below the 2023 MW (27% versus 39%). Columns (4) and (5) present the characteristics of the matched sample, which contains 7,515 treated

[20] For firms not observed in IMSS in 2017, we use 2018 as the base year instead.
[21] The net flow is computed at the *registro patronal* level as in Casco *et al.* (2024).

and 7,515 control firms (about 30% of the full sample of union firms).[22] After matching, all statistically significant differences between the two groups disappear, where the covariates used in the matching procedure (employment, the share of workers earning below the 2023 MW, region, industry, and exporter status) are balanced by construction.

An important result shown in Table 1 is how the average pay gap between union and non-union firms changes once the sample is balanced on observables. Before matching, column (3) shows that union firms exhibit 12.5% higher mean log daily wages on average than non-union firms, in line with the 15% pay premium of private union firms documented in Canada by Beauregard *et al.* (2025). However, as shown in column (6), this difference becomes small and statistically insignificant after matching, suggesting that the raw pay gap between these firms largely reflects differences in observable characteristics such as firm size, location, and industry. Although this comparison is descriptive, the absence of a significant pay differential among similar union and non-union firms is consistent with the view that many pre-reform CBAs were associated with paper unions and provided workers with little, if any, wage benefits. The legitimization outcomes of these union firms point in the same direction as 71% of them did not legitimize their CBA in the matched sample, echoing the low legitimization rates documented in Section 3.

Main Outcome Variables. Our main analysis focuses on four key firm-level outcomes:[23] i) mean log wages, calculated as the average of workers' log real daily wages within the firm, ii) log formal employment, calculated as the log of the number of formal workers registered at the firm, iii) log wage bill, computed as the log of the sum of real daily wages across all workers registered at the firm, and iv) formal-sector status, a binary indicator equal to one if the firm has at least one worker registered in IMSS and zero otherwise.[24]

We complement these outcomes by analyzing employment composition and worker flows. First, we decompose employment into low, middle, and high-paid employment, defined as the number of workers earning less than two, between two and five, and at least five times the 2024 MW, respectively. Second, we measure entrants and separations, computed by comparing the firm's workforce in February between consecutive years. Entrants are further decomposed into low, middle, and high-paid entrants using the same wage thresholds. Finally, we measure hires from outside the formal sector, defined as the number of workers registered at the firm in February of year t who were not employed in the formal sector in February of year $t-1$. To deal with zeros, we normalize these variables by the employment level of the firm in the reference period (February 2022).

[22] Section 5.4 reports an alternative specification that replaces exact matching on state and industry with state-by-year and industry-by-year fixed effects in the event-study regression. This raises the share of matched treated firms to 79.4%, while leaving our main findings unchanged.

[23] We aggregate worker-level data in IMSS at the RFC level rather than at *registro patronal* since our main union indicator is defined at that level.

[24] To construct formal-sector status, we complete the unbalanced panel of matched firms by assigning a value of zero to this outcome in years when a firm does not have any workers registered in IMSS.

Identification. To interpret the post-reform coefficients β_r from the event-study regression (1) as the average causal effect of the reform on $y_{j,t}$ among union firms r years after its implementation, we rely on the standard parallel trends assumption. In our context this assumption implies that the outcomes of union and non-union firms would have evolved in parallel in the absence of the reform. Because treated and control firms are matched on pre-reform characteristics, our matched-DID design invokes conditional rather than unconditional parallel trends as its main identifying assumption (Heckman *et al.*, 1997; Smith and Todd, 2005). Although this is untestable, we follow the convention in the literature and assess its plausibility by examining the evolution of outcomes prior to 2022, with particular attention to variables not directly targeted by the matching procedure (e.g. mean log wages).

We identify two main threats to identification in our setting. The first is contamination of the control group. If the reform also affected non-union firms, for instance by encouraging their workers to organize and sign new CBAs, non-union firms would no longer provide an appropriate counterfactual for union firms. However, in practice, we view this concern as limited. Less than 1% of firms in our control group have signed a new CBA post-reform, consistent with the low rate of new CBAs shown in Figure 1.

The second threat arises from two contemporaneous shocks that could confound our estimates by differentially affecting union and non-union firms. First, Mexico experienced large increases in the minimum wage beginning in 2019 (Campos-Vázquez and Esquivel, 2021; Díaz de León and Pérez Pérez, 2025). To balance firms on their exposure to these increases, our matching procedure includes the share of workers whose current wage lies below the following year's minimum wage, between 2018 and 2022. Secondly, in 2021, Mexico implemented an outsourcing reform, prohibiting the outsourcing of workers performing firms' core activities and inducing substantial worker flows from outsourcing companies to the firms where these workers actually performed their jobs (Estefan *et al.*, 2026). To limit contamination from this reform, we exclude potentially affected firms and drop those with an absolute net worker flow of more than 20 employees between May and August 2021 (Casco *et al.*, 2024). In addition, our matching procedure accounts for differences in how treated and control firms responded to this reform by pairing union and non-union firms with similar employment growth between 2017 and 2022.

Lastly, a related concern arises if the Covid-19 pandemic impacted union and non-union firms asymmetrically. In that case, we would expect more accentuated effects in more exposed firms. To test this, we follow Estefan *et al.* (2026) and include a robustness check estimating the effects of the reform separately for essential and non-essential industries. Essential industries include those operating during the March-May 2020 lockdown and those that were allowed to resume operations in early June 2020, while non-essential industries experienced longer disruptions and were allowed to resume their activities gradually. All these results are presented in the next section.

5. Results

This section presents our main findings. Section 5.1 reports the firm-level effects of the reform on our main outcome variables, and Section 5.2 unpacks the employment response. Section 5.3 presents our heterogeneity analysis by CBA and union characteristics, and Section 5.4 presents our robustness checks.

5.1. The Impact of the 2019 Reform on Union Firms

Wages. We begin by analyzing the effects on union firms' wages, the primary outcome targeted by the reform. Panel (a) of Figure 2 presents the results. Prior to 2022, there is no evidence of differential wage growth between union and non-union firms, supporting our research design. In the post-reform period, we find no statistically significant effect on the mean log daily wage of union firms. The raw means, displayed in panel (a) of Figure C1 in Appendix C, confirm this pattern. Mean log daily wages in treated and control firms evolved closely throughout the sample period, rising from roughly 5.6 to 5.9 between 2017 and 2026. This finding suggests that most union firms were already paying wages close to those of comparable non-union firms before the reform, so the cancellation of their CBA after May 2023 left wages essentially unchanged.

Figure C3 in Appendix C provides additional evidence consistent with the absence of a wage effect. Panel (a) shows similar null effects for mean log wages of workers who remain employed at the same firm throughout the sample period ("stayers"), while panel (b) shows no statistically significant effects for different percentiles of the within-firm wage distribution. In panel (c), we re-estimate our baseline specification in (1) but this time weighting firms by their employment level in the reference period (February 2022). The resulting estimates remain statistically indistinguishable from zero. Lastly, following recent advances in the AKM literature (Lachowska *et al.*, 2023; Engbom *et al.*, 2023; Bergolo *et al.*, 2025), we decompose the wage effect into changes in firm-specific pay premia and in the average quality of the workforce by estimating a Time-Varying AKM (TV-AKM) specification.[25] We then use the time-varying firm fixed effects and the firm-level average of worker fixed effects as dependent variables in equation (1). The results, displayed in panel (d) of Figure C3, show no substantial effect on either outcome. If anything, we find a slight decline in average worker quality at union firms. The absence of any increase in the firm fixed effect of treated firms suggests that the reform has not induced an increase in the average bargaining power of workers at union firms after its implementation (Beauregard *et al.*, 2025).

[25] More precisely, we fit the following TV-AKM model:

$$\log(w_{i,t}) = \alpha_i + \psi_{j(i,t),t} + \boldsymbol{\eta}' \boldsymbol{X}_{i,t} + e_{i,t},$$

where $\log(w_{i,t})$ is the log daily real wage of worker i at time t, α_i is worker i fixed effect, $\psi_{j(i,t),t}$ is the time-varying firm fixed effect of firm $j(i,t)$ at t, $\boldsymbol{X}_{i,t}$ includes a cubic term in age, and $e_{i,t}$ is the error term. The effects $\{\psi_{j,t}\}$ are identified, up to a normalization, within the largest connected set of firm-year pairs linked by workers' transitions. Under this reinterpretation, workers who switch employers identify differences in pay premia across firms, while stayers act as "movers" between pairs $(j, t-1)$ and (j, t) (Engbom *et al.*, 2023).

Employment. Next, panel (b) of Figure 2 presents the results for log employment. We estimate a positive effect on employment at union firms that goes from 1% in 2023 to 3.6% by 2026. The 2026 estimate translates into approximately 3 additional workers relative to the average size of treated firms in 2022. Panel (b) in Figure C1 displays the average log employment by treatment group in the matched sample. Between 2017 and 2022, treated and control firms evolve in parallel, both experiencing a similar drop during the Covid-19 pandemic in February 2021. After 2023, however, the gap between the two groups widens, starting at 0.075 in 2022 and reaching 0.112 by 2026. Panel (b) of Figure C2 presents the series in levels. Between 2022 and 2026, the average size of control firms remained roughly stable at around 74 workers, while average employment of treated firms increased from 77 to 81 workers. This pattern is consistent with union firms paying a per-worker fee to paper unions for their services (Bensusán *et al.*, 2007). Once the reform dissolved these agreements, the marginal cost of labour at these firms fell, and firms responded by expanding employment. Below, we show that these employment gains are concentrated among low-paid workers and operate through the hiring margin.

Wage bill. Our third main outcome variable is the log wage bill, defined as the log of the sum of real daily wages of all workers in the firm. Panel (c) of Figure 2 presents the event-study estimates. There is a marginally significant pre-trend in 2017, but it fades out as we move closer to 2022. After this, the wage bill of union firms increases by 1.1% in 2023 and grows to 3.1% by 2026. Evaluated at the mean wage bill of treated firms in 2022 ($34,670 MXN per day - $1,806 USD per day), the 2026 estimate corresponds to an annual increase of approximately $20,400 USD (392,000 MXN) in the wage bill. The raw means by treatment group are shown in panel (c) in Figure C1. Consistent with the evidence from the event-study, treated and control firms evolve in parallel before the implementation of the reform in 2022 and diverge thereafter. By 2026, the average log wage bill of union firms exceeds that of non-union firms by roughly 0.124. Given the absence of wage effects documented above, the growth in the wage bill is driven by the expansion of employment at union firms.

Survival in the Formal Sector. Lastly, we examine whether the reform pushed union firms out of the formal sector. This margin is of particular interest since advocates of paper unions claimed that this "flexibility" of the Mexican labour market (which allowed employers to forestall real unionization and have full control over wage setting) was necessary to attract firms and keep them operating in the formal sector. Panel (d) of Figure 2 reports the event-study estimates for an indicator equal to one if the firm has at least one worker registered in IMSS in a given year, and zero otherwise. The coefficients for 2018–2022 are zero by construction, as we restrict the sample to firms observed in IMSS throughout this period. After 2022, we don't find evidence that the reform reduced the probability of union firms remaining in the formal sector. If anything, their survival probability is about 1 pp higher by 2026. Panel (d) in Figure C1 displays the underlying raw means by treatment group. From 2022 to 2026, the share of treated firms remaining in the formal sector falls by 6.7 pp (from 1 to 0.933), compared with a slightly larger decline of 7.7 pp (from 1 to 0.923)

among control firms. Thus, contrary to the idea that paper unions were necessary to keep firms in Mexico, eliminating many of their CBAs and closing the loopholes that allowed them to proliferate did not drive incumbent union firms out of the formal sector. This finding is also consistent with the reform increasing the cost of forming a union, which reduced the incentives for workers at these firms to unionize even after their CBA was cancelled.

5.2. Unpacking the Employment Effects on Union Firms

To better understand the employment response to the reform, we now examine which workers account for these gains. We split firm-level employment in each year into workers earning less than two (low-paid), between two and five (middle-paid), and five or more times (high-paid) the 2024 federal minimum wage.[26] To deal with zeros, we use as outcome variable the number of workers in each group divided by the firm's employment level in 2022. Figure 3 reports the results. Low-paid employment accounts for close to 70% of the overall employment increase by 2026, while middle-paid employment rises only modestly, by about 1.4% at the end of the sample period. For high-paid employment, we cannot reject a null effect following the reform. These findings align with the main employment results, suggesting that removing paper-union arrangements reduced employers' costs and encourage them to expand employment post-reform. At the same time, the concentration of gains among low-paid workers, who tend to be more inclined to unionize (Taschereau-Dumouchel, 2020), is consistent with the reform increasing the cost of forming new unions. Indeed, despite the termination of many CBAs and the expansion in employment, relatively few places have signed new CBAs (as shown in Figure 1), suggesting that the new requirements have limited subsequent unionization. Figure C5 in Appendix C further shows that the employment gains are driven by increased hiring rather than reduced separations, with new hires concentrated among low-paid workers as before. Union firms are also 2.3 pp more likely to hire a non-formal worker by 2026, suggesting that part of the employment expansion draws workers into the formal sector rather than just reshuffling workers that were already formal. In addition, Figure C6 shows that the employment expansion is driven by prime-age workers (25–54) and that the gains are similar for men and women.

5.3. Are the Employment Effects Driven by Firms Whose Unions Exhibit Characteristics of Paper Unions?

An important question is whether the employment effects documented above are driven by firms with paper unions. Our treatment group includes all firms with a pre-reform CBA, some of which may have had a truly representative union before the reform. Since we cannot identify firms with paper unions deterministically, we conduct two empirical exercises to provide suggestive evidence on this question. First, we examine whether the effects are concentrated among firms whose CBAs and unions display characteristics that the literature

[26] In 2024, the federal minimum wage in Mexico was $248.93 MXN per day (approximately $13.58 USD), equivalent to $31.12 MXN per hour ($1.70 USD) for an eight-hour workday.

associates with paper unions. Second, we estimate a logistic regression to predict the probability that a CBA was not legitimized and examine whether employment effects are larger among firms with a higher predicted probability of non-legitimization.

Heterogeneity by CBA and Union Characteristics. CBAs of paper unions are characterized by providing only the minimum benefits required by the labour law (Bensusán *et al.*, 2007; de Buen Unna, 2013). So, we begin by dividing treated firms (together with their matched controls) into two groups based on whether their historical CBA included at least one of the following extra-legal benefits: scholarship support for workers' children, an annual or vacation bonus above the legal minimum, or food benefits, which are items that a paper union would not create for workers. Panel (a) of Figure 4 reports the estimated effects on log employment for each group. We find larger employment effects among firms whose CBAs did not provide any of these extra-legal benefits (4.1% by 2026), whereas the point estimates are smaller and statistically insignificant among firms whose CBAs included at least one extra-legal benefit. Panel (b) examines heterogeneity by the presence of closed-shop clauses in the CBA, defined as clauses that explicitly state that the union is in charge of providing workers to fill new vacancies or that the worker must be separated from her job if she stops being a union member. As discussed in Section 2.1, these clauses gave paper unions full control over workers and were used to discourage them from challenging the incumbent union. For this dimension, we don't find clear evidence of differential effects on log employment between the two groups post-reform.

In panel (c) of Figure 4, we split firms according to whether their union was affiliated with one of the three major confederations historically linked to Mexico's political system: CTM, CROC, or CROM. These confederations are known for their undemocratic union practices and many paper unions belonged to them (Bensusán and Middlebrook, 2012). The estimates indicate that firms with a CBA signed by a union affiliated with one of these confederations experienced larger employment effects post-reform. Specifically, for these firms, employment increases by 4.8% in 2026, whereas we find no statistically significant effects among firms with independent unions or unions affiliated with other confederations. Lastly, panel (d) examines the heterogeneity of employment effects by the scope of unions' operations. As mentioned in Section 2.1, paper unions tend to operate across many unrelated industries, providing firms with CBAs that prevent real unionization rather than representing workers in any particular sector or firm. We therefore separate firms by whether their union appears in more than five industries (the sample median). In line with the patterns shown in panels (a) and (c), the post-reform employment response among firms whose union operates in many industries is about 2 log points larger on average than among firms whose union operates in five or fewer. Overall, these findings suggest that the employment gains are driven by firms whose CBAs provided only minimal benefits to workers and whose unions were affiliated with CTM/CROC/CROM confederations or operated across many industries, characteristics commonly associated with paper unions (Bensusán *et al.*, 2007; Bensusán and Middlebrook, 2012; de Buen Unna, 2013). We provide additional results by

firm size, region, exporter status, and for the manufacturing sector in Figures C7 and C8 in Appendix C.

Heterogeneity by Propensity to Not Legitimize. Another relevant dimension along which to explore heterogeneous effects is the outcome of the legitimization process. Paper unions, anticipating that workers would reject their CBAs, are less likely to call for a legitimization vote. However, splitting treated firms by whether their CBA was actually legitimized is problematic since this variable is a post-treatment outcome and conditioning on it would introduce selection bias in the resulting estimates. To avoid these issues, we instead first construct a predicted probability of non-legitimization based on pre-reform contractual and firm-level characteristics, and then split the sample of treated firms along this measure. Specifically, we estimate the following logistic regression at the CBA level:

$$Pr\left(\text{CBA not legitimized}_c = 1 \mid \boldsymbol{X}_c\right) = \frac{1}{1+\exp\{-\boldsymbol{\gamma}'\boldsymbol{X}_c\}}. \tag{2}$$

Where c indexes CBAs and $\boldsymbol{X}_c$ includes indicators for an indefinite-term CBA, closed-shop clauses, scholarship support for workers' children, whether the union operates in more than five industries (the sample median), an annual bonus above the statutory minimum, contract-length quartiles, as well as characteristics of the firm signing the contract such as log employment, exporter status to the U.S. and Canada, industry, and state. To estimate (2), we use the sample of historical CBAs for which we obtained the contractual characteristics described in Section 3, dropping duplicates and combining it with firm characteristics from IMSS in February 2019. Table D1 in Appendix D reports summary statistics for the resulting sample of CBAs.

Before turning to the heterogeneity results, we show how the non-legitimization outcome correlates with a subset of the characteristics used to estimate (2).[27] Figure 5 presents the corresponding average marginal effects (AMEs), ordered from the covariate with the largest reduction on the probability of non-legitimization (top) to the one with the largest increase (bottom). We document that exporting to the U.S. or Canada is the strongest predictor of legitimization, reducing by 16.5 pp the probability of CBA non-legitimization. This pattern reflects the stronger incentive among exporters to comply with the new rules of collective bargaining, given their greater exposure to the new enforcement mechanisms under the USMCA (RRM). CBAs that provide benefits above the legal minimum are also more likely to be legitimized. For instance, having an annual bonus above the legal minimum or scholarship support for workers' children reduces the probability of non-legitimization by 8.3 and 5.8 pp, respectively. In contrast, CBA features associated in the literature with paper unions are positively associated with the non-legitimization outcome. In particular, closed-shop clauses and indefinite-duration contracts increase this probability by 2.5 and 3.5 pp, respectively, while short contracts (1–12 pages) and agreements signed by unions operating in more than five industries increase it by 3.6 and 4.1 pp, respectively. We also find that non-legitimization is 9.8 pp more likely in construction and 11.9 pp more likely in Nuevo León,

[27] Figure C9 in Appendix C presents the average marginal effects for the full set of covariates.

a state historically known for employer-aligned unions (Bensusán *et al.*, 2007). It is worth highlighting that construction is a special case because many of its CBAs are project-based, so a non-legitimized agreement in this sector may reflect the completion of the underlying project rather than a decision by the union not to submit it to a vote.

We next use the fitted probabilities from (2) to examine whether the employment effects are concentrated among firms with a higher propensity to not legitimize their CBAs. To do so, we first collapse the fitted probabilities to the firm level by taking the average across all CBAs associated with each firm.[28] Then, we divide treated firms (together with their matched controls) into terciles of the average predicted probability of non-legitimization and separately estimate a static DID version of (1) for each subsample. Figure 6 reports the results, plotting the estimated DID coefficients against the actual share of CBAs legitimized within each tercile. Panel (a) shows that the absence of wage effects holds across all three terciles. In contrast, panel (b) shows that the employment effects are larger among firms with a higher predicted probability of non-legitimization. More precisely, employment increases by 3% in the middle tercile and 4.5% in the highest tercile, whereas the effect is statistically insignificant in the lowest tercile. These findings reinforce the evidence presented above that employment gains are concentrated among firms whose CBAs exhibit characteristics associated with paper unions. They are also consistent with our proposed mechanism: the elimination of paper-union arrangements reduced firms' marginal cost of labour, allowing them to expand employment without increasing wages.

5.4. Robustness Checks

Covid. The Covid-19 pandemic falls within our period of analysis, so a potential concern is that our estimates capture differential post-pandemic recovery between union and non-union firms rather than the effect of the reform. We address this concern in two ways. First, our matching procedure directly incorporates employment growth between 2017 and 2022, which guarantees that treated firms and their matched controls exhibit similar employment dynamics over the pandemic period. In particular, panel (b) in Figure C2 shows that employment at treated and control firms fell similarly during the pandemic and evolved in parallel through 2022.

[28] Figure C10 in Appendix C plots the firm-level distribution of the predicted probability of non-legitimization and shows how firm size and wages vary along it. The density is skewed toward high probabilities, consistent with the fact that most historical CBAs were not legitimized, and firms with a higher predicted probability tend to be smaller and pay lower wages. Figure C11 further examines the union wage premium along this distribution. Panel (a) reports estimates from a Mincerian regression of log wages on quintile indicators of the predicted probability, with non-union workers as the omitted category. We find that the premium is largest in the bottom quintile and is statistically indistinguishable from zero in the upper part of the distribution. Panel (b) reports estimates from a RIF regression on the Gini coefficient, which measures how wage inequality in the formal sector would change if non-union workers were reallocated to union firms in each quintile. Results indicate that the Gini coefficient falls (from 0.452 to 0.412) only when non-union workers are reallocated to union firms in the bottom quintile.

Secondly, we examine whether our results are driven by industries that were more exposed to pandemic disruptions. Following Estefan *et al.* (2026), we estimate the employment effects separately for essential and non-essential industries. Essential industries include activities that continued operating during the March–May 2020 lockdown or were allowed to resume operations in early June 2020, whereas non-essential industries faced longer shutdowns and a more gradual reopening.[29] If our post-reform estimates were driven by an asymmetric recovery from the pandemic, we would expect larger effects in non-essential industries, which experienced the most severe disruptions. Figure 7 shows that this is not the case. We find that the employment gains are larger among essential industries and less pronounced among non-essential industries. Together with our earlier finding that the employment response is driven by prime-age workers, this evidence makes a differential post-pandemic recovery an unlikely explanation for our results.

Additional Robustness. We conduct three additional robustness exercises for our main wage and employment results. First, because the CFCRL was introduced gradually across states, firms located in states covered by the first two implementation stages may have already been partially exposed to the new institutional framework before our October 2022 treatment date. We therefore restrict the sample to firms located in the eleven states that entered the third and final implementation stage, for which the CFCRL became operational in October 2022. Second, we assess whether the linkage between the historical CBA records and IMSS data affects the composition of our control group. Our baseline linkage classifies a firm as unionized when its legal name in the historical CBA records can be matched to IMSS with a Jaro–Winkler similarity score of at least 0.98. If this threshold is too restrictive, some union firms may remain unmatched and consequently be misclassified as non-union controls. We address this concern by lowering the similarity threshold to 95% and reestimating the reduced-form results using the same procedure as in our baseline analysis. Lastly, to assess whether our results are sensitive to the matching rate (30%) in our main sample, we relax the matching procedure. Rather than requiring exact matches on state and industry, we include state-by-year and industry-by-year fixed effects in the DID regression, which increases the share of matched treated firms to 79.4%.

Figure 8 reports estimates from the static version of the DID specification in (1) for mean log daily wages and log employment, under each robustness exercise. Across all three exercises, we continue to find no significant effects on wages and positive employment effects of similar magnitude to our baseline estimate (2.1%). Finally, we test whether our main results in Figure 2 are sensitive to the use of a balanced panel by re-estimating equation (1) using the unbalanced panel of matched firms. Figure C4 in Appendix C presents the results. The

[29] We classify industries following the federal government's reopening plan ("Nueva Normalidad"), announced in May 2020. Essential industries comprise agriculture, mining, utilities, construction, food and pharmaceutical manufacturing, transportation equipment, transport and logistics, telecommunications, finance and insurance, waste management, health care and social assistance, and public safety. Since the plan lists activities rather than industry codes, we map them to three-digit NAICS codes: 111, 112, 114, 211, 212, 213, 221, 236, 237, 238, 311, 325, 336, 481–486, 488, 491–493, 515, 517, 521–525, 562, 621–624, and 931. All remaining industries are classified as non-essential.

resulting estimates closely follow our baseline results, with no significant effects on wages and positive effects on employment and the wage bill.

6. Theoretical Framework

In this section, we develop a simple theoretical framework to explain why firms engaged with paper unions and rationalize our main empirical findings on wages, employment, and the wage bill following the reform. Our work is built on the union threat literature (Taschereau-Dumouchel, 2020; Green *et al.*, 2026), but extends it by introducing paper unions as an optimal response to avoid real unionization. We derive two additional predictions from the model and verify whether they are consistent with the patterns in our data in Section 6.2. Below, we describe the main elements of the model and present the mathematical derivations in Appendix E.

6.1. The Model

Set-up. The economy consists of a fixed number of N firms, each of them characterized by a pair (ε, c), where ε denotes productivity and c the marginal cost of providing amenities to workers.[30] We assume ε and c are independent random variables drawn from distributions G and H with bounded support in $\mathbb{R}_+$, respectively. Firms produce output with a decreasing-returns-to-scale technology, $F(L) = \varepsilon L - \frac{\sigma}{2}L^2$, where L denotes employment and $\sigma > 0$ is a parameter reflecting the potential span of control issues (Green *et al.*, 2026). A firm can operate under one of three arrangements: non-union (n), union (u), or paper union (p). The arrangement determines the firm's cost per worker. Non-union firms pay only the wage w_n, while union firms pay the bargained wage w_u and, in addition, provide amenities $\psi > 0$ per worker at cost $c\psi$. Paper-union firms, in turn, respond to the threat of unionization by signing a CBA with a paper union, preventing workers from unionizing. We model the supply of this service as competitive. I.e., there is a large number of paper unions willing to sign such an agreement in exchange for a fee equal to a fraction $\tau \in (0,1)$ of each worker's wage w_p, so that the firm takes τ as given and its cost per worker becomes $(1+\tau)w_p$.[31] Taking the output price as the numeraire, profits in each case can be written as follows:

$$\pi_j(w_j, L_j) = \begin{cases} F(L_n) - w_n L_n, & \text{if } j = n. \\ F(L_u) - w_u L_u - c\,\psi\, L_u, & \text{if } j = u. \\ F(L_p) - (1+\tau) w_p L_p, & \text{if } j = p. \end{cases} \tag{3}$$

[30] Heterogeneity in the cost of providing amenities could arise from differences in local market conditions, such as the local cost of the school supplies or food that firms provide to their workers, as well as from differences in firms' human resources capabilities for implementing new benefits (Lagos, 2026).

[31] The fee is a pure transfer from the firm to the paper union and is consumed by the latter, so it affects wages and employment only through the firm's marginal cost of labour. Following the anecdotal evidence described in Section 2.1, we focus on firms' incentives to hire a paper union rather than on the behaviour of the paper union.

We assume an infinite supply of identical workers with outside option $\bar{w} = \bar{w}(w_{inf}) > 0$, which is increasing in the informal-sector wage, w_{inf}.[32] Because our analysis focuses on the optimal sorting of firms within the formal sector, we treat both w_{inf} and $\bar{w}$ as exogenous.[33] Workers have quasilinear preferences over wages and amenities, so that the value of a job paying wage w and providing amenities ψ is $W = w + a\sqrt{\psi}$, where $a > 0$ captures the workers' willingness to pay for amenities. Thus, the value of a job is $W_j = w_j$ for $j \in \{n, p\}$, and $W_u = w_u + a\sqrt{\psi}$ for the union case. Additionally, forming a union involves a one-time cost $\lambda > 0$ for each worker, which captures the organizational and legal requirements that workers must meet to establish a union. As we discuss below, the reform operates both by increasing this cost and by removing paper unions from the set of arrangements available to firms.

Labour Demand and Wage Setting. For arrangement $j \in \{n, p\}$, the firm chooses employment and the wage to maximize profits as follows

$$\max_{w_j \geq \bar{w},\, L_j \geq 0} \pi_j(w_j, L_j), \tag{4}$$

where $\pi_j(w_j, L_j)$ is given in (3). Because there is an infinite supply of workers, the non-union firm has no incentive to pay above the outside option and sets $w_n^* = \bar{w}$, hiring $L_n^* = (\varepsilon - \bar{w})/\sigma$ workers and earning profits $\pi_n^* = (\varepsilon - \bar{w})^2/2\sigma$. Firms with productivity $\varepsilon \leq \bar{w}$ cannot profitably hire any worker and remain inactive, so we restrict attention to cases where $\varepsilon > \bar{w}$. Similarly, a firm engaged with a paper union pays $w_p^* = \bar{w}$, but the fee charged by the paper union raises the marginal cost of labour to $(1+\tau)\bar{w}$, so the firm reduces employment to $L_p^* = [\varepsilon - (1+\tau)\bar{w}]/\sigma$ and obtains lower profits $\pi_p^* = [\varepsilon - (1+\tau)\bar{w}]^2/2\sigma$. The value of a job evaluated at the optimal wage in both types of firms is therefore $W_n^* = W_p^* = \bar{w}$.

Under the union arrangement, we follow Lagos (2026) and adopt a right-to-manage setting in which the firm and the union bargain over the wage and the level of amenities, while the firm retains the right to choose employment along its labour demand curve, $L(w_u, \psi) = (\varepsilon - w_u - c\psi)/\sigma$. If the parties reach an agreement, the firm produces and each worker obtains the value of a union job, $W_u = w_u + a\sqrt{\psi}$. If bargaining breaks down, the union withdraws all workers, the firm earns zero profits, and workers receive their outside option $\bar{w}$. The optimal wage and amenities are then determined by the Nash bargaining problem

$$\max_{(w_u, \psi):\, W_u \geq \bar{w}} \Big[\pi_u\big(w_u, L(w_u, \psi)\big)\Big]^{1-\beta} \Big[\Big(w_u + a\sqrt{\psi} - \bar{w}\Big)\, L(w_u, \psi)\Big]^{\beta}, \tag{5}$$

where $\beta \in (0, 1)$ denotes the bargaining weight of the union. Solving (5), yields an amenity level $\psi^* = a^2/4c^2$, which equates the marginal value of amenities to workers $\big(a/\big(2\sqrt{\psi}\big)\big)$

[32] Since Mexico doesn't have a national system of unemployment insurance benefits, formal workers who become unemployed immediately need to find a new job. The informal sector's flexibility allows it to absorb most of the people who cannot find a job in the formal labour market (Aguilar-Argaez *et al.*, 2021).

[33] Data from ENOE indicate that unionization is virtually absent in Mexico's informal sector.

with their marginal cost to the firm (c). Union firms facing a higher cost c therefore provide fewer amenities. In terms of wages, workers in union firms receive

$$w_u^* = \bar{w} + \frac{\beta}{2}\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right) - \frac{a^2}{2c},$$

where the second term captures the wage premium generated by a union job. Meanwhile, the last term shows that amenities also act as a compensating differential, i.e., when amenities are cheap to provide, the union firm offers more of them and pays a lower wage. The resulting value of a union job evaluated at the optimal wage and amenities is

$$W_u^* = \bar{w} + \frac{\beta}{2}\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right),$$

which exceeds the value of the outside option $\bar{w}$. Employment and profits at a union firm are then

$$L_u^* = \left(1 - \frac{\beta}{2}\right)\frac{\varepsilon - \bar{w} + \frac{a^2}{4c}}{\sigma} \quad \text{and} \quad \pi_u^* = \left(1 - \frac{\beta}{2}\right)^2 \frac{\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right)^2}{2\sigma},$$

respectively. We summarize the optimal values for each arrangement in Table 2.

The Decision to Form a Union. We follow Green *et al.* (2026) and use a median voter approach to model the decision of workers to unionize. Since all workers are identical, the preference of the median worker determines the outcome. This worker compares the gain from a union job against the cost of organizing, so workers decide to form a union if and only if the surplus from unionizing exceeds the cost of doing so: $W_u^* - W_n^* > \lambda$. Using the expressions in Table 2, this condition becomes

$$\frac{\beta}{2}\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right) > \lambda. \tag{6}$$

The condition (6) determines whether the firm faces the union threat. We can characterize this region in the (ε, c)–space as follows

$$\mathrm{T}(\lambda) = \left\{(\varepsilon, c) : \varepsilon \geq \bar{w} + \tfrac{2\lambda}{\beta}\right\} \bigcup \left\{(\varepsilon, c) : \varepsilon < \bar{w} + \tfrac{2\lambda}{\beta} \text{ and } c < c^u(\varepsilon, \lambda)\right\},$$

where $c^u(\varepsilon, \lambda) = a^2 / \left[4\left(\bar{w} + \frac{2\lambda}{\beta} - \varepsilon\right)\right]$. Hence, workers in highly productive firms always find it optimal to unionize because the wage premium alone covers the cost of organizing. On the other hand, workers in less productive firms unionize only if the cost of providing amenities is low enough for the firm, so that the amenities gained through bargaining compensate for the smaller wage premium. Firms with productivity and cost of amenities outside $\mathrm{T}(\lambda)$ remain non-union, whereas firms with values in $\mathrm{T}(\lambda)$ can either accommodate the union or hire a paper union to forestall workers' unionization.

Optimal Firm Sorting. The choice set of a firm with pair (ε, c) is defined as

$$\mathcal{A}(\varepsilon, c) = \begin{cases} \{u, p\}, & \text{if } (\varepsilon, c) \in \mathrm{T}(\lambda). \\ \{n\}, & \text{if } (\varepsilon, c) \notin \mathrm{T}(\lambda). \end{cases} \tag{7}$$

Anticipating whether its workers would unionize, the firm selects the available arrangement that yields the highest profits, $j^*(\varepsilon, c) = \arg\max_{j \in \mathcal{A}(\varepsilon,c)} \pi_j^*$, where π_n^*, π_u^*, and π_p^* are the optimal profits reported in Table 2.

We illustrate the optimal decision of firms using a particular example and leave the full mathematical characterization to Proposition E.1 in Appendix E.[34] Panel (a) of Figure 9 shows how firms sort across arrangements in the (ε, c)–space. Firms with productivity below $\bar{w}$ remain inactive (grey area). Among active firms, the curve $c^u(\varepsilon, \lambda)$ defines the union threat. Firms below this curve face the threat of unionization, while those above it do not. This reflects the fact that workers are more likely to organize in more productive firms, where collective bargaining generates larger wage gains, and in firms with lower amenity costs, where unions can secure additional benefits. Firms that do not face the union threat remain non-union (green area), while threatened firms choose between allowing workers to unionize and hiring a paper union to prevent workers from doing so. This choice is governed by the curve $c^p(\varepsilon, \tau)$, along which $\pi_p^* = \pi_u^*$. The union arrangement is more attractive when amenities are inexpensive to provide (below the curve in purple), while paper unions become more attractive as productivity and amenity costs increase (above the curve in orange). This is because the wage premium captured by unionized workers rises with productivity, whereas the per-worker fee charged by paper unions is a fixed share of the outside wage. Point A denotes the intersection of the two curves. To the left of A, all threatened firms become unionized. Because these firms have low amenity costs, bargaining lets them substitute cheap amenities for wages, so allowing unionization costs them less than the fee a paper union would charge. In contrast, to the right of A, the wage premium is large enough that firms with high amenity costs find it cheaper to pay the fee and hire a paper union, while firms with low amenity costs continue to accommodate the union.[35] We next use this framework to explain what the reform changed and how firms respond to the new rules of collective bargaining.

Comparative Statics of the 2019 Labour Reform. The reform introduced two major changes to the Mexican union system. First, it imposed new requirements for workers to organize, increasing the cost of unionization from λ to $\tilde{\lambda} > \lambda$. Second, it required the legitimization of all pre-reform CBAs, which we model as removing the paper-union arrangement from firms' choice set. Under these changes, firms that were non-union or union before the reform remain in their respective arrangements. Workers in non-union firms, who did not find it profitable to organize before the reform, have even less incentive to do

[34] In this example, we set $\bar{w} = 315$, $a = 100$, $\beta = 0.5$, $\tau = 0.02$, $\lambda = 1.5\,\bar{w}$.

[35] Allowing for heterogeneity in amenity cost allows union and paper-union firms to coexist at the top of the productivity distribution. In contrast, a model with heterogeneity only in productivity would predict that highly productive firms always prefer paper-union arrangements.

so at the higher cost. Meanwhile, workers in union firms have already incurred the cost of organizing and continue to prefer union employment ($W_u^* > W_n^*$), so they have no incentive to dissolve their unions. Consequently, only firms that operated under a paper-union arrangement before the reform are affected. These firms must either accommodate a union or become non-union, depending on whether their workers find it profitable to organize at the higher cost $\tilde{\lambda}$. Thus, their post-reform choice set becomes

$$\tilde{\mathcal{A}}(\varepsilon, c) = \begin{cases} \{u\}, & \text{if } (\varepsilon, c) \in \mathrm{T}(\tilde{\lambda}). \\ \{n\}, & \text{if } (\varepsilon, c) \notin \mathrm{T}(\tilde{\lambda}). \end{cases} \tag{8}$$

Panel (b) of Figure 9 illustrates how the reform reshapes firms' optimal arrangements using the same parameter values as in panel (a) but with a cost of unionization that more than doubles ($\tilde{\lambda} = 2.3\,\lambda$). The increase in this cost shifts the union-threat curve to the right, from $c^u(\varepsilon, \lambda)$ to $c^u(\varepsilon, \tilde{\lambda})$, shrinking the set of firms whose workers find it profitable to unionize. As a result, former paper-union firms with a pair (ε, c) located inside the (yellow) region delimited by the curves $c^u(\varepsilon, \lambda)$, $c^p(\varepsilon, \tau)$, and $c^u(\varepsilon, \tilde{\lambda})$ no longer face the union threat and become non-union, whereas those with $(\varepsilon, c) \in \mathrm{T}(\tilde{\lambda})$ (red area) become unionized. The model therefore predicts a decline in the number of firms covered by a CBA, as most former paper-union firms become non-union. For these firms, wages remain unchanged ($w_p^* = w_n^* = \bar{w}$), while employment increases because the elimination of the paper-union fee reduces the marginal cost of labour ($L_n^* - L_p^* = \tau\bar{w}/\sigma > 0$), leading to an increase in their wage bill as well.

6.2. Additional Implications

Informal-Sector Wage. The first prediction we derive from the model is that the employment change for firms moving from the paper union arrangement to the non-union state is increasing in the informal-sector wage w_{inf}.[36] The economic intuition behind this is that firms facing a higher informal-sector wage must offer higher wages to attract workers into formal employment. Since the fee charged by paper unions is proportional to wages, these firms also face a higher marginal cost of labour under this arrangement. Consequently, removing the paper-union fee after the reform generates a larger reduction in the marginal cost of labour for firms facing higher informal-sector wages, leading to a larger increase in their demand for labour.

[36] To see this, note that, from Table 2,

$$\frac{\partial}{\partial\, w_{inf}}\left(\frac{L_n^* - L_p^*}{L_p^*}\right) = \frac{\tau\varepsilon}{[\varepsilon - (1+\tau)\bar{w}]^2}\bar{w}' > 0.$$

To assess the plausibility of this implication empirically, we first use data from ENOE 2022Q1 to compute the average wage of informal workers in each state.[37] We then divide the 32 states into two equally sized groups according to their average wage of informal workers and estimate the employment effects separately for treated firms (and their matched controls) in each group using (1).[38] Figure 10 presents the results. In line with the model's prediction, we find larger employment effects among union firms located in states with above median average informal-sector wages. The difference becomes particularly pronounced toward the end of the sample period, when the estimated employment effects are, on average, approximately 2 pp larger in high-informal-wage states. These findings are consistent with the mechanism highlighted by the model where removing the paper-union fee generates larger employment gains where the outside option of formal-sector workers is higher.

Profits. The model also predicts that profits rise for paper-union firms that become non-union after the reform ($\pi_p^* < \pi_n^*$). This reflects the fact that, from the firm's perspective, the paper-union arrangement is not the preferred of the three arrangements. Rather, it is a cheap way to forestall genuine unionization and preserve the wage-setting regime of the non-union status quo. Figure 11 illustrates the intuition behind the profit increase. The fee charged by paper unions acts as an ad-valorem tax on labour, raising the firm's marginal cost from $\bar{w}$ to $(1+\tau)\bar{w}$. Because labour supply is perfectly elastic at $\bar{w}$, the standard tax-incidence result applies: the entire burden of the fee falls on the firm. Consequently, paper-union firms employ fewer workers and earn profits equal to the area of triangle A. Post-reform, the removal of the fee raises profits through two channels. First, firms no longer pay the fee on their existing workforce, yielding savings equal to the area of rectangle B. Second, the lower marginal labour cost induces firms to expand employment from L_p^* to L_n^*, generating additional profits equal to the area of triangle C. Post-reform profits for these firms are therefore given by the combined area $A+B+C$, reflecting both the elimination of payments to paper unions and the recovery of the deadweight loss generated by the ad-valorem fee.

We examine this prediction empirically using the balanced panel of manufacturing establishments from EAIM described in Section 3. To do so, we estimate a static DID specification comparing union establishments (treated), defined as those linked to at least one historical CBA, with non-union establishments (controls), which are not linked to any historical CBA. The sample covers 2021–2024, with 2023 and 2024 defining the post-reform period. Table 3 presents summary statistics for the 4,470 union and 3,296 non-union establishments in our sample in 2022. Union establishments are, on average, almost twice as large as non-union establishments and have higher revenue, profits, and fixed assets. In particular, their

[37] We identify informal workers using the `emp_ppal` variable in the ENOE, which classifies workers as informal based on the nature of their employment and access to social security. This includes workers in informal establishments, self-employed agricultural workers, unpaid workers, and employees without access to social security (Instituto Nacional de Estadística y Geografía, 2014).

[38] The 16 states with the highest average informal-sector wages are Nuevo León, Baja California Sur, Coahuila, Chihuahua, Sinaloa, Nayarit, Michoacán, Baja California, Quintana Roo, Colima, Sonora, Jalisco, Tamaulipas, Durango, Campeche, and Tabasco.

average revenue is approximately 59% higher, while their share of outsourced workers is lower. Union establishments are also more likely to export, with 59.5% reporting exports compared with 37.9% of non-union establishments. To account for potential differences in outcome trends associated with these characteristics, we include a set of flexible controls in the regression. We adopt this approach rather than matching to avoid further reducing the sample size in EAIM. In particular, our specification includes establishment and year fixed effects, three-digit NAICS industry-by-year fixed effects, and interactions of year indicators with 2022 revenue, the share of outsourced employment in 2022, and exporter status in 2022. We cluster standard errors at the establishment level. Our main outcome variable is establishment profits, defined as total revenue minus expenditures on intermediate inputs, labour costs, and capital depreciation, normalized by the average profits of treated establishments in 2022.

Table 4 presents the results. Panel A reports estimates for all manufacturing establishments in our sample. Column (1) shows that, after the reform, profits in union establishments increase by an amount equivalent to 5.4% of their 2022 mean. This finding aligns with the model's prediction that eliminating paper-union fees increases firm profitability through both the savings from these payments and the expansion of employment. To complement this result, columns (2) and (3) examine the effects on union establishments' employment and fixed assets, respectively, both expressed relative to their 2022 means among the treated. We find that employment increases by 2.9%, consistent with the employment gains documented using IMSS data, while fixed assets increase by 3.7%, suggesting that the expansion of treated establishments extends to their capital stock. Panel B restricts the sample to establishments with at least 10 employees in 2022 and yields similar results across all three outcomes. We also report positive effects on the wage bill, value of production, and total revenue of union establishments in Table D2 in Appendix D. Taken together, these findings provide additional evidence supporting the mechanism highlighted by the model in which the elimination of paper-union arrangements reduced firms' marginal cost of labour, allowing them to expand employment and increase profits.

7. Quantifying the Gains from the Reform

In this section, we use our empirical results to quantify the economic gains from the reform for firms and workers. We first estimate the dollar amount of the increase in profits among union establishments in the manufacturing sector using our estimates from EAIM. We then quantify the gains to workers through the increased access to formal employment following the reform.

Firms. As shown in Section 6.2, the reform increased profits among union establishments in the manufacturing sector by an amount equivalent to 5.4% of their average profits in 2022. To translate this coefficient into total gains in U.S. dollars, we multiply it by the average profits of treated establishments in 2022 (344.3 million MXN), the average FIX exchange

rate in 2018 (0.052 USD per MXN), and the number of treated establishments in our EAIM sample (4,470). This calculation implies a total annual increase in profits among treated manufacturing establishments of

$$\Delta F = \$4,319 \text{ million of 2018 USD} \quad (\$83,098 \text{ million of 2018 MXN}),$$

equivalent to $966,000 USD (18.6 million MXN) in additional annual profits per establishment. As illustrated in Figure 11, for establishments that transition from paper-union to non-union arrangements, the increase in profits reflects both savings from no longer paying paper-union fees and the recovery of the associated deadweight loss. A back-of-the-envelope calculation using our model and empirical estimates implies that these establishments previously paid approximately 1.5 million MXN per month to paper unions, in line with the 1–4 million MXN range of monthly payments to paper unions in Mexico's cleaning sector reported by Bensusán *et al.* (2007).[39]

Workers. Although we find null effects on wages at union firms, we document in Section 5.2 that the reform generated gains for workers by increasing formalization. To quantify these gains, we assume that workers who entered formal employment as a result of the reform would have otherwise remained outside formal employment earning the average wage in the informal sector. Under this counterfactual, the gains from formalization correspond to the difference between the earnings of additional workers hired into formal employment and what they would have earned in the informal sector. We can then calculate the total gains in annualized earnings for these workers as

$$\Delta W = \sum_{t=2023}^{2026} 12 \times J \times \left(\hat{\beta}^{\text{Wage bill}}_{t,\text{Non-formal}\to\text{Formal}} - \hat{\beta}^{\text{Entrants}}_{t,\text{Non-formal}\to\text{Formal}} \times \bar{w}_t^{\text{Informal}} \right), \tag{9}$$

where J is the number of treated firms in our matched sample, and $\hat{\beta}^{\text{Wage bill}}_{t,\text{Non-formal}\to\text{Formal}}$ and $\hat{\beta}^{\text{Entrants}}_{t,\text{Non-formal}\to\text{Formal}}$ are the year-t coefficients from equation (1), estimated using the monthly wage bill and the number of non-formal entrants at the firm as outcome variables, respectively.[40] Lastly, $\bar{w}_t^{\text{Informal}}$ is the average monthly earnings of informal-sector workers, calculated using ENOE data from the first quarter of year t. We present the numerical components of equation (9) in Table D3 in Appendix D.

This calculation implies a total increase in employment earnings of

$$\Delta W = \$75.9 \text{ million of 2018 USD} \quad (\$1,460 \text{ million of 2018 MXN}),$$

[39] From Figure 11, the ratio of the recovered deadweight loss (area C) to the savings from paper-union fees (area B) equals one-half of the proportional increase in employment. Using our estimated employment effect of 2.9%, fee savings account for $1/(1+0.029/2) \approx 98.6\%$ of the total profit gain. Applying this share to the estimated annual profit increase of 18.6 million MXN per establishment and dividing by 12 yields an implied monthly payment of approximately 1.5 million MXN.

[40] Non-formal entrants are workers registered in IMSS in February of year t but not in February of year $t-1$. Daily wages in IMSS are converted to monthly earnings by multiplying by 365/12.

equivalent to an average annualized earnings gain of $6,090 USD (117,180 MXN) per additional non-formal entrant.[41] For each of these workers, this increase represents a gain equal to 2.4 times the average monthly earnings in the informal sector in 2026.

Taken together, these estimates suggest that firms captured a substantially larger share of the economic gains from the reform, while the benefits for workers were more limited given the absence of wage increases. Although workers who transitioned into formal employment experienced substantial earnings gains, these benefits were concentrated among a relatively small share of the workforce at union firms.

8. Conclusion

This paper examines the causal impact of a major Mexican labour reform, induced by the USMCA, on the outcomes of union firms. The reform sought to improve Mexican workers' wages and working conditions by eliminating the widespread practice of employers signing CBAs with paper unions—unions that did not represent workers during negotiations and allowed firms to forestall real unionization and retain control over wage setting. To do so, the reform required existing CBAs to be ratified by workers through secret-ballot votes and introduced stricter requirements for signing new CBAs. These measures led to the termination of 78% of the pre-reform stock of CBAs, with relatively few new agreements created subsequently.

We combine a novel web-scraped dataset covering the universe of pre-reform CBAs with matched employer–employee administrative data from IMSS, and employ a matched DID design comparing union firms with similar non-union firms, before and after October 2022 (when the CFCRL became operational nationwide). Our results suggest that the reform had a null effect on mean log wages of union firms and did not affect their survival in the formal sector. Nonetheless, we document that the reform increased union firms' employment and wage bill by 3.6% and 3.1%, respectively, by 2026. Employment gains are driven by low-paid workers, including a rise in hiring of non-formal workers, and are concentrated among firms whose pre-reform CBAs exhibited characteristics associated with paper unions.

To rationalize our main empirical findings, we develop a simple model in which firms optimally sort into non-union, union, and paper-union arrangements. Paper unions allow firms to prevent workers' unionization in exchange for a fee proportional to the wage bill, raising firms' marginal labour costs and reducing employment demand. We model the reform as eliminating the paper-union option and increasing the cost of unionization for workers. As a result, firms that previously relied on paper unions may no longer face a credible union threat and become non-union, allowing them to expand employment without changing wages. Consistent with the model, we find larger employment gains in states with higher informal-sector wages, and document a 5.4% increase in profits among union establishments in manufacturing using EAIM data. Our analysis of the gains generated by the

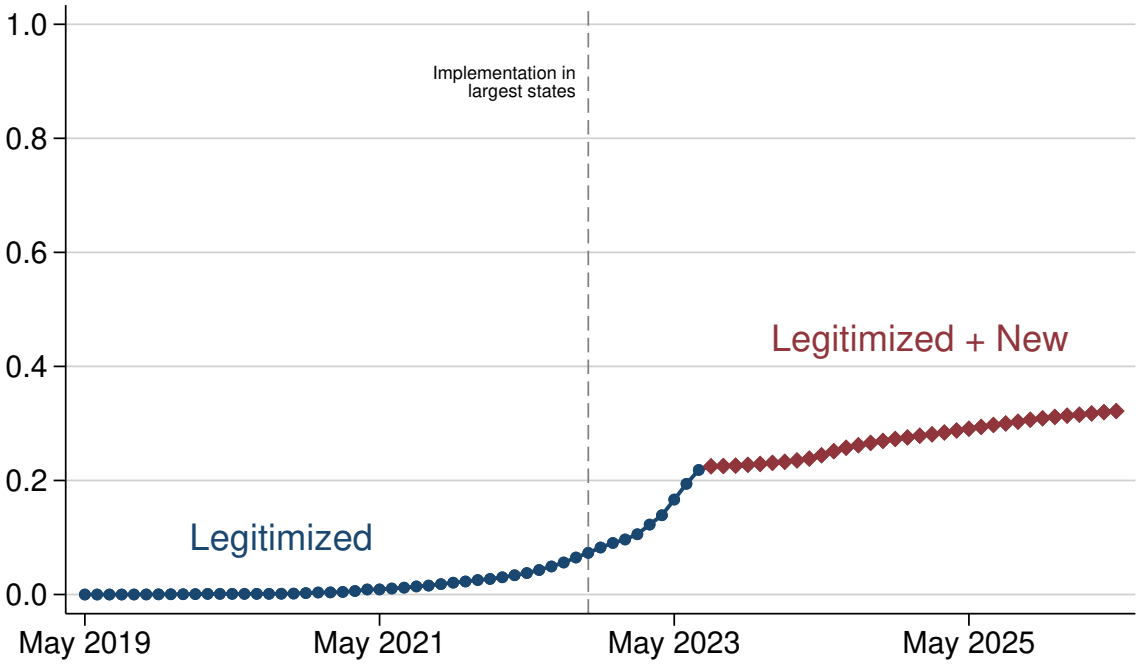
[41] We calculate the average annualized gain per additional entrant by dividing the total gains over 2023–2026 by the sum of the estimated additional entrants across these years (12,460).

reform suggests that firms benefited substantially more than workers, largely because the reform did not have any impact on wages.

In terms of policy implications, the absence of significant wage gains among workers in union firms suggests that the reform was unsuccessful in achieving one of the central objectives of the USMCA's labour provisions. Our findings also highlight a trade-off between strengthening worker representation through stricter requirements on union formation and keeping unionization attractive for workers. Understanding whether new technologies can reduce the organizational costs of unions without compromising democratic oversight and workers' representation is a fruitful avenue for future research.

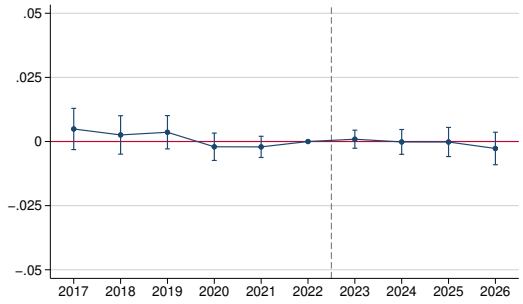
Figures

FIGURE 1. Legitimized and New CBAs as a Share of the Pre-Reform Stock.

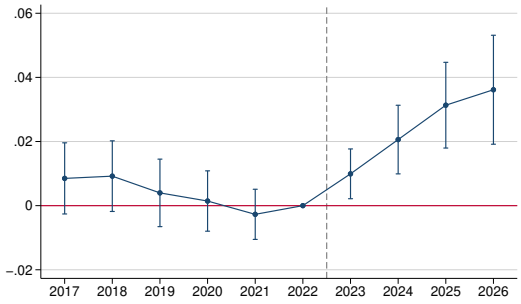


Notes: The navy series (circles) shows the cumulative number of pre-reform CBAs (also referred as historical CBAs) that were legitimized through workers' votes between May 2019 and July 2023, while the maroon series (diamonds) adds the cumulative number of new CBAs deposited with the CFCRL from August 2023 through May 2026. Both series are expressed as a share of the pre-reform stock of 139,000 CBAs (Secretaría del Trabajo y Previsión Social, 2023). Each legitimized CBA is dated by the month in which its voting record was filed with the CFCRL. Although the deadline to legitimize was May 2023, unions that had registered their intention to hold a vote before the deadline were allowed to conduct it through July 2023. By the end of the legitimization process, only 22% of historical CBAs were legitimized, and by May 2026, legitimized and new CBAs together accounted for only 32% of the pre-reform stock. The dashed vertical line marks October 2022, when the CFCRL became operational in Mexico's largest states, which is the implementation date of the reform used in our analysis. *Source:* RIRL.

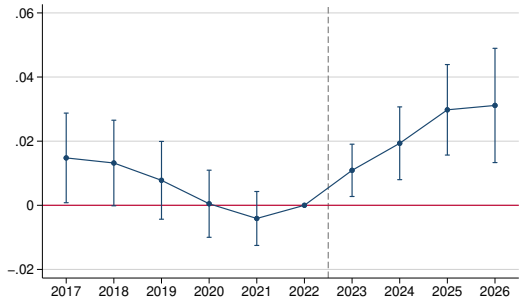
FIGURE 2. The Effects of the Reform on Union Firms.



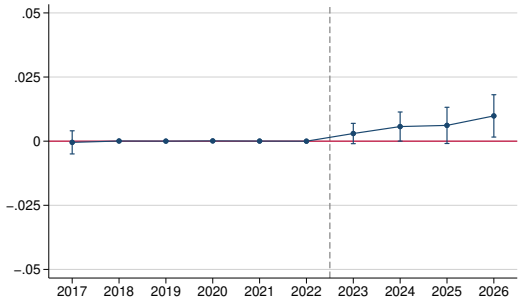
(a) Mean log daily wages



(b) Log employment



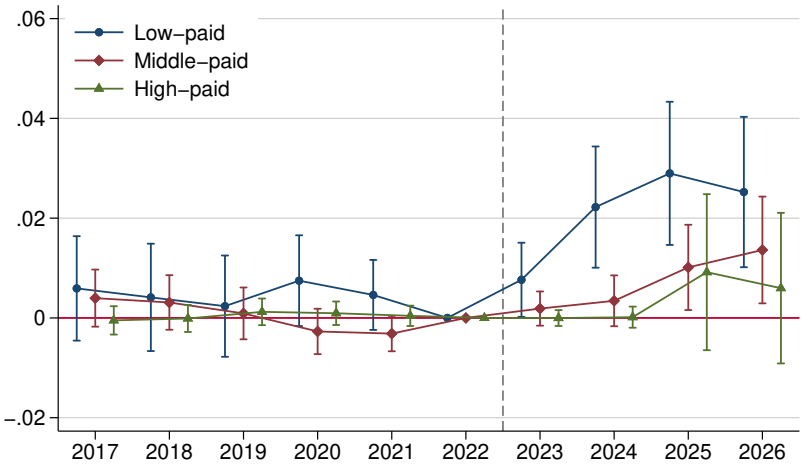
(c) Log wage bill



(d) 1{Formal}

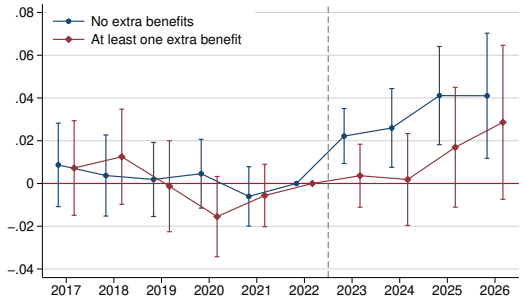
Notes: This figure displays the event-study coefficients from equation (1) estimated on the matched sample of firms described in Section 4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). Panel (a): Mean log daily wages are calculated as the average of workers' log real daily wages within the firm in each period, where daily wages are deflated using the national CPI (base second half of July 2018). Panel (b): Log employment is the log of the number of workers registered in IMSS at the firm in each period. Panel (c): Log wage bill is the log of the sum of real daily wages across all workers registered at the firm in each period. Panel (d): 1{Formal} is a year-to-year indicator equal to 1 if the firm has at least one worker registered in IMSS in February of that year, and zero otherwise. For all outcomes except formal-sector status, the sample is restricted to matched pairs in which both (treated and control) firms remain in the formal sector throughout the post-reform period. The vertical dashed line corresponds to October 2022, the period when the CFCRL became operational in Mexico's largest states. Event-study coefficients are normalized relative to 2022. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL, and IMSS data in February of each year.

FIGURE 3. The Effects of the Reform on Union Firms' Employment by Wage Group.

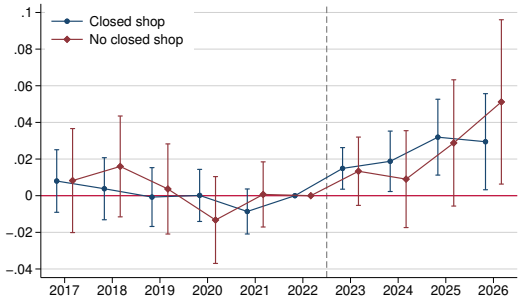


Notes: This figure displays the event-study coefficients from equation (1) estimated on the matched sample of firms described in Section 4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). Workers in each period are classified into three wage groups based on their daily wages relative to the 2024 federal minimum wage (248.93 MXN per day): low-paid (less than two times the minimum wage, circles), middle-paid (between two and five times, diamonds), and high-paid (five or more times, triangles). The outcome variables are the number of workers registered in IMSS at the firm in each wage group, scaled by the firm's level of employment in 2022. The sample is restricted to matched pairs in which both treated and control firms remain in the formal sector throughout the post-reform period. The vertical dashed line corresponds to October 2022, when the CFCRL became operational in Mexico's largest states. Event-study coefficients are normalized relative to 2022. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL and IMSS data in February of each year.

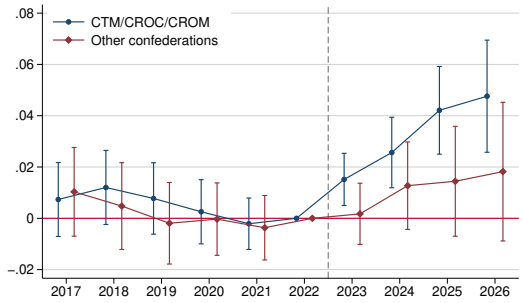
FIGURE 4. The Effects of the Reform on Union Firms' Log Employment: Heterogeneity by CBA and Union Characteristics



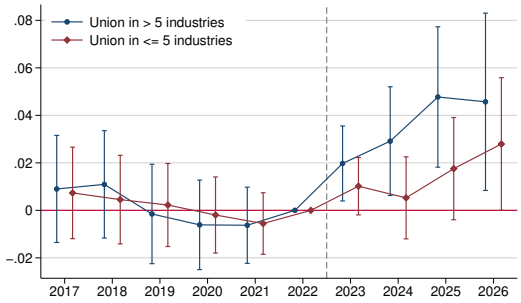
(a) Extra benefits in CBA



(b) Closed-shop clause in CBA



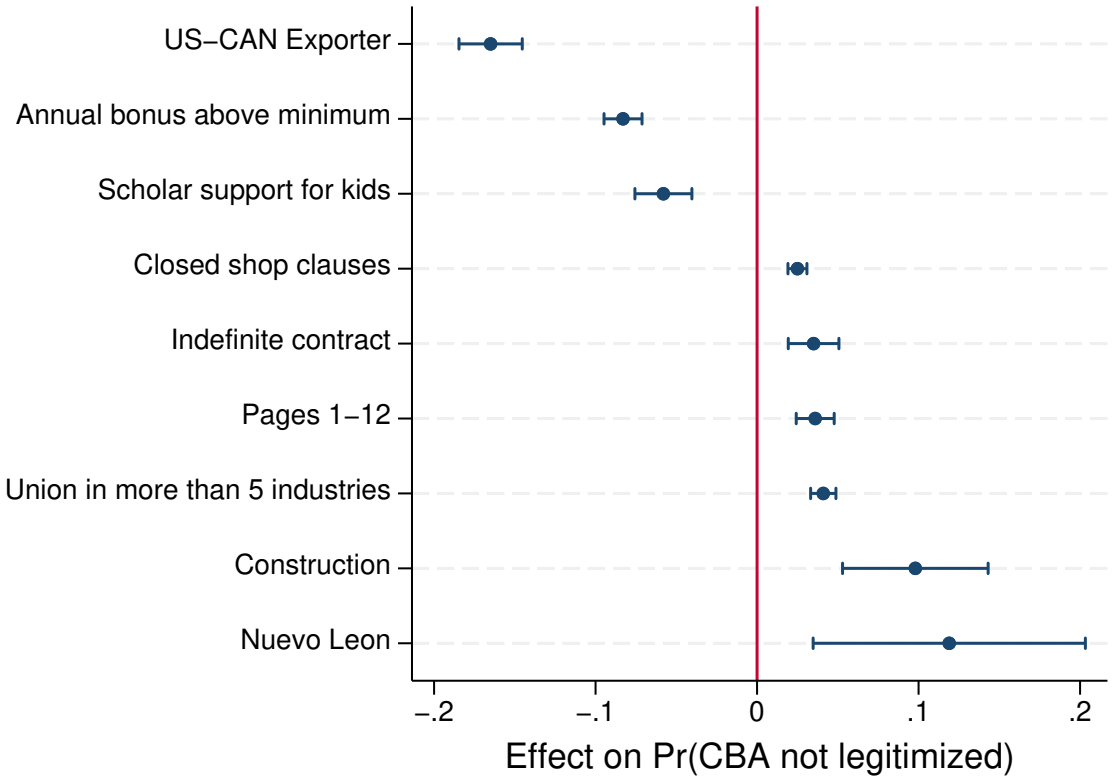
(c) Union confederation



(d) Multi-industry union

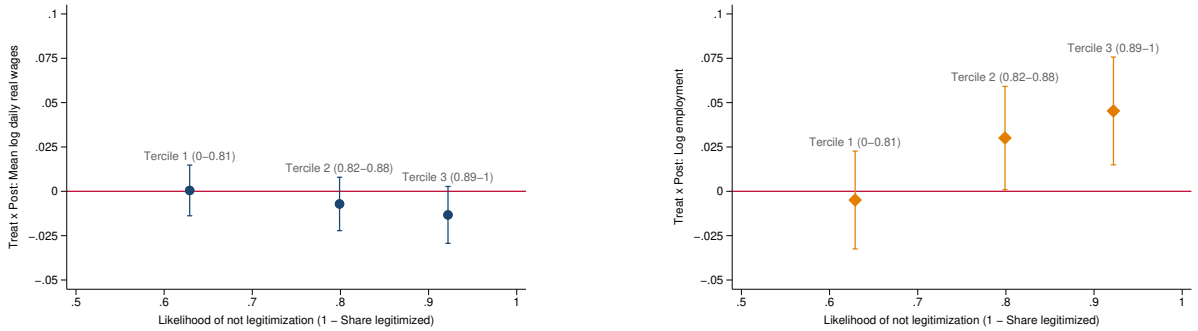
Notes: This figure displays the event-study coefficients from equation (1) estimated separately for different subgroups of treated firms and their corresponding matched controls, as described in Section 4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). The outcome variable in all panels is the log of the number of workers registered in IMSS at the firm in each period. Panel (a): Firms are divided according to whether their historical CBA included at least one of the following extra-legal benefits: scholarship support for workers' children, an annual or vacation bonus above the legal minimum, or food benefits. Panel (b): Firms are split according to whether their historical CBA included a closed-shop clause, defined as a provision giving the union control over hiring or requiring workers to leave their jobs if they cease to be union members. Panel (c): Firms are divided according to whether their union was affiliated with one of the three largest union confederations in Mexico (CTM, CROC, or CROM). Panel (d): Firms are split according to whether their union operated in more than five industries (the sample median) or in five or fewer industries. The sample is restricted to matched pairs in which both treated and control firms remain in the formal sector throughout the post-reform period. The vertical dashed line corresponds to October 2022, when the CFCRL became operational in Mexico's largest states. Event-study coefficients are normalized relative to 2022. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL and IMSS data in February of each year.

FIGURE 5. Average Marginal Effects from Logistic Regression.



Notes: This figure displays the average marginal effects (AMEs) from the logistic regression in equation (2) for a subset of covariates, estimated on the sample of historical CBAs matched to firm-level characteristics from IMSS in February 2019, as described in Section 5.3. The dependent variable is an indicator equal to 1 if the CBA was not legitimized following the reform, and zero otherwise. The full set of covariates includes indicators for an indefinite-term CBA, closed-shop clauses, scholarship support for workers' children, whether the union operates in more than five industries, an annual bonus above the statutory minimum, and contract-length quartiles, as well as firm-level characteristics including log employment, exporter status to the U.S. or Canada, industry, and state fixed effects. The omitted categories are: CBAs with more than 63 pages (for CBA length), non-exporting firms (for exporter status), Agriculture, Forestry, and Fishing (for industry), and Aguascalientes (for state). The procedure used to extract the CBA characteristics is described in Appendix B. AMEs measure the average change in the predicted probability of non-legitimization associated with each covariate. The estimates are ordered from the largest negative AME (top) to the largest positive AME (bottom). Figure C9 in Appendix C reports the full set of AMEs. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL, CExt, and IMSS data in February 2019.

FIGURE 6. The Effects of the Reform on Union Firms: Heterogeneity by Terciles of Propensity to Not Legitimize.

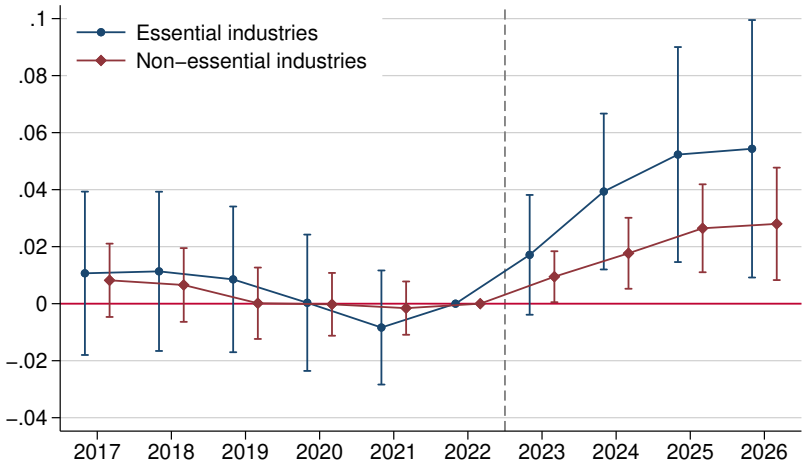


(a) Mean log daily wages

(b) Log employment

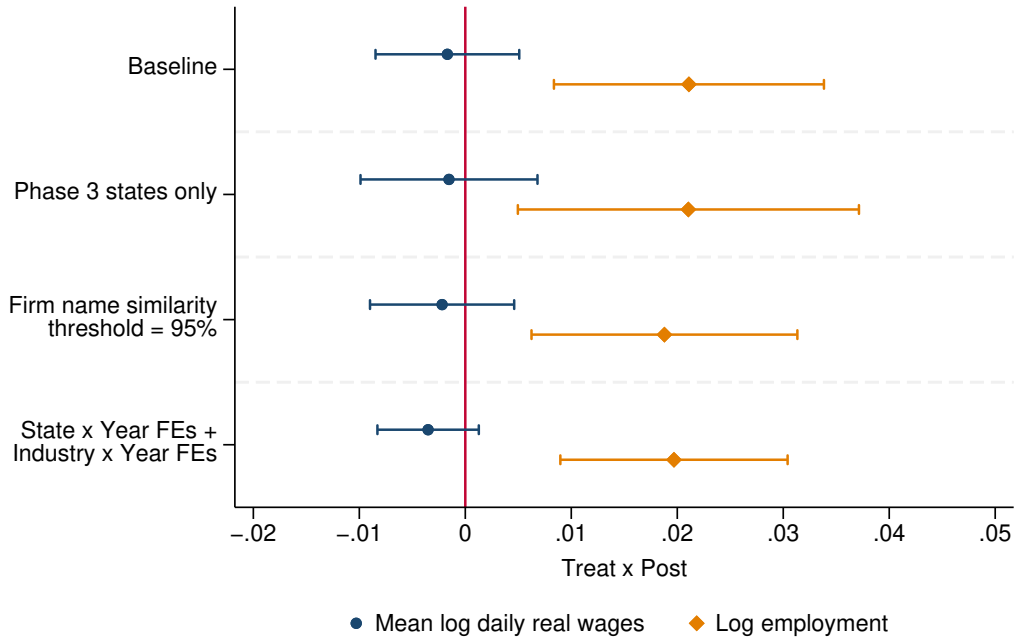
Notes: This figure displays the coefficients from the static version of the DID specification in (1), estimated separately by terciles of the predicted probability of CBA non-legitimization, as described in Section 5.3. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). The predicted probabilities are obtained from the logistic regression in (2). These probabilities are then averaged across all CBAs associated with each firm, and treated firms (together with their corresponding matched controls) are divided into terciles of the resulting firm-level measure. The horizontal axis reports the actual share of CBAs legitimized within each tercile. Panel (a): Mean log daily wages are calculated as the average of workers' log real daily wages within the firm in each period, where daily wages are deflated using the national CPI (base second half of July 2018). Panel (b): Log employment is the log of the number of workers registered in IMSS at the firm in each period. The sample is restricted to matched pairs in which both treated and control firms remain in the formal sector throughout the post-reform period. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL and IMSS data in February of each year.

FIGURE 7. The Effects of the Reform on Union Firms' Log Employment: Heterogeneity by Essential Industries.



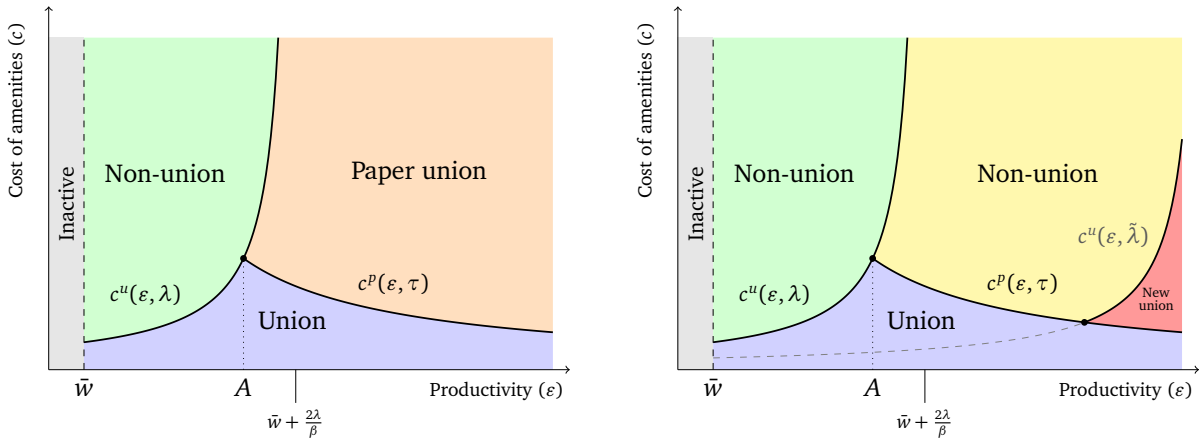
Notes: This figure displays the event-study coefficients from equation (1) estimated separately for firms in essential and non-essential industries, together with their corresponding matched controls, as described in Section 4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). The outcome variable is the log of the number of workers registered in IMSS at the firm in each period. Essential industries are defined as those that continued operating during the March–May 2020 lockdown or were allowed to resume operations in early June 2020, following the Mexican government's reopening plan ("Nueva Normalidad"). These industries correspond to the following three-digit NAICS codes: 111, 112, 114, 211, 212, 213, 221, 236, 237, 238, 311, 325, 336, 481–486, 488, 491–493, 515, 517, 521–525, 562, 621–624, and 931. All remaining industries are classified as non-essential. The sample is restricted to matched pairs in which both treated and control firms remain in the formal sector throughout the post-reform period. The vertical dashed line corresponds to October 2022, when the CFCRL became operational in Mexico's largest states. Event-study coefficients are normalized relative to 2022. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL and IMSS data in February of each year.

FIGURE 8. Additional Robustness.



Notes: This figure displays the coefficients from the static version of the DID specification in (1) for the baseline estimates and three additional robustness exercises, as described in Section 5.4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). The first row presents the baseline estimates. The second restricts the sample to firms located in the eleven states that entered the third and final stage of the reform's implementation in October 2022. The third relaxes the Jaro–Winkler similarity threshold used to link historical CBAs to IMSS records from 98% to 95%, and re-estimates the results using the resulting classification of union and non-union firms. The fourth relaxes the matching procedure by replacing exact matching on state and industry with state-by-year and industry-by-year fixed effects in the DID specification, increasing the share of matched treated firms from 30% to 79.4%. The outcome variables are mean log daily wages, calculated as the average of workers' log real daily wages within the firm in each period, and log employment, defined as the log of the number of workers registered in IMSS at the firm in each period. Daily wages are deflated using the national CPI (base second half of July 2018). The sample is restricted to matched pairs in which both treated and control firms remain in the formal sector throughout the post-reform period. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL and IMSS data in February of each year.

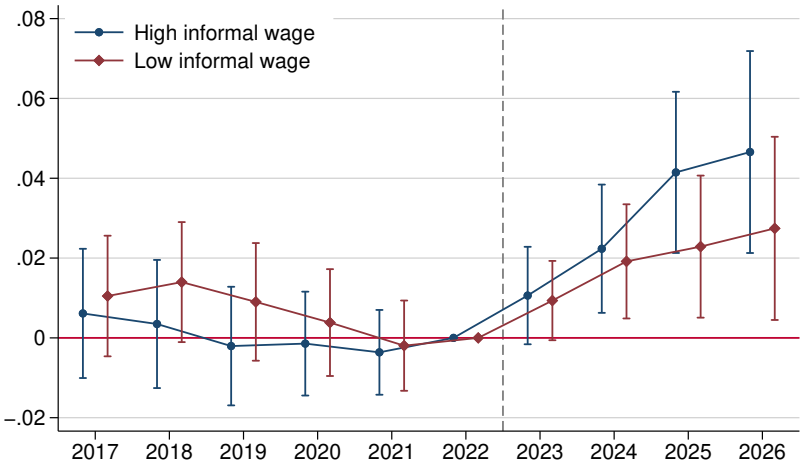
FIGURE 9. Optimal Firm Sorting Before and After the Reform.



(a) Pre-reform (b) Post-reform

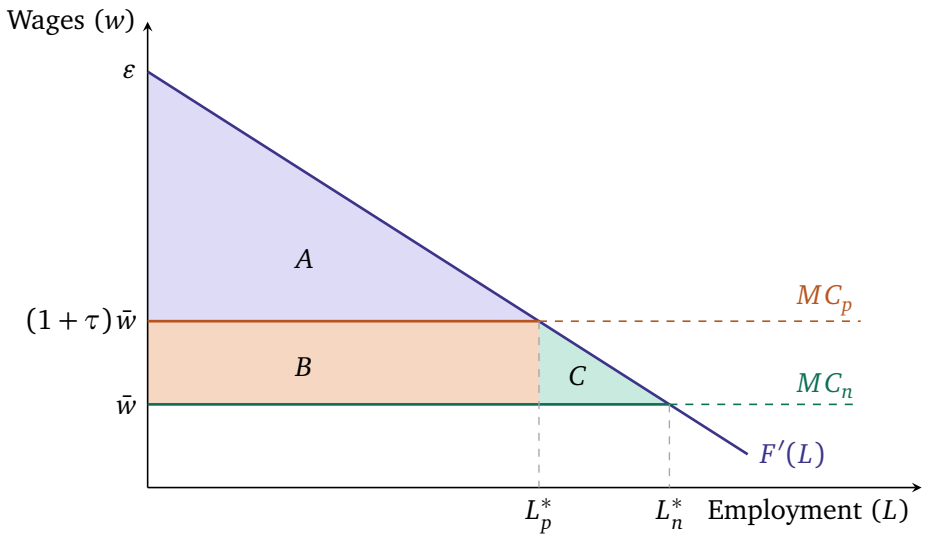
Notes: This figure illustrates firms' optimal sorting across non-union (n), union (u), and paper union (p) arrangements in the (ε, c)-space, where ε denotes firm productivity and c the marginal cost of providing amenities to union workers, as described in the model in Section 6. Panel (a) presents the pre-reform equilibrium. Firms with productivity below the outside option $\bar{w}$ remain inactive, while those with productivity above $\bar{w}$ sort into three arrangements. The curve $c^u(\varepsilon,\lambda)$ defines the union-threat threshold. Firms above this curve remain non-union, whereas those below it face the threat of unionization and choose between accommodating the union and hiring a paper union. The curve $c^p(\varepsilon,\tau)$ represents the combinations of productivity and amenity costs at which firms are indifferent between arrangements u and p. Firms below this curve choose to accommodate the union, while those above it hire a paper union. Point A denotes the intersection of the two curves. Panel (b) illustrates the post-reform equilibrium, in which the paper-union arrangement is no longer available and the cost of unionization increases from λ to $\tilde{\lambda}$. The higher cost shifts the union-threat threshold from $c^u(\varepsilon,\lambda)$ to $c^u(\varepsilon,\tilde{\lambda})$, reducing the set of firms facing the threat of unionization. Firms that were previously non-union or union remain in their original arrangements, while former paper-union firms become either non-union (yellow region) or union (red region), depending on whether their workers still find it profitable to unionize at the higher cost of organizing $\tilde{\lambda}$. The values for the parameters used to construct the diagrams are: $\bar{w} = 315$, $a = 100$, $\beta = 0.5$, $\tau = 0.02$, $\lambda = 1.5\bar{w}$, and $\tilde{\lambda} = 2.3\,\lambda$.

FIGURE 10. The Effects of the Reform on Union Firms' Log Employment: Heterogeneity by State-Level Informal Wages.



Notes: This figure displays the event-study coefficients from equation (1) estimated separately for firms located in states with high and low informal-sector wages, together with their corresponding matched controls, as described in Section 4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). The outcome variable is the log of the number of workers registered in IMSS at the firm in each period. States are classified into high or low informal wage based on the average wage of informal workers in the first quarter of 2022, calculated using ENOE data. The high-informal-wage group consists of firms located in: Nuevo León, Baja California Sur, Coahuila, Chihuahua, Sinaloa, Nayarit, Michoacán, Baja California, Quintana Roo, Colima, Sonora, Jalisco, Tamaulipas, Durango, Campeche, and Tabasco. Firms located in the remaining 16 states constitute the low-informal-wage group. Informal workers are identified using the `emp_ppal` variable in ENOE. The sample is restricted to matched pairs in which both treated and control firms remain in the formal sector throughout the post-reform period. The vertical dashed line corresponds to October 2022, when the CFCRL became operational in Mexico's largest states. Event-study coefficients are normalized relative to 2022. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* ENOE 2022Q1, RIRL, and IMSS data in February of each year.

FIGURE 11. Profits of Paper-Union Firms that Become Non-Union After the Reform.



Notes: This figure illustrates how the reform affects the profits of firms that transition from the paper-union (p) to the non-union (n) arrangement, as described in the model in Section 6. The downward-sloping curve represents the firm's marginal revenue product of labour, while labour supply is perfectly elastic at the outside option value $\bar{w}$. Before the reform, these firms optimally decide to hire a paper union to forestall the threat of unionization and keep control over the wage setting as in the non-union status quo. However, the fee charged by paper unions raises the marginal cost of labour from $\bar{w}$ to $(1+\tau)\bar{w}$, leading firms to employ L_p^* workers and earn profits represented by the area of triangle A. After the reform, the paper-union arrangement is no longer available, and the higher cost of unionization, $\tilde{\lambda} > \lambda$, makes unionization unprofitable for workers in these firms, leading them to become non-union. The elimination of the paper-union fee then reduces the marginal cost of labour to $\bar{w}$, increasing optimal employment to L_n^* and generating additional profits through two channels. First, the firm no longer pays the paper-union fee on its existing workforce, generating savings equal to the area of rectangle B. Second, the reduction in the marginal cost of labour induces the firm to expand employment from L_p^* to L_n^*, generating additional profits equal to the area of triangle C, which represents the deadweight loss generated by the paper-union fee. Post-reform profits are therefore represented by the combined area $A+B+C$. Expressions for the optimal values of employment and profits for each arrangement are provided in Table 2.

Tables

TABLE 1. Descriptive Statistics of Firms, 2022.

	Full sample			Matched sample		
	(1) Treated	(2) Control	(3) Diff.	(4) Treated	(5) Control	(6) Diff.
Employment	127.356	53.022	74.333***	71.812	68.452	3.359
	(482.951)	(346.664)		(175.926)	(172.815)	
Log daily wage	5.563	5.437	0.125***	5.703	5.693	0.010
	(0.453)	(0.434)		(0.456)	(0.467)	
Firm age	14.599	14.165	0.434***	16.292	16.292	0.000
	(4.442)	(4.577)		(3.534)	(3.534)	
Share earning below 2023 MW	0.270	0.391	-0.122***	0.152	0.155	-0.003
	(0.337)	(0.391)		(0.259)	(0.261)	
US–CAN exporters	0.145	0.063	0.081***	0.096	0.098	-0.002
	(0.352)	(0.244)		(0.295)	(0.298)	
North	0.214	0.291	-0.077***	0.256	0.256	0.000
	(0.410)	(0.454)		(0.437)	(0.437)	
North Center	0.255	0.246	0.009***	0.206	0.206	0.000
	(0.436)	(0.431)		(0.404)	(0.404)	
Center	0.472	0.332	0.140***	0.488	0.488	0.000
	(0.499)	(0.471)		(0.500)	(0.500)	
South	0.059	0.131	-0.072***	0.050	0.050	0.000
	(0.235)	(0.337)		(0.217)	(0.217)	
Manufacturing	0.341	0.209	0.131***	0.314	0.314	0.000
	(0.474)	(0.407)		(0.464)	(0.464)	
Wholesale Trade	0.201	0.216	-0.015***	0.275	0.275	0.000
	(0.401)	(0.412)		(0.447)	(0.447)	
Retail Trade	0.066	0.056	0.009***	0.048	0.048	0.000
	(0.248)	(0.230)		(0.213)	(0.213)	
CBA not legitimized (by May 2023)	0.677	–	–	0.710	–	–
	(0.468)			(0.454)		
Observations	24,679	60,432		7,515	7,515	

Notes: This table reports descriptive statistics for firms in February 2022, before and after matching, as described in Section 4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of non-union firms (without a CBA pre-reform). Columns (1) and (2) report the means for treated and control firms in the raw sample, respectively, while columns (4) and (5) report the corresponding statistics for the matched sample. Columns (3) and (6) report the differences in means between treated and control firms, with statistical significance assessed using two-sample t-tests. Employment is the number of workers registered in IMSS. Log daily wage is the firm-level average of workers' log real daily wages, deflated using the national CPI (base second half of July 2018). Firm age is the number of years since 2005 with at least one worker registered in IMSS. Share earning below 2023 MW is the fraction of workers earning less than the 2023 federal minimum wage (207.44 MXN per day). US–CAN exporters indicates firms exporting to the U.S. or Canada. Geographic regions are defined as follows: North (Baja California, Chihuahua, Coahuila, Nuevo León, Sonora, Tamaulipas), North Center (Aguascalientes, Baja California Sur, Colima, Durango, Jalisco, Michoacán, Nayarit, San Luis Potosí, Sinaloa, Zacatecas), Center (Ciudad de México, Estado de México, Guanajuato, Hidalgo, Morelos, Puebla, Querétaro, Tlaxcala), and South (Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, Veracruz, Yucatán). Manufacturing, Wholesale Trade, and Retail Trade are industry indicators. CBA not legitimized (by May 2023) indicates firms not linked to any legitimized CBA. Standard deviations are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source:* RIRL, CExt, and IMSS data in February 2022.

TABLE 2. Optimal Wages, Amenities, Employment, Profits, and Job Values.

	Non-union (n)	Union (u)	Paper union (p)
Wage (w_j^*)	$\bar{w}$	$\bar{w} + \frac{\beta}{2}\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right) - \frac{a^2}{2c}$	$\bar{w}$
Amenities (ψ_j^*)	0	$\frac{a^2}{4c^2}$	0
Employment (L_j^*)	$\frac{\varepsilon - \bar{w}}{\sigma}$	$\left(1 - \frac{\beta}{2}\right)\frac{\varepsilon - \bar{w} + \frac{a^2}{4c}}{\sigma}$	$\frac{\varepsilon - (1+\tau)\bar{w}}{\sigma}$
Profits (π_j^*)	$\frac{(\varepsilon - \bar{w})^2}{2\sigma}$	$\left(1 - \frac{\beta}{2}\right)^2 \frac{\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right)^2}{2\sigma}$	$\frac{[\varepsilon - (1+\tau)\bar{w}]^2}{2\sigma}$
Value of the job (W_j^*)	$\bar{w}$	$\bar{w} + \frac{\beta}{2}\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right)$	$\bar{w}$

Notes: This table reports the expressions for optimal wages, amenities, employment, profits, and job values under the three firm arrangements (non-union (n), union (u), and paper union (p)) considered in the model in Section 6. Firms differ in productivity (ε) and the marginal cost of providing amenities (c), and produce output according to $F(L) = \varepsilon L - \frac{\sigma}{2}L^2$, where $\sigma > 0$ governs the curvature of the production function. Workers have an outside option $\bar{w}$ and value wages and amenities according to $W = w + a\sqrt{\psi}$, where $a > 0$ captures their willingness to pay for amenities. Under the non-union and paper-union arrangements, firms do not provide amenities and choose wages and employment to maximize profits subject to workers' outside option, as described in (4). Paper-union firms hire a paper union to forestall workers' unionization and retain control over wage setting. In exchange for this service, paper unions charge a fee equal to a fraction $\tau \in (0,1)$ of each worker's wage, which acts as an ad-valorem tax on labour. This, in turn, raises the firm's marginal cost of labour to $(1+\tau)\bar{w}$ and reduces the optimal level of employment. Under the union arrangement, the firm and the union bargain over wages and amenities through the Nash bargaining problem in (5), where $\beta \in (0,1)$ denotes the union's bargaining weight, and the firm retains the right to choose employment along its labour demand curve. Full derivations are provided in Appendix E.

TABLE 3. Descriptive Statistics of Establishments in Manufacturing, 2022.

	(1) Treated	(2) Control	(3) Diff.
Employment	526.571	298.523	228.047***
	(856.310)	(760.819)	
Outsourced workers	10.599	14.232	-3.633
	(82.621)	(122.321)	
Wage bill (thousands MXN)	125,098	70,268	54,830***
	(251,493)	(194,811)	
Total revenue (thousands MXN)	1,419,617	895,364	524,253***
	(5,702,261)	(5,167,553)	
Fixed assets (thousands MXN)	424,100	293,691	130,409***
	(1,950,093)	(2,321,724)	
Profits (thousands MXN)	344,263	242,493	101,770***
	(1,274,755)	(1,923,437)	
Exporter	0.595	0.379	0.216***
	(0.491)	(0.485)	
Observations	4,470	3,296	

Notes: This table reports descriptive statistics for manufacturing establishments in 2022, using the balanced panel from the Annual Manufacturing Survey (EAIM) described in Section 3. The treatment group consists of union establishments (linked to a pre-reform CBA), and the control group consists of non-union establishments (without a pre-reform CBA). Columns (1) and (2) report the means for treated and control establishments, respectively. Column (3) reports the differences in means between the two groups, with statistical significance assessed using two-sample t-tests. Employment is the number of workers directly hired by the establishment, while outsourced workers are those employed through third-party firms. Wage bill is the total remuneration paid to directly hired workers. Total revenue includes income from all sources, while fixed assets measure the establishment's total stock of fixed assets. Profits are defined as total revenue minus intermediate input expenditures, the wage bill, and capital depreciation. All monetary variables are expressed in thousands of 2018 MXN, deflated using the national CPI (base second half of July 2018). Exporter is an indicator equal to one if the establishment reports positive export revenue. Standard deviations are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source:* RIRL and EAIM 2022.

TABLE 4. The Effects of the Reform on Union Establishments in Manufacturing: Profits, Employment and Capital.

	(1) Profits	(2) Employment	(3) Fixed assets
	Panel A. All establishments		
Treat × Post	0.054**	0.029**	0.037**
	(0.026)	(0.012)	(0.018)
Observations	31,064	31,064	31,064
R-squared	0.962	0.958	0.950
Mean for the Treated in 2022	344,263	527	424,100
	Panel B. Establishments with ≥ 10 employees in 2022		
Treat × Post	0.054*	0.028**	0.028**
	(0.030)	(0.013)	(0.014)
Observations	26,820	26,820	26,820
R-squared	0.962	0.956	0.998
Mean for the Treated in 2022	353,607	553	435,609
Establishment FEs	✓	✓	✓
Year FEs	✓	✓	✓
Industry × Year	✓	✓	✓
Revenue 2022 × Year	✓	✓	✓
Outsourcing 2022 × Year	✓	✓	✓
Exporter 2022 × Year	✓	✓	✓

Notes: This table reports estimates from a static DID specification using the balanced panel of manufacturing establishments from EAIM described in Section 3. The treatment group consists of union establishments (linked to a pre-reform CBA), and the control group consists of non-union establishments (without a pre-reform CBA). The sample covers 2021–2024, with 2023 and 2024 defining the post-reform period. Panel A reports estimates for all establishments in the sample, while Panel B restricts the sample to establishments with at least 10 directly hired workers in 2022. Column (1) reports the effects on profits, defined as total revenue minus intermediate input expenditures, the wage bill, and capital depreciation. Column (2) reports the effects on employment, measured as the number of workers directly hired by the establishment. Column (3) reports the effects on fixed assets, measured as the establishment's total stock of fixed assets. All outcomes are expressed relative to their respective means among treated establishments in 2022, reported in the row "Mean for the Treated in 2022". Profits and fixed assets are deflated using the national CPI (base second half of July 2018), and their means are expressed in thousands of 2018 MXN, while employment is measured in workers. All specifications include establishment and year fixed effects, three-digit NAICS industry-by-year fixed effects, and interactions of year indicators with total revenue, the share of outsourced employment, and exporter status, all measured in 2022. Standard errors are clustered at the establishment level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source:* RIRL and EAIM.

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Appendix A. An Example of a CBA Signed by a Paper Union

As discussed in Section 2, CBAs signed by paper unions were a pervasive feature of the pre-reform Mexican labour market. To illustrate the main characteristics of these agreements, in this appendix we present the case of Delta Staff Manufacturing (Nazareno plant), a textile manufacturing firm located in the state of Durango. This plant produces garments for international brands including Levi's and Gap, and employs approximately 1,000 workers.[42] News reports described the pre-reform agreement as *contrato de protección*, negotiated without workers' knowledge, and documented acts of intimidation against workers seeking to organize an independent union (see La Jornada (2024)).

We analyze the 2018 historical CBA at the Nazareno plant signed between Delta Staff and the *Sindicato Industrial de Trabajadores y Trabajadoras de la Industria del Vestido, Similares y Conexos de la Región Lagunera del Estado de Durango*, affiliated with the *Confederación de Trabajadores de México (CTM)*.[43] We find several features pointing to a paper-union contract. First, the agreement is short (only 6 pages) and contains hiring and separations closed-shop clauses, under which union membership is a condition of employment. These types of clauses discourage workers from seeking a truly representative union. Specifically, clause 6 established that:

> "To enter Delta Staff in positions that are not managerial positions, the following requirements must be met: (1) Be a member of the contracting union."

Moreover, clause 17 says that:

> "Delta Staff agrees with the union to lay off workers who resign from or are expelled from the union, upon receipt of the corresponding notice from the union."

Secondly, the agreement sets most benefits to the legal minimum. For instance, it provided six days of vacation after the first year of employment, a 25% vacation premium, and a 15-day year-end bonus (*aguinaldo*), exactly the statutory minima prevailing at the time. Most strikingly, the wage schedule in the contract contains only two occupations, one of which (general assistant) is paid MXN 88.36 per day, exactly the national minimum wage in 2018. Lastly, clause 3 of the contract stipulates that it will be revised in accordance with the law, but does not specify any mechanism for workers to participate or the exact date on which the revision will take place. This adds to the contract's indefinite duration, established in clause 2.

The reform gave workers the opportunity to remove this paper union. In July 2023, workers voted against the legitimization of CTM's CBA. Of 895 valid votes, 762 were cast against the agreement and only 133 in favour, cancelling the CBA. Workers subsequently voted in favour of a new independent union to represent them, *Liga Sindical Obrera Mexicana*

[42] The current CBA registered with the CFCRL covers 1,080 workers, including sewing and cutting workers, warehouse workers, and general assistants.

[43] Delta Staff's historical CBA can be accessed here: https://repositorio.centrolaboral.gob.mx/contrato/54282

(La Liga). The contrast between the previous agreement and La Liga's CBA is stark. The new agreement introduced a substantially richer benefit package and a more detailed wage structure. Among other provisions, it increased the vacation premium from 25% to 30% and the year-end bonus from 15 to 16 days, introduced employer-provided transportation, a matching savings fund, attendance and punctuality bonuses, and additional educational and family benefits. It also replaced the two-category wage schedule with a wage grid covering more than 80 occupations and nine wage levels. The new benefits were estimated to be worth approximately USD 134,000 (see Maquila Solidarity Network (2024)).[44]

[44]Delta Staff's new CBA, bargained by La Liga can be accessed here: https://repositorio.centrolaboral.gob.mx/contrato/646472

Appendix B. Extraction of CBA Characteristics and Validation

This appendix describes the procedure we follow to extract and validate the information from historical CBAs.[45] We focus on contracts that were successfully merged with IMSS data. These documents were downloaded in pdf format between May and October 2024 and converted into plain text using the *pytesseract* library in Python. We use *gpt-oss-20b* via the OpenRouter API to extract the information from the text of the CBAs. Specifically, the prompt we use consists of three main blocks. In the first block, we include the following description of the union context in Mexico to anchor the model's reasoning and reduce ambiguity:

> In the context of Mexican labour unions, consider a paper-union collective bargaining agreement as a contract signed between a firm and a union in which workers have no voice or vote in wage or contractual negotiations, contractual clauses are included to protect the firm against truly representative unions (such as closed-shop clauses), and the agreement provides only the minimum benefits required by the Federal Labour Law.

The second block contains the specific questions about the information we want to extract from the CBA and limits the scope of the model's responses. Table B1 contains the queries asked to the model for the group of variables used in the analysis. Finally, the last part of the prompt appends the text of the contract. We complement the LLM data by collecting the number of pages of the CBA, the name of the union and its confederation, and the number of industries in which the union has an historical CBA.

To avoid identifying firms in the confidential IMSS data, we reduce the number of variables and coarsen their values. First, we combine the two closed-shop questions (hiring and separations) into a single indicator equal to one if the CBA contains any type of closed-shop clause. Second, we convert the number of days granted as an annual bonus into an indicator for whether the bonus exceeds the legal minimum of 15 days. Third, we transform the number of CBA pages into a categorical variable indicating the quartile in which each observation lies. Finally, we use union names to compute the number of industries in which each union appears and create an indicator for whether the union operates in more than five industries (the median of the distribution).[46] The final dataset linked to IMSS covers 84,601 contracts and includes indicators for indefinite contract duration, closed-shop clauses, food or meal benefits, scholarships for workers' children, a vacation bonus above the legal 25%, a year-end bonus above the legal 15 days, union presence in more than five industries, union confederation, and the quartiles of the number of pages.

[45] Here, the concept of CBA represents a url linked to the archive of files of the contractual relationship between the union and the firm.

[46] To measure the number of industries in which a union operates, we standardize union names (removing accents, punctuation, stopwords, and confederation acronyms) and group them using a Jaro–Winkler similarity threshold of 0.95.

TABLE B1. CBA Variables Extracted with LLM

Variable	Query	Values
Contract duration	What is the duration of the contract?	1–2 years, 3–5 years, indefinite
Closed-shop (Hiring)	Is the union responsible for providing workers to fill company vacancies (excluding trusted positions)?	No/Yes
Closed-shop (Separations)	Is it mentioned whether the company will terminate workers who resign, are expelled, or sanctioned by the union (exclusion clause)?	No/Yes
Food benefit	Is any food or grocery support (e.g., cafeteria or vouchers) mentioned?	No/Yes
Scholar support for kids	Is there any scholarship or educational support for workers' children in the contract?	No/Yes
Annual bonus	How many days of salary are granted as a year-end bonus during the first year at the company?	[15,365]
Vacation bonus	Is there a vacation bonus higher than the legal 25% mentioned?	No/Yes
Union dues	Does the contract mention the amount of the union dues deducted from workers?	No/Yes
Units of union dues	In what units are the union dues expressed?	% of salary, Fixed amount, Days of salary, Other
Amount of union dues	What is the amount of the union dues?	$[0,\infty)$

Notes: This table presents the prompts used to extract information from the text of historical CBAs using a large language model (LLM). The original prompts were written in Spanish and are translated into English for presentation. Column (1) reports the variable name, column (2) the corresponding question posed to the LLM, and column (3) the set of possible responses.

B.1. Performance Assessment of LLM

We evaluate the performance of the LLM model used to extract the CBA features using a random sample of 100 historical CBAs.[47] We read these contracts and manually code four key variables in our analysis: an indicator for the contract having indefinite duration, an indicator for the presence of any type of closed-shop clause (hiring or separations), an indicator for whether the contract provides scholar support for workers' children, and the number of days of salary granted as an annual bonus.[48] We use the same prompt and queries described previously to get the answers from the LLM model and repeat this process five times. In each iteration, we benchmark the model's responses against our answers and assess its performance according to the accuracy metric.[49] For the binary indicators, accuracy is the share of contracts whose clause status is correctly classified, while for the continuous

[47]Fifteen of the sampled CBAs contain incomplete or invalid information, so we restrict the validation analysis to the remaining 85 CBAs.

[48]We label a CBA as *indefinite* whenever it explicitly states that it is of indefinite or indeterminate length, or when it does not mention a specific date for the next revision. Whenever a CBA does not specify the annual bonus amount, we assign the legal minimum of 15 days.

[49]For dichotomous labels, accuracy is formally defined as follows: Accuracy $= (TP + TN)/(TP + TN + FP + FN)$, where TP, TN, FP, and FN denote true positives, true negatives, false positives, and false negatives, respectively.

TABLE B2. Performance Metrics by LLM.

Model	Variable	Accuracy
`gpt-oss-20b`	Indefinite duration	0.955
	Closed-shop clauses	0.833
	Scholar support for worker's kids	0.969
	Annual bonus	0.972
	Overall	0.932
`qwen3-30b-a3b`	Indefinite duration	0.918
	Closed-shop clauses	0.899
	Scholar support for worker's kids	0.960
	Annual bonus	0.936
	Overall	0.928

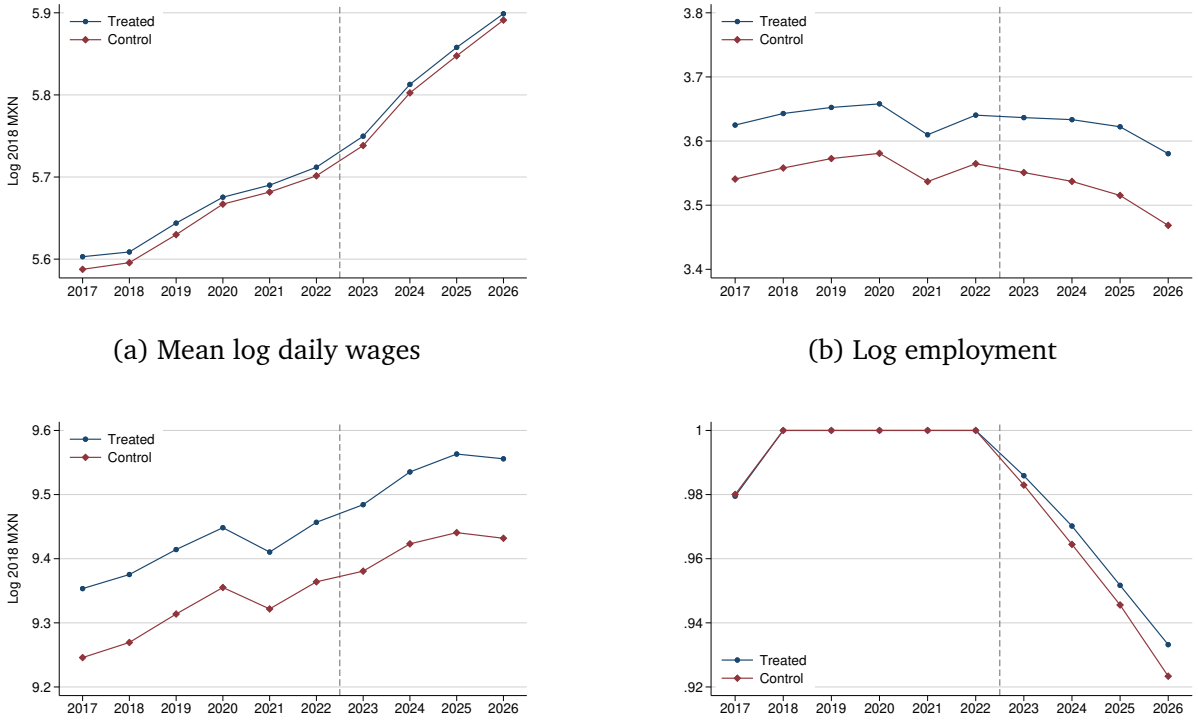
Notes: This table evaluates the accuracy of two large LLMs in extracting information from historical CBAs. Column (1) identifies the LLM used and column (2) reports the variables assessed. Indefinite duration is an indicator equal to one if the CBA explicitly specifies an indefinite duration or does not provide a date for its next revision. Closed-shop clauses is an indicator equal to one if the CBA contains a clause requiring the firm to hire workers through the union or dismiss workers who leave or are expelled from the union. Scholarship support indicates whether the CBA provides educational benefits for workers' children. Annual bonus measures the number of days of salary granted as a year-end bonus. Column (3) reports the average accuracy of each model relative to manually coded benchmark responses. Accuracy is defined as the share of correctly classified observations for binary variables and the share of exact matches for the annual bonus. Performance is evaluated using a random sample of 100 contracts, with results averaged over five iterations per model. The overall row reports the average accuracy across the four variables. *Source:* Authors' calculations.

annual bonus, it is the share of exactly matched values. To provide an additional benchmark for our model, we apply the same prompts and evaluation procedure to an alternative LLM (*qwen3-30b-a3b*) and compare the resulting performance in terms of accuracy across models.

We report the average accuracy across the five iterations in Table B2. Results show that the *gpt-oss-20b* model captures the contract characteristics reliably. In particular, *gpt-oss-20b* attains an average accuracy of 93.2% across the four variables, outperforming *qwen3-30b-a3b* by 0.4 pp. Our preferred model surpasses the alternative LLM in three of the four variables. For indefinite contract duration, *gpt-oss-20b* reaches an accuracy of 95.5%, exceeding *qwen3-30b-a3b* by 3.7 pp. For scholarship support for workers' children, both models achieve accuracy rates above 96% (96.9% versus 96.0%), with a modest advantage of 0.9 pp for *gpt-oss-20b*. For the annual bonus, the exact-match accuracy of *gpt-oss-20b* is 97.2%, exceeding that of *qwen3-30b-a3b* by 3.6 pp. Lastly, when identifying closed-shop clauses, *qwen3-30b-a3b* exhibits a better performance (89.9% versus 83.3%) than *gpt-oss-20b*, which is the only variable for which the alternative model outperforms our preferred one. We thus use the CBA data extracted by *gpt-oss-20b* to conduct our main analysis in the paper.

Appendix C. Additional Figures

FIGURE C1. Raw Means of Main Outcomes.



(a) Mean log daily wages

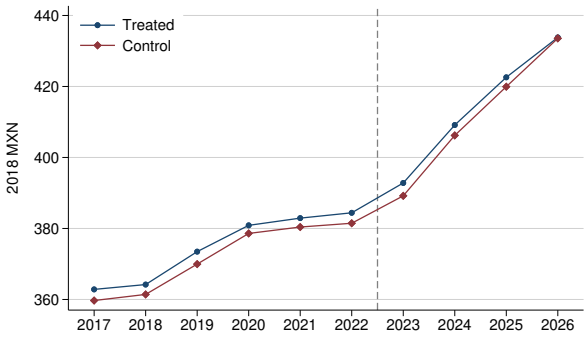
(b) Log employment

(c) Log wage bill

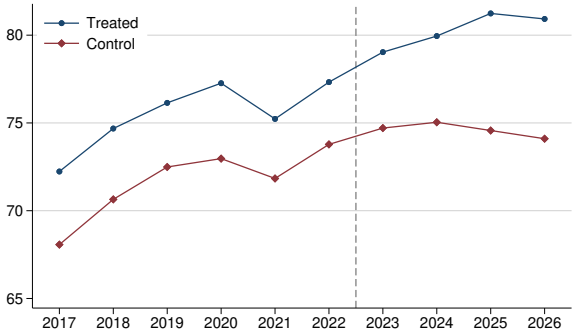
(d) 1{Formal}

Notes: This figure displays the raw means of the main outcome variables by treatment group for the matched sample of firms described in Section 4. The treatment group consists of union firms (with a CBA pre-reform, circles), and the control group consists of matched non-union firms (without a CBA pre-reform, diamonds). Panel (a): Mean log daily wages are calculated as the average of workers' log real daily wages within the firm in each period, where daily wages are deflated using the national CPI (base second half of July 2018). Panel (b): Log employment is the log of the number of formal workers registered in IMSS at the firm in each period. Panel (c): Log wage bill is the log of the sum of real daily wages across all workers registered at the firm in each period. Panel (d): 1{Formal} is a year-to-year indicator equal to 1 if the firm has at least one worker registered in IMSS in February of that year, and zero otherwise. For all outcomes except formal-sector status, the sample is restricted to matched pairs in which both (treated and control) firms remain in the formal sector throughout the post-reform period. The vertical dashed line corresponds to October 2022, the period when the CFCRL became operational in Mexico's largest states. *Source:* RIRL and IMSS data in February of each year.

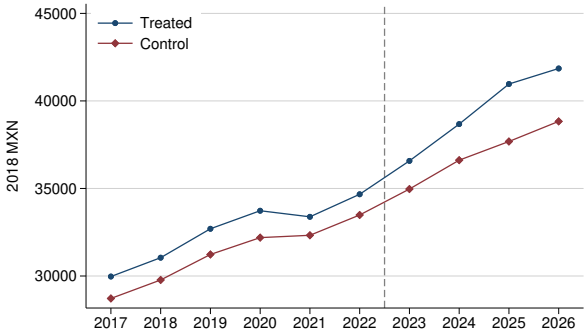
FIGURE C2. Raw Means of Main Outcomes in Levels.



(a) Mean daily wages



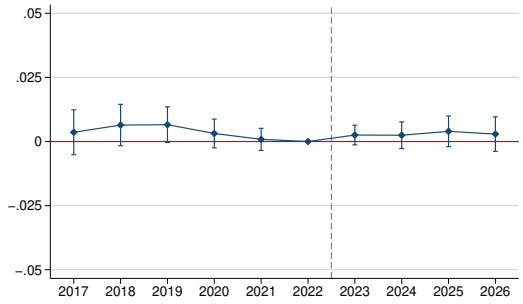
(b) Employment



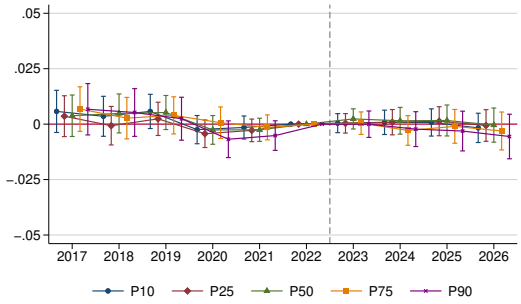
(c) Wage bill

Notes: This figure displays the raw means of the main outcome variables in levels by treatment group for the matched sample of firms described in Section 4. The treatment group consists of union firms (with a CBA pre-reform, circles), and the control group consists of matched non-union firms (without a CBA pre-reform, diamonds). Panel (a): Mean daily wages are calculated as the average of workers' real daily wages within the firm in each period, where daily wages are deflated using the national CPI (base second half of July 2018). Panel (b): Employment is the number of formal workers registered in IMSS at the firm in each period. Panel (c): Wage bill is the sum of real daily wages across all workers registered at the firm in each period. The sample is restricted to matched pairs in which both (treated and control) firms remain in the formal sector throughout the post-reform period. The vertical dashed line corresponds to October 2022, the period when the CFCRL became operational in Mexico's largest states. *Source:* RIRL and IMSS data in February of each year.

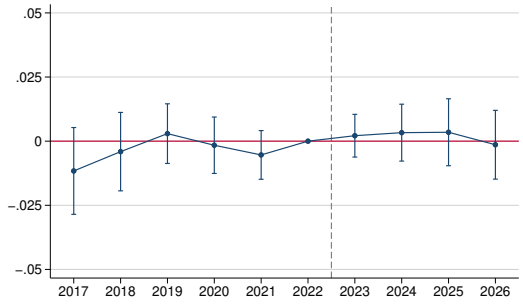
FIGURE C3. The Effects of the Reform on Union Firms' Wages.



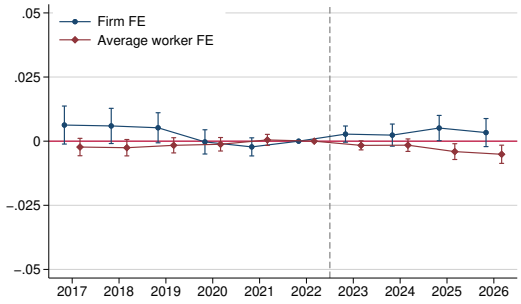
(a) Stayers' mean log daily wages



(b) Percentiles of log wages



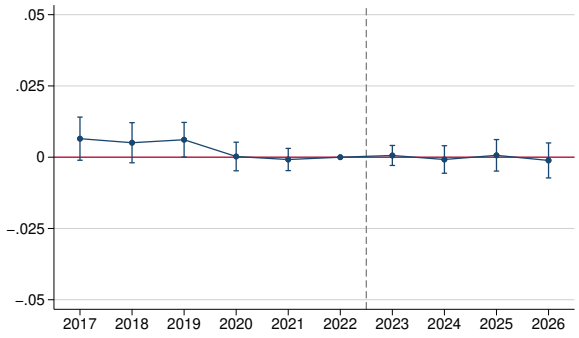
(c) Weighted by 2022 employment



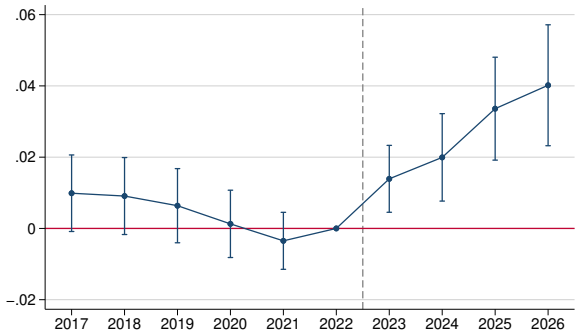
(d) TV-AKM outcomes

Notes: This figure displays the event-study coefficients from equation (1) estimated on the matched sample of firms described in Section 4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). Panel (a): Mean log daily wages in each firm are calculated using only workers who remain employed at the same firm throughout the sample period (stayers). Panel (b): The outcome variables are the 10th (circles), 25th (diamonds), 50th (triangles), 75th (squares), and 90th (crosses) percentiles of the within-firm distribution of log real daily wages in each period. Panel (c): The outcome variable is the mean log daily wage in each period but the event-study regression weights firms by their employment level in February 2022. Panel (d): The outcome variables are the time-varying firm fixed effects (firm pay premia, circles) and the firm-level averages of worker fixed effects (worker quality, diamonds), estimated from the time-varying AKM model described in Section 5.1. Daily wages are deflated using the national CPI (base second half of July 2018). The sample is restricted to matched pairs in which both treated and control firms remain in the formal sector throughout the post-reform period. The vertical dashed line corresponds to October 2022, when the CFCRL became operational in Mexico's largest states. Event-study coefficients are normalized relative to 2022. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL and IMSS data in February of each year.

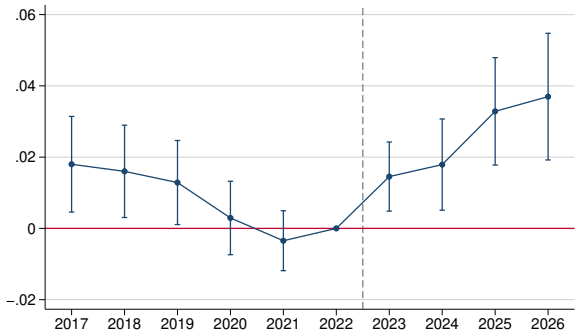
FIGURE C4. The Effects of the Reform on Union Firms: Unbalanced Panel of Firms.



(a) Mean log daily wages



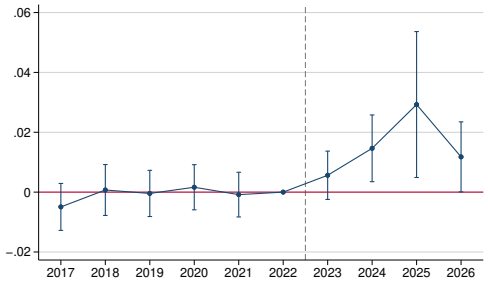
(b) Log employment



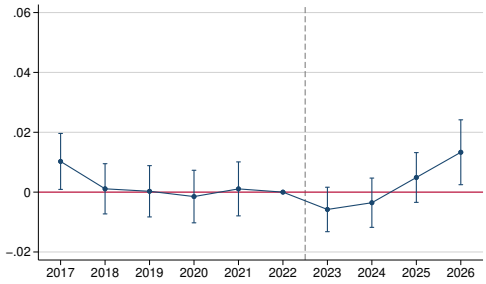
(c) Log wage bill

Notes: This figure displays the event-study coefficients from equation (1) estimated on the matched sample of firms described in Section 4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). Unlike results shown in figure 2, the sample of firms here is not restricted to matched pairs in which both firms remain in the formal sector throughout the post-reform period. Panel (a): Mean log daily wages are calculated as the average of workers' log real daily wages within the firm in each period, where daily wages are deflated using the national CPI (base second half of July 2018). Panel (b): Log employment is the log of the number of formal workers registered in IMSS at the firm in each period. Panel (c): Log wage bill is the log of the sum of real daily wages across all workers registered at the firm in each period. The vertical dashed line corresponds to October 2022, the period when the CFCRL became operational in Mexico's largest states. Event-study coefficients are normalized relative to 2022. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL, and IMSS data in February of each year.

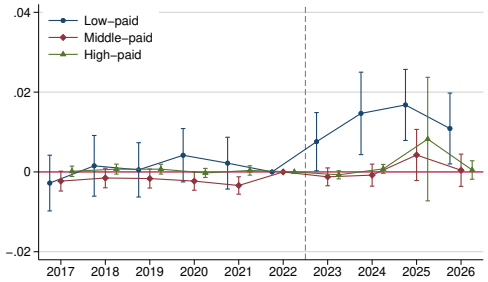
FIGURE C5. The Effects of the Reform on Union Firms' Hiring and Separations.



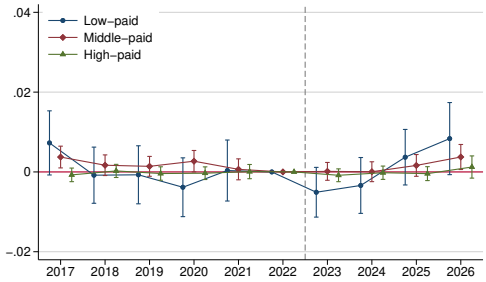
(a) Entrants



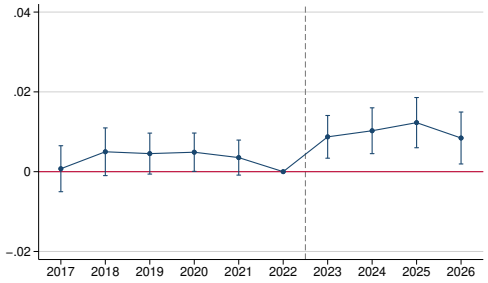
(b) Separations



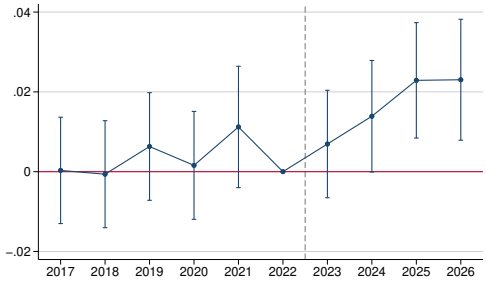
(c) Entrants by wage group



(d) Separations by wage group



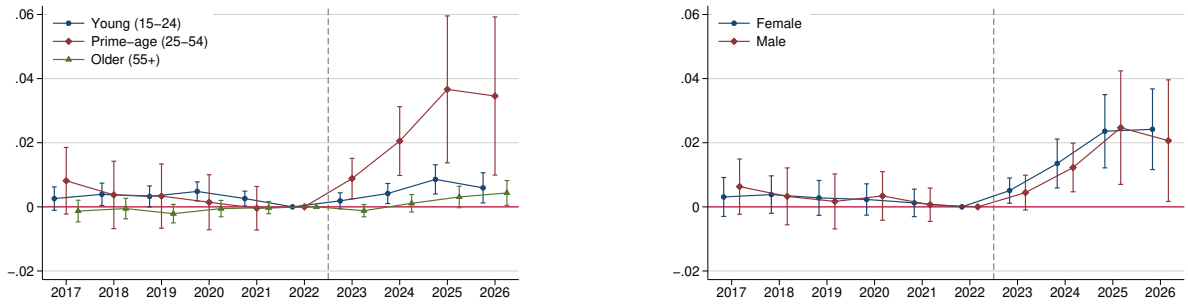
(e) Non-formal entrants



(f) 1{Hiring a non-formal worker}

Notes: This figure displays the event-study coefficients from equation (1) estimated on the matched sample of firms described in Section 4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). All outcomes are scaled by the firm's level of employment in 2022, except in Panel (f). Panel (a): Entrants are the number of workers registered in IMSS at the firm in year t who were not in the firm in year $t-1$. Panel (b): Separations are the number of workers registered in IMSS at the firm in year $t-1$ who are no longer registered at the firm in year t. Panels (c) and (d): The outcome variables are the number of entrants (Panel c) and separations (Panel d) in each wage group in a given year. Workers are classified into three wage groups in each period based on their daily wages relative to the 2024 federal minimum wage (248.93 MXN per day): low-paid (less than two times the minimum wage, circles), middle-paid (between two and five times, diamonds), and high-paid (five or more times, triangles). Panel (e): Non-formal entrants are entrants at the firm in year t who were not observed in IMSS in year $t-1$. Panel (f): 1{Hiring a non-formal worker} is an indicator equal to 1 if the firm registers in IMSS at least one worker in year t who was not observed in IMSS data in year $t-1$, and zero otherwise. The sample is restricted to matched pairs in which both treated and control firms remain in the formal sector throughout the post-reform period. The vertical dashed line corresponds to October 2022, when the CFCRL became operational in Mexico's largest states. Event-study coefficients are normalized relative to 2022. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL and IMSS data in February of each year.

FIGURE C6. The Effects of the Reform on Union Firms' Employment by Age and Gender.

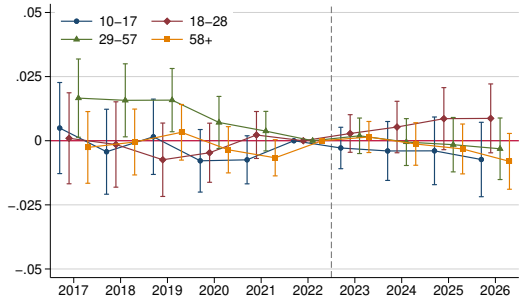


(a) Age

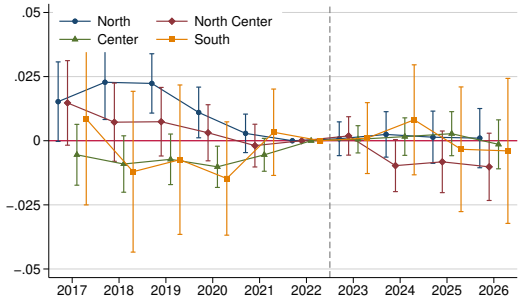
(b) Gender

Notes: This figure displays the event-study coefficients from equation (1) estimated on the matched sample of firms described in Section 4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). Panel (a): Workers are classified each period into three age groups, young (15–24 years, circles), prime-age (25–54 years, diamonds), and older (55–65 years, triangles). The outcome variables are the number of workers in each age group at the firm registered in IMSS in each period, scaled by the firm's level of employment in 2022. Panel (b): Workers are classified each period by gender into female (circles) and male (diamonds). The outcome variables are the number of workers in each gender group at the firm registered in IMSS, scaled by the firm's level of employment in 2022. The sample is restricted to matched pairs in which both treated and control firms remain in the formal sector throughout the post-reform period. The vertical dashed line corresponds to October 2022, when the CFCRL became operational in Mexico's largest states. Event-study coefficients are normalized relative to 2022. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL and IMSS data in February of each year.

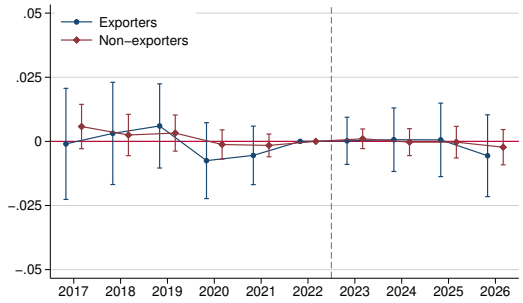
FIGURE C7. The Effects of the Reform on Union Firms' Wages: Heterogeneity by Size, Location, Exporter Status and Manufacturing.



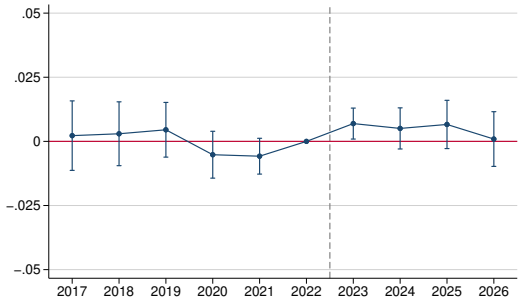
(a) Firm size in 2022



(b) Region



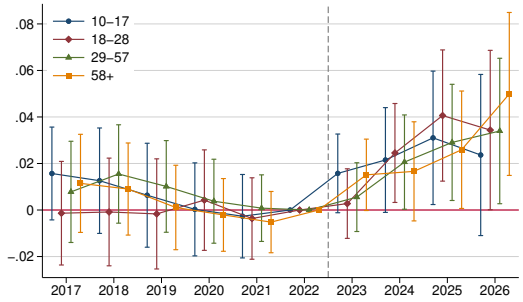
(c) Exporter status in 2022



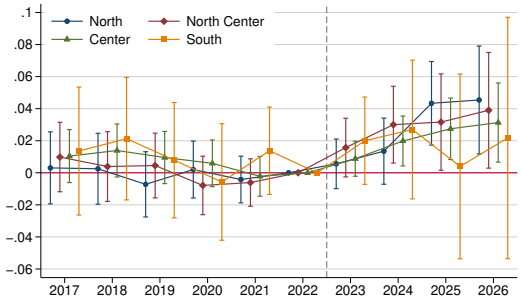
(d) Manufacturing

Notes: This figure displays the event-study coefficients from equation (1) estimated separately for the different subgroups of treated firms and their corresponding matched controls, as described in Section 4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). The outcome variable in all panels is the mean of workers' log real daily wages within the firm in each period, deflated using the national CPI (base second half of July 2018). Panel (a): Firms are divided into quartiles based on their employment level in February 2022 (10–17, 18–28, 29–57, and 58 or more workers). Panel (b): Firms are divided into four geographic regions. North (Baja California, Chihuahua, Coahuila, Nuevo León, Sonora, and Tamaulipas), North-Center (Aguascalientes, Baja California Sur, Colima, Durango, Jalisco, Michoacán, Nayarit, San Luis Potosí, Sinaloa, and Zacatecas), Center (Ciudad de México, Estado de México, Guanajuato, Hidalgo, Morelos, Puebla, Querétaro, and Tlaxcala), and South (Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, Veracruz, and Yucatán). Panel (c): Firms are classified as exporters if they exported any goods in 2022. Panel (d): Considers only firms in the manufacturing sector. The sample is restricted to matched pairs in which both treated and control firms remain in the formal sector throughout the post-reform period. The vertical dashed line corresponds to October 2022, when the CFCRL became operational in Mexico's largest states. Event-study coefficients are normalized relative to 2022. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL, CExt, and IMSS data in February of each year.

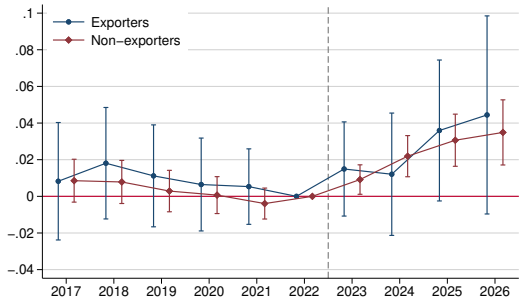
FIGURE C8. The Effects of the Reform on Union Firms' Log Employment: Heterogeneity by Size, Location, Exporter Status and Manufacturing.



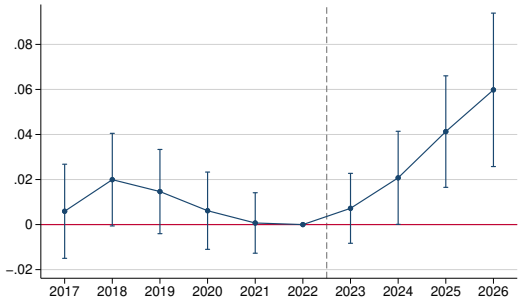
(a) Firm size in 2022



(b) Region



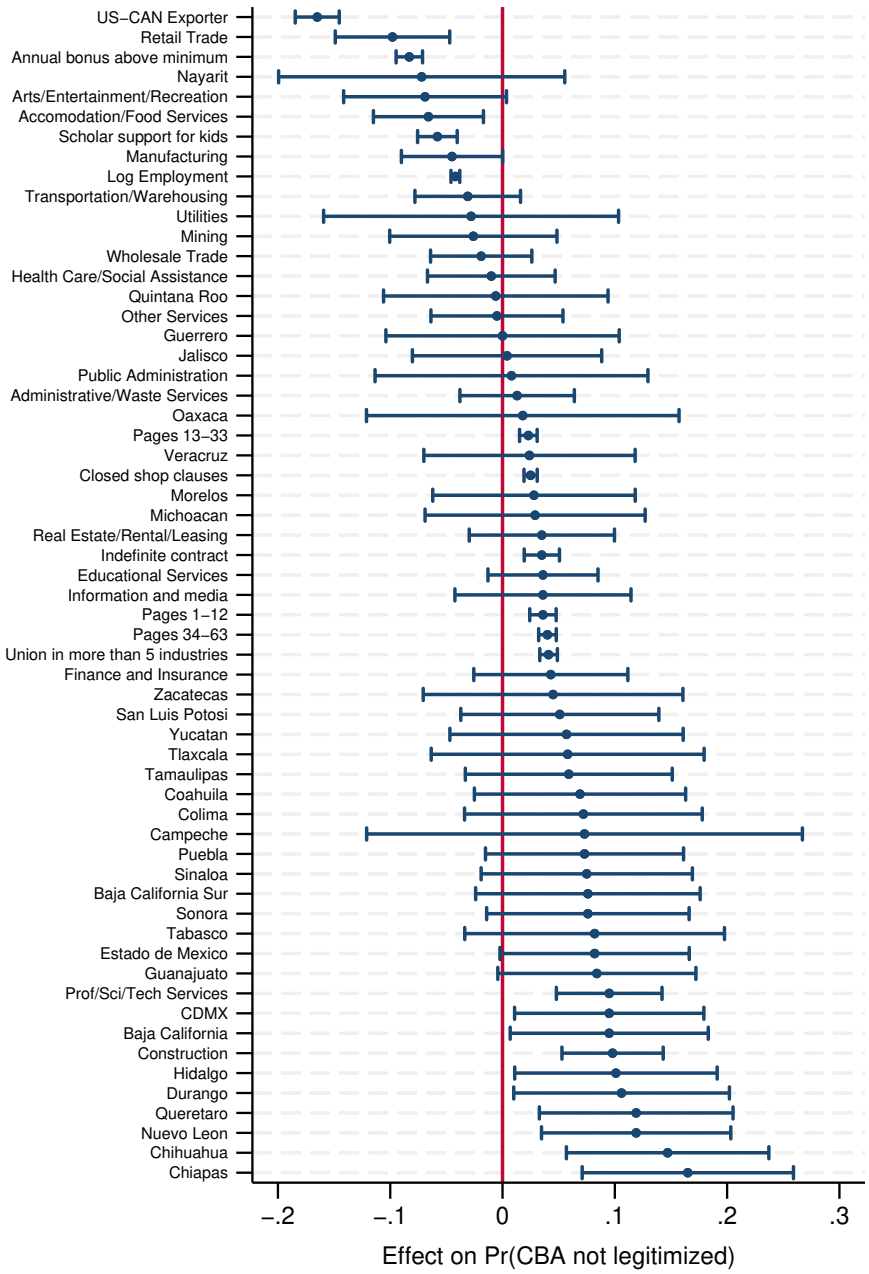
(c) Exporter status in 2022



(d) Manufacturing

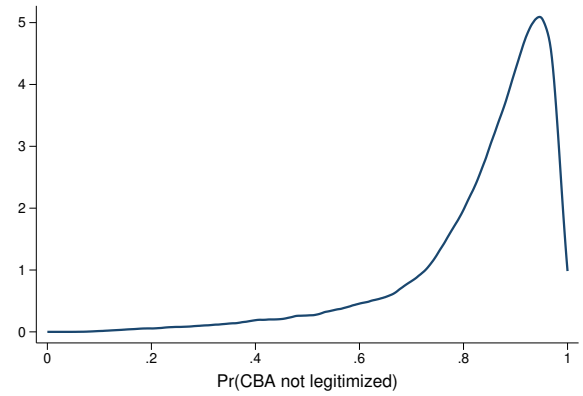
Notes: This figure displays the event-study coefficients from equation (1) estimated separately for the different subgroups of treated firms and their corresponding matched controls, as described in Section 4. The treatment group consists of union firms (with a CBA pre-reform), and the control group consists of matched non-union firms (without a CBA pre-reform). The outcome variable in all panels is the log of the number of workers registered in IMSS at the firm in each period. Panel (a): Firms are divided into quartiles based on their employment level in February 2022 (10–17, 18–28, 29–57, and 58 or more workers). Panel (b): Firms are divided into four geographic regions. North (Baja California, Chihuahua, Coahuila, Nuevo León, Sonora, and Tamaulipas), North-Center (Aguascalientes, Baja California Sur, Colima, Durango, Jalisco, Michoacán, Nayarit, San Luis Potosí, Sinaloa, and Zacatecas), Center (Ciudad de México, Estado de México, Guanajuato, Hidalgo, Morelos, Puebla, Querétaro, and Tlaxcala), and South (Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, Veracruz, and Yucatán). Panel (c): Firms are classified as exporters if they exported any goods in 2022. Panel (d): Considers only firms in the manufacturing sector. The sample is restricted to matched pairs in which both treated and control firms remain in the formal sector throughout the post-reform period. The vertical dashed line corresponds to October 2022, when the CFCRL became operational in Mexico's largest states. Event-study coefficients are normalized relative to 2022. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL, CExt, and IMSS data in February of each year.

FIGURE C9. Full Set of Average Marginal Effects from Logistic Regression.

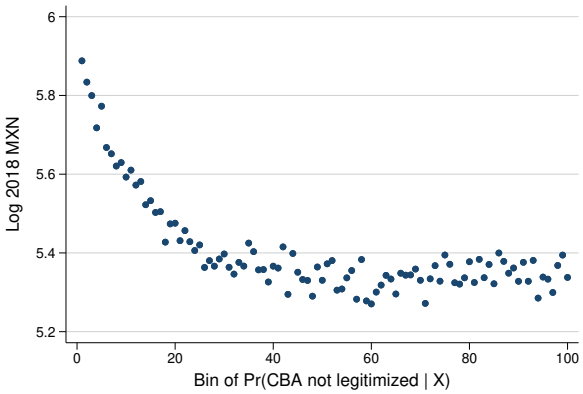


Notes: This figure displays the average marginal effects (AMEs) from the logistic regression in equation (2), estimated on the sample of historical CBAs matched to firm-level characteristics from IMSS in February 2019, as described in Section 5.3. The dependent variable is an indicator equal to 1 if the CBA was not legitimized following the reform, and zero otherwise. The set of covariates include indicators for an indefinite-term CBA, closed-shop clauses, scholarship support for workers' children, whether the union operates in more than five industries, an annual bonus above the statutory minimum, and contract-length quartiles, as well as firm-level characteristics including log employment, exporter status to the U.S. or Canada, industry, and state fixed effects. The omitted categories are: CBAs with more than 63 pages (for CBA length), non-exporting firms (for exporter status), Agriculture, Forestry, and Fishing (for industry), and Aguascalientes (for state). The procedure used to extract the CBA characteristics is described in Appendix B. AMEs measure the average change in the predicted probability of non-legitimization associated with each covariate. The estimates are ordered from the largest negative AME (top) to the largest positive AME (bottom). Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source:* RIRL, CExt, and IMSS data in February 2019.

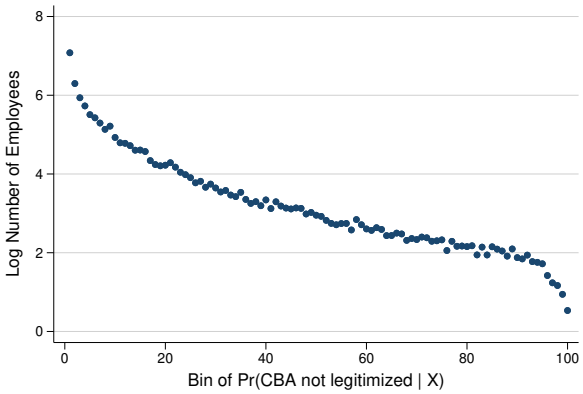
FIGURE C10. Density and Means within Percentiles of Propensity Score.



(a) Density



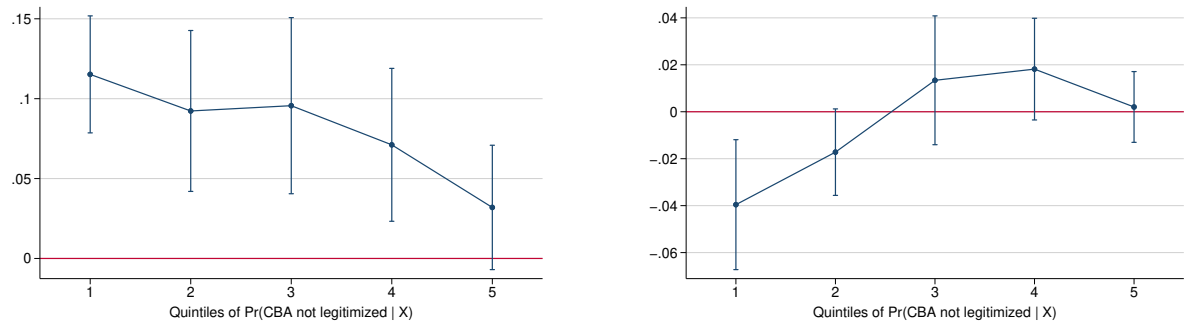
(b) Mean log daily wages



(c) Log employment

Notes: This figure presents the distribution of the predicted probability of CBA non-legitimization and its relationship with firm-level wages and employment, as described in Section 5.3. We first compute the fitted probabilities using the logistic regression model at the CBA level in (2). The predicted probabilities from this regression are then averaged across all CBAs associated with each firm to construct a firm-level measure. Panel (a): Displays the density of the average predicted probability of non-legitimization across firms. Panel (b): Reports mean log daily wages of firms within each percentile of the distribution of predicted probabilities. Panel (c): Reports mean log employment of firms within each percentile of the distribution of predicted probabilities. Wage and employment measures are taken from February 2019. *Source:* RIRL and IMSS data in February 2019.

FIGURE C11. Union Wage Premium and RIF Effects on Gini Across Quintiles of Propensity to Not Legitimize.



(a) Union wage premium

(b) RIF effects on Gini

Notes: This figure presents estimates of the union wage premium and the relationship between union coverage and wage inequality across quintiles of the predicted probability of CBA non-legitimization, using worker-level data from IMSS in February 2019. The predicted probabilities are obtained from the logistic regression model in (2) and then averaged across all CBAs associated with each firm. Union firms are then divided into quintiles of this firm-level measure. Panel (a) reports coefficients from a Mincerian regression of log real daily wages on indicators for each quintile, with workers in non-union firms as the omitted category. The regression controls for log firm employment, age, age squared, gender, whether the firm is located in the Northern Border Free Zone (ZLFN), exporter status to the U.S. or Canada, and state and industry fixed effects. The coefficients represent the conditional wage differential between workers in union firms in each quintile and workers in non-union firms. Panel (b) reports estimates from a Recentered Influence Function (RIF) regression for the Gini coefficient of log daily wages, with non-union workers as the reference group and controlling for firm employment. The Gini coefficient in the full sample is 0.452. The estimates are used to assess how wage inequality in the formal sector would change under a counterfactual reallocation of non-union workers to union firms in each quintile, relative to this baseline. The horizontal axis in both panels orders quintiles from the lowest (Q1) to the highest (Q5) predicted probability of non-legitimization. Bars represent 95% confidence intervals. Standard errors are clustered at the firm level. *Source*: RIRL and IMSS data in February 2019.

Appendix D. Additional Tables

TABLE D1. Descriptive Statistics of Historical CBAs.

	(1) All CBAs	(2) Non-Legitimized	(3) Legitimized	(4) Diff.
Indefinite contract	0.956	0.963	0.929	0.034***
	(0.205)	(0.190)	(0.258)	
Closed shop clauses	0.654	0.667	0.597	0.070***
	(0.476)	(0.471)	(0.490)	
Scholar support for kids	0.037	0.026	0.081	-0.054***
	(0.188)	(0.161)	(0.272)	
Union in multiple industries	0.459	0.481	0.364	0.117***
	(0.498)	(0.500)	(0.481)	
Annual bonus above minimum	0.102	0.079	0.201	-0.122***
	(0.302)	(0.269)	(0.401)	
Pages 64+	0.281	0.267	0.338	-0.070***
	(0.449)	(0.443)	(0.473)	
US–CAN Exporter	0.094	0.059	0.242	-0.183***
	(0.291)	(0.236)	(0.428)	
North	0.157	0.162	0.135	0.027***
	(0.364)	(0.369)	(0.342)	
North Center	0.385	0.375	0.425	-0.050***
	(0.487)	(0.484)	(0.494)	
Center	0.404	0.411	0.375	0.037***
	(0.491)	(0.492)	(0.484)	
South	0.054	0.051	0.065	-0.014***
	(0.226)	(0.221)	(0.247)	
Manufacturing	0.262	0.229	0.402	-0.173***
	(0.440)	(0.420)	(0.490)	
Wholesale Trade	0.224	0.229	0.203	0.026***
	(0.417)	(0.420)	(0.402)	
Retail Trade	0.059	0.053	0.083	-0.030***
	(0.235)	(0.224)	(0.276)	
Observations	58,405	47,377	11,028	

Notes: This table reports descriptive statistics for the sample of historical CBAs used to estimate the logistic regression in (2), as described in Section 5.3. The sample consists of CBAs for which we extracted contractual characteristics and linked them to firm-level information from IMSS in February 2019. Column (1) reports the means for all CBAs, while columns (2) and (3) report the corresponding statistics for CBAs that were not legitimized and those that were legitimized, respectively. Column (4) reports the differences in means between columns (2) and (3), with statistical significance assessed using two-sample t-tests. Indefinite contract indicates CBAs with an indefinite duration. Closed shop clauses indicates CBAs containing provisions requiring the union to supply workers for vacancies or the dismissal of workers who cease to be union members. Scholar support for kids indicates CBAs providing scholarships or educational support for workers' children. Union in multiple industries indicates CBAs signed by unions operating in more than five industries (the sample median). Annual bonus above minimum indicates CBAs granting a year-end bonus exceeding the statutory minimum of 15 days of wages. Pages 64+ indicates CBAs with at least 64 pages, corresponding to the highest quartile of contract length. US–CAN Exporter indicates firms exporting to the U.S. or Canada. Geographic regions are defined as in Table 1. Manufacturing, Wholesale Trade, and Retail Trade are industry indicators. Appendix B describes the extraction of the CBA characteristics in detail. Standard deviations are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source:* RIRL, CExt, and IMSS in February 2019.

TABLE D2. The Effects of the Reform on Union Establishments in Manufacturing: Wage bill, Value of Production and Total Revenue.

	(1) Wage bill	(2) Value of production	(3) Total revenue
	Panel A. All establishments		
Treat × Post	0.046**	0.054**	0.046**
	(0.019)	(0.025)	(0.022)
Observations	31,064	31,064	31,064
R-squared	0.952	0.976	0.976
Mean for the Treated in 2022	125,098	1,259,788	1,419,617
	Panel B. Establishments with ≥ 10 employees in 2022		
Treat × Post	0.047**	0.057**	0.050**
	(0.021)	(0.028)	(0.025)
Observations	26,820	26,820	26,820
R-squared	0.952	0.976	0.976
Mean for the Treated in 2022	131,338	1,297,882	1,463,862
Establishment FEs	✓	✓	✓
Year FEs	✓	✓	✓
Industry × Year	✓	✓	✓
Revenue 2022 × Year	✓	✓	✓
Outsourcing 2022 × Year	✓	✓	✓
Exporter 2022 × Year	✓	✓	✓

Notes: This table reports estimates from a static DID specification using the balanced panel of manufacturing establishments from EAIM described in Section 3. The treatment group consists of union establishments (linked to a pre-reform CBA), and the control group consists of non-union establishments (without a pre-reform CBA). The sample covers 2021–2024, with 2023 and 2024 defining the post-reform period. Panel A reports estimates for all establishments in the sample, while Panel B restricts the sample to establishments with at least 10 directly hired workers in 2022. Column (1) reports the effects on the wage bill, defined as total remuneration paid to directly hired workers. Column (2) reports the effects on the value of production, defined as the value of products manufactured using the establishment's own raw materials plus fixed assets produced for own use. Column (3) reports the effects on total revenue, which includes income from the supply of goods and services to domestic and foreign markets. All outcomes are expressed relative to their respective means among treated establishments in 2022, reported in the row "Mean for the Treated in 2022". All monetary variables are deflated using the national CPI (base second half of July 2018), and their means are expressed in thousands of 2018 MXN. All specifications include establishment and year fixed effects, three-digit NAICS industry-by-year fixed effects, and interactions of year indicators with total revenue, the share of outsourced employment, and exporter status, all measured in 2022. Standard errors are clustered at the establishment level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source:* RIRL and EAIM.

TABLE D3. Earnings Gains from Formalization Induced by the Reform.

Year (t)	(1) Treated firms (J)	(2) $\hat{\beta}^{\text{Wage bill}}_{t,\text{Non-formal}\to\text{Formal}}$	(3) $\hat{\beta}^{\text{Entrants}}_{t,\text{Non-formal}\to\text{Formal}}$	(4) $\bar{w}^{\text{inf}}_{t}$	(5) Additional entrants	(6) Annual gains (millions MXN)	(7) Annual gains (millions USD)
2023	7,515	2,931.9	0.281	3,337.3	2,114	179.7	9.3
2024	7,515	5,601.2	0.440	3,457.5	3,308	367.9	19.1
2025	7,515	8,287.5	0.608	3,374.6	4,573	562.2	29.2
2026	7,515	5,206.0	0.328	4,029.1	2,466	350.3	18.2
Total					12,460	1,460.1	75.9
Average annual gain per worker						0.117	0.006

Notes: This table reports the components used to calculate the total earnings gains from formalization induced by the reform over 2023–2026, as described in Section 7 and equation (9). The calculation assumes that workers who entered formal employment because of the reform would otherwise have remained outside the formal sector and earned the average wage of informal-sector workers. Column (1) reports the number of treated firms (union firms with a CBA pre-reform) in the matched sample. Columns (2) and (3) report the year-t coefficients from the event-study specification in (1), estimated using the monthly wage bill of non-formal entrants and the number of non-formal entrants, respectively, as outcome variables. Non-formal entrants are defined as workers registered in IMSS in February of year t who were not registered in the formal sector in February of year $t-1$. Monthly earnings are calculated by multiplying daily wages reported in IMSS by 365/12. Column (4) reports the average monthly earnings of informal-sector workers, including zero earnings, calculated using ENOE data from the first quarter of each year. Column (5) reports the implied number of additional non-formal entrants, obtained by multiplying the coefficient in column (3) by the number of treated firms in column (1). Columns (6) and (7) report the annualized earnings gains from formalization in millions of 2018 MXN and 2018 USD, respectively. Annual gains in column (6) are calculated by multiplying the number of treated firms by 12 times the difference between the coefficients in column (2) and the product of columns (3) and (4), while column (7) converts these gains to USD using the average FIX exchange rate in 2018 (19.24 MXN per USD). The row "Total" sums the additional entrants and annualized earnings gains over 2023–2026. The last row reports the average annualized earnings gain per worker, calculated by dividing the total earnings gains by the total number of additional entrants. Columns (2) and (4) are expressed in monthly 2018 MXN, while the last row is expressed in millions of 2018 MXN and 2018 USD per additional entrant. All monetary variables are deflated using the national CPI (base second half of July 2018). *Source:* RIRL, IMSS, and ENOE.

Appendix E. Model Derivations

This appendix contains the mathematical derivations of the theoretical model presented in Section 6. We first derive the optimal level of employment and wages for firms in each of the three arrangements, and then prove our main result containing the optimal sorting rules for firms in the (ε, c)–space. Throughout, we maintain the assumptions of Section 6 in terms of parameters and production technology. Specifically, the outside option is $\bar{w} > 0$, workers' bargaining power is $\beta \in (0,1)$, the taste for amenities is $a > 0$, the fee charged by the paper union as a share of the wage bill is $\tau \in (0,1)$, the cost of unionizing is $\lambda > 0$, productivity ε and the cost of amenities c are independent random variables drawn from distributions G and H with bounded support in $\mathbb{R}_+$, respectively, and the production function is $F(L) = \varepsilon L - \frac{\sigma}{2}L^2$, with $\sigma > 0$. We begin by showing an auxiliary result.

Lemma E.1 (Labour demand)**.** *Consider the profit maximization problem* $\max_{L \geq 0} F(L) - kL$*, where* $k > 0$ *is the marginal cost of labour. If* $k < \varepsilon$*, the unique solution is* $L^* = (\varepsilon - k)/\sigma > 0$ *and the maximized value is*

$$\pi^* = \frac{(\varepsilon - k)^2}{2\sigma} = \frac{\sigma}{2}(L^*)^2.$$

If $k \geq \varepsilon$*, then* $L^* = 0$ *and* $\pi^* = 0$*.*

Proof. The objective $F(L) - kL = (\varepsilon - k)L - \frac{\sigma}{2}L^2$ is strictly concave in L since $F''(L) = -\sigma < 0$, so the first-order condition $\varepsilon - \sigma L - k = 0$ is necessary and sufficient for an interior maximum. If $k < \varepsilon$, it yields $L^* = (\varepsilon - k)/\sigma > 0$. Substituting back and using $\varepsilon - k = \sigma L^*$,

$$\pi^* = (\varepsilon - k)L^* - \frac{\sigma}{2}(L^*)^2 = \frac{\sigma}{2}(L^*)^2 = \frac{(\varepsilon - k)^2}{2\sigma}.$$

If $k \geq \varepsilon$, the derivative of the objective function, $\varepsilon - k - \sigma L$, is non-positive for all $L \geq 0$, so $L^* = 0$ and $\pi^* = 0$. □

Lemma E.2 (Non-union firms)**.** *Consider the profit maximization problem of a non-union firm,* $\max_{w_n \geq \bar{w},\, L_n \geq 0} F(L_n) - w_n L_n$*.*

(i) If $\varepsilon > \bar{w}$*, the solution is* $w_n^* = \bar{w}$ *and* $L_n^* = (\varepsilon - \bar{w})/\sigma$*, and the maximized profits are* $\pi_n^* = (\varepsilon - \bar{w})^2/2\sigma$*.*

(ii) If $\varepsilon \leq \bar{w}$*, the firm cannot operate profitably and stays out of the market, so* $L_n^* = \pi_n^* = 0$*.*

Proof. For any $L_n > 0$, profits are strictly decreasing in w_n, so the wage constraint binds and $w_n^* = \bar{w}$. The firm therefore faces a marginal cost of labour $k = \bar{w}$. (i) If $\varepsilon > \bar{w}$, then $k < \varepsilon$ and Lemma E.1 yields $L_n^* = (\varepsilon - \bar{w})/\sigma$ and $\pi_n^* = (\varepsilon - \bar{w})^2/2\sigma$. (ii) If $\varepsilon \leq \bar{w}$, then $k \geq \varepsilon$ and Lemma E.1 yields $L_n^* = 0$ and $\pi_n^* = 0$. □

From now on, we focus on the case $\varepsilon > \bar{w}$, since firms with productivity below the outside option cannot operate profitably in the non-union arrangement.

Lemma E.3 (Paper-union firms)**.** *Consider the profit maximization problem of a paper-union firm,* $\max_{w_p \geq \bar{w},\, L_p \geq 0} F(L_p) - (1+\tau) w_p L_p$*.*

(i) If $\varepsilon > (1+\tau)\bar{w}$, the solution is $w_p^* = \bar{w}$ and $L_p^* = [\varepsilon-(1+\tau)\bar{w}]/\sigma$, and the maximized profits are $\pi_p^* = [\varepsilon-(1+\tau)\bar{w}]^2/2\sigma$.
(ii) If $\varepsilon \le (1+\tau)\bar{w}$, the firm cannot operate profitably, so $L_p^* = \pi_p^* = 0$.

Proof. For any $L_p > 0$, profits are strictly decreasing in w_p since $1+\tau > 0$, so the wage constraint binds and $w_p^* = \bar{w}$. The firm therefore faces a marginal cost of labour $k = (1+\tau)\bar{w}$. (i) If $\varepsilon > (1+\tau)\bar{w}$, then $k < \varepsilon$ and Lemma E.1 yields $L_p^* = [\varepsilon-(1+\tau)\bar{w}]/\sigma$ and $\pi_p^* = [\varepsilon-(1+\tau)\bar{w}]^2/2\sigma$. (ii) If $\varepsilon \le (1+\tau)\bar{w}$, then $k \ge \varepsilon$ and Lemma E.1 yields $L_p^* = 0$ and $\pi_p^* = 0$. □

Union firms. Given a wage w_u and amenities ψ, the union firm's cost per worker is $k = w_u + c\psi$, so by Lemma E.1 its labour demand and profits are

$$L(w_u,\psi) = \begin{cases} \dfrac{\varepsilon - w_u - c\psi}{\sigma}, & \text{if } \varepsilon > w_u + c\psi. \\ 0, & \text{if } \varepsilon \le w_u + c\psi. \end{cases} \tag{10}$$

And

$$\pi_u(w_u, L(w_u,\psi)) = \begin{cases} \dfrac{(\varepsilon - w_u - c\psi)^2}{2\sigma}, & \text{if } \varepsilon > w_u + c\psi. \\ 0, & \text{if } \varepsilon \le w_u + c\psi. \end{cases} \tag{11}$$

respectively.

Lemma E.4 (Union firms)**.**
(i) The Nash bargaining problem

$$\max_{(w_u,\psi):\, W_u \ge \bar{w}} \Big[\pi_u(w_u, L(w_u,\psi))\Big]^{1-\beta} \Big[\Big(w_u + a\sqrt{\psi} - \bar{w}\Big) L(w_u,\psi)\Big]^{\beta}, \tag{12}$$

has a unique solution, given by

$$\psi^* = \frac{a^2}{4c^2} \qquad \text{and} \qquad w_u^* = \bar{w} + \frac{\beta}{2}\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right) - \frac{a^2}{2c}.$$

(ii) Employment and profits at union firms are

$$L_u^* = \left(1 - \frac{\beta}{2}\right)\frac{\varepsilon - \bar{w} + \frac{a^2}{4c}}{\sigma} \quad \text{and} \quad \pi_u^* = \left(1 - \frac{\beta}{2}\right)^2 \frac{\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right)^2}{2\sigma}.$$

Proof. (i) We take the log of the objective function in (12), which by (10) equals

$$(2-\beta)\ln(\varepsilon - w_u - c\psi) + \beta\ln\Big(w_u + a\sqrt{\psi} - \bar{w}\Big) - (1-\beta)\ln(2\sigma) - \beta\ln\sigma. \tag{13}$$

Notice that the objective function in (13) is strictly concave on the feasible set, so the first-order conditions are necessary and sufficient and any interior solution is the unique maximizer. Then, the first-order conditions with respect to w_u and ψ are

$$-\frac{2-\beta}{\varepsilon - w_u - c\psi} + \frac{\beta}{w_u + a\sqrt{\psi} - \bar{w}} = 0, \tag{14}$$

$$-\frac{(2-\beta)\,c}{\varepsilon - w_u - c\psi} + \frac{\beta\, a}{2\sqrt{\psi}\left(w_u + a\sqrt{\psi} - \bar{w}\right)} = 0. \tag{15}$$

Multiplying (14) by c and subtracting it from (15) yields

$$\frac{\beta}{w_u + a\sqrt{\psi} - \bar{w}}\left(\frac{a}{2\sqrt{\psi}} - c\right) = 0 \quad \Longrightarrow \quad \frac{a}{2\sqrt{\psi}} = c \quad \Longrightarrow \quad \psi^* = \frac{a^2}{4c^2}.$$

At ψ^*, $c\psi^* = a^2/4c$ and $a\sqrt{\psi^*} = a^2/2c$, so (14) becomes

$$\beta\left(\varepsilon - w_u - \frac{a^2}{4c}\right) = (2-\beta)\left(w_u + \frac{a^2}{2c} - \bar{w}\right).$$

Solving for w_u yields

$$w_u^* = \bar{w} + \frac{\beta}{2}\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right) - \frac{a^2}{2c}.$$

Finally, we verify that (w_u^*, ψ^*) is interior. First, $\psi^* > 0$. Second, the participation constraint is slack, since $w_u^* + a\sqrt{\psi^*} - \bar{w} = \frac{\beta}{2}\left(\varepsilon - \bar{w} + a^2/4c\right) > 0$. Third, the firm's labour demand is strictly positive, since

$$\varepsilon - w_u^* - c\psi^* = \left(1 - \frac{\beta}{2}\right)\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right) > 0.$$

(ii) Evaluating (10) and (11) in the optimal values for wages and amenities gives the desired result. □

Lemma E.5 (The union threat)**.** *Workers in a firm with productivity and cost of amenities* (ε, c) *form a union if and only if* $(\varepsilon, c) \in \mathrm{T}(\lambda)$*, where*

$$\mathrm{T}(\lambda) = \left\{(\varepsilon, c) : \varepsilon \geq \bar{w} + \tfrac{2\lambda}{\beta}\right\} \bigcup \left\{(\varepsilon, c) : \varepsilon < \bar{w} + \tfrac{2\lambda}{\beta} \text{ and } c < c^u(\varepsilon, \lambda)\right\},$$

and $c^u(\varepsilon, \lambda) = a^2/\left[4\left(\bar{w} + \frac{2\lambda}{\beta} - \varepsilon\right)\right]$.

Proof. By Lemma E.4, the value of a union job is $W_u^* = w_u^* + a\sqrt{\psi^*} = \bar{w} + \frac{\beta}{2}\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right)$, while by Lemma E.2 the value of a non-union job is $W_n^* = \bar{w}$. Using (6), workers unionize if and only if $W_u^* - W_n^* > \lambda$, which can be rewritten as

$$\frac{a^2}{4c} > \bar{w} + \frac{2\lambda}{\beta} - \varepsilon. \tag{16}$$

If $\varepsilon \geq \bar{w} + \frac{2\lambda}{\beta}$, the right-hand side in (16) is non-positive while the left-hand side is strictly positive, so the condition holds for every $c > 0$. If $\varepsilon < \bar{w} + \frac{2\lambda}{\beta}$, the right-hand side is strictly positive and (16) is equivalent to $c < c^u(\varepsilon, \lambda)$. □

Optimal sorting. The choice set of a firm with productivity and cost of amenities (ε, c) is

$$\mathcal{A}(\varepsilon, c) = \begin{cases} \{u, p\}, & \text{if } (\varepsilon, c) \in \mathrm{T}(\lambda). \\ \{n\}, & \text{if } (\varepsilon, c) \notin \mathrm{T}(\lambda). \end{cases} \tag{17}$$

Each firm selects $j^*(\varepsilon, c) = \arg\max_{j \in \mathcal{A}(\varepsilon,c)} \pi_j^*$, where π_n^*, π_p^*, and π_u^* are given in Lemmas E.2, E.3, and E.4, respectively. We adopt the convention that a firm indifferent between the union and paper-union arrangements chooses the latter. The following auxiliary lemma characterizes the firms for which hiring a paper union is more profitable than accommodating workers' union.

Lemma E.6 (Paper union decision)**.** *We have that $\pi_p^* \geq \pi_u^*$ if and only if $(\varepsilon, c) \in \mathrm{R}$, where*

$$\mathrm{R} = \left\{(\varepsilon, c) : \varepsilon > \bar{w} + \tfrac{2\tau\bar{w}}{\beta} \text{ and } c \geq c^p(\varepsilon, \tau)\right\}, \tag{18}$$

and $c^p(\varepsilon, \tau) = \frac{(2-\beta)a^2}{4\left[\beta(\varepsilon - \bar{w}) - 2\tau\bar{w}\right]}$.

Proof. (⇒) Suppose $\pi_p^* \geq \pi_u^*$. Since $\pi_u^* > 0$ by Lemma E.4, we must have $\pi_p^* > 0$, which by Lemma E.3 requires $\varepsilon > (1+\tau)\bar{w}$. Then $\pi_p^* = \frac{\sigma}{2}(L_p^*)^2$ and $\pi_u^* = \frac{\sigma}{2}(L_u^*)^2$ with $L_p^*, L_u^* > 0$ given as in Lemmas E.3 and E.4, respectively. So $\pi_p^* \geq \pi_u^*$ implies $L_p^* \geq L_u^*$, i.e.

$$\varepsilon - (1+\tau)\bar{w} \geq \left(1 - \frac{\beta}{2}\right)\left(\varepsilon - \bar{w} + \frac{a^2}{4c}\right). \tag{19}$$

Expanding the right-hand side and rearranging, (19) is equivalent to

$$\frac{\beta}{2}(\varepsilon - \bar{w}) - \tau\bar{w} \geq \frac{(2-\beta)a^2}{8c}. \tag{20}$$

Since the right-hand side of (20) is strictly positive, so is the left-hand side, which gives $\varepsilon > \bar{w} + 2\tau\bar{w}/\beta$. Dividing both sides of (20) by the left-hand side and multiplying by c yields

$$c \geq c^p(\varepsilon, \tau).$$

In summary, $\varepsilon > \bar{w} + 2\tau\bar{w}/\beta > (1+\tau)\bar{w}$ and $c \geq c^p(\varepsilon, \tau)$. Hence $(\varepsilon, c) \in \mathrm{R}$.

(⇐) Suppose $(\varepsilon, c) \in \mathrm{R}$. Since $2/\beta > 1$, we have $\varepsilon > \bar{w} + 2\tau\bar{w}/\beta > (1+\tau)\bar{w}$, so by Lemma E.3 $L_p^* > 0$ and $\pi_p^* = \frac{\sigma}{2}(L_p^*)^2$. Moreover, $\frac{\beta}{2}(\varepsilon - \bar{w}) - \tau\bar{w} > 0$, so $c \geq c^p(\varepsilon, \tau)$ implies (20), which in turn is equivalent to (19), i.e., $L_p^* \geq L_u^*$. Since $\pi_u^* = \frac{\sigma}{2}(L_u^*)^2$ with $L_u^* > 0$, it follows that $\pi_p^* \geq \pi_u^*$. □

The following proposition summarizes the optimal sorting rules for each possible combination of (ε, c).

Proposition E.1 (Optimal sorting)**.** *The optimal arrangement of a firm with productivity and cost of amenities* (ε, c) *is*

$$j^*(\varepsilon, c) = \begin{cases} p, & \text{if } (\varepsilon, c) \in \mathrm{T}(\lambda) \cap \mathrm{R}. \\ u, & \text{if } (\varepsilon, c) \in \mathrm{T}(\lambda) \setminus \mathrm{R}. \\ n, & \text{if } (\varepsilon, c) \notin \mathrm{T}(\lambda). \end{cases}$$

Proof. If $(\varepsilon, c) \notin \mathrm{T}(\lambda)$, then $\mathcal{A}(\varepsilon, c) = \{n\}$ by (17), so $j^* = n$. On the other hand, if $(\varepsilon, c) \in \mathrm{T}(\lambda)$, then $\mathcal{A}(\varepsilon, c) = \{u, p\}$ and, by the tie-breaking convention, the firm hires a paper union if and only if $\pi_p^* \geq \pi_u^*$. By Lemma E.6, this holds if and only if $(\varepsilon, c) \in \mathrm{R}$. Hence $j^* = p$ if $(\varepsilon, c) \in \mathrm{T}(\lambda) \cap \mathrm{R}$ and $j^* = u$ if $(\varepsilon, c) \in \mathrm{T}(\lambda) \setminus \mathrm{R}$. □