

Credit Guarantees, Firm Response, and Macroeconomics¹

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Abstract

We evaluate the impact of Belgium’s 2020 Public Credit Guarantee Scheme (CGS) using administrative data. The CGS applied to all firms, with those employing fewer than 50 workers benefiting from a 25 basis point reduction in interest rates. Leveraging this policy-induced discontinuity, we compare firms around the employment threshold. Firms receiving the lower interest rates experienced increases in employment and investment, along with a reduction in firm exit rates. The scheme helped address the debt overhang problem by easing price-related credit constraints: for every €1 of guaranteed debt at a 25 basis points lower rate, non-guaranteed debt decreased by €0.13.

Keywords: Credit guarantees, credit frictions, regression discontinuity design, debt overhang

JEL Codes: E32, G21, H81

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1 Introduction

During periods of economic disruption, governments often seek to stimulate economic activity through firm-level interventions. Policymakers have long debated the optimal design and implementation of these measures. This paper empirically examines one such intervention by assessing the impact of guaranteed loans on firms' economic performance. The Small Business Acts (1953, 1958, 2010), as well as the American Recovery and Reinvestment Act of 2009 and the Paycheck Protection Program (PPP) under the CARES Act of 2020, offer loan guarantees to encourage banks and other lenders to extend credit to small businesses. In response to the Covid-19 pandemic, all 27 EU countries implemented loan guarantee programs, constituting the largest resource allocated as part of response measures, with CGS constituting 59% of the Euro-wide response package [IMF \(2020\)](#). In this arrangement, a third party—typically the government—partially or fully guarantees the loan, thereby insuring banks against the risk of firm default. Firms that secure guaranteed loans also benefit from more favorable pricing terms relative to other debt instruments. Advocates argue that these Credit Guarantee Schemes (CGS) stimulate economic activity. However, critics contend that such schemes may crowd out bank lending for other sectors of the economy by diverting funds through the CGS.

Our paper provides novel evidence on the effectiveness of this policy using Belgium's 2020 Credit Guarantee Scheme by utilizing its unique design. We contribute to policy and theoretical discussions by leveraging a policy-induced variation in the pricing conditions of guaranteed loans. Specifically, we exploit a discontinuity in loan price eligibility. While all firms were eligible to apply for the CGS, those with more than 50 employees were required to pay an additional fee of 25 basis points (bp), in compliance with EU State aid regulations.

The setup in our paper provides an ideal context for isolating the causal effect of favorable pricing conditions on firm outcomes. As we later show, firms near the eligibility threshold are comparable in all key dimensions, including access to additional credit, with the only distinction being that some receive more favorable loan pricing conditions. Using a regression discontinuity (RD) design, we compare firms above and below the 50-employee threshold to estimate the causal impact of lower borrowing costs for credit guarantees on firms' economic performance.

Our main results indicate that a reduction in interest rates for guaranteed loans improves firms' real outcomes. Specifically, compared to firms paying higher interest rates, those benefiting from lower rates experienced increases in investment rate, employment growth, and revenue growth by 0.20 percentage points (pp), 0.31 pp, and 0.34 pp, respec-

tively, along with a 0.19 pp decline in firm exit rates. Per the validity of our design, firms near the eligibility cutoff did not differ in all these dimensions in the year prior to the policy's implementation.

In theory, CGS should not have general equilibrium effects unless there are inefficiencies addressed by the scheme in the economy. The underlying intuition is that loans diverted to firms via CGS would otherwise have been allocated by banks to alternative loans. However, we identify a specific inefficiency in the economy and a distinct channel through which credit guarantees operate: firms face price-related constraints rather than quantity constraints. The policy mitigates the *debt overhang problem* —measured by the ratio of EBITDA to short-term debt—where the debt burden becomes so substantial that it prevents firms from taking on additional debt to finance future projects.

Specifically, we observe that firms on the both side of the cut-off accumulate similar amounts of guaranteed debt. However, firms that secure loans at interest rates 25 bp lower reduce their non-guaranteed debt by 0.18 pp, which, in turn, lowers their average interest costs by 0.015 pp and increase their debt service capacity by 0.29 pp.

By partially replacing their existing debt, these firms alleviate the debt overhang problem. With a mitigated debt overhang, firms invest more in profitable ventures, leading to increased investment and employment, along with a reduction in firm exit rates.

Literature Review: Our paper contributes to the literature on financial frictions and macroeconomics by offering micro-level evidence on how relaxing credit constraints, particularly during times of economic hardship, can reshape the economic landscape. Credit access limitations are now widely recognized as a crucial aspect of the economic environment. For instance, using India as a case study under a targeted lending program, [Banerjee and Duflo \(2014a\)](#) demonstrate the significant role that credit alleviation plays in a firm's decision-making process. We contribute to these discussions by demonstrating that, in addition to credit constraint channel, the pricing of credit plays a crucial role as well. We show that credit guarantees can similarly improve outcomes by facilitating access to cheaper credit and mitigating the debt overhang problem, which is introduced by [Myers \(1977\)](#) in the context of corporate finance, illustrating how firms with high debt levels might avoid beneficial investments because returns accrue mainly to creditor. [Krugman \(1988\)](#), on the other hand, addresses the issue in a macroeconomic context, exploring how large levels of sovereign debt can dissuade countries from investing in growth. He also discusses mechanisms for relieving such debt to encourage investment and development.

Our paper also joins the literature on alleviation measures for firms that are in stress. The two most common measures during the Covid-19 pandemic were the CGS, and debt moratoria, [Önder et al. \(2023\)](#) and [Guler et al. \(2024\)](#) study the effect of firm and consumer

moratoria in Colombia, respectively. Of the two, the largest resources were allocated to fund the CGS (IMF (2020)). Following EU wide implementation of the policy, subsequent studies regarding credit guarantees emerged. Some recent studies regarding CGS are Gonzalez-Urbe and Wang 2022, Bonfim et al. 2023, Lelarge et al. 2010. For the Belgian CGS, Güler and Samarin 2023 studies the impact of guarantee fees on banks' decisions on non-guaranteed loans issuance and pricing. Our paper contributes to this literature by providing a causal estimate that can isolate the impact of credit guarantees pricing on firms. Additionally, our paper also contributes to the literature studying the impact of policy interventions on financial frictions faced by firms (Brown et al. 2009, Banerjee and Duflo 2014b). We show that lower borrowing costs with credit guarantees impact firms primarily by reducing price related financial frictions.

2 Institutional Details and Research Design

We begin by describing the characteristics of the 2020 CGS in Belgium. Next, we focus on the policy's eligibility criteria for the interest rates charged to firms and how this feature creates the ideal scenario to isolate the causal impact of better price conditions on guaranteed loans.

2.1 The Belgian Credit Guarantees Scheme

The Belgian government announced the implementation of the CGS on April 1st, 2020. The envelope amount for the guarantee scheme was €50 billion, equivalent to 11.8% nominal GDP in 2020, and accounted for more than 90% of the nominal fiscal measures put forward by the Belgian government to respond to the COVID-19 pandemic. The program targeted firms affected by liquidity problems linked to the pandemic: eligible Belgian firms need not have arrears on existing loans and tax and social security contributions by February 1, 2020, and have less than 30 days in arrears by February 29, 2020.¹

Under the first scheme, valid from April 1 to December 31, 2020, Belgian financial institutions received a fraction of the €50 billion envelope based on their market share to issue new loans to any eligible firm. New loans guaranteed by the Belgian government² had a maturity up to a year. Banks were required to issue guaranteed loans to any eligible

¹With the COVID-19 pandemic, the European Commission relaxed the restrictions on state aid allowing EU economies to implement CGS under the *Temporary Framework*, which, among other things, defined eligibility requirements based on the definition of "undertakings in difficulty" (Anderson et al. 2021)

²In the event of default, the Belgian government would cover 50% and 80% of the losses on guaranteed loans after the bank's reference portfolio losses were 3%-5% and more than 5%, respectively.

firm but could "deselect" up to 15% of the total loans to eligible firms.³ In such cases, an eligible firm still received the loan but with a maturity longer than one year and without a public guarantee.

Certain types of credit are explicitly excluded from the guarantee program. These include: (1) leasing agreements, (2) factoring arrangements, (3) consumer and mortgage loans, (4) refinancing of existing credit, (5) renewed borrowing under credit issued before April 1, 2020, (6) credit restricted by contract for activities outside Belgium, and (7) credit that would normally qualify as "guaranteed credit" but has been specifically designated as outside the guarantee scheme at the time it is issued. The maximum loan amount was determined by the highest among the (i) the firm's liquidity needs⁴, (ii) twice the last wage bill reported by the firm, and (iii) 25% of the firm's turnover reported in the previous financial report. Most importantly, the interest rate, which included a fee for the guarantee the lender needed to refund the government, was capped differently for certain firms receiving guaranteed loans. See [NBB, 2020](#) for more details on the Belgian CGS.

2.2 Loan Price Conditions on Guaranteed Loans

Now, we describe the circumstances generating a differential interest rate on new loans guaranteed by the Belgian government in 2020. We show that eligibility for better price conditions on guaranteed loans was linked to a size category defined by three pre-determined dimensions: employment, turnover, and total assets.

Eligible firms receiving guaranteed loans were charged a differential interest rate that was directly linked to their size category. Specifically, the loan pricing varied due to the differential guarantee fee: (i) 25 bp for Small and Medium Enterprise (SMEs) and (ii) 50 bp. for large enterprises. This meant that the interest rate on guarantee loans was capped at 1.50% for SMEs and 1.75% for large enterprises.

The size category a firm receives in a given year is based on comparing the last two previous yearly balance sheet reports with three thresholds: 50 full-time employees, a turnover of €9 million, and €4.5 million in total assets. Any firm surpassing no more than one threshold is classified as an SME, while it is categorized as large if it is above two or more thresholds. It is worth noting that employment is the most relevant dimension in determining a firm's size category. Particularly, about 98% of firms during 2018-2019 are classified as SMEs or large corporations due to the employment being above and below the 50-employee threshold.

³Banks that "deselected" more than 15% of their total eligible loans had to refund a higher fee for any credit guarantee: (i) 27 bp for SMEs and (ii) 54 bp for large corporations.

⁴Which was set to 12 months for Small and Medium Enterprises and 18 months for large enterprises.

Overall, this implies that for firms receiving guarantee loans in 2020, the interest rate deterministically increases once pre-determined employment, assets, or turnover surpasses more than one of the cutoffs defining the size category for firms.

2.3 Identification

Next, we argue how the discontinuity in eligibility to receive a different guaranteed loan pricing can be exploited as an exogenous source of variation to estimate the effect of lowering the interest rate on credit guarantees. Then, formulate the empirical strategy characterizing our RD setup.

As explained previously, the differential fee imposed by the Belgian government to provide guarantees on new loans under the CGSs in 2020 generated a unique variation in borrowing costs: the interest rate on guaranteed loans reduced deterministically by 25 bp. for firms classified as SMEs relative to large corporations.

The first step to define our empirical strategy is to single out firms receiving credit guarantees in 2020. This step is crucial as the discontinuity in the interest rate is only relevant for firms that obtain guaranteed loans. To identify firms participating in the CGSs, we employ administrative balance-sheet data on statements for amounts payable for 2020; in that year, firms were required to report in detail the outstanding amount on all items in their guaranteed debt portfolio. Using this information, we define firms participating in the Belgian CGSs if they report having a positive outstanding balance on total debts guaranteed by Belgian public authorities at the end of 2020.

Our second step is to reduce the number of dimensions characterizing the discontinuity of our RD setup to simplify our analysis. As noted in Section 2.2 receiving a lower interest rate on credit guarantees depends on a multidimensional size categorization defined by three cutoffs: employment, total assets, and turnover. Since 98 percent of the time, employment alone is the determinant dimension: firms are classified depending on whether they surpass the employment cutoff. With this in mind, we restrict our sample to firms that, at the end of 2018, were either (i) SMEs with less than 50 employees or (ii) large corporations with more than 50 employees. In this way, we are sure that firms above and below the employment cutoff are treated by a differential interest rate on their credit guarantees.

We can employ a *sharp* RDD setup based on the sample selection restrictions described before. For any firm " i " receiving a publicly guaranteed loan in 2020, let $FTE_i = 50 - fte_i$, be our running variable defined as the difference between the employment threshold and the number of employees (fte_i) for that firm at the end of 2018. Moreover, let D_i be the treatment indicator for receiving a lower interest rate (i.e., "treatment") on a guaranteed

loan in 2020, with $D_i = 1$ a firm is treated and zero if the firm belongs to the control group. Given the regulatory conditions of the Belgian CGSs, we know that D_i is entirely defined by the running variable FTE_i . Therefore:

$$D_{ij} = \mathbf{1}\{FTE_i \geq 0\} \quad (1)$$

To obtain our *sharp*-RD estimates, we employ a local non-parametric linear regression approach (Calonico et al., 2014). In particular, for an outcome variable $Y_{i,t}$ of firm "i" at the end of year "t" we estimate:

$$\arg \min_{\beta_{Y_t}} \sum_i^I \left(Y_{i,t} - \beta_{0,Y} - \beta_{1,Y_t} D_i + \beta_{2,Y_t} FTE_i - \beta_{3,Y_t} FTE_{ij} \times D_i \right)^2 K \left(\frac{FTE_i}{h} \right) \quad (2)$$

In the non-parametric approach described in equation (??), we first estimate the optimal employment bandwidth " h " to determine the firm variation arbitrarily close to the cutoff we employ. Then, restricting our sample to firms within the optimal bandwidth, we estimate β_{Y_t} by minimizing the quadratic sum of residuals weighted by our triangular kernel $K(\cdot)$ giving more importance to firms closer to the cutoff.

The baseline specification in our RD design controls for fixed effects at the two-digit industry level (NACE-BEL 2008-Rev. 2) to absorb any industry unobservable confounders affecting some industries differently than others (e.g., 2020 COVID pandemics). Additionally, our specification also controls for a dummy taking the value of one if firms report having guaranteed loans with private banks in 2020.⁵

The coefficient of interest capturing the sharp-RD estimator is β_{1,Y_t} . Notice that this coefficient is computed on a year-by-year basis using cross-section variation of firms: (i) one year before (i.e., $t = T - 1$), (ii) during the year (i.e., $t = T$), and (ii) up to three years after (i.e., $t = T + 1, T + 2, T + 2$) the policy was implemented. Equation (3) defines the RD estimator for the contemporaneous effect of lowering the interest rate on outcome Y .

$$\beta_{1,Y_t} = \lim_{x \downarrow 0} \mathbb{E}[Y_{i,t} | FTE_i = x] - \lim_{x \uparrow 0} \mathbb{E}[Y_{i,t} | FTE_i = x] \quad (3)$$

Intuitively, this expression captures the mean difference in Y across firms receiving credit guarantees at the end of 2020 but differently treated in terms of the interest rate: some firms treated with a lower interest rate due to being marginally below the employment

⁵For economic performance outcomes, we also control by the difference between the assets threshold (i.e., €4.5 million) and firms' total assets in 2018. The latter increases the precision of the RD estimates, but our baseline results are robust enough to exclude this control.

threshold in 2018, and firms charged a higher interest rate because had slightly more than 50 employees in 2018.

Our RD design identifies the local treatment effect of receiving a lower interest rate for firms exactly at the employment cutoff (i.e., continuity condition). In our case, this condition required that firms within an arbitrarily small bandwidth of the employment threshold are similar in all observable and unobservable characteristics, then any difference in Y_i during the year of the policy should be explained by the fact that some received a guaranteed loan with relatively lower interest rate.

3 Data

We use firm-level balance sheet information from *Bel-first*. This data source provides comprehensive annual information on balance sheet items for the universe of companies in Belgium from 2015 to 2024. We employ the unconsolidated balance-sheet reports. In particular, we focus on the statements of amounts payable for 2020 to be able to identify firms receiving credit guarantees in that year. Additionally, to measure real and financial outcome variables, we gathered information from the assets, income, and social balance statements from 2018 to 2023.

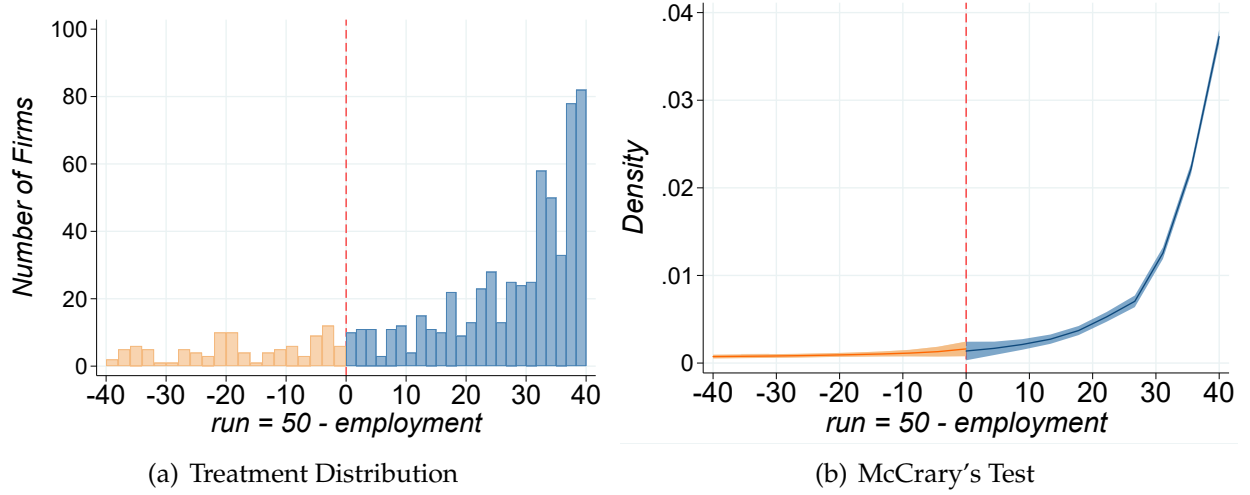
The total number of firms reporting positive publicly guaranteed debt in 2020 in the *Bel-first* data is 3,458. Firms in our sample capture 99.7% of all Belgian companies reporting positive balances of guaranteed debt in 2020, based on the official National Bank of Belgium statistics.⁶ For our RD setup, our sample includes 2,904 firms, with 2,564 firms treated (i.e., less than or equal to 50 employees) and 344 in the control group (i.e., more than 50 employees).

Figure 1 plots the distribution of firms in our sample along the running variable. Panel (a) presents a histogram of the frequency of firms receiving a publicly guaranteed loan in 2020 within a small bin of our running variable. The x-axis represents the distance of a firm's employment level in 2018 from the threshold (i.e., 50 employees). Then, conditional on obtaining a guaranteed loan in 2020, any firm to the right (orange colored) of zero receives a lower interest rate, while a firm to the left of zero (blue colored) gets a higher interest rate on its credit guarantee. Notice that we move along our running variable from -40 to +40 the number of firms increases. This only reflects the importance of firms

⁶According to the aggregate annual accounts of enterprises, NPI, and foundations reported by the NBB, 3,468 enterprises reported positive amounts of payable amounts guaranteed by Belgian public authorities in 2020. Although 50 billion euros was allocated, 26 billion was used, and our sample covers 83% of guaranteed debt allocations (see [NBB.stat](https://nbb.stat.be/)).

with less than 50 employees in Belgium and is consistent with the case of other advanced economies: in 2017 SMEs captured 70% of total employment.

Figure 1: Treatment Distribution Along the Employment Cutoff



Panel (a) shows the histogram of firms with a guaranteed loan in 2020 along the running variable. The running variable represents 2018 employment re-centered around zero using the cutoff of 50 employees. All firms to the right (blue) of the cutoff report less than 50 employees in 2018 are treated with a lower interest rate while firms to the left (orange) of the cutoff with more than 50 employees in 2018 get a higher interest rate. Panel (b) shows the point estimates (line) and confidence intervals (shaded) for the density to evaluate bunching of observations around the employment cutoff (McCrary, 2008). The p-value (0.61) does not reject the null, indicating a lack of manipulation of the running variable.

In [Appendix A](#), [Table A1](#) we report the summary statistics for firms in our sample at the end of 2020. The average firm in our sample holds €2.5 million in publicly credit guarantees, which represents 33% of their total debt portfolio. In terms of assets, the average firm in our sample holds €13.6 million in total assets, out of which 44% of can be used as collateral (i.e., tangible fixed assets) while only 13% are fully liquid (i.e., cash and equivalents). The latter is consistent with 39% of firms in our sample holding privately guaranteed credit.

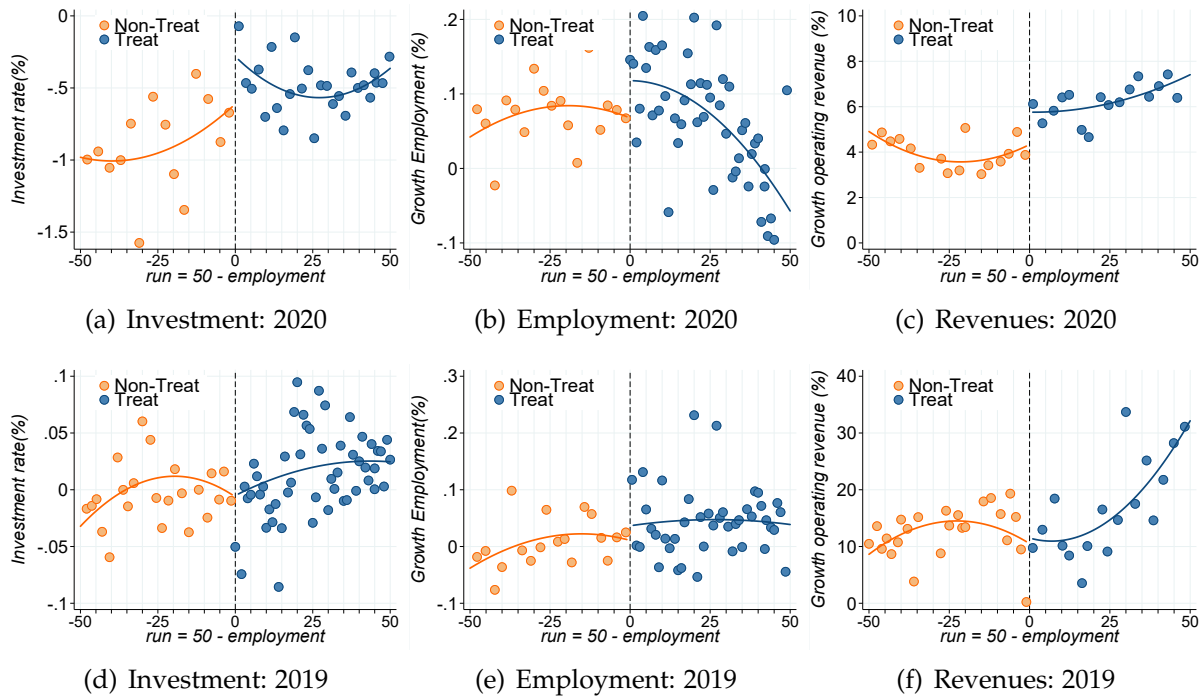
4 Main Results

In this section, we report the main results. We begin describing the RD-estimates for firm's economic performance. Next, we show evidence on the mechanism explaining how lower borrowing costs from credit guarantees impact firms' performance. Finally, we present the evidence supporting the identification strategy in our RD setup.

4.1 Firm Real Outcomes

First, we describe our results on firm's performance. Our variables of interest are investment rate, employment growth, and revenue growth. We define the investment rate as the ratio of tangible fixed assets acquisition relative to the previous year's total fixed assets. We measure employment using the number of full-time equivalent employees entered in the staff register. Finally, we proxy revenues with gross added value.⁷ We compute growth rates using a yearly symmetric definition.

Figure 2: Firm-level outcomes



The figure examines the impact of the policy on year before and during the year the guarantee scheme implementation. We employ balance sheet data for firms receiving a guaranteed loan in 2020. All variables are expressed as percentage changes. Panel (a), (b), and (c) shows the investment rate, and growth rate of employment and revenue for 2020, while panel (d), (e), (f) shows the same variables for 2019. Each dot represents the mean of the outcome within a bin of the running variable. The solid lines are quadratic fits using dots on each side of the cutoff. The number of bins and specific location are determined using a quantile-spaced mimicking variance approach (see Cattaneo et al., 2019).

Figure 2 visually depicts our main findings for these variables. In each plot, a dot captures the average outcome value using information for firms within a particular bin of the running variable. The lines depict a quadratic fit estimated using only dots to the right

⁷Information on operating revenues (turnover) is missing for most firms in our sample. This is because Belgian SMEs are not required to report this variable in their annual statements.

side (orange) or left side (blue) of the employment cutoff. The first row visually depicts an upward jump in investment (Panel A), employment growth (Panel B), and revenue growth (Panel C) in 2020 when moving along the employment cutoff. Notice that, in the second row, the discontinuous increase disappears on the three variables one year before the Belgian CGS was implemented.

Table 1 presents the RD estimates on firm performance outcomes. Panel (A) presents the results for investment, while Panel (B) and Panel (C) report our findings for employment and revenue growth. On each panel, the first row reports the point estimates for β_{Y_t} (equation (??)) one year before the start of the CGS (Column 1), during the year of the policy (Column 2), and up to three years after the program ended (Columns 3-5).

Consistent with our previous visual evidence, we find that firms receiving credit guarantees at a lower interest rate are performing better during the year the policy was implemented. Specifically, firms borrowing credit guarantees at a 25 bp. lower interest rate increase investment, employment growth, and revenue growth by 0.20 pp., 0.28 pp., and 0.34 pp., respectively. Our results are not explained by pre-existent differences in economic performance: one year prior, the estimates for investment, employment growth, and revenue growth are not statistically significant and economically small (i.e., 0.05 pp., 0.02 pp., and 0.03 pp.).

The dynamic response of investment, employment, and revenues following the end of the policy aligns with the policy's structure: the benefit of lower interest rates on credit guarantees persists until the guaranteed loans mature 12 months later. First, treated firms experience a 0.11 pp and 0.20 pp higher investment rate one and two years after the policy was implemented, though these estimates are statistically insignificant. Ultimately, the effect on investment dissipates three years after the credit guarantee scheme (CGS) ends. Employment growth is 0.21 pp lower in the first year and 0.07 pp higher in the second year, which can be interpreted as employment catching up—initially for firms in the control group and later for those in the treatment group. Nonetheless, the difference in employment growth returns to pre-policy levels three years after the policy ends. A similar pattern is observed for revenue growth, except for a short-lived 0.32 pp increase for treated firms in the year following the policy's conclusion.

Table 1: RD benchmark results: Firm-Level Outcomes

	T-1 (1)	T (2)	T+1 (3)	T+2 (4)	T+3 (5)
(A) Investment Rate					
Sharp-RD	0.05 (0.08)	0.20** (0.08)	0.11 (0.08)	0.20 (0.19)	0.07 (0.28)
Obs.	2,331	2,773	2,429	2,392	1,700
BW (in # emp)	8.0	10.5	9.9	14.6	10.0
(B) ΔEmployment					
Sharp-RD	0.02 (0.03)	0.28*** (0.04)	-0.21*** (0.07)	0.07*** (0.03)	-0.07 (0.04)
Obs.	1,729	1,743	1,702	1,643	1,337
BW (in # emp)	10.4	7.3	8.5	5.9	13.7
(C) ΔRevenues					
Sharp-RD	0.03 (0.11)	0.34*** (0.02)	0.32*** (0.06)	-0.59** (0.26)	0.06** (0.03)
Obs.	2,545	2,897	2,529	2,480	1,767
BW (in # emp)	8.1	4.7	4.5	7.6	6.9
(D) ΔTotal Assets					
Sharp-RD	0.003 (0.04)	0.032 (0.07)	0.020 (0.05)	-0.042 (0.05)	0.010 (0.04)
Obs.	2,274	2,337	2,322	2,270	2,066
BW (in # emp)	23.8	8.6	18.1	28.6	18.9
(E) ΔEquity					
Sharp-RD	-0.008 (0.03)	0.011 (0.02)	0.036 (0.03)	-0.002 (0.03)	-0.009 (0.03)
Obs.	2,551	2,551	2,530	2,483	2,256
BW (in # emp)	25.5	24.3	14.7	18.7	18.5
(F) ΔLiabilities					
Sharp-RD	0.102 (0.07)	-0.117* (0.06)	-0.034 (0.06)	-0.074 (0.07)	-0.069 (0.06)
Obs.	2,551	2,552	2,531	2,485	2,254
BW (in # emp)	22.9	22.0	24.3	25.0	13.8

Authors' calculations. The table shows the estimates of the effect of lower interest rates on credit guarantees on firm's economic performance. We employ balance-sheet information for 2017-2023 for Belgian firms participating in the 2020 CGS. Investment rate is the acquisition of tangible fixed assets acquisition divided by total fixed assets in the previous year. Employment represents the number of full-time equivalent employees in the staff register. Revenues are proxied by gross added value. Δ Employment and Δ Revenues are computed using a symmetric definition. Δ Total assets, Δ Liabilities are calculated as the yearly change in assets and liabilities relative to their current value. Δ Equity is the yearly change in equity relative to total assets. The columns report the estimates for one year before the implementation of the policy ($T - 1$), during the year firms receive credit guarantees (T), and up to three years after the guarantee scheme ended ($T + 1$, $T + 2$, and $T + 3$). Estimates in the first row correspond to RD estimate in equation . Robust Bias-corrected standard errors in parentheses, *, **, ***, indicate significance at the 10% 5% and 1% level, respectively. In all columns, we control for two-digit industry (NACE-BEL 2008-Rev. 2) fixed effects, an indicator for firms with guaranteed loans provided by private banks, and the difference between the assets threshold (i.e., €4.5 million) and firms' total assets in 2018.

Additionally, Panel (D), Panel (E), and Panel (F) show the dynamic response for the growth rate of total assets, equity, and total liabilities. First, firms do not differ in pre-policy growth trends for assets, equity, and liabilities across treatment and control groups. However, firms treated with a lower interest rate on guaranteed loans increase their total assets growth rate by 0.032 pp and 0.020 pp during the year and one year after the policy was implemented, albeit the estimated effect is not statistically significant in both periods. Similarly, equity grows by 0.011 pp and 0.036 pp higher for firms receiving credit guarantees at a lower interest rate during the first two years of the CGS introduction, but again, both estimates are not significant. Lastly, we estimate that during the first two years of the policy implementation, total liabilities growth is 0.117 pp and 0.034 lower, although only the contemporaneous effect is statistically significant. As we show later, the lower growth of total liabilities for treated firms is consistent with our evidence that lower interest rates on credit guarantees reduce inefficiencies linked to debt overhang.

4.2 Exploring the Mechanism

Table 2 presents the RD estimates for the contemporaneous impact on the firm's debt portfolio, financial burden, and default probability. In particular, we study how a firm's credit guarantee issuances, non-guaranteed liabilities, average borrowing costs, debt service capacity, and exit probability respond to the lower interest rate on credit guarantees. This analysis provides evidence on the mechanism to explain our findings on real performance for firms.

First, our results suggest that firms receiving additional credit guarantees at a lower interest rate are not accumulating more guaranteed debt than the control group. Instead, they are reducing their holdings of relatively more expensive non-guaranteed debt (i.e., substitution), thereby lowering the average financial costs of their debt portfolio. In column (1), we present estimates of publicly guaranteed debt accumulation during the policy year. We find that firms benefiting from lower interest rates issue 0.003 pp less publicly guaranteed debt compared to firms ineligible for the rate discount. This estimate is economically insignificant and can be considered effectively zero.

On the other hand, column (2) provides evidence that firms eligible for the interest rate discount on credit guarantees substitute non-guaranteed debt more intensively. We measure this substitution as the yearly change in non-guaranteed debt balances relative to total liabilities. Our findings indicate that firms benefiting from the interest rate reduction on credit guarantees reduce their non-guaranteed debt by 0.18 pp more than firms facing

higher interest rates. This result suggests that for every €1 of credit guaranteed at a 25 bp lower interest rate, non-guaranteed debt decreases by approximately €0.13.⁸

Our results also show that the financial burden for firms receiving credit guarantees reduces if they obtain a discount on their interest rate. In column (3), average interest costs, defined as the ratio of financial costs on total liabilities relative to the total debt balance, drop by 0.015 pp for firms receiving guarantees in 2020 with a lower interest rate. While in column (4), we find that the yearly change in the EBITDA to short-term debt ratio, a measure of improvement/deterioration of debt service capacity in the short run, is approximately 0.30 pp higher for firms receiving a discount on their guaranteed loans interest rate.

Table 2: Debt Substitution, Financial Burden, Debt Service, and Default Risk

	Guarant. Debt Accum.	Debt Subst.	Average Interest	ΔDebt Serv. Capacity	Exit Probability	
	(1)	(2)	(3)	(4)	Last Availab. Year (5)	Legal Situation (6)
Sharp-RD	-0.003 (0.02)	-0.181** (0.09)	-0.015*** (0.00)	0.294*** (0.08)	-0.192** (0.09)	-0.067** (0.03)
Obs.	1,437	1,424	2,547	2,552	2,662	2,662
BW (in # emp)	12.0	10.0	8.5	7.4	8.9	8.9

Authors' calculations. The table shows the estimates for the contemporaneous effect of lower interest rates on credit guarantees on firm's debt portfolio and default risk. We employ balance-sheet information for 2017-2023 for Belgian firms participating in the 2020 CGS. Guaranteed Debt Accumulation and Debt Substitution represent the change in debt guaranteed by public Belgian authorities and non-guaranteed debt relative to total debt. Average interest costs are computed as the ratio of financial charges on total liabilities relative to total liabilities. ΔDebt Service Capacity is the yearly difference in the EBITDA to short-term debt ratio. We define exit probability as an indicator variable for firms (i) with available balance sheet information up to 2022 (Last Available Year) and (ii) that went through a liquidation, bankruptcy, dissolution, or absorption during 2020-2023 (Legal Situation). Each column reports the estimates on the year firms received credit guarantees (i.e., 2020). Estimates in the first row correspond to RD estimate in equation . Robust Bias-corrected standard errors in parentheses, *, **, ***, indicate significance at the 10% 5% and 1% level, respectively. In all columns, we control for two-digit industry (NACE-BEL 2008-Rev. 2) fixed effects and an indicator for firms with guaranteed loans provided by private banks.

Finally, we find evidence suggesting default risk reduces as the probability of exiting the market lowers for treated firms. We define exit as a dummy taking the value of one for firms with available balance sheet information up to 2022. Column (5) shows that the exit probability is 0.19 pp for firms with lower interest rates on credit guarantees. We arrive at similar results in column (6) if our exit measure is based on liquidation, bankruptcy,

⁸We use a back-of-the-envelope calculation to obtain this estimate. Specifically, Table A1 shows that the average firm holds €8.99 million non-guaranteed debt, which was reduced by -3.4% in 2020. At the same time, the average firm holds €2.5 million in publicly credit-guaranteed debt. Therefore our estimate of -€0.1287 is equal to $-\frac{-(3.4+0.18)}{100} \times 8.99$.

dissolution, or absorption events for firms during 2020-2023.⁹, for this measure of firm exit we find that exit probability reduces almost 0.07 pp for firms treated with a lower interest rate.

Table B2 (Appendix B) further explores the dynamics of debt substitution, average interest costs, and debt service capacity. In column (1), we show no significant difference between firms receiving credit guarantees in 2020 across treatment and control groups one year prior to the policy's implementation, which shows the validity of the design. In column (2), we observe that the reduction in non-guaranteed debt substitution, average interest costs, and improvement in debt service capacity persists one year after the policy, likely due to the varying timing of when firms received the credit guarantees. In column (3), we observe a short-lived increase of 0.13 pp in non-guaranteed debt balances for firms benefiting from the interest rate discount two years after the policy ended, as firms in the treatment group reverted to non-guaranteed debt following the maturity of their guaranteed loans. However, in column (5), we find that any significant differences in debt substitution, interest costs, and debt service capacity completely vanish three years after the policy.

4.3 Supporting Evidence on Identification

To close our empirical analysis, we explore the appropriateness of our research design in isolating the effect of lower interest rates on credit guarantees. Specifically, we provide evidence supporting our identification strategy regarding the continuity assumption in our RD setup. This is also important to address potential selection concerns: the policy requires banks to participate in the CGS and to lend to firms that meet specified criteria, but it also provides leeway by allowing banks to choose which firms to lend to.

The most important element in our RDD identification strategy is that firms with lower (treatment) and higher (control) interest rates on their credit guarantees in 2020 are almost identical except for receiving treatment. We begin by testing how suitable this assumption is for our RD setup. In particular, we present evidence of potential jumps in the distribution of firms and other firm-level pre-determined observable characteristics along our running variable.

A first concern is that the announcement of the Belgian government about the conditions imposed on the interest rate for credit guarantees could induce firms to "manipulate" their employment levels to reduce the cost of credit guarantees (i.e., around the cutoff).

⁹These events are registered and reported by the Crossroads Bank for Enterprises (CBE) managed by the Ministry of Economy (FPS).

Figure 1, Panel (b) evaluates manipulation or self-selection by checking for evidence on bunching of observations around the employment cutoff. A simple inspection of this figure shows no discernible jump in the estimated densities (continuous lines) when we move to the right side of the employment cutoff. More formally, we follow McCrary, 2008 and evaluate the null of continuity of the treatment distribution around the cutoff: the resulting p-value of 0.61 eliminates any concern of firms misreporting their employment levels in 2018.

Additionally, Figure 3 Panel B presents the “donut-hole” test, where we further check for evidence on manipulation that the McCrary test might have potentially missed. We estimate the contemporaneous coefficient (β_{1,Y_T}) for all the firm-level outcomes in our analysis, but we exclude observations in the immediate neighborhood to test for “bunching” of observations around the employment cutoff. Most of our results are similar when excluding firms with 1, 2, and 3 employees above or below the cutoff.

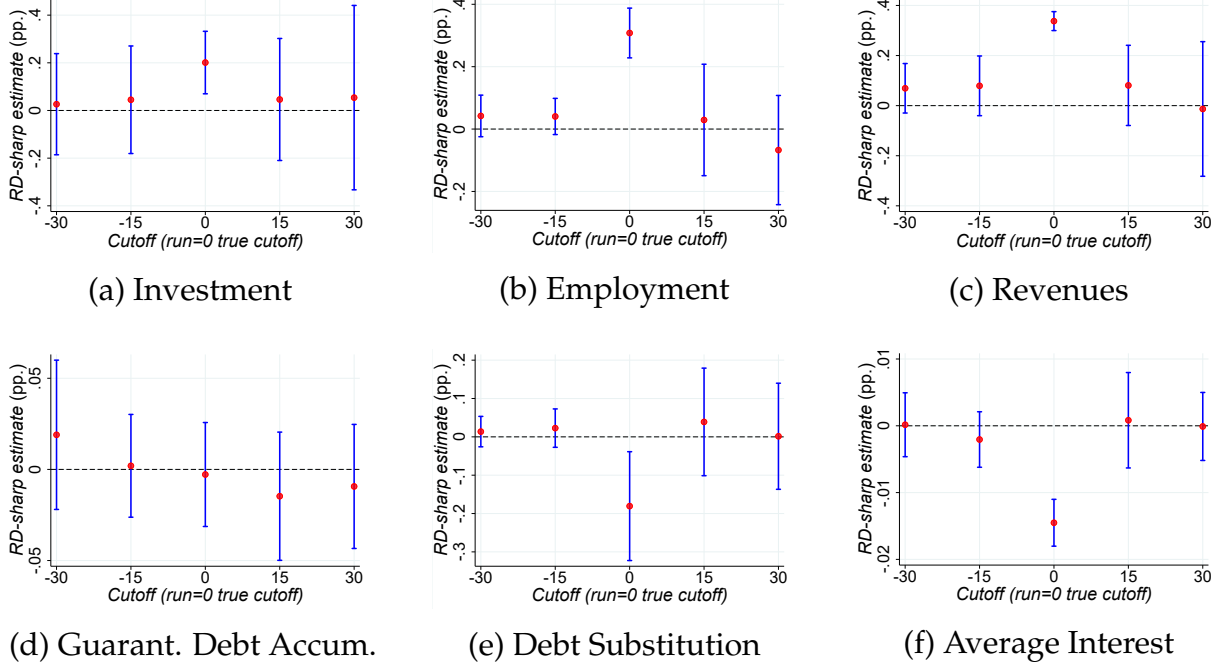
On the other hand, if our continuity assumption holds, there should not be any observable difference in pre-determined characteristics when moving from the left side to the right side of the employment threshold. We have already shown that this was the case for the main outcomes of interest. Next, we expand this analysis to other firm-level observable characteristics.

Table C3 (Appendix C) presents our formal results using firm-level variables related to assets, debt, labor costs, and profitability during 2018-2019. The second column provides the sharp-RD point estimates, and the third and fourth columns report the p-values and 95% confidence intervals. Our results provide evidence of equally balanced distributions across the running variable before the CGS were enacted: firms on either side of the cutoff are not statistically different in terms of pre-determined levels of assets (i.e., total, fixed, tangible fixed, and cash), leverage, short-term and long-term debt share, wage bill, earnings, and profits.

Finally, In Figure 3 Panel A, we evaluate arbitrary cutoff points different from the one that triggers a discount in the interest rate. Finding significant effects on placebo cutoffs could indicate systematic differences among firms on each side of the cutoff or a concurrent policy, potentially contaminating our results. We evaluate placebo cutoffs for up to ± 30 employees lower and higher than the actual cutoff $FTE_i = 0$. As expected, none of our baseline results on firm performance and debt portfolio are statistically significant on the placebo cutoffs.

Figure 3: Additional Robustness Tests

Panel A: Alternative Cutoffs



Panel B: Donut-Hole Sensitivity Test

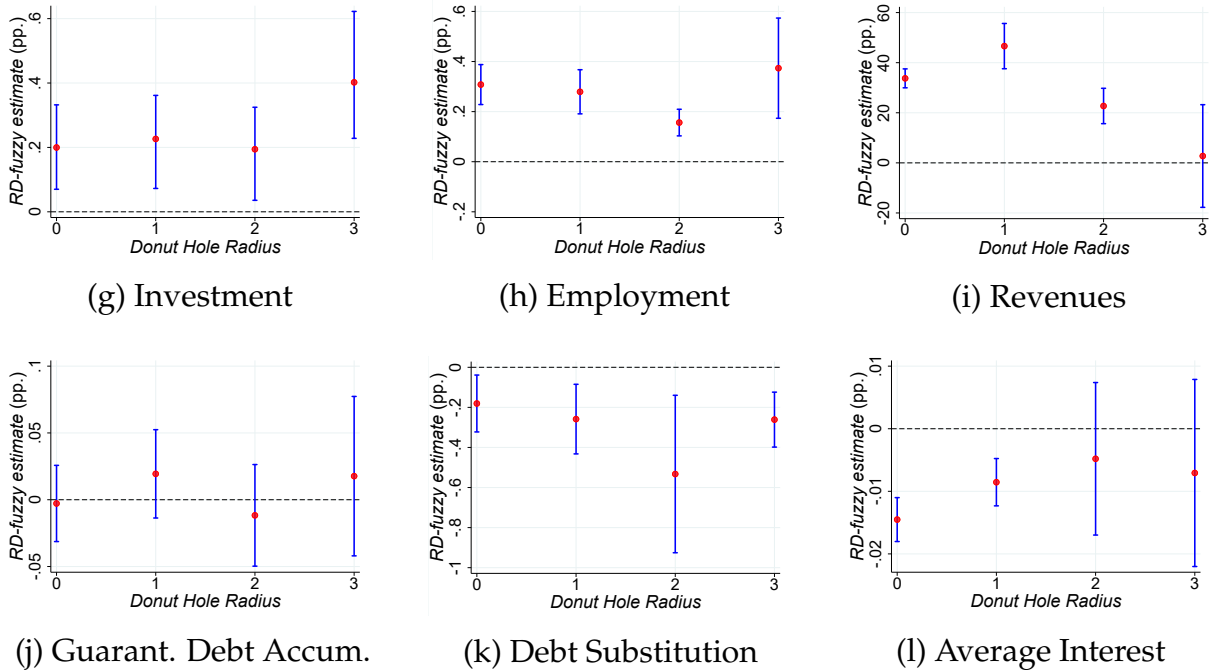


Figure shows the test for alternative placebo cutoffs (Panel A) and Donut-hole sensitivity test (Panel B) on the contemporaneous estimated effect of lower interest rates on credit guarantees for firm's investment rate (Figures (a) and (g)), employment growth (Figures (b) and (h)), revenues growth (Figures (c) and (i)), guaranteed debt accumulation (Figures (d) and (j)), debt substitution (Figures (e) and (k)), and average interest costs (Figures (f) and (l)). Panel A shows RD estimates under alternative placebo cutoffs. Panel B shows the RD estimates, excluding firms with 1, 2, and 3 equivalent full-time employees above/below the cutoff.

5 Discussion

In this section, we explore the implications of our results regarding the effectiveness of guaranteed programs and discuss some potential improvements in light of the empirical results in the paper.

We show that enabling stressed firms to secure financing on credit guarantees at more favorable terms facilitates investment opportunities and expands employment and revenue growth. First, our results contrast with the traditional view of credit guarantees as only increasing the credit supply, which can lead to credit rationing and potential misallocation of resources. Our evidence should highlight the importance of the interest rate on credit guarantees as instruments for financial frictions to stressed firms.

Our evidence highlights the mechanism through which lowering interest rates on credit guarantees influences firms' economic performance. Among firms receiving credit guarantees, treated firms eligible for an interest rate discount hold similar levels of guaranteed debt compared to the control group. However, they reduce their non-guaranteed debt holdings, which helps mitigate the debt overhang problem. By lowering their non-guaranteed debt, these firms experience fewer defaults and a reduced cost of interest on new loans. As a result, they can access new loans at lower rates, facilitating higher investment, employment, and a reduced probability of exit. Addressing debt overhang can therefore resolve an important inefficiency in the economy by alleviating this problem. Future research can focus on the effectiveness of these policies on the extensive margin and spillover effects of these policies on the overall economy.

6 Conclusions

This paper examines the impact of reducing interest rates for credit guarantees on firms. Empirically, we leverage a discontinuity in loan pricing eligibility under Belgium's 2020 Credit Guarantee Scheme. Although all firms were eligible to apply for the CGS, those with more than 50 employees were required to pay an additional fee of 25 basis points. Using a RD design, we compare firms just above and below the 50-employee threshold in 2020 to estimate the causal effect of improved pricing conditions on firms' economic performance.

Our primary finding is that firms receiving guaranteed loans at lower interest rates exhibit increases in investment, employment, and revenue, alongside a general reduction in firm exit rates. We identify that the scheme mitigates a significant inefficiency in the economy: the debt overhang problem, where the debt burden becomes so substantial that

it hinders firms from acquiring additional debt to finance future profitable projects. We demonstrate that firms reduce their non-guaranteed debt, thereby lowering their interest payment costs, which enables them to undertake additional projects.

We further show that our RD setup is robust and provides the ideal context for isolating the causal effect of improved pricing conditions on guaranteed loans. In particular, we demonstrate that firms near the eligibility threshold are comparable in all key dimensions, including access to additional credit, with the only distinction being that some receive more favorable loan pricing conditions.

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Appendix A Summary Statistics

Table A1: Summary Statistics: 2020

	Mean	S.D	p^{25}	p^{50}	p^{75}	N_{obs}
Total debt (mill. €')	7.4	25.5	0.4	1.0	3.4	2,744
Pub. guarant. debt (mill. €')	2.5	10.2	0.1	0.3	0.9	2,908
Non guarant. debt (mill. €')	9.0	125.4	0.2	0.5	2.0	2,744
Leverage	0.6	0.3	0.4	0.6	0.8	2,744
Short-term debt (%)	54.6	29.4	29.2	57.0	81.4	1,668
Long-term debt (%)	45.4	29.4	18.6	43.0	70.8	1,668
Priv. guarant. debt (%)	39.8	24.7	18.9	37.1	57.1	710
Total assets (mill. €')	13.6	48.2	0.7	1.7	5.7	2,908
Fixed assets (mill. €')	7.6	26.5	0.2	0.8	3.2	2,908
Tangible fixed assets (%)	44.8	29.4	18.2	45.3	69.0	2,810
Cash and equiv. (%)	13.5	14.9	2.6	8.2	19.6	2,870
Acquis. tang. fixed assets (mill. €')	2.9	19.4	0.0	0.1	0.7	2,773
Investment rate (%)	34.0	94.5	1.0	5.8	24.9	2,773
Δ Employment (%)	-0.5	55.2	-9.5	0.0	7.3	1,743
Δ Revenues (%)	-0.9	72.4	-22.6	1.2	15.5	2,897
Average interest (%)	2.5	2.9	1.3	2.0	3.0	2,264
Guaranteed debt accumulation (%)	35.4	32.5	9.1	26.0	59.9	1,339
Debt substitution (%)	-3.4	52.7	-8.3	-0.6	7.3	1,518
Δ Debt service (%)	52.9	63.32	11.13	33.7	75.3	2,897
Exit (Last Available Year)	0.11	0.31	0	0	0	2,662
Exit (Legal Situation)	0.031	0.17	0	0	0	2,662

Authors' calculations. The table presents the summary statistics of firms in our selected sample for 2020. We employ firm-level balance sheet data for Belgian firms participating in the 2020 CGS. Total debt represents the sum of short-term debt (current liabilities) and long-term debt (non-current liabilities). Total debt, public guaranteed debt, non-guaranteed debt, total assets, fixed assets, and acquisition of tangible fixed assets are expressed in millions of euros. Short-term, long-term, and private guaranteed debt are expressed in percentages relative to total debt. Tangible fixed assets and cash at hand are expressed in percentages relative to total assets. Leverage is the ratio of total liabilities relative to total fixed assets. Investment rate is the acquisition of tangible fixed assets divided by total fixed assets in the previous year. Δ Employment and Δ Revenues are the symmetric growth rate of full-time equivalent employees and gross added value, respectively. Guaranteed Debt Accumulation and Debt Substitution represent the change in debt guaranteed by public Belgian authorities and non-guaranteed debt relative to total debt. Average interest costs are computed as the ratio of financial charges on total liabilities relative to total liabilities. Δ Debt Service Capacity is the yearly difference in the EBITDA to short-term debt ratio. Exit probability is an indicator variable for firms (i) with available balance sheet information up to 2022 (Last Available Year) and (ii) that went through a liquidation, bankruptcy, dissolution, or absorption during 2020-2023 (Legal Situation).

Appendix B Debt Substitution, Interest Costs, and Debt Service Capacity Dynamics

Table B2: Debt Substitution, Financial Burden, and Debt Service: Dynamics

	T-1 (1)	T (2)	T+1 (3)	T+2 (4)	T+3 (5)
(A) Debt Substitution					
Sharp-RD	0.020 (0.03)	-0.181** (0.09)	-0.095*** (0.02)	0.137*** (0.03)	0.047 (0.06)
Obs.	895	1,518	1,541	1,153	685
BW (in # emp)	18.5	10.0	7.8	9.3	14.8
(B) Average Interest					
Sharp-RD	-0.001 (0.00)	-0.015*** (0.00)	-0.015*** (0.00)	0.007 (0.01)	0.003 (0.01)
Obs.	2,442	2,264	2,525	2,478	1,763
BW (in # emp)	9.8	8.5	7.1	13.7	14.6
(C) ΔDebt Service Capacity					
Sharp-RD	-0.019 (0.09)	0.294*** (0.08)	0.207*** (0.06)	-0.013 (0.05)	-0.135 (0.09)
Obs.	2,551	2,552	2,529	2,481	1,766
BW (in # emp)	20.0	7.4	12.7	14.6	10.3

Authors' calculations. The table shows the estimates of the effect of lower interest rates on credit guarantees on firm's debt portfolio. We employ balance-sheet information for 2017-2023 for Belgian firms participating in the 2020 CGS. Guaranteed Debt Accumulation and Debt Substitution represent the change in debt guaranteed by public Belgian authorities and non-guaranteed debt relative to total debt. Average interest costs are computed as the ratio of financial charges on total liabilities relative to total liabilities. Δ Debt Service Capacity is the yearly difference in the EBITDA to short-term debt ratio. The columns report the estimates for one year before the implementation of the policy ($T - 1$), during the year firms receive credit guarantees (T), and up to three years after the guarantee scheme ended ($T + 1$, $T + 2$, and $T + 3$). Estimates in the first row of each panel correspond to RD estimate in equation . Robust Bias-corrected standard errors in parentheses, *, **, *** indicate significance at the 10% 5% and 1% level, respectively. In all columns, we control for two-digit industry (NACE-BEL 2008-Rev. 2) fixed effects and an indicator for firms with guaranteed loans provided by private banks.

Appendix C Pre-existing differences

Table C3: Testing for pre-policy differences in firms' observable characteristics

Variable	Mean		RD Estimator	Robust Inference		BW (in # emp.)	Obs.
	Treatment	Control		p-value	95% Conf. Int.		
Total assets	44.53	44.19	-0.35	0.87	[-3.95, 3.26]	7.5	5,319
Fixed assets	17.05	16.61	-0.44	0.74	[-2.63, 1.75]	10.1	5,297
Tangible fixed assets	14.29	14.14	-0.14	0.91	[-2.23, 1.94]	9.8	5,131
Cash at hand	1.84	2.12	0.28	0.44	[-0.32, 0.88]	13.7	5,226
Leverage	2.21	2.18	-0.03	0.92	[-0.57, 0.50]	15.8	4,814
Short-term debt (%)	0.30	0.35	0.05	0.27	[-0.02, 0.12]	8.8	5,319
Long-term debt (%)	0.28	0.24	-0.04	0.42	[-0.12, 0.04]	13.9	4,904
Wage Bill	3.01	2.84	-0.17	0.35	[-0.47, 0.13]	22.1	5,283
EBITDA	1.08	1.13	0.05	0.91	[-0.62, 0.72]	12.8	5,318
Profit rate	-0.00	0.02	0.02	0.21	[-0.006, 0.052]	13.4	5,318

Authors' calculations. The table shows the RD estimates (rows) for pre-determined observable characteristics across the employment threshold. We employ balance-sheet information for 2017-2019 of firms receiving credit guarantees in 2020. Total assets, fixed assets, tangible fixed assets, cash at hand, wage bills, and EBITDA are expressed in millions of euros. Leverage is the ratio of total liabilities relative to total fixed assets. Short-term and long-term debt shares are computed as expressed as the ratio of liabilities due in one year and more than one year relative to total liabilities. Profit rate is the ratio of net profits to total assets. In all rows, control for industry and year-fixed effects. Robust bias-corrected standard errors are employed for computing the confidence intervals and p-values and an indicator for firms with guaranteed loans provided by private banks in 2020.