Loan Renegotiation and Firm Performance: Evidence from a Brazilian Public Development Fund*

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Abstract

This paper examines the effects of loan renegotiation on firm-level labor market outcomes using administrative data from Brazil's Northeastern Constitutional Fund (FNE) linked to matched employer–employee records from the Annual Social Information Survey (RAIS) over 2000–2021. Our results, based on difference-in-differences models, show that renegotiation is associated with a 16.8 percent contraction in employment, a 9.7 percent decline in average wages, and a 28.0 percent reduction in the total wage bill. These effects intensify over time, reaching approximately 30 percent for employment after five years, and are robust across alternative specifications and subsamples. Heterogeneity analysis reveals that the largest impacts concentrate in firms operating in the commerce sector, firms with higher credit ratings, and those located in economically peripheral municipalities. These findings suggest that renegotiation is largely activated in the context of pre-existing financial distress and induces persistent labor adjustments. Policy implications favor conditioned renegotiation schemes that pair financial relief with credible restructuring commitments.

Keywords: loan renegotiation; public credit; employment; wages; difference-in-differences; Brazil.
JEL codes: G21; G32; G33; J23; O16.

*The authors gratefully acknowledge financial support from the Superintendence for the Development of the Northeast (SUDENE), under Administrative Contract No. 01/2025, in partnership with the Apolônio Salles Foundation for Educational Development (FADURPE). The authors also thank participants in the SUDENE technical seminars for valuable comments and suggestions. This manuscript benefited from the use of artificial intelligence tools for language refinement and improvements in writing clarity.

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1 Introduction

Over the past two decades, the Northeastern Constitutional Fund (*Fundo Constitucional do Nordeste* – FNE) executed more than 12 million lending operations, benefiting approximately 4.2 million borrowers – both individuals and legal entities. Among firms alone, more than 177,000 enterprises obtained FNE financing during this period, with each borrowing an average of 2.47 contracts and receiving an average loan value of roughly R$ 1.17 million (in 2020 constant prices). The portfolio dedicated to firms expanded at an annual real rate of 7.1 percent between 2000 and 2021, climbing from R$ 17.2 billion to R$ 59.9 billion. This growth reflected both the sustained increase in new originations and the progressive concentration of Fund resources toward legal entities, whose share in the total FNE portfolio rose from 51.4 percent in 2000 to 73.3 percent in 2021.

Alongside this expansion in originations, a significant and growing share of the portfolio became subject to renegotiation. Approximately 38 percent of firms with FNE obligations renegotiated at least one contract over the sample period. The annual number of renegotiating firms remained relatively stable at between 1,500 and 3,500 throughout most of the period but surged dramatically to more than 45,000 in 2020, driven by emergency measures adopted in response to the COVID-19 pandemic. By 2021, the renegotiated balance for firms exceeded R$ 42 billion (nearly 87 percent of the total renegotiated portfolio of the Fund) up from shares of roughly 30 percent observed in the mid-2000s. These dynamics highlight renegotiation not as an exceptional measure but as a structural feature of public credit management in a region susceptible to climatic and macroeconomic shocks.

Public development finance occupies a central role in economies where credit market frictions (including information asymmetries, weak creditor protection, and limited collateral) constrain private lending and generate underinvestment, particularly among small and medium-sized enterprises (Stiglitz and Weiss, 1981; Mishkin, 2007). In this context, state-owned development banks and constitutional funds such as the FNE serve a dual mandate: promoting regional convergence and productive inclusion while maintaining financial sustainability. The theoretical case for debt renegotiation within such institutions rests on the incompleteness of financial contracts (Grossman and Hart, 1986; Hart and Moore, 1988; Roberts and Sufi, 2009). Since it is impractical to specify all contingencies at origination, renegotiation provides a mechanism for adjusting contractual terms in response to unforeseen shocks, thereby preserving firm continuity and averting inefficient liquidation. From the creditor's perspective, renegotiating may also dominate collateral enforcement when recovery rates are low. This is consistently observed in emerging economies, where the World Bank estimates credit recovery rates to be below 25 percent for countries such as Brazil, Argentina and Venezuela. In contrast, rates exceed 85 percent in Canada, the United States and the United Kingdom (The World Bank,

2023).

Despite the theoretical and institutional relevance of renegotiation in public credit programs, the empirical evidence on its consequences for firm-level outcomes, particularly labor market indicators, remains scarce, especially in developing economies. This paper fills that gap by asking: what are the effects of FNE loan renegotiation on firm employment, average wages, and the total wage bill? We construct a firm-year panel by linking FNE administrative records on contracts and renegotiations with matched employer–employee data from the Annual Social Information Survey (*Relação Anual de Informações Sociais*—RAIS) for the period 2000–2021. Treating the timing of a firm's first renegotiation event as a staggered treatment, we estimate difference-in-differences (DiD) models that account for treatment effect heterogeneity across cohorts and periods – using the estimators of Callaway and Sant'Anna (2021), Sun and Abraham (2021), and Wooldridge (2025) – alongside a conventional two-way fixed-effects (TWFE) specification as a benchmark. The analysis further examines dynamic effects through event-study designs and explores heterogeneity across firm size, sector, FNE program, credit rating, contract intensity, and regional dimensions including the semiarid zone, PNDR territorial typologies, and urban hierarchy.

Our results consistently indicate that renegotiation is associated with meaningful and statistically robust declines in all three labor market outcomes. In the preferred specification, which includes firm and year fixed effects together with state and sector fixed effects and contract-level controls, renegotiation is linked to a contraction of approximately 16.8 percent in employment, a 9.7 percent reduction in average wages, and a 28.0 percent fall in the wage bill. Event-study estimates reveal that these negative effects are not merely contemporaneous; they intensify persistently over time, with employment declining by approximately 30 percent five years after renegotiation. The magnitude and direction of results are stable across alternative estimators, subsamples, and specifications.

The heterogeneity analysis produces several notable findings. First, firms in the commerce sector experience the largest employment losses (approximately -20.4 percent), consistent with that sector's dominance in the FNE portfolio and its exposure to demand-side shocks. Second, firms classified at the highest credit rating (AA) suffer the most severe reductions in employment and the wage bill, a pattern that likely reflects the concentrated weight of that category in the portfolio rather than superior resilience among prime borrowers. Third, firms located in peripheral municipalities (*entorno*) of urban hierarchical regions exhibit reductions roughly twice as large as those observed in central cities (*polo*), pointing to structural vulnerabilities that amplify adjustment costs in economically lagging territories. Fourth, firms in semiarid municipalities face marginally larger contractions than counterparts in non-semiarid areas, underscoring the heightened exposure of FNE's priority zone to financial stress.

These findings speak to multiple strands of the literature. Evidence for the United States documents that debt renegotiation generates positive long-run stock returns for renegotiating firms (Xiang, Wang and Basu, 2023) and that creditor control rights activated by covenant violations induce significant employment reductions and operational restructuring (Ersahin, Irani and Le, 2021; Falato and Liang, 2016). For Brazil, Pucci (2019) finds revenue improvements only in the second year following renegotiation, while Mourad (2019) shows that prior renegotiation strongly predicts subsequent renegotiation, implying path-dependence. Our contribution is to provide the first large-scale quasi-experimental assessment of the labor market consequences of renegotiation in a major Latin American public credit fund, covering a full two-decade horizon and exploiting rich administrative micro-data.

The paper also contributes to the policy debate on moral hazard in public credit programs. If borrowers anticipate lenient renegotiation conditions, the incentive to repay punctually may be weakened (Melo and Resende Filho, 2017; Mishkin, 2007). Moreover, recurrent renegotiation of financially distressed firms risks perpetuating low-productivity "zombie" enterprises that absorb resources at the expense of more dynamic investment (Caballero, Hoshi and Kashyap, 2008; Jordà et al., 2022). Our evidence that renegotiation coincides with sustained reductions in employment and wages – rather than recovery – is consistent with this concern and suggests that program design should condition financial relief on credible restructuring plans.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 documents the evolution of FNE renegotiations. Section 4 describes the data and presents descriptive statistics. Section 5 lays out the empirical strategy. Section 6 reports the main estimates, robustness exercises, and heterogeneity analysis. Section 7 concludes.

2 Related Literature

This paper contributes to three interconnected strands of the literature: (i) the determinants and consequences of debt renegotiation; (ii) the effects of public development credit on firm outcomes; and (iii) the employment consequences of financial frictions.

2.1 Debt Renegotiation: Theory and Evidence

Debt renegotiation arises naturally from the inherent incompleteness of financial contracts. As it is impractical to specify all relevant contingencies at the time of contract origination, the contracting parties must revisit the terms when unforeseen circumstances arise, whether relating to macroeconomic conditions, investment opportunities or borrower liquidity shocks (Grossman and Hart, 1986; Hart and Moore, 1988). Roberts and Sufi (2009) and Roberts (2015) provide foundational evidence

on this mechanism using U.S. data, documenting that renegotiation occurs in approximately 75 percent of contracts before maturity and is driven primarily by improved borrower creditworthiness or attractive investment opportunities rather than financial distress, an observation that contrasts with conventional assumptions.

The institutional and legal environment plays a central role in shaping renegotiation dynamics. Godlewski (2020) shows that stronger contract enforcement and creditor legal protection increase the likelihood of renegotiation and favor favorable amendments to value or maturity in European credit markets. Godlewski (2014) and Godlewski (2015) further document that European firms renegotiate less frequently than U.S. counterparts, with approximately 40 percent of amendments concentrated in loan amounts, and that initial loan terms, banking pool characteristics, and the legal environment significantly influence the time between renegotiations.

In emerging-market settings, characterized by greater information asymmetry, weaker creditor protection, and lower contract enforceability, renegotiation serves additional functions as an information-gathering mechanism, a risk-mitigation tool, and an insolvency-prevention device (Eça, Albanez and Valle, 2025). Eça et al. (2024) examine Brazilian publicly listed firms and find that deteriorating financial conditions, manifested in declining profitability and rising leverage, significantly increase the probability of renegotiation and trigger creditor demands for compensatory mechanisms such as additional guarantees or tighter covenants. Similarly, Mourad (2019) documents strong path-dependence: prior renegotiation substantially increases the likelihood of future renegotiations, and more than 80 percent of renegotiations are granted within four months of the onset of delinquency. Pucci (2019) applies a difference-in-differences estimator to Brazilian firm data and finds that renegotiation produces revenue improvements only in the second year post-event, with no discernible effect in the immediate aftermath.

For the United States, Xiang, Wang and Basu (2023) show that renegotiating firms earn stock returns 8.8 percent (16.7 percent) higher over three (five) years relative to matched non-renegotiating peers – gains that are more pronounced when insiders trade around renegotiation announcements, suggesting that private information flows between contracting parties. Nikolaev (2018) establishes that firms with greater monitoring needs (proxied by financial constraints or audit premiums) renegotiate more frequently, while firms with higher retention risk (proxied by growth options and intangible assets) renegotiate less. Chu (2021) exploits lender consolidation through syndicate member mergers as an exogenous source of renegotiation ease and finds that firms subsequently increase capital investment—evidence that renegotiation can facilitate productive reallocation beyond pure survival.

A critical caveat concerns the risks of poorly designed renegotiations. Peek and Rosengren (2005) document that banks engaged in evergreening (artificially rolling over credit to insolvent firms

to avoid provisioning) distort credit allocation and crowd out healthy firms. Caballero, Hoshi and Kashyap (2008) show that such practices perpetuated Japan's stagnation by reducing profitability and discouraging productive investment. At the aggregate level, however, Arrowsmith et al. (2013) find that renegotiations extended to U.K. SMEs had a limited impact on aggregate productivity (approximately one percentage point), suggesting that systemic risks depend heavily on institutional context and firm composition.

2.2 Public Development Credit and Firm Performance

The existing literature on the FNE focuses predominantly on macroeconomic and sectoral dimensions. Silva, Resende and Silveira Neto (2009) and Resende (2014) document employment growth exceeding 60 percentage points among FNE-benefited firms relative to non-benefited counterparts, though effects on average wages are limited. Oliveira et al. (2019) and Daniel and Braga (2020) corroborate these employment findings while underscoring heterogeneous impacts across firm size and regional income levels. Resende, da Silva and da Silva Filho (2017) and Da Mata and Resende (2020) establish that the FNE is most effective in lower-income segments and peripheral municipalities, reinforcing its role as an instrument of productive inclusion and regional convergence. Ribeiro et al. (2020) finds modest but positive effects on regional GDP growth and reductions in intermunicipal inequality at the aggregate level.

Notwithstanding this evidence on new originations, the effects of renegotiation, a structurally distinct intervention, on firm-level labor market outcomes have not been examined in the FNE context. This is the primary gap addressed by the present study.

2.3 Financial Frictions and Labor Market Outcomes

The connection between creditor rights, financial distress, and employment is well established in corporate finance. Ersahin, Irani and Le (2021) show that creditor control rights activated by covenant violations trigger internal restructuring, including workforce reductions, unit closures, and asset reallocation, consistent with a governance mechanism that constrains managerial discretion. Falato and Liang (2016) demonstrate that incentive conflicts between firms and creditors generate substantial employment reductions, particularly in high-friction environments, during recessions, and in settings with weaker worker bargaining power. Campello, Graham and Harvey (2010) corroborate these patterns using survey evidence from over 1,000 CFOs across the United States, Europe, and Asia during the 2008 crisis, showing that credit-constrained firms sharply cut employment, investment, and capital expenditures while liquidating assets to preserve liquidity.

These findings collectively suggest that financial distress and restricted access to credit induce labor adjustments as firms prioritize solvency. Our paper extends this line of inquiry to the context of a large public development fund in an emerging economy, where renegotiation, rather than outright default or bankruptcy, constitutes the primary adjustment mechanism.

3 Evolution of FNE Renegotiations

This section documents the evolution of renegotiation operations within the FNE over the period 2000 to 2021, drawing on administrative micro-data provided by the Banco do Nordeste do Brasil (BNB). The focus is restricted to legal entities (firms), given the analytical scope of the paper.

Drawing on the legal framework documented in the administrative records, the renegotiation landscape for firms evolved through successive waves of regulatory intervention over the two decades under study. In the early 2000s, the dominant instrument was the so-called *administração de crédito usual* (routine credit administration), which accounted for up to 41 percent of contracts in 2000 and consistently exceeded 20 percent throughout the period through 2016. Alongside this baseline instrument, emergency provisional measures (most notably MP nº 1.988 and MP nº 1.846/10) introduced FNE-specific renegotiation and charge-swap (*troca de encargos*) modalities that together concentrated nearly 30 percent of contracts in 2000. These early instruments were progressively supplemented by resolutions targeting specific distress episodes: Resolution nº 2.765/BACEN addressed small rural producer delinquency, while the Programa Terra family of resolutions (Res. nº 2.445/2.530, 2.928/3.010/3.018/3.032, and 3.115/Lei nº 10.696) provided restructuring for land-reform beneficiaries through the early 2000s. From 2003 onward, Lei nº 10.696 and Lei nº 10.823 (operationalized through Resolution CMN nº 3.163) became the dominant statutory basis, reaching nearly 28 percent of contracts in 2004 and sustaining high frequencies through 2007. The period 2008–2016 was marked by the proliferation of Pronaf-linked resolutions (Res. nº 3.578, 4.030, 4.031, 4.028, 4.211, 4.212, and 4.250), which targeted specific borrower categories (from Grupo B smallholders to investment credit holders) and were frequently triggered by drought declarations in the Sudene area. Although individually representing modest portfolio shares, these instruments collectively exhibited the highest delinquency rates in the sample, with some categories reaching arrears ratios above 80 percent, underscoring the elevated credit risk associated with emergency renegotiation programs relative to routine credit management.

From 2017 onwards, the legal framework underwent a structural shift driven by two landmark statutes that became the dominant regulatory basis for firm renegotiations throughout the remainder of the period. Law No. 13,340/2016 (art. 2), which authorised the renegotiation of rural credit debts

incurred before December 2011, with discounts ranging from 40 to 95 per cent, depending on the age and location of the contract, rose to 28 per cent of contracts in 2017, 34.5 per cent in 2018, and maintained a share above 30 per cent until 2021, while exhibiting near-zero arrears rates. Law No. 13,606/2018 (art. 36), which allowed the restructuring of cost and investment debts incurred before December 2016, with extended repayment schedules up to 2030 and the original contractual charges, accounted for 24.5% of contracts in 2019, remaining the second most prevalent basis in 2020 and 2021. Resolution CMN No. 4,591/2017, targeting producers in the Sudene area affected by drought between 2012 and 2016, provided a complementary instrument that accounted for approximately 10 to 14 per cent of contracts between 2017 and 2021. The 2020–2021 period saw a final and quantitatively exceptional regulatory mobilisation triggered by the pandemic. Resolution CMN No. 4,798/2020 and its companion Resolution No. 4,782/2020 established special credit lines with an annual fixed rate of 2.5 percent and suspended instalments for up to twelve months. This generated the largest renegotiated balances in the entire series, exceeding R$36 billion in 2020, despite a relatively modest number of contracts. Resolution CMN No. 4840/2020 simultaneously automated the renegotiation of Pronaf B instalments for borrowers affected by the pandemic, covering over 123,000 contracts. These instruments from the pandemic era demonstrate the Fund's ability to implement emergency regulatory measures swiftly. However, the substantial arrears recorded for certain modalities of the pandemic response, such as Res. Nos. 4.801 and 4.840/2020, which registered a 90 percent delinquency ratio, highlight the associated risks.

3.1 Growth of the Firm Portfolio

The FNE portfolio attributable to firms grew substantially over the sample period, rising from R$ 17.2 billion in 2000 to R$ 59.9 billion in 2021 in constant 2020 prices (see Figure 1). This equates to an average annual real growth rate of 7.1 percent. This expansion was not monotonic. During 2000-2006, the balance oscillated, declining to R$ 13.3 billion in 2002 before partially recovering. From 2007 onward, growth became more sustained, driven by expanded credit supply and rising demand, with the balance reaching R$ 42.3 billion in 2014. Following a period of relative stability between 2015 and 2018 (R$ 37-41 billion), the portfolio accelerated sharply again during 2019-2021, partly owing to emergency measures associated with the COVID-19 pandemic. Firms' share in the total FNE portfolio expanded from 51.4 percent in 2000 to 73.3 percent in 2021, reflecting a progressive concentration of Fund resources toward legal entities.

3.2 Renegotiation Dynamics

The renegotiated balance attributable to firms exhibited an even more pronounced upward trajectory, increasing in both absolute value and relative share over the sample period. In the early 2000s, as shown in Figure 2, the renegotiated firm balance stood at approximately R$ 2.5-3.0 billion, representing slightly more than half of total renegotiations. Their relative share declined to around 30 percent between 2004 and 2007, before recovering and surpassing 50 percent in 2012 and 70 percent by 2016. The most dramatic shift occurred in 2020, when the renegotiated balance for firms exceeded R$ 42 billion (representing approximately 87 percent of total Fund renegotiations), a share maintained through 2021. This surge was directly associated with emergency legislative measures enabling mass renegotiation in response to the COVID-19 crisis.

In terms of the number of firms entering renegotiation each year, the series remained relatively stable at 1,500 to 3,500 annually throughout most of the period. This equilibrium was sharply disrupted in 2020, when more than 45,000 firms renegotiated at least one contract. This episode underscores that renegotiation in the FNE operates at two distinct registers: a regular, low-frequency channel through which individual firms respond to idiosyncratic distress, and an emergency channel activated by systemic shocks enabling broad portfolio adjustments.

These patterns collectively demonstrate that renegotiation is a structural component of the FNE credit cycle rather than an exceptional corrective measure. The progressive concentration of renegotiated balances in firms, combined with the surge observed during crisis episodes, motivates the empirical investigation of renegotiation's effects on firm-level performance that follows.

4 Data and Descriptive Statistics

This section describes the data sources used in the empirical analysis, the construction of the main variables, and the composition of the estimation sample. It also presents descriptive statistics that characterize firms participating in the FNE and highlights key differences between renegotiating and non-renegotiating firms. These descriptive patterns provide initial evidence on the economic conditions associated with renegotiation and help motivate the empirical strategy developed in the subsequent sections.

4.1 Data Sources

The empirical analysis draws on two primary sources merged at the firm level using the *Cadastro Nacional da Pessoa Jurídica* (CNPJ), a unique and permanent firm identifier.

FNE Administrative Records. The BNB provided comprehensive contract-level micro-data covering all FNE operations by legal entities from 2000 to 2021. The dataset includes: original and renegotiated contract codes, the CNPJ of the borrower, gross borrower income at origination, contract date and renegotiation year (when applicable), contracted amount, financing and grace periods (in months), municipality and state of the financed enterprise, semiarid and PNDR sub-regional typology classifications, sector of activity (agro-industry, agricultural, livestock, commerce, services, industry, and infrastructure), firm size category (micro, mini, small, small-medium, medium, and large), FNE sub-program, risk allocation type, and borrower credit rating. Each renegotiated contract receives a new identifier, enabling the reconstruction of renegotiation chains over time.

Annual Social Information Survey (RAIS). The RAIS constitutes the official administrative registry of formal employment in Brazil, collected annually by the Ministry of Labor and Employment since 1975. It provides universal coverage of firms and workers with formal contracts. Firm-level variables include sectoral classification (at the two-digit CNAE level), year of establishment, legal form, and headcount. Worker-level variables include total compensation, occupation, schooling, age, race, and gender. Firms are identified by CNPJ and workers by the *Cadastro de Pessoas Físicas* (CPF), enabling longitudinal linkage. RAIS records spanning 2000-2021 are used to construct an unbalanced panel of establishments.

4.2 Descriptive Statistics

Over the full period 2000–2021, FNE lending operations reached approximately 177,000 unique firms. Of the 171,531 firms for which complete contract characteristics are available, more than 67,000 renegotiated at least one contract, representing approximately 39.4 percent of the sample, indicating that renegotiation is a quantitatively important phenomenon in the FNE portfolio rather than a marginal occurrence.

As evidenced in Figure 1, firms that renegotiated held more contracts on average (3.34 vs. 2.47), borrowed larger amounts (mean loan value of R$ 1.81 million vs. R$ 1.17 million), and had longer financing terms (59.9 vs. 52.0 months) compared with the full borrower population. Mean gross income was somewhat lower for renegotiating firms (R$ 11.49 million vs. R$ 14.34 million), consistent with the pattern that financial deterioration precedes renegotiation documented in the literature (Eça et al., 2024).

In Table 2, when considering regional characteristics, Ceará (21.7 percent), Bahia (18.6 percent), and Pernambuco (13.0 percent) concentrate the largest shares of borrowers; renegotiating firms track this distribution closely, suggesting that renegotiation propensity broadly mirrors portfolio

weights rather than region-specific factors. Municipalities classified under medium-income PNDR typologies host more than 50 percent of borrowers and renegotiating firms alike. Rural firms represent only 1.88 percent of total borrowers but 2.86 percent of renegotiating firms, while semiarid and non-semiarid firms are nearly evenly split in both groups.

Finally, in Table 3, by firm size, small firms constitute the largest share of both borrowers (50.45 percent) and renegotiating firms (56.15 percent), while microenterprises are underrepresented among renegotiating firms (32.99 percent) relative to their portfolio weight (41.36 percent), indicating that the smallest firms renegotiate proportionally less. Commerce dominates both groups (63.49 and 59.73 percent, respectively), followed by services and industry. The FNE MPE (Micro and Small Enterprise) program accounts for 69.84 percent of all borrowers and 77.04 percent of renegotiating firms. With respect to credit risk, the overwhelming majority of contracts are classified as shared-risk (98.9 percent), and 60.2 percent of all borrowers carry an AA rating, rising to 76.6 percent among renegotiating firms.[1]

4.3 Treatment Definition and Analysis Sample

The estimation sample comprises firms that entered into at least one lending contract with the FNE over the study period. As documented in Section 3, successive waves of renegotiation policies were implemented throughout this interval, largely in response to prevailing macroeconomic conditions and episodic shocks. Firms that availed themselves of at least one such policy are classified as treated, while those that held FNE contracts but never renegotiated any of them constitute the comparison group. As noted earlier, firms may hold multiple FNE contracts simultaneously or sequentially, and may likewise renegotiate different contracts at different points in time under the applicable legal framework. To obtain a single, well-defined treatment date for each firm, we assign treatment to the calendar year in which a firm renegotiates its first contract. The treatment indicator is therefore set to one from that year onward and zero in all prior periods, regardless of whether the firm subsequently renegotiates additional contracts.

To construct the estimation sample, several restrictions are applied. First, approximately 73 percent of FNE firm borrowers are matched to RAIS records; unmatched firms are dropped. Second, contracts without complete characteristics, approximately 1.5 percent of operations, are excluded. Third, given the extraordinary concentration of first renegotiations in 2020, the main analysis restricts the treated group to firms that renegotiated for the first time by 2019, so as to avoid confound-

[1]Figure A.1 in the Appendix shows that the distribution of contract counts is heavily right-skewed: 53.7 percent of firms held a single contract and 72.5 percent held two or fewer. Among renegotiating firms, 70.9 percent renegotiated only one contract and 89.3 percent renegotiated at most two, indicating that multiple renegotiations are a minority phenomenon.

ing the treatment effect with COVID-19 emergency measures. Fourth, firms that permanently exited and subsequently re-entered the RAIS panel are excluded.

The resulting estimation sample comprises 596,940 firm-year observations for 59,940 unique firms, of which 8,366 renegotiated at least one contract during the observation window. Table 4 reports descriptive statistics for the outcome variables. Renegotiating firms employ more workers on average (27.45 vs. 17.16), pay lower average wages (R$ 887.82 vs. R$ 915.56), and generate a larger total wage bill (R$ 36,219 vs. R$ 21,616) than non-renegotiating firms, reflecting the size composition of renegotiating firms and their pre-renegotiation financial conditions.

5 Empirical strategy

This section presents the empirical strategy used to estimate the effects of FNE loan renegotiation on firm-level labor market outcomes. The unit of observation is the firm–year pair, covering 2000-2021.

5.1 Baseline Specification

The baseline specification is a difference-in-differences model in which the treatment indicator equals one for firm i in all periods at or following its first renegotiation event:

$$Y_{it} = \alpha + \beta\, \textit{Renegotiation}_{it} + X_{it}'\,\gamma + \mu_i + \tau_t + \varepsilon_{it}, \tag{1}$$

where Y_{it} is alternately $\ln$(employment), $\ln$(average wage), or $\ln$(total wage bill); $\textit{Renegotiation}_{it}$ equals one from the year of first renegotiation onward; X_{it} includes contract-level controls; μ_i are firm fixed effects; and τ_t are year fixed effects. Selected specifications add state and sector (two-digit CNAE) fixed effects or state-by-sector linear trends. The coefficient β captures the average treatment effect of renegotiation on firm performance. Identification rests on the parallel trends assumption conditional on the included controls. Standard errors are heteroskedasticity-robust and clustered at the firm level.

5.2 Event-Study Specification

To assess pre-trends and trace the dynamic path of effects, we estimate an event-study specification that decomposes the impact into leads and lags relative to the year of first renegotiation:

$$Y_{it} = \alpha + \sum_{\substack{k \\ k \neq -1}} \beta_k\, \mathbb{1}\{t - T_i = k\} + X_{it}'\,\gamma + \mu_i + \tau_t + \varepsilon_{it}, \tag{2}$$

where T_i is the year of firm i's first renegotiation and $k = -1$ (the year immediately before the event) is the omitted period. Periods distant from the event are binned into endpoints ($k \leq -5$ and $k \geq 5$), centering the analysis on the symmetric five-year window around renegotiation – consistent with the average financing term in the sample. Coefficients on lead terms ($k < -1$) serve as pre-trend tests.

5.3 Heterogeneity-Robust Estimators

The conventional TWFE estimator may produce biased estimates of average treatment effects under staggered adoption when treatment effects are heterogeneous across cohorts and periods, because it implicitly uses already-treated units as controls and can assign negative weights to certain group-time comparisons (De Chaisemartin and d'Haultfoeuille, 2020; Goodman-Bacon, 2021; Borusyak, Jaravel and Spiess, 2024; Wooldridge, 2025). To address these concerns, we supplement the TWFE estimates with three heterogeneity-robust estimators.

The first is Callaway and Sant'Anna (2021), who define the group-time average treatment effect:

$$ATT(g,t) = \mathbb{E}\big[\, Y_t(g) - Y_t(0) \,\big|\, G_g = 1 \big]\,, \tag{3}$$

where g denotes the cohort defined by the year of first renegotiation, $Y_t(0)$ represents the potential outcome under no renegotiation, and $G_g = 1$ identifies firms that enter treatment for the first time in year g. Using never-treated or not-yet-treated firms as the comparison group, this approach aggregates cohort-specific effects into an overall ATT. The second estimator is Sun and Abraham (2021), who decompose the TWFE coefficient into a weighted average of cohort-specific effects and correct for negative weighting through interaction-weighted estimation. The third is Wooldridge (2025), who proposes a Mundlak-based approach that nests staggered DiD within a correlated random effects framework, yielding consistent estimates under treatment effect heterogeneity. All three estimators use never-treated and not-yet-treated firms as the reference group.

6 Results

This section presents the empirical results on the effects of renegotiation on firms' labor outcomes. Baseline TWFE estimates are reported first. The dynamic response of the outcomes is then examined, followed by robustness analyses using alternative estimators and specifications. Finally, heterogeneity across firm characteristics, sectors, programs, and regional contexts is explored, providing suggestive evidence on the mechanisms underlying the results.

6.1 Main Estimates

Table 5 presents baseline TWFE estimates across five progressively richer specifications. Across all three outcome variables, coefficients on the renegotiation indicator are negative, statistically significant at the one-percent level, and relatively insensitive to specification. Panels A, B, and C report estimates for employment, average wages, and the total wage bill, respectively. All specifications include firm and year fixed effects. Column (1) presents the most parsimonious specification, with firm and year fixed effects only. Column (2) adds state fixed effects, while column (3) further incorporates sector fixed effects.[2] Column (4) replaces state and sector fixed effects with state-by-sector linear trends, allowing for differential pre-existing trajectories across these dimensions. Column (5) retains the specification of column (3) and additionally controls for contract-level characteristics, including a linear trend in the year of contract origination and FNE sub-program indicators. In the preferred specification (column 5), which controls for firm and year fixed effects, state and sector fixed effects, and contract-level characteristics, renegotiation is associated with a 16.8 percent contraction in employment (coefficient -0.1846, implying a semi-elasticity of $(e^{-0.1846} - 1) \times 100 \approx -16.85$ percent), a 9.1 percent decline in average wages (coefficient -0.0954), and a 28.0 percent reduction in the total wage bill (coefficient -0.3288).

These estimates are consistent with financial distress-driven labor adjustment: firms that activate renegotiation compress operational costs, both by reducing headcount and by shifting toward a lower-wage workforce composition, in a manner that yields the combined reduction in the wage bill. The results align with the broader literature linking creditor governance to employment restructuring (Ersahin, Irani and Le, 2021; Falato and Liang, 2016) and with survey evidence on credit-constrained firms during downturns (Campello, Graham and Harvey, 2010). Although identification requires caution given the absence of a fully exogenous renegotiation instrument, the negative association is unlikely to be explained solely by regression-to-the-mean dynamics: the effect persists and intensifies over time, as documented in Section 6.2.

6.2 Dynamic Effects and Robustness

Panels (a), (b), and (c) of Figure 3 display the dynamic path of the renegotiation effect on employment, average wages, and the total wage bill, respectively. The vertical red line marks the baseline period $(t-1)$, which serves as the reference category for all relative-time coefficients. Coefficients to the left of this line (spanning periods $t-5$ through $t-2$) correspond to pre-treatment leads and serve as tests of the parallel trends assumption, while coefficients to the right capture the post-treatment

[2] Sectors are defined at the two-digit level of the Brazilian National Classification of Economic Activities (CNAE). For details on the CNAE classification, see https://cnae.ibge.gov.br/.

dynamic response. All point estimates are presented alongside 95% confidence intervals. Event-study estimates reveal that most pre-renegotiation coefficients for wages are statistically indistinguishable from zero, lending support to the parallel trends assumption in that dimension. For employment and the wage bill, a subset of lead coefficients are marginally significant, suggesting possible anticipatory adjustment or mild pre-existing divergence in trajectories (a finding that warrants interpretive caution).

Post-renegotiation, all three outcomes exhibit a pronounced and monotonically deepening negative response. Employment falls by approximately 10 percent in the year of renegotiation, intensifying to roughly 30 percent after five years. Average wages follow a similar pattern, reaching approximately 20 percent below baseline after four years. The total wage bill mirrors these dynamics, combining the employment and wage compression channels. This progressive deterioration is consistent with firms engaging in successive rounds of adjustment as renegotiated obligations remain binding constraints on operations, or with repeated renegotiations reflecting ongoing financial fragility.

The main results are robust across multiple exercises. First, the heterogeneity-robust estimators of Callaway and Sant'Anna (2021), Sun and Abraham (2021), and Wooldridge (2025) yield virtually identical magnitudes (employment: approximately -21 to -25 percent; wages: -10 to -13 percent; wage bill: -37 to -45 percent), confirming that the TWFE estimate is not materially distorted by negative weighting in this context, as shown in Table 6.[3] Second, successive exclusion of individual renegotiation years and individual states from the sample produces coefficients that cluster tightly around the baseline estimates, demonstrating that no single cohort or state drives the results (see FigureA.5 in the Appendix). Third, in Table A.1 in the Appendix, we enrich the specification with municipality-by-sector linear trends, firm-level workforce controls (gender composition, education share, average age, tenure, contracted hours, and size bracket), as well as credit risk and rating linear trends, leaving the estimates stable in both magnitude and precision.

6.3 Heterogeneity

So far, we have presented the average effect of renegotiation on firms' outcomes of interest. In this section, we investigate the heterogeneous effects of renegotiation on firms' performance indicators across different dimensions.

[3]Figures A.2, A.3, and A.4 in the Appendix complement Table 6 by presenting the dynamic treatment effects under each heterogeneity-robust estimator – Callaway and Sant'Anna, Sun and Abraham, and Wooldridge, respectively. Across all three estimators, the event-study profiles closely mirror the pattern documented in Figure 3: pre-treatment coefficients are largely indistinguishable from zero, while post-treatment estimates turn negative and deepen progressively over time, reinforcing the robustness of the baseline findings to the choice of estimation method.

6.3.1 Firm characteristics

Firm Size – Using the SEBRAE size classification (Table 7), renegotiation effects on employment are negative and significant across all size groups, with greater intensity for medium (-26.0 percent) and large firms (-26.4 percent) than for microenterprises (-15.1 percent). Wage effects are significant only for micro and small enterprises, while wage bill reductions are most pronounced in medium and large firms. Using the FNE's own size classification (Table 8), medium-sized firms experience the largest employment contraction (-20.9 percent) and firms classified as mini or micro the smallest (-8.4 percent). Across both classifications, the pattern suggests that larger firms have greater capacity to implement employment restructuring in response to financial stress, while the smallest firms may face constraints that prevent equally sharp adjustments.

Sector and FNE Program – Tables 9 and 10 investigate, respectively, the effect of renegotiation by exploring different sectors of economic activity and different programs. Commerce – the dominant sector in the FNE portfolio – exhibits the largest and most precisely estimated effects: employment -20.4 percent, wages -10.3 percent, and wage bill -33.0 percent. Services and industry also show consistent negative effects of lesser magnitude. Agro-industrial, agricultural, and livestock sectors, which represent a small fraction of the portfolio, do not exhibit statistically significant effects, potentially reflecting small sample sizes or the distinct nature of agricultural credit cycles.

Effects are most severe for the FNE *Comércio e Serviços* program – employment -24.3 percent, wage bill -35.5 percent – and the FNE *Seca* (drought) program—employment -20.5 percent, wage bill -34.0 percent. The FNE MPE program, which dominates the portfolio, shows consistent but slightly attenuated effects (employment -16.4 percent). The FNE *Industrial* program exhibits smaller and less precisely estimated effects. Notably, the FNE *Verde* program yields positive and significant coefficients for wages and the wage bill, suggesting a distinctive profile possibly associated with the longer-term nature of environmental investments or differing borrower composition.

Credit Rating – A counterintuitive pattern emerges from the rating heterogeneity analysis: firms classified at the highest credit rating (AA) suffer the most severe renegotiation-associated reductions in employment (-20.6 percent), wages (-12.8 percent), and wage bill (-34.8 percent), as evidenced in Table A.2 in the Appendix. This finding most likely reflects portfolio composition, AA-rated firms constitute the dominant share of the renegotiation sample (76.6 percent), rather than superior financial resilience translating paradoxically into worse outcomes. Firms with intermediate ratings (A and B) experience consistently negative but less intense effects.

Contract Intensity and Renegotiation Frequency – Table 11 presents the results considering the

intensity of contracts signed over time and the number of renegotiated contracts. Firms that contracted more frequently with the FNE exhibit progressively larger renegotiation effects: employment declines range from approximately -13 percent for single-contract firms to -26 percent for firms with five contracts. This gradient is consistent with a selection mechanism whereby firms with higher credit exposure are more susceptible to financial fragility and undergo more pronounced adjustments when liquidity is constrained. Regarding renegotiation frequency, firms that renegotiated only once show marginally larger effects than those with multiple renegotiations, suggesting that firms surviving multiple renegotiations may have implemented earlier restructuring measures that partially attenuate subsequent adjustment costs.

6.3.2 Regional Heterogeneity

In Table 12, the effects on employment are negative and statistically significant across all eleven states served by the FNE, ranging approximately from -14.0 to -21.8 percent. Wage effects are predominantly negative and significant but exhibit greater cross-state variability. The wage bill contracts significantly across all states, typically in the range of -27 to -34 percent. In addition, Table 13 shows that firms located in semiarid municipalities experience marginally larger reductions than those outside the semiarid zone: employment -17.8 vs. -16.2 percent; wages -10.0 vs. -8.2 percent; wage bill -30.1 vs. -26.1 percent. This differential likely reflects the compounded vulnerability of semiarid borrowers to climatic and financial shocks, which the FNE's legislative mandate explicitly targets.

Finally, Table A.3 in the Appendix shows that the PNDR territorial typologies indicate that low-income municipalities, although accounting for a smaller share of the portfolio, exhibit the largest contractions in employment and wage bill among the statistically significant estimates. Medium-income municipalities (home to more than 50 percent of the sample) experience employment reductions of 15.5 to 17.9 percent and wage bill declines of 22.3 to 31.5 percent. High-income territories show somewhat attenuated and less consistent effects. Table A.4 in the Appendix indicates that the urban hierarchy analysis reveals a systematic pattern: firms in peripheral (*entorno*) municipalities experience reductions in employment and the wage bill that are approximately twice as large as those observed for firms in central urban areas (*polo*). For immediate geographic regions, the employment effect in peripheries is -17.4 percent versus -16.6 percent in centers; for intermediate regions, the gap is larger (-11.0 vs. -6.3 percent). Wages follow the same gradient, with salary reductions in peripheral municipalities approximately double those observed in urban centers. This differential likely reflects lower economic diversification, thinner labor markets, and structurally weaker firms in

peripheral areas, which amplify the adjustment costs triggered by renegotiation.

7 Concluding Remarks

This paper provides the first large-scale quasi-experimental assessment of the labor market consequences of loan renegotiation in a major Latin American public development fund. Exploiting staggered renegotiation timing over 2000–2021 in the FNE and matching administrative lending data to employer-employee records from RAIS, we estimate that renegotiation is associated with a 16.8 percent contraction in employment, a 9.7 percent decline in average wages, and a 28.0 percent reduction in the total wage bill. These effects intensify persistently over time, reaching approximately 30 percent for employment after five years, and are robust to alternative estimators, specifications, and sample restrictions.

The heterogeneity analysis reveals that the largest labor market costs concentrate in commerce-sector firms, borrowers with high credit ratings (whose dominance in the portfolio likely drives this result), firms with greater lending intensity, and, particularly, enterprises located in economically peripheral municipalities, where reductions can be approximately twice as large as those in urban centers. Firms in the semiarid zone face marginally larger contractions, consistent with their heightened exposure to climatic and financial shocks. These patterns underscore that renegotiation produces spatially and structurally heterogeneous outcomes.

The consistently negative and intensifying post-renegotiation trajectory suggests that renegotiation is predominantly activated in the context of pre-existing operational deterioration, consistent with the view that firms in financial distress resort to cost compression as a survival strategy (Eça et al., 2024; Campello, Graham and Harvey, 2010). In this light, the policy-relevant counterfactual is not "renegotiation vs. full repayment" but rather "renegotiation vs. delinquency and possible firm exit", a comparison that would require information on denied renegotiation requests, currently unavailable in the data.

These findings carry direct implications for the design of public credit renegotiation programs. First, the evidence does not support eliminating renegotiation instruments, which serve an essential function in preventing liquidation cascades in regions with limited financial alternatives. Rather, it argues for conditioned renegotiation: linking financial relief to credible restructuring plans, with explicit performance benchmarks for employment and wage-bill preservation where technically feasible. Such conditioning would also reduce moral hazard risks by signaling that relief is not unconditional. Second, the heightened vulnerability of peripheral and low-income municipalities calls for targeted post-renegotiation support to mitigate the more pronounced labor market costs observed in

structurally fragile territories.

Several limitations bound the scope of these conclusions. The absence of an exogenous renegotiation eligibility criterion precludes a fully clean causal identification; the DiD strategy rests on the conditional parallel trends assumption, which some pre-trend evidence calls into question for employment and wage bill specifications. Promising avenues for future research include: (i) examining the joint dynamics of renegotiation, subsequent delinquency, and firm survival using linked data on both approved and denied renegotiation requests; (ii) assessing whether conditioned renegotiation programs (requiring restructuring commitments as a precondition for relief) yield better firm-level outcomes than unconditional alternatives; and (iii) extending the analysis to other Brazilian constitutional funds and development programs to assess the generalizability of these findings.

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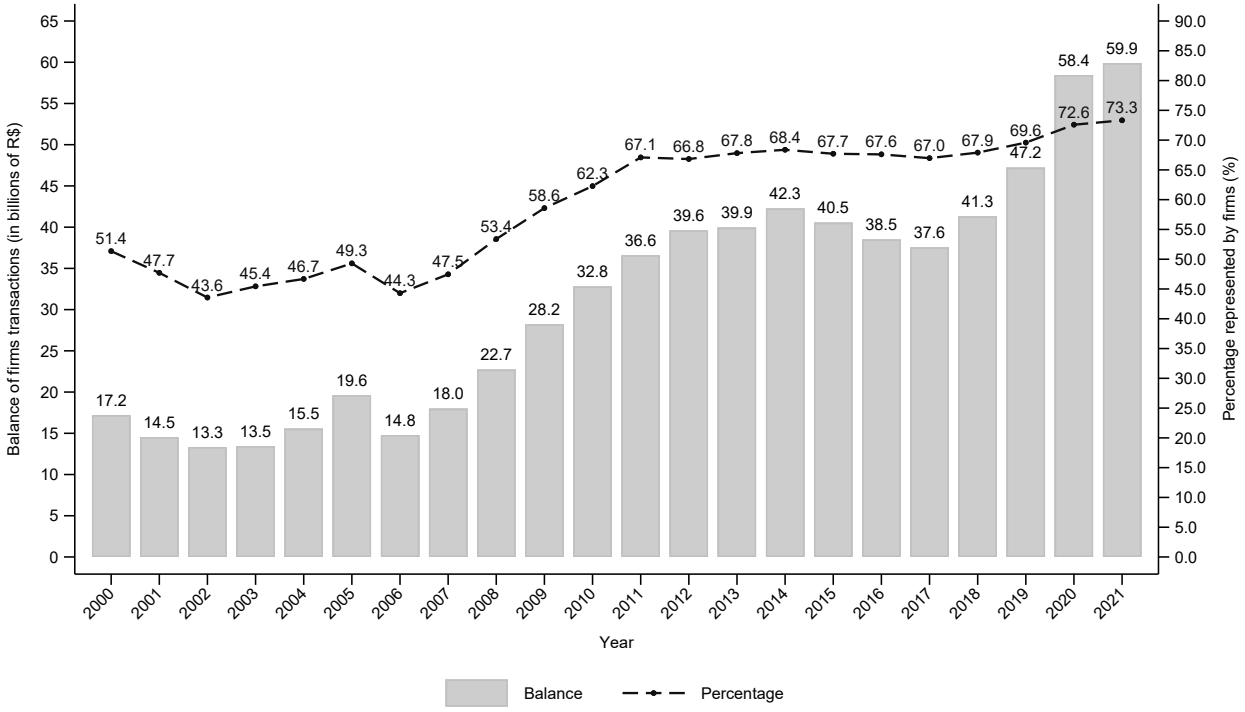
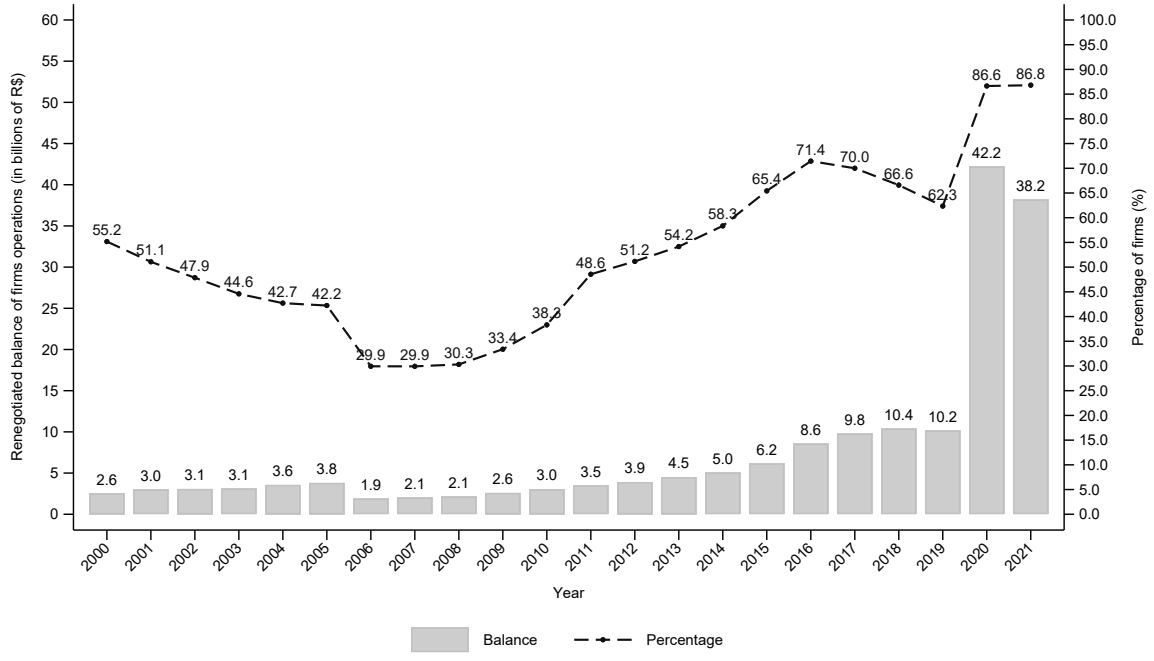
Figure 1: Balance of corporate operations (in billions of reais) and share of total balance (in %) - 2000 to 2021



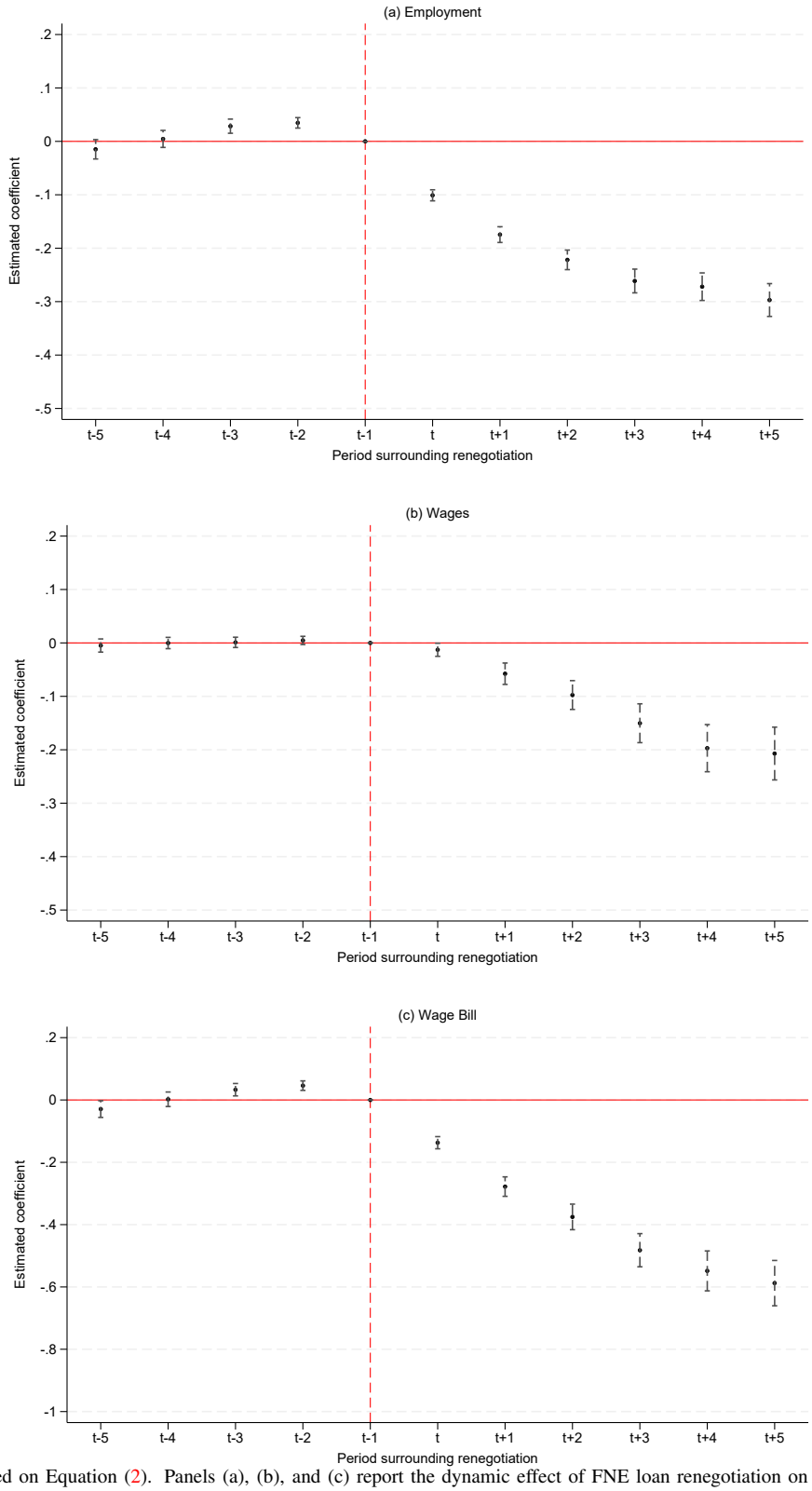
Source: Prepared by the authors based on administrative data from the FNE, provided by BNB.

Figure 2: Balance of renegotiated corporate operations (in billions of reais) and share of total renegotiated balance (in %) - 2000 to 2021



Source: Prepared by the authors based on administrative data from the FNE, provided by BNB.

Figure 3: Dynamic Effects of FNE Renegotiation on Employment, Wages, and Wage Bill



Notes: Estimated based on Equation (2). Panels (a), (b), and (c) report the dynamic effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Black dots represent point estimates; vertical bars represent 95% confidence intervals. Reference period: $t-1$. **Source:** Compiled by the authors.

Table 1: Descriptive Statistics

	Full Sample			Renegotiating Firms		
	Mean	Std. Dev.	Observations	Mean	Std. Dev.	Observations
No. of renegotiated contracts	0.59	1.06	171,531	1.51	1.21	67,470
No. of contracts	2.47	4.80	171,531	3.34	7.14	67,470
Loan value (R$ million)	1.17	19.40	171,531	1.81	26.45	67,470
Financing term (months)	52.01	32.37	171,531	59.89	34.19	67,470
Grace period (months)	7.45	6.64	168,796	7.86	7.16	65,749
Gross income (R$ million)	14.34	818.31	157,890	11.49	409.26	64,937

Notes: Compiled by the authors based on FNE administrative data.

Table 2: Descriptive Statistics – Regional Characteristics of Borrowers

Characteristic	**Share (%)**	
State	**All firms**	**Renegotiating firms**
Alagoas	3.45	3.48
Bahia	18.55	17.74
Ceará	21.73	20.92
Espírito Santo	1.43	1.48
Maranhão	8.76	9.06
Minas Gerais	6.19	5.89
Paraíba	6.91	6.73
Pernambuco	13.02	13.35
Piauí	6.49	7.09
Rio Grande do Norte	8.26	8.42
Sergipe	5.22	5.83
PNDR Territorial Typology		
Low Income and Low Dynamism	1.50	1.48
Low Income and Medium Dynamism	8.02	7.68
Low Income and High Dynamism	3.27	3.50
Medium Income and Low Dynamism	8.47	8.38
Medium Income and Medium Dynamism	32.50	31.28
Medium Income and High Dynamism	19.36	19.52
High Income and Low Dynamism	4.45	4.13
High Income and Medium Dynamism	20.33	21.56
High Income and High Dynamism	2.10	2.46
Location		
Rural	1.88	2.86
Urban	98.12	97.14
Semiarid Zone		
No	50.39	50.67
Yes	49.61	49.33
Observations	171,531	67,470

Notes: Compiled by the authors based on FNE administrative data.

Table 3: Descriptive Statistics – Borrower Characteristics

Characteristic	**Share (%)**	
Firm Size	**All firms**	**Renegotiating firms**
Micro	41.36	32.99
Mini	0.69	1.23
Small	50.45	56.15
Small-Medium	3.14	4.62
Medium	3.37	3.68
Large	1.01	1.34
Sector		
Agro-industry	0.62	0.80
Agricultural	1.02	1.72
Livestock	0.42	0.60
Commerce	63.49	59.73
Services	22.21	23.61
Industrial	12.05	13.32
Infrastructure	0.19	0.22
BNB Program		
FNE Agrin	0.27	0.35
FNE Aquipesca	0.06	0.10
FNE Commerce & Services	18.13	12.42
FNE Industrial	2.81	2.68
FNE Innovation	0.08	0.09
FNE Irrigation	0.03	0.03
FNE MPE	69.84	77.04
FNE Proatur	0.42	0.47
FNE Profrota Pesqueira	0.00	0.00
FNE Proinfra	0.15	0.21
FNE Rural	0.46	0.54
FNE Health	0.16	0.00
FNE Drought	1.51	0.76
FNE Green	1.04	1.72
Pronaf	0.02	0.03
Other	5.00	3.57
Risk Type		
100% FNE Risk	1.08	1.88
Shared Risk	98.90	98.11
Bank Risk	0.02	0.01
Credit Rating		
AA	60.21	76.62
A	18.94	11.20
B	8.52	5.06
C	0.52	0.56
D	0.40	0.48
E	0.14	0.10
F	0.04	0.02
G	0.01	0.01
H	0.03	0.01
N/A	11.18	5.94
Observations	171,531	67,470

Notes: Compiled by the authors based on FNE administrative data.

Table 4: Descriptive Statistics of Firm Performance Indicators

	Full Sample		Non-Renegotiating		Renegotiating	
	Mean	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**
Panel A: Levels						
Employment (workers)	18.91	105.02	17.16	92.82	27.45	150.73
Average wage (R$)	910.84	597.93	915.56	582.49	887.82	667.77
Total wage bill (R$)	24,098.01	210,923.49	21,616.6	167,944.67	36,219.13	351,886.50
Panel B: Logarithms						
ln(Employment)	1.99	1.06	1.96	1.04	2.13	1.18
ln(Average wage)	7.01	0.68	7.01	0.65	6.98	0.81
ln(Total wage bill)	8.75	1.56	8.72	1.52	8.88	1.74
Observations	596,940		495,468		101,472	
Firms	59,940		50,074		8,366	

Notes: Means and standard deviations (S.D.) of outcome variables. Panel A reports values in levels; Panel B reports natural logarithms. Source: RAIS micro-data.

Table 5: Effect of FNE Renegotiation on Employment, Wages, and Wage Bill

	(1)	(2)	(3)	(4)	(5)
Panel A: Employment					
Renegotiation$_{it}$	-0.2111^{***}	-0.2111^{***}	-0.2111^{***}	-0.2111^{***}	-0.1846^{***}
	(0.0089)	(0.0089)	(0.0088)	(0.0088)	(0.0088)
Panel B: Average Wage					
Renegotiation$_{it}$	-0.1229^{***}	-0.1227^{***}	-0.1226^{***}	-0.1229^{***}	-0.0954^{***}
	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0106)
Panel C: Total Wage Bill					
Renegotiation$_{it}$	-0.3919^{***}	-0.3917^{***}	-0.3916^{***}	-0.3919^{***}	-0.3288^{***}
	(0.0178)	(0.0178)	(0.0178)	(0.0178)	(0.0176)
Firm FE	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓
State FE		✓	✓		✓
Sector FE			✓		✓
State×Sector trends				✓	
Contract controls					✓
Observations	596,940	596,940	596,939	596,939	596,939
Firms	59,940	59,940	59,940	59,940	59,940
Renegotiating firms	8,366	8,366	8,366	8,366	8,366

Notes: Each cell reports the coefficient from a separate regression based on Equation (1). Panels A, B, and C report the average effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Contract controls include a linear trend for the contract origination year and FNE sub-program indicators. Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 6: Effect of FNE Renegotiation on Employment, Wages, and Wage Bill – Callaway and Sant'Anna, Sun and Abraham, and Wooldridge

	(1)	(2)	(3)
	Employment	Average Wage	Total Wage Bill
Panel A: Callaway and Sant'Anna			
$Renegotiation_{it}$	-0.2122^{***}	-0.1013^{***}	-0.3693^{***}
	(0.0076)	(0.0091)	(0.0150)
Observations	552,854	552,854	552,854
Panel B: Sun and Abraham			
$Renegotiation_{it}$	-0.2461^{***}	-0.1344^{***}	-0.4467^{***}
	(0.0087)	(0.0113)	(0.0181)
Observations	563,327	563,327	563,327
Panel C: Wooldridge			
$Renegotiation_{it}$	-0.2201^{***}	-0.1107^{***}	-0.3892^{***}
	(0.0075)	(0.0095)	(0.0154)
Observations	560,901	560,901	560,901

Notes: Panels A, B, and C report the average effect of FNE loan renegotiation using the estimators of Callaway and Sant'Anna, Sun and Abraham, and Wooldridge, respectively. All specifications include firm and year fixed effects. Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 7: Heterogeneity by Firm Size – SEBRAE Classification

	(1)	(2)	(3)	(4)
	Firm Size			
	Micro	**Small**	**Medium**	**Large**
Panel A: Employment				
Renegotiation$_{it}$	-0.1642^{***}	-0.1735^{***}	-0.2310^{**}	-0.3055^{**}
	(0.0084)	(0.0254)	(0.0952)	(0.1209)
Panel B: Average Wage				
Renegotiation$_{it}$	-0.0917^{***}	-0.0868^{***}	-0.1194	-0.0121
	(0.0110)	(0.0298)	(0.0962)	(0.0688)
Panel C: Total Wage Bill				
Renegotiation$_{it}$	-0.3075^{***}	-0.2870^{***}	-0.3694^{**}	-0.3340^{*}
	(0.0175)	(0.0512)	(0.1776)	(0.1732)
Observations	493,062	88,247	8,822	6,804

Notes: Each cell reports the coefficient from a separate regression based on Equation (1). Panels A, B, and C report the average effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Size classification follows SEBRAE criteria: column (1) micro firms (up to 9 employees); column (2) small firms (10–49 employees); column (3) medium firms (50–99 employees); column (4) large firms (100 or more employees). Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 8: Heterogeneity by Firm Size – FNE Classification

	(1)	(2)	(3)	(4)
	Firm Size			
	Mini and Micro	**Small and Small-Medium**	**Medium**	**Large**
Panel A: Employment				
Renegotiation$_{it}$	-0.0876^{***}	-0.1951^{***}	-0.2342^{***}	-0.1602^{**}
	(0.0144)	(0.0095)	(0.0443)	(0.0725)
Panel B: Average Wage				
Renegotiation$_{it}$	-0.0519^{***}	-0.0965^{***}	-0.0826^{*}	-0.0539
	(0.0167)	(0.0126)	(0.0442)	(0.0535)
Panel C: Total Wage Bill				
Renegotiation$_{it}$	-0.1736^{***}	-0.3443^{***}	-0.3445^{***}	-0.2259^{**}
	(0.0274)	(0.0202)	(0.0803)	(0.1117)
Observations	155,411	381,160	47,865	12,496

Notes: Each cell reports the coefficient from a separate regression based on Equation (1). Panels A, B, and C report the average effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Size classification follows FNE criteria: column (1) micro and mini firms; column (2) small and small-medium firms; column (3) medium firms; column (4) large firms. Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 9: Heterogeneity by Economic Sector

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Sector						
	Agro-ind.	**Agricultural**	**Livestock**	**Commerce**	**Services**	**Industry**	**Infrastr.**
Panel A: Employment							
Renegotiation$_{it}$	-0.0093	-0.0305	0.0432	-0.2284^{***}	-0.1319^{***}	-0.1370^{***}	-0.4793^{**}
	(0.0855)	(0.0934)	(0.0971)	(0.0099)	(0.0237)	(0.0218)	(0.1856)
Panel B: Average Wage							
Renegotiation$_{it}$	-0.1993^{*}	-0.0416	-0.0821	-0.1087^{***}	-0.0522^{***}	-0.0773^{***}	0.0691
	(0.1181)	(0.0860)	(0.0649)	(0.0141)	(0.0195)	(0.0248)	(0.1225)
Panel C: Total Wage Bill							
Renegotiation$_{it}$	-0.2327	-0.0682	-0.0477	-0.3991^{***}	-0.2141^{***}	-0.2431^{***}	-0.4563^{**}
	(0.1834)	(0.1598)	(0.1481)	(0.0220)	(0.0386)	(0.0429)	(0.1904)
Observations	4,916	4,293	2,819	380,752	116,191	87,658	299

Notes: Each cell reports the coefficient from a separate regression based on Equation (1). Panels A, B, and C report the average effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Sector classification: agro-industry, agricultural, livestock, commerce, services, industry, and infrastructure. Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 10: Heterogeneity by FNE Sub-Program

	(1)	(2)	(3)	(4)	(5)	(6)
	Sub-Program					
	FNE MPE	**FNE Commerce & Services**	**FNE Industrial**	**FNE Drought**	**FNE Green**	**Other**
Panel A: Employment						
Renegotiation$_{it}$	-0.1782^{***}	-0.2767^{***}	-0.1535^{***}	-0.2297^{***}	0.1804	-0.0356
	(0.0092)	(0.0215)	(0.0420)	(0.0347)	(0.1409)	(0.0521)
Panel B: Average Wage						
Renegotiation$_{it}$	-0.1065^{***}	-0.1098^{***}	-0.0239	-0.1183^{**}	0.2079^{*}	-0.0891^{**}
	(0.0134)	(0.0229)	(0.0388)	(0.0506)	(0.1058)	(0.0419)
Panel C: Total Wage Bill						
Renegotiation$_{it}$	-0.3411^{***}	-0.4378^{***}	-0.1947^{***}	-0.4139^{***}	0.3969^{**}	-0.1366^{*}
	(0.0208)	(0.0404)	(0.0725)	(0.0778)	(0.2000)	(0.0826)
Observations	363,793	165,645	30,861	15,590	4,455	16,583

Notes: Each cell reports the coefficient from a separate regression based on Equation (1). Panels A, B, and C report the average effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Sub-programs as described in Table 3. Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 11: Heterogeneity by Number of Contracts and Number of Renegotiated Contracts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Number of contracts						**Number of renegotiated contracts**	
	1	**2**	**3**	**4**	**5**	**≥6**	**1**	**>1**
Panel A: Employment								
Renegotiation$_{it}$	-0.1386^{***}	-0.1917^{***}	-0.2027^{***}	-0.2604^{***}	-0.3006^{***}	-0.2027^{***}	-0.2048^{***}	-0.1603^{***}
	(0.0145)	(0.0191)	(0.0236)	(0.0301)	(0.0357)	(0.0210)	(0.0112)	(0.0139)
Panel B: Average Wage								
Renegotiation$_{it}$	-0.0646^{***}	-0.1210^{***}	-0.1261^{***}	-0.1877^{***}	-0.1608^{***}	-0.0819^{***}	-0.1010^{***}	-0.0974^{***}
	(0.0181)	(0.0235)	(0.0314)	(0.0417)	(0.0432)	(0.0191)	(0.0141)	(0.0163)
Panel C: Total Wage Bill								
Renegotiation$_{it}$	-0.2437^{***}	-0.3682^{***}	-0.3806^{***}	-0.5195^{***}	-0.5325^{***}	-0.3332^{***}	-0.3617^{***}	-0.2993^{***}
	(0.0297)	(0.0395)	(0.0500)	(0.0660)	(0.0710)	(0.0356)	(0.0231)	(0.0272)
Observations	263,669	124,308	67,200	41,098	26,811	73,845	552,026	540,381

Notes: Each cell reports the coefficient from a separate regression based on Equation (1). Panels A, B, and C report the average effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Columns (1)–(6) stratify firms by total number of FNE contracts held over the sample period. Columns (7) and (8) stratify renegotiating firms by whether they renegotiated exactly one or more than one contract. Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 12: Heterogeneity by State

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	State										
	MA	**PI**	**CE**	**RN**	**PB**	**PE**	**AL**	**SE**	**BA**	**MG**	**ES**
Panel A: Employment											
Renegotiation$_{it}$	-0.2083^{***}	-0.2248^{***}	-0.2318^{***}	-0.2317^{***}	-0.2108^{***}	-0.2033^{***}	-0.2268^{***}	-0.1539^{***}	-0.1731^{***}	-0.2426^{***}	-0.1654^{**}
	(0.0296)	(0.0336)	(0.0222)	(0.0278)	(0.0320)	(0.0201)	(0.0470)	(0.0334)	(0.0229)	(0.0337)	(0.0750)
Panel B: Average Wage											
Renegotiation$_{it}$	-0.1289^{***}	-0.1177^{***}	-0.1082^{***}	-0.0820^{***}	-0.1354^{***}	-0.1385^{***}	-0.1140^{**}	-0.1088^{**}	-0.1301^{***}	-0.0413	-0.3608^{***}
	(0.0360)	(0.0434)	(0.0239)	(0.0289)	(0.0387)	(0.0252)	(0.0569)	(0.0429)	(0.0303)	(0.0359)	(0.1381)
Panel C: Total Wage Bill											
Renegotiation$_{it}$	-0.3915^{***}	-0.4125^{***}	-0.3921^{***}	-0.3753^{***}	-0.4083^{***}	-0.3964^{***}	-0.3835^{***}	-0.3192^{***}	-0.3559^{***}	-0.3442^{***}	-0.6042^{***}
	(0.0591)	(0.0705)	(0.0409)	(0.0516)	(0.0650)	(0.0407)	(0.0969)	(0.0708)	(0.0487)	(0.0650)	(0.2145)
Observations	40,662	33,997	100,201	53,625	43,710	91,836	20,798	32,975	127,858	37,080	13,824

Notes: Each cell reports the coefficient from a separate regression based on Equation (1). Panels A, B, and C report the average effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. States: Maranhão (MA), Piauí (PI), Ceará (CE), Rio Grande do Norte (RN), Paraíba (PB), Pernambuco (PE), Alagoas (AL), Sergipe (SE), Bahia (BA), Minas Gerais (MG), and Espírito Santo (ES), corresponding to columns (1) through (11). Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 13: Heterogeneity by Semiarid Zone

	(1)	(2)
	Semiarid Zone	
	Semiarid	**Non-Semiarid**
Panel A: Employment		
Renegotiation$_{it}$	-0.1946^{***}	-0.1759^{***}
	(0.0121)	(0.0124)
Panel B: Average Wage		
Renegotiation$_{it}$	-0.1061^{***}	-0.0848^{***}
	(0.0149)	(0.0147)
Panel C: Total Wage Bill		
Renegotiation$_{it}$	-0.3578^{***}	-0.3025^{***}
	(0.0242)	(0.0248)
Observations	256,511	340,427

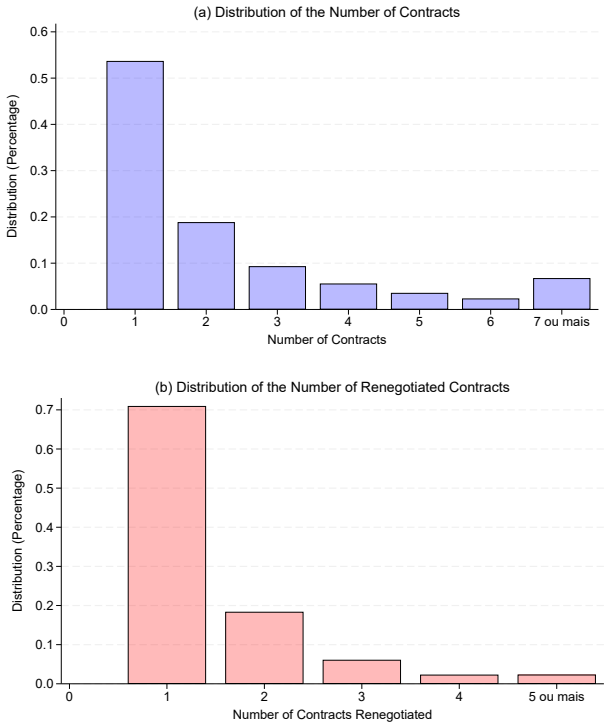
Notes: Each cell reports the coefficient from a separate regression based on Equation (1). Panels A, B, and C report the average effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Column (1): firms located within the semiarid zone; column (2): firms located outside the semiarid zone. Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Online Appendix to "Loan Renegotiation and Firm Performance: Evidence from a Brazilian Public Development Fund"

Dieison Casagrande, Conrado Mallmann, and Paulo Feistel

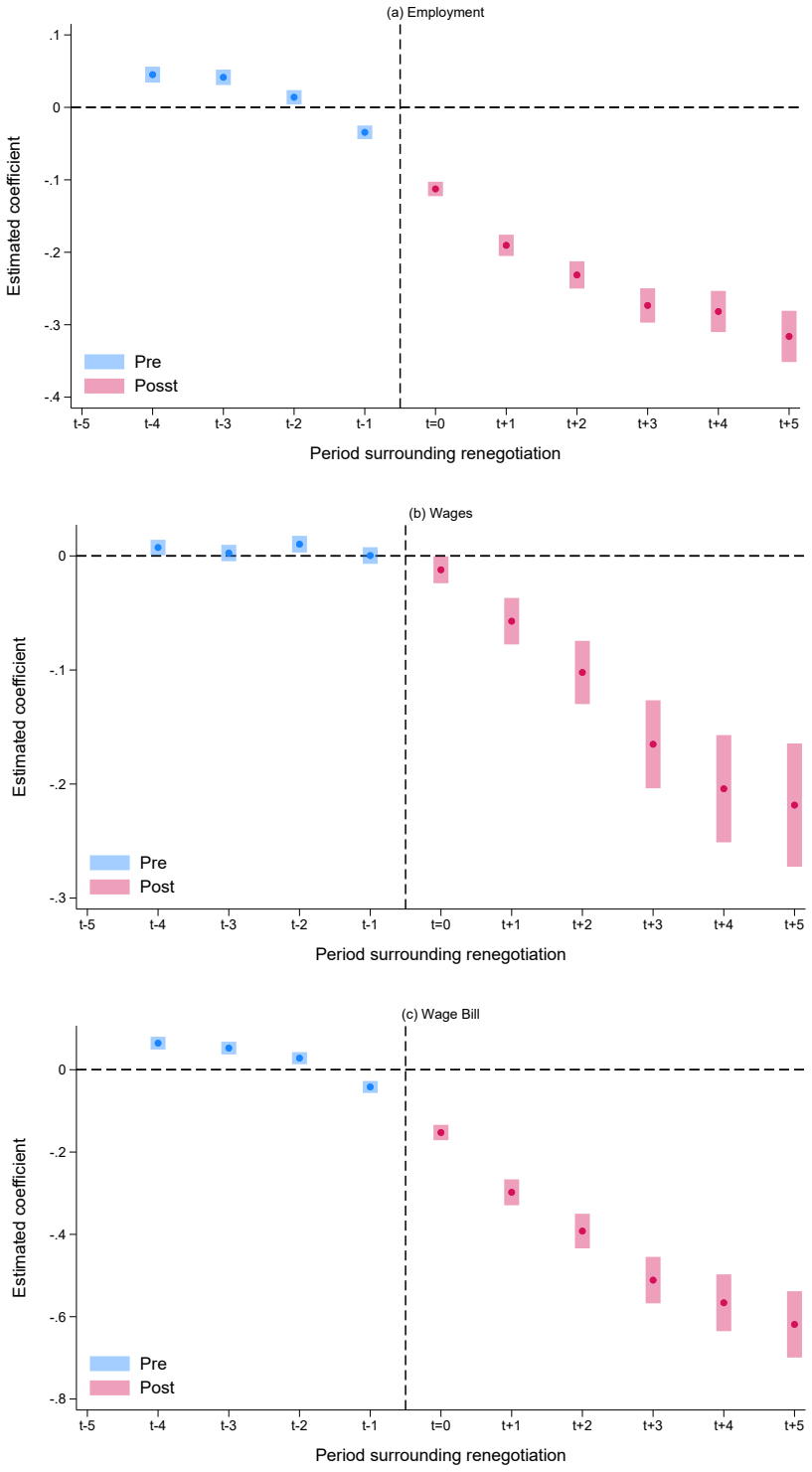
A Additional Figures and Tables

Figure A.1: Distribution of Number of Contracts (total and renegotiated) – 2000 to 2021



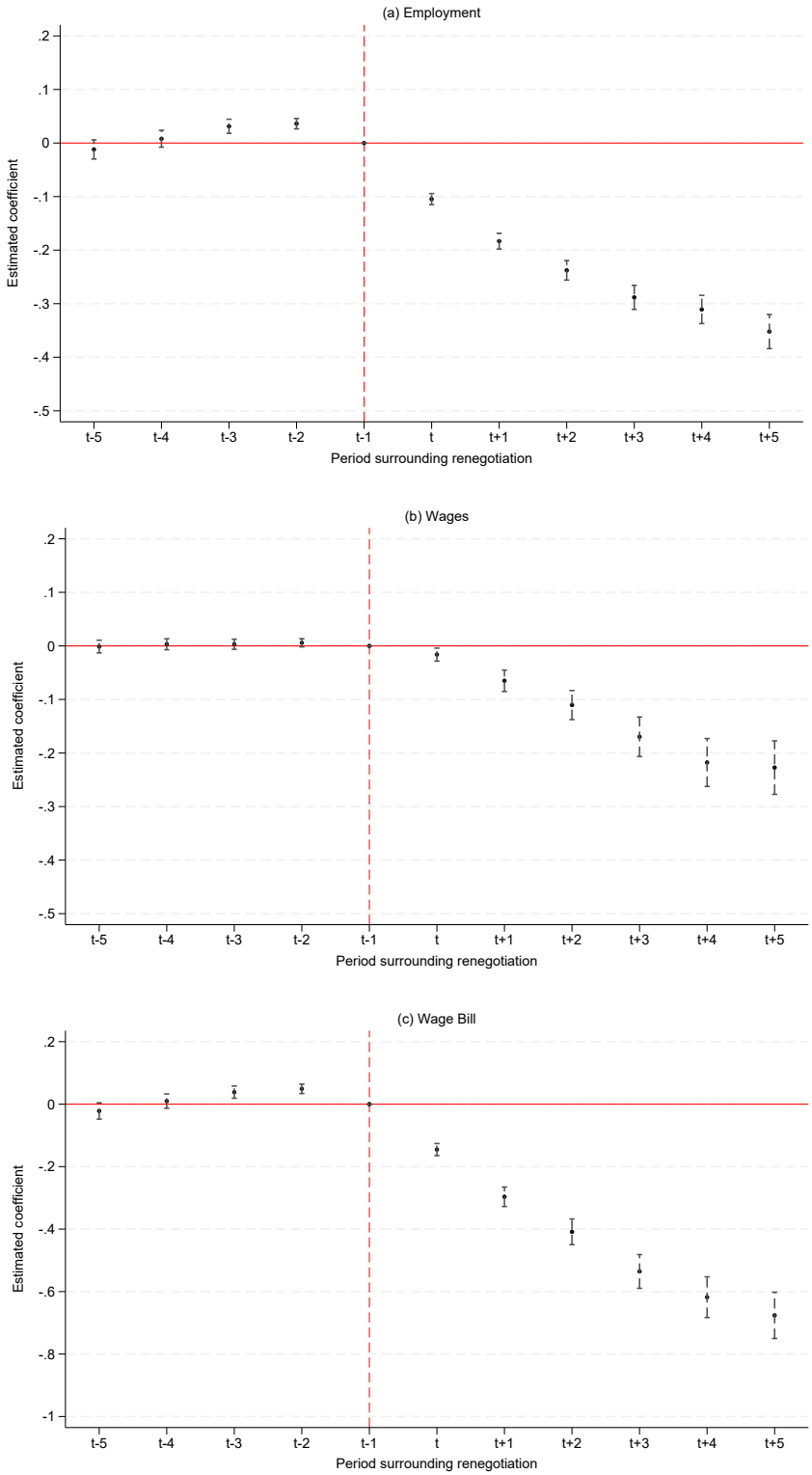
Source: Compiled by the authors based on FNE administrative data provided by BNB. Panel (a): distribution of firms by number of contracts signed (171,531 firms); Panel (b): distribution of firms by number of renegotiated contracts (67,470 firms).

Figure A.2: Dynamic Effects of FNE Renegotiation on Employment, Wages, and Wage Bill – Callaway and Sant'Anna



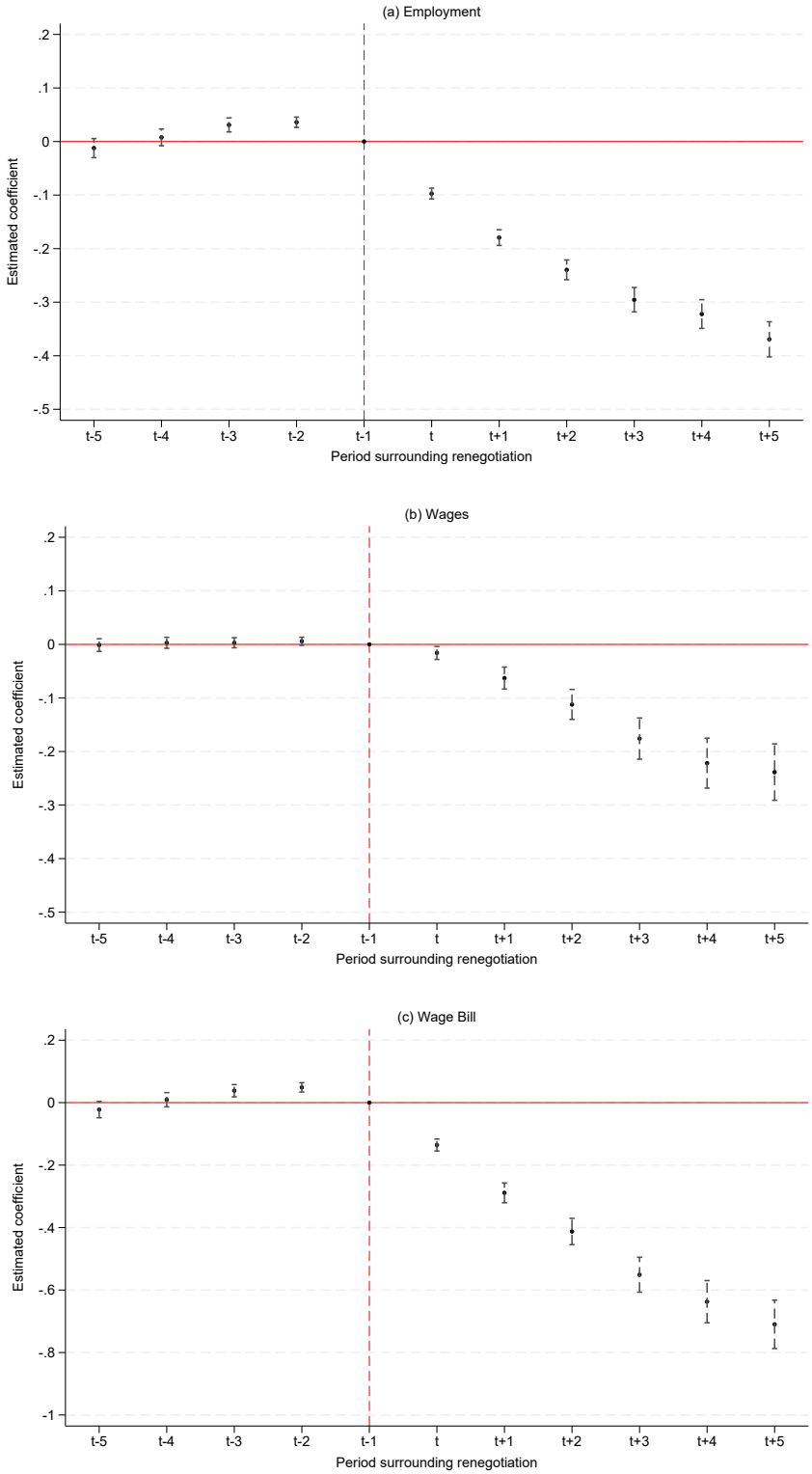
Notes: Estimated using the estimator proposed by Callaway and Sant'Anna (2021). Panels (a), (b), and (c) report the dynamic effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Blue (red) dots represent pre- (post-)treatment point estimates. Bars represent 95% confidence intervals. **Source:** Compiled by the authors.

Figure A.3: Dynamic Effects of FNE Renegotiation on Employment, Wages, and Wage Bill – Sun and Abraham



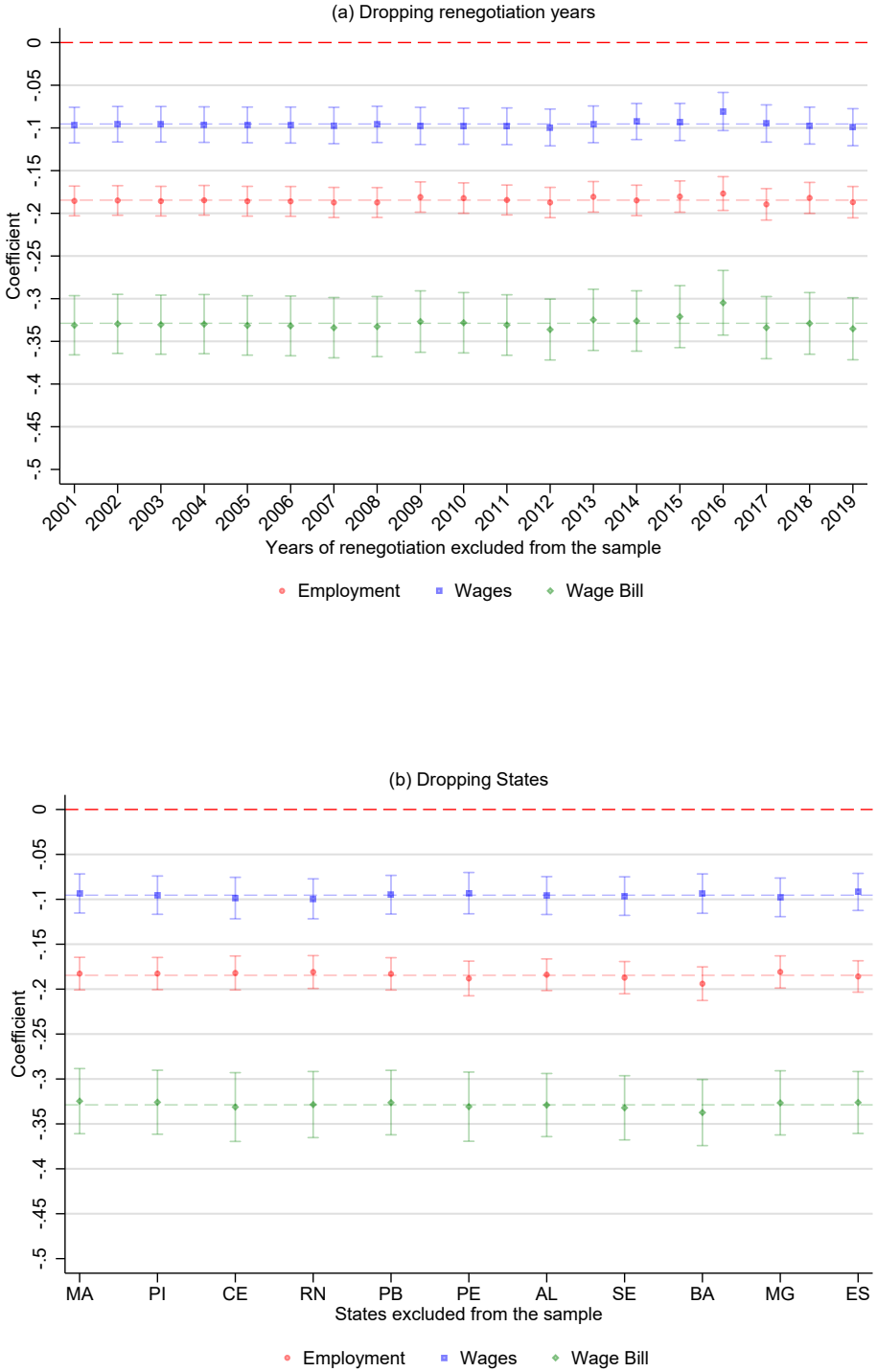
Notes: Estimated based on Equation (2) using the method proposed by Sun and Abraham (2021). Panels (a), (b), and (c) report the dynamic effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Black dots represent point estimates; vertical bars represent 95% confidence intervals. Reference period: $t-1$. **Source:** Compiled by the authors.

Figure A.4: Dynamic Effects of FNE Renegotiation on Employment, Wages, and Wage Bill – Wooldridge



Notes: Estimated based on Equation (2) using the method proposed by Wooldridge (2025). Panels (a), (b), and (c) report the dynamic effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Black dots represent point estimates; vertical bars represent 95% confidence intervals. Reference period: $t-1$. **Source:** Compiled by the authors.

Figure A.5: Robustness to Exclusion of Specific Subsamples – Renegotiation Years and States



Notes: Estimated based on Equation (1). Panel (a): sequential exclusion of renegotiation cohort years. Panel (b): sequential exclusion of states. Each point represents a point estimate with its 95% confidence interval. Red, blue, and green dots correspond to estimates for employment, average wages, and total wage bill, respectively. Horizontal lines in the corresponding colors indicate the baseline average coefficient from column (5) of Table 5. **Source:** Compiled by the authors.

Table A.1: Effect of FNE Renegotiation on Employment, Wages, and Wage Bill: Specific Trends and Additional Controls

	(1)	(2)	(3)	(4)
Panel A: Employment				
Renegotiation$_{it}$	-0.1846^{***}	-0.1849^{***}	-0.1430^{***}	-0.1814^{***}
	(0.0088)	(0.0088)	(0.0082)	(0.0089)
Panel B: Average Wage				
Renegotiation$_{it}$	-0.0954^{***}	-0.0928^{***}	-0.0762^{***}	-0.0930^{***}
	(0.0106)	(0.0104)	(0.0103)	(0.0106)
Panel C: Total Wage Bill				
Renegotiation$_{it}$	-0.3288^{***}	-0.3259^{***}	-0.2575^{***}	-0.3218^{***}
	(0.0176)	(0.0175)	(0.0164)	(0.0177)
Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
State FE	✓		✓	✓
Sector FE	✓		✓	✓
Contract controls	✓	✓	✓	✓
Municipality×Sector trends		✓		
Workforce controls			✓	
Risk×Rating trends				✓
Observations	596,939	596,918	596,939	596,939

Notes: Each cell reports the coefficient from a separate regression based on Equation (1). Panels A, B, and C report the average effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Workforce controls include: share of male workers, share of workers with tertiary education, average worker age, average job tenure, average contracted hours, and firm size bracket. Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A.2: Heterogeneity by Risk Allocation Type

	(1)	(2)
	Risk Allocation Type	
	Shared Risk	**100% FNE Risk and Bank Risk**
Panel A: Employment		
Renegotiation$_{it}$	-0.1839^{***}	-0.2061^{*}
	(0.0089)	(0.1157)
Panel B: Average Wage		
Renegotiation$_{it}$	-0.0958^{***}	-0.1922^{*}
	(0.0106)	(0.1133)
Panel C: Total Wage Bill		
Renegotiation$_{it}$	-0.3283^{***}	-0.4625^{**}
	(0.0177)	(0.2274)
Observations	595,227	1,708

Notes: Each cell reports the coefficient from a separate regression based on Equation (1). Panels A, B, and C report the average effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Column (1): shared-risk contracts; column (2): contracts under 100% FNE risk or bank risk. Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A.3: Heterogeneity by PNDR Territorial Typology

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Low Income			**Medium Income**			**High Income**		
				Dynamism					
	Low	**Medium**	**High**	**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
Panel A: Employment									
Renegotiation$_{it}$	-0.2423^{***}	-0.1883^{***}	-0.2969^{***}	-0.1690^{***}	-0.1812^{***}	-0.1980^{***}	-0.0648	-0.1963^{***}	-0.1625^{***}
	(0.0686)	(0.0354)	(0.0502)	(0.0294)	(0.0149)	(0.0172)	(0.0544)	(0.0192)	(0.0589)
Panel B: Average Wage									
Renegotiation$_{it}$	-0.0638	-0.1798^{***}	-0.1873^{**}	-0.0483	-0.1005^{***}	-0.1203^{***}	-0.1494^{**}	-0.0569^{***}	-0.0271
	(0.0599)	(0.0556)	(0.0768)	(0.0308)	(0.0185)	(0.0236)	(0.0706)	(0.0195)	(0.0550)
Panel C: Total Wage Bill									
Renegotiation$_{it}$	-0.4040^{***}	-0.4404^{***}	-0.5843^{***}	-0.2517^{***}	-0.3304^{***}	-0.3786^{***}	-0.2527^{**}	-0.2892^{***}	-0.2251^{**}
	(0.1245)	(0.0818)	(0.1170)	(0.0528)	(0.0308)	(0.0373)	(0.1160)	(0.0349)	(0.1047)
Observations	4,508	27,518	10,826	52,180	186,412	122,553	34,591	145,063	13,277

Notes: Each cell reports the coefficient from a separate regression based on Equation (1). Panels A, B, and C report the average effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. PNDR typologies: Low Income & Low Dynamism, Low Income & Medium Dynamism, Low Income & High Dynamism, Medium Income & Low Dynamism, Medium Income & Medium Dynamism, Medium Income & High Dynamism, High Income & Low Dynamism, High Income & Medium Dynamism, and High Income & High Dynamism. Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A.4: Heterogeneity by Immediate and Intermediate Geographic Regions

	(1)	(2)	(3)	(4)
	Geographic Region			
	Immediate		**Intermediate**	
	Periphery	**Hub**	**Periphery**	**Hub**
Panel A: Employment				
Renegotiation$_{it}$	-0.1913^{***}	-0.1811^{***}	-0.1169^{***}	-0.0654^{***}
	(0.0146)	(0.0109)	(0.0143)	(0.0152)
Panel B: Average Wage				
Renegotiation$_{it}$	-0.1346^{***}	-0.0746^{***}	-0.1169^{***}	-0.0654^{***}
	(0.0194)	(0.0122)	(0.0143)	(0.0152)
Panel C: Total Wage Bill				
Renegotiation$_{it}$	-0.3824^{***}	-0.3005^{***}	-0.3576^{***}	-0.2904^{***}
	(0.0312)	(0.0208)	(0.0231)	(0.0266)
Observations	194,562	399,529	328,924	265,381

Notes: Each cell reports the coefficient from a separate regression based on Equation (1). Panels A, B, and C report the average effect of FNE loan renegotiation on the natural logarithm of employment, average wages, and total wage bill, respectively. Odd-numbered columns correspond to firms located in peripheral municipalities (entorno); even-numbered columns to firms located in hub cities (polo), within each geographic classification. Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the firm level. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.