

Precautionary Debt Capacity*

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Abstract

A central theme in macroeconomics and finance is that firms' investment and growth depend on their ability to raise financing. In a field experiment that randomly increases debt limits for firms with similar characteristics, investment and sales increase by 79 cents and 2.75 dollars on the dollar. Firms with low ex-ante default risk – those with low debt burdens and high "distance to debt limits" – explain 98 percent of the sales response, and yet, their borrowing increases only moderately. This heterogeneous response supports models in which the interplay between precautionary motives and financing frictions amplifies fluctuations in investment and output.

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1 Introduction

An influential body of work in macroeconomics and finance emphasizes that financing frictions amplify fluctuations in investment, output, and productivity (Bernanke et al., 1999). How much firms grow in response to a relaxation of borrowing constraints – and the persistence of such growth – has crucial implications for the propagation of business cycles and the extent of capital misallocation (Gilchrist and Zakrajšek 2012; Midrigan and Xu (2014); Bau and Matray 2023). However, a vigorous debate remains regarding the basic magnitude and interpretation of firms’ responses to financing. Understanding how the responses are best interpreted remains debated even for small, privately-held firms that have long been conjectured to be subject to financing frictions but for which comprehensive micro data are scarce (Zwick and Mahon, 2017; Crouzet and Mehrotra, 2020). Moreover, the central role that firm heterogeneity plays in the transmission of monetary policy (Ottonello and Winberry, 2020) highlights a need to better understand which firms generate large growth responses and why they respond.

We collaborate with a large European bank in Türkiye (henceforth, our bank) to conduct a field experiment that randomly expands debt capacity – i.e., borrowing limits – on business credit lines for some firms while withholding it for others with otherwise similar characteristics. The experiment involves 3,169 pre-existing business credit line clients of our bank that face a uniform pricing due to a nationwide interest rate cap in Türkiye. These firms represent privately-held small firms in the bottom 30 percent of the national firm size distribution, which is in line with the definition of small firms in prior research (e.g., Gertler and Gilchrist (1993)). We combine the experiment with administrative microdata on firms’ borrowing, investment, and sales and document the precisely estimated magnitude and persistence of their growth response to capacity expansion. We then show which firms generate the largest gains in sales and investment growth, highlighting the importance of heterogeneity in understanding the nature of financial frictions that hampers growth.

Our first empirical finding is that the experiment generates large, immediate responses in firm borrowing, investment, sales, and productivity in the short-run. The

experiment increased firms' debt capacity by 55 percent relative to pre-experiment levels, generating a strong first-stage effect. Using a two-stage least squares (2SLS) approach that employs the treatment assignment, Z_i , as an instrument for the change in firms' debt capacity (Angrist and Imbens, 1994), we show that firms increase credit line borrowing by 0.35 lira for each lira increase in debt capacity following the first-year of the capacity expansion. This increase in credit-line borrowing does not crowd out other borrowing. Instead, firms' total debt – including loans from other banks – rose by 1.14 lira per lira of expanded capacity in the first-year. Sales and total factor productivity (TFP) – measured as the residual from a regression of sales on capital stock – increase by 3.33 per lira and by 47 log points per log point of additional debt capacity, respectively. Examining granular expense categories show that firms increased investments in customer capital, physical assets, and operating expenses.

The effects of the capacity expansion are highly persistent. After three years, treated firms cumulatively earned 7.19 lira more in sales and 3.9 lira more in profits per lira of increased capacity since the onset of the experiment relative to control firms. The average effect over the three years following the experiment, expressed in annual terms, shows that investment and sales increased by 0.79 and 2.75 liras, respectively, for each lira increase in debt capacity. The corresponding profit effect is 1.36 liras per lira, equivalent to moving a firm from the bottom to the top quartile of the annual profit growth distribution. The long-run sales response is well-above 1, indicating that initial shock is amplified. These results are robust to adjusting for inflation and using other currencies. Reweighting our sample to match the credit line utilization distribution of the universe of privately held Turkish firms yields qualitatively similar estimates, indicating that our findings are not specific to the particular sample of firms in our experiment. Overall, these results indicate that expanding debt capacity has large and persistent effects on firm growth.

In the second part of the paper, we present a series of heterogeneity tests to shed light on the mechanisms underlying the large baseline responses. We find that firms with low ex-ante default risk – those with low debt burdens and high "distance to debt limits" (i.e., low utilization ratio), and high risk-adjusted returns and cash liquidity before the experiment – exhibit the largest growth responses. For example, firms with

below median pre-experimental utilization ratios generate a sales increase of 3.52 lira per lira of additional debt capacity, averaged over the three years of the experiment, whereas those with above-median utilization ratios exhibit a positive but statistically insignificant response of 0.17 lira. Decomposing the average treatment effects into weighted contributions by each subgroup shows that 98 percent of the average sales growth is driven by firms with below-median utilization, suggesting growth response is overwhelmingly driven by firms that have stronger financial position. We do not find statistically significant heterogeneity in responses by firm age, owner age, or by whether the firm maintains an exclusive banking relationship with our partner bank.

What is the nature of financing friction limiting the growth of firms with low ex-ante default risk? We speculate that firms' precautionary motives – the desire to maintain substantial unused borrowing capacity as a buffer against volatility in cash flows or default risk – may explain why firms with low default risk with ample financial slack generate large growth responses (Modigliani and Miller, 1963).¹ Although firms on average utilized only 40 percent of their debt capacity, roughly three-quarters had used more than 75 percent of their available capacity at some point before the experiment, suggesting that the liquidity risk of fully exhausting their borrowing limits are widespread and that firms actively manage these risks. Moreover, cross-sectional analyses show that a one-standard deviation increase in the volatility of unpredictable expenses, sales, and financing reduces utilization rates by 1.04, 1.56, and 5.57 percentage points, respectively – consistent with precautionary behavior. While this evidence is suggestive, the precautionary motives channel is particularly relevant for small firms like those we study, whose owners face significant personal financial risk, creating strong incentives to be cautious.²

In the last section, we discuss the implications for the financial amplification lit-

¹We also consider other mechanisms. One possibility is that the expansion of debt capacity allowed firms to undertake investments that were previously infeasible with existing borrowing limits. However, only 4 percent of firms in our sample engage in such lumpy investments in the first year. Another possibility is that lender-initiated capacity increases serve as a signal of greater profitability, thereby encouraging firms to borrow and expand. However, firms with no prior capacity expansion before the experiment – those that should be most encouraged given the higher signaling value – exhibit growth similar to that of firms that had experienced multiple prior capacity increases.

²In Turkey, business owners have unlimited liability and can lose personal assets such as cars or homes in the event of bankruptcy. Even in developed countries such as the United States, small business owners remain personally liable for unsecured business debt, and government-backed loans (e.g., SBA guarantees) are not dischargeable in bankruptcy.

erature by comparing the magnitude of the sales and investment responses to prior estimates. Our estimates are consistent with the large investment and sales responses Gertler and Gilchrist (1994) document for small manufacturing firms in the U.S., but well above estimates from studies on investment response to financing frictions. We show that a possible explanation for the sizable magnitudes we estimate – relative to prior work – is that earlier studies primarily rely on cross-sectional comparisons using balance-sheet-based proxies for financial constraints, which can attenuate the true effects of financial frictions. Specifically, our experimental estimates indicate that firms invest 0.79 lira for every 1 lira increase in debt capacity, averaged over three years after the experiment. In contrast, when we regress the same investment response on changes in total debt – a conventional proxy for indebtedness – the estimated effect declines by 86 percent, to 0.11, suggesting that using balance-sheet-based proxies attenuates the true effects of financing frictions firms face.

An advantage of our experimental approach is that we provide an explanation for why balance-sheet-based proxies can attenuate true financing effects. In the experiment, the firms that generate growth responses are not necessarily the ones that borrow more – i.e., those that appear most subject to financing frictions based on balance-sheet-based proxies. Examining heterogeneous treatment effects on firms' total and credit line borrowing by ex-ante default risk shows that – across various measures of default risk, including utilization ratio, financial slack, and indebtedness – it is the higher-default-risk firms that borrow more than their lower-default-risk counterparts. For example, as discussed earlier, although firms with below-median utilization account for the majority of sales growth, they exhibit a positive but statistically insignificant borrowing response of 0.29 lira per lira increase in debt capacity. In contrast, firms with above-median utilization display a statistically significant borrowing response of 2.6 lira per lira increase in debt capacity. In other words, using realized borrowing as a proxy for financial constraints may understate the true financing effects because firm growth responses are facilitated by having greater borrowing power (i.e., debt capacity) rather than by actual borrowing itself.

Our paper builds on a long literature on financial amplification. In canonical macroeconomic models with financial frictions, the extent of business cycle amplification de-

depends crucially on firms' sales and investment responses to changes in financing conditions (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997). Motivated by this, early empirical tests seeking evidence of the financial amplification mechanism have taken firm size as a proxy for the degree of financial frictions, under the premise that small firms face greater external financing costs relative to large firms (Fazzari et al., 1988). An influential contribution is Gertler and Gilchrist (1994), which shows that sale and investment of small firms respond more to monetary shocks.³ However, whether the differences in small versus large firms can be attributed to financing remains debated, as standard balance sheet measures of financial status do not appear to have explanatory power for the difference (Crouzet and Mehrotra, 2020).

We contribute to this literature by showing large and persistent responses of investment and output, which supports the long-standing conjecture that financial amplification operates through small firms. We depart from the literature that infers financial amplification from cross-sectional variation by conducting a field experiment that exogenously varies firms' financing conditions and by examining heterogeneity to shed light on the mechanisms driving firm growth.⁴ The large effects of debt capacity expansion on firms' sales, investment, and productivity not only confirm the importance of financing frictions for small firms, but also provide new evidence that changes in financing status have lasting effects on their growth. In addition, our finding that firms with low ex-ante default risk account for the bulk of average sales growth implies that financial amplification may operate not only through firms near their borrowing constraints, but through a broader set of firms that appear financially sound. This insight helps reconcile the seemingly contrasting conclusions of Gertler and Gilchrist (1994) and Crouzet and Mehrotra (2020): if both slack and constrained firms are sensitive to financing conditions, then standard balance sheet measures may fail to capture differences in the cyclicity of small versus large firms, even when those differences stem

³A non-exhaustive list of important contributions in the literature of financing frictions include Whited (1992), Cooley and Quadrini (2001), Hennessy and Whited (2005), Cooley and Quadrini (2006).

⁴A parallel literature in corporate finance has examined investment-cash flow sensitivities as a test for the presence of financing frictions, but the interpretation of sensitivities remains debated (Fazzari et al., 2000; Kaplan and Zingales, 1997, 2000; Gomes, 2001). Our experimental approach complements a voluminous literature using a quasi-experimental approach to identify financing constraints (Blanchard et al., 1994; Lamont, 1997; Rauh, 2006; Chaney et al., 2012), but differs in the type of firms analyzed: we study small, privately-held firms rather than large corporations.

from financing frictions.⁵

Our heterogeneity results align closely with Ottonello and Winberry (2020), which also finds that firms with low ex-ante default risk and low debt burden are the most responsive to monetary shocks, as these firms face a flatter marginal cost curve for financing investment. We similarly find that less risky firms have the greatest potential to stimulate growth, but offer an alternative, complementary explanation: when such firms possess a greater *option to borrow*, they can stimulate growth even without increasing actual borrowing. We provide suggestive evidence that precautionary motives may constrain firm growth and that greater borrowing capacity can relax firms' self-imposed borrowing constraints, enabling them to grow without necessarily taking on additional debt. In this respect, our evidence can be useful in evaluating a new class of quantitative macroeconomic models that incorporate precautionary behavior to explain investment dynamics under financing frictions (see, for example, Eisfeldt and Muir (2016), Amberg et al. (2023), and Xiao (2024)) as well as the voluminous literature in corporate finance that emphasizes precautionary motives.⁶

Section 2 describes the experimental design, data, and estimation strategy. Sections 3 and 4 present results on firms' borrowing, investment, sales, and productivity. Section 5 explores the role of heterogeneity in driving our results. Section 6 connects our findings to past work and discusses implications for the literature. Section 7 concludes.

2 Experimental Context and Design

This section describes the institutional setting and our experimental design.

⁵Our evidence reinforces prior work that questions the validity of using observable balance sheet measures to identify financial amplification in empirical analyses (Farre-Mensa and Ljungqvist, 2016).

⁶A non-exhaustive list of theoretical contributions includes Froot et al. (1993), Hennessy and Whited (2005), Rampini and Viswanathan (2010), and Nikolov et al. (2019). There is also an empirical literature on credit lines in corporate finance (Sufi, 2009). The literature has shown that credit lines serve as a valuable contingent liquidity that allows firms to insure against unexpected negative shocks (Shockley and Thakor, 1997; Jiménez et al., 2009; Campello et al., 2010; Ivashina and Scharfstein, 2010; Acharya et al., 2013; Brown et al., 2021; Chodorow-Reich et al., 2022; Chodorow-Reich and Falato, 2022). Recent theory emphasizes the role of credit lines as a debt-dilution mechanism that protects existing creditors and the importance of analyzing credit lines jointly with total firm-level borrowing (Donaldson et al., 2024), in line with the approach we take in our experiment.

2.1 Institutional Background

Macroeconomic Environment. The experiment was conducted in Türkiye, which ranked as the world’s 19th largest economy in 2023 – just below the Netherlands (18th) and above Switzerland (20th). Table A.1 compares Türkiye with the U.S., Europe, and other emerging markets. Türkiye’s GDP per capita is comparable to that of Bulgaria, Greece, and Romania, and its poverty rate is similar to that of the U.S. Macroeconomic conditions in Türkiye were relatively stable during our experimental period. Figure A.2 shows annual inflation, GDP growth, and the exchange rate against the U.S. dollar. We conduct a series of robustness checks to confirm that our results are not driven by inflation or exchange rate fluctuations.

Small, privately held firms form the backbone of the Turkish economy, accounting for roughly half of the country’s total value added (Turkish Statistical Institute, 2021). Beginning in the 2000s, Türkiye undertook ambitious reforms that fueled rapid economic growth and halved the poverty rate between 2006 and 2020 (The World Bank, 2023). These firms played a central role in this transformation, prompting the government to launch one of the world’s largest small business credit guarantee programs – equivalent to 7.6 percent of GDP in 2017 to foster their growth (OECD, 2019).

Despite their importance, access to finance remains a major obstacle for Turkish businesses. In 2019, it was cited as the most significant constraint across all firm sizes. While only 15 percent of small and medium-sized enterprises (SMEs) in Europe and Central Asia identified finance as their primary challenge, one-third of Turkish firms did so – ranking it above other concerns such as tax rates and political instability (The World Bank, 2019). Small firms rely heavily on bank lending and face higher costs of external capital, making them particularly vulnerable to macroeconomic fluctuations and credit cycles (Davis et al., 1996). Given this context, our experiment represents a high-stakes opportunity for participating businesses.

Our bank. We collaborate with one of the largest commercial banks in Türkiye, which offers retail banking products to privately-held firms. Our bank holds a 17 percent market share in Turkey’s retail banking, serving over 13 million businesses representative of the population that participates in the local banking system. The market share

is comparable to that of JPMorgan Chase in the U.S. (Statista, 2023). The bank underwrites covenant-free, unsecured lines of credit in exchange for an upfront fee.⁷ Firms can draw any amount up to the committed debt capacity at any time. These contracts typically last 3 to 5 years and are renewed upon expiration. Our bank’s clients operate in a wide range of sectors including services (e.g., health, education, restaurants, etc), construction (e.g., builders, construction materials, manufacturer, etc), food (e.g., bakery, butcher, grocery, etc), among others. See Table A.2 for the sectoral breakdown of business credit line clients at our bank.⁸

2.2 Research Design

Sample. The experiment’s participants consist of 3,169 businesses pre-approved for a credit line capacity increase in the summer of 2014. The partner bank periodically reviews existing clients’ debt limits to identify firms that may require higher credit capacity. Firms that had recently opened accounts or received a capacity increase within the past six months were excluded. Potential candidates were then selected based on proprietary underwriting criteria, which balance predicted revenue and costs using firms’ credit line usage histories and other characteristics. This process resulted in 3,169 firms being deemed eligible for automatic credit line increases.

Randomization The eligible firms are stratified into equal-width bins based on their end-of-billing cycle balances relative to their debt capacity. A random subsample is drawn from each stratum using a random number generator. This group, denoted as $\mathbb{Z}_i = 1$, receives an automatic capacity increase, while the control group ($\mathbb{Z}_i = 0$) is excluded from the lender-initiated capacity increase. Although assignment to the treatment group ($\mathbb{Z}_i$), is random, the magnitude of the capacity increase is not randomized.

After selecting the treatment group, the capacity expansion was applied automati-

⁷Although the unsecured debt we study is not explicitly collateralized, it is effectively backed by unencumbered assets due to the non-dischargeability of business debt – making it implicitly collateralized, similar to unsecured debt in the U.S. (Benmelech et al., 2025; Rampini and Viswanathan, 2025; Donaldson and Piacentino, 2025).

⁸We do not directly observe the industry classifications of firms in our sample, as the partner bank did not make this information available for research purposes. However, the bank confirmed that the sectoral distribution of our sample closely resembles that of its overall client base.

cally and communicated to firms via their preferred notification method (email or text) specified at account opening. Control firms were not informed that they were also eligible for an expansion. The pre-approval process was entirely bank-initiated and part of routine operations, so firms were unaware they were participating in an experiment. The treatment rollout occurred over two calendar months due to institutional constraints. See Figure A.1 for the experimental timeline.

2.3 Data

We obtained administrative credit line data from our bank, covering three years before and after the experiment. The data includes monthly information on firms' debt capacity, drawdown balances, spending transactions, loan performance (delinquency or restructuring), liquid asset holdings (checking, savings, or brokerage) at our bank, whether the firm has accounts at other banks, and the owner's age. We separately obtained firm-level quarterly data on total debt from the Turkish Central Bank's credit registry, *Memzuç*. This dataset captures all debt issued to our firms by our bank and other financial intermediaries. See Table A.3 for detailed variable definition and data sources.

Our bank collects firm-level annual profits data from tax filings for a subset of clients enrolled in one of their eight bundled "financing packages." These packages are tailored to address a variety of business needs, and as such, these firms represent our bank's core client base with access to multiple financing products.⁹ In our experimental sample, 551 firms were enrolled in these financing products, providing firm-level profit data for this subset of clients. See Table A.4 for a comparison of firms with profits information to those without.

Outcomes. Our main outcomes of interest are debt capacity, credit line debt, and financial and real outcomes at the firm level. Debt capacity refers to the maximum limit on credit lines. Debt refers to the stock of interest-accruing credit-line debt carried across periods, net of balances paid off at the end of the billing cycle. Transactions

⁹For instance, the "Promissory Note Package" is tailored to firms with supplier relationships that necessitate frequent wire transfers and includes benefits such as waived wire transaction fees and a complimentary checkbook. Alternatively, the "Foreign Trade Package" is designed for firms engaged in international trade, providing advantages such as foreign currency transaction fee waivers, complimentary transfers via the bank's ATMs, and a checkbook.

refer to total spending on credit lines. Monthly transactions may exceed debt since it captures all outflow expenditures, including those paid off within the billing cycle. Our bank classifies all credit line transactions into eight mutually exclusive categories, based on the transaction counterparty's point-of-sale identifier. We group these business expenses into three categories: (1) professional business services, which include advertising, consulting, marketing, etc., (2) investment spending on capital expenditures like machinery, equipment, durable expenses, etc., and (3) all other operating expenses. See Table A.5 for more details on purchase categories.

Firm-level total debt represents the outstanding interest-accruing balances carried over from previous periods. Annual profits, defined as net income (revenues minus expenses), are reported on a fiscal-year basis. We infer sales by adding business expenses to net income. Using expenses on credit lines to estimate total firm-level expenses is a reasonable proxy, as 60 percent of firms with profits data exclusively bank with our bank and have no other banking relationships. However, sales may be underestimated if firms maintain additional business credit line accounts at other banks that we cannot observe. We conduct robustness using a sample of firms that have an exclusive banking relationship with our bank to address this concern.

Which firms are in our sample? We assess the representativeness of our sample by comparing firms' pre-experimental characteristics to those of all incorporated Turkish firms, using data from the Central Bank of Türkiye. Table A.6 reports the comparison. Relative to the national distribution, our firms fall within the lower 30th to 50th percentiles of the capacity distribution. The median firm in the national dataset has a debt capacity equivalent to that of the top 5 percent of firms in our sample.

Our sample is not representative of the full universe of Turkish firms. However, consistent with prior work focusing on the bottom 30th percentile of the firm-size distribution to study financing frictions (Gertler and Gilchrist, 1994), our data are well suited to examine the small-firm segment of the Turkish economy. The firms in our sample are relatively small – yet nontrivial in scale and with high growth potential – and are therefore informative about the financial amplification mechanism.

2.4 Randomization Assessment and Estimation Framework

Balance. The random assignment successfully balanced the characteristics of treated and control firms. Table 2 reports covariate balancing in levels for all sample and for the subsample of firms with sales and profits information.

Estimation Framework. We estimate the first-stage (FS) and intent-to-treat (ITT) effects using regressions of the following form

$$Y_{i,t} = \beta Z_i + f_s + \gamma_t + \epsilon_{i,t} \quad (1)$$

where i denotes a firm, f_s stands for randomization-strata fixed effects, and γ_t denotes time fixed effects. To facilitate comparison between stock variables (e.g., debt) and flow variables (e.g., profits, sales, expenses), we transform the outcome $Y_{i,t}$ such that stock variables are expressed as changes, and flow variables as cumulative changes relative to the onset of the experiment.

The treatment effect is calculated as the ratio of the ITT and FS effects:

$$\beta_{\tau}^{\text{Wald}} = \frac{\beta_{\tau}^{\text{ITT}}}{\beta_{\tau}^{\text{FS}}} = \frac{\mathbb{E} [\Delta^{\tau} Y_i | Z_i = 1] - \mathbb{E} [\Delta^{\tau} Y_i | Z_i = 0]}{\mathbb{E} [\Delta^{\tau} \text{Capacity}_i | Z_i = 1] - \mathbb{E} [\Delta^{\tau} \text{Capacity}_i | Z_i = 0]}$$

and captures the local average treatment effect (LATE) of increased debt capacity. Since the model is exactly identified, the Wald estimate aligns with the treatment effect obtained through a two-stage least-squares (2SLS) approach, where changes in capacity is used as the endogenous variable, with Z_i as an instrument for the change in debt capacity.¹⁰ We present both dynamic treatment effects and average treatment effects over the three-year period, expressed at an annual rate. In the dynamic specification, we estimate effects at $t = \tau$ (e.g., after Y1) and omit time fixed effects γ_t . To estimate average effects over the three-year period, we pool all post-experiment observations and include time effects γ_t .

¹⁰Note that the experiment features partial compliance because our bank did not prevent control firms from requesting and obtaining higher debt capacity (i.e., "always-takers") nor did they prevent treated firms from opting out (i.e., "never-takers"). Thus, after 12 months, 77% of the treatment group and 24% of the control group received a capacity increase, while 22% of treatment did not receive a capacity increase. The never-takers represent firms that opted out of automatically receiving promotional offers when they first opened a credit line. Partial compliance is a common feature of RCTs, and 2SLS-IV addresses this by identifying the causal effects for compliers (Angrist and Pischke, 2009).

When analyzing firm-level outcomes, we follow the approach of Khwaja and Mian (2008) and Greenwald et al. (2024) and modify the instrument to reflect each firm’s exposure to our bank’s debt capacity expansion. Specifically, we measure each firm’s exposure as the treatment assignment weighted by the firm’s pre-experimental share of debt capacity from our bank relative to its total debt $\widetilde{Z}_i = Z_i \times \left(\frac{DebtCapacity_i^{pre}}{TotalDebt_i^{pre}} \right)$ and run the following regression:

$$Y_{i,t} = \beta \widetilde{Z}_i + f_s + \gamma_t + \epsilon_{i,t} \quad (2)$$

This framework captures the idea that firm-level effects depend on how much each firm relied on our bank’s credit line relative to its total debt prior to the experiment.

Heterogeneous Treatment Effects. We estimate a heterogeneous 2SLS specification in which the treatment effect of debt capacity is allowed to differ by subgroup K_i . Participants are sorted into two subgroups, $K_i \in \{0, 1\}$, based on their baseline (pre-experimental) characteristics. The estimating equation is:

$$Y_{it} = \alpha + \sum_{k=0}^1 \beta_k (L_{it} \cdot \widehat{\mathbf{1}\{K_i = k\}}) + \delta \mathbf{1}\{K_i = 1\} + f_s + \gamma_t + u_{it} \quad (3)$$

where $(L_{it} \cdot \widehat{\mathbf{1}\{K_i = k\}})$ denotes the fitted value from the first stage using the instrument interacted with the subgroup indicator $(Z_i \times \mathbf{1}\{K_i = k\})$. We include subgroup fixed intercepts, $\mathbf{1}\{K_i = 1\}$, to allow for systematic level differences in outcomes across groups. The coefficients β_k therefore capture group-specific treatment effects of debt capacity. For all heterogeneity analyses, we decompose the overall treatment effect into components attributable to each subgroup to quantify the share of the total effect explained by each group. See Appendix A for details on the decomposition procedure.

2.5 Pre-Experimental Characteristics

We begin by examining the pre-intervention characteristics of our experimental sample. Table 1 displays summary statistics. The average debt capacity and credit line debt were 4,662 TRY and 1,569 TRY, respectively. For context, the size of this debt capacity corresponds to roughly 4.5 months of cash runway without generating any

income (i.e., cash buffer). The unused debt capacity alone provides just under three months of runway, based on average monthly operating expenses before the experiment. Average monthly expenses was 1,050 TRY, with one-quarter of the expenses allocated to financing investments. On average, firms held 1,248 TRY in liquid cash deposits at our bank. Figure 1 reports graphical illustration of pre-experimental credit line account and firm characteristics.

Most firms have debt levels well below their available capacity before the experiment. Figure 1 visually illustrates this finding. In the month prior to the intervention, fewer than 10 percent of firms had nearly exhausted their credit capacity (with a utilization ratio above 98 percent). On average, firms utilized 39 percent of their debt capacity, while the median firm used only 33 percent. Roughly 13 percent of firms had no outstanding debt on their credit lines at all. Figure A.3 reports histograms over different pre-experimental periods and shows a consistent pattern: most firms borrow only a portion of their credit lines. More than 60 percent of firms held debt other than credit-line debt, and over 40 percent had been in operation for at least five years.

3 Debt Capacity Expansions and Borrowing

This section examines the causal effects of debt capacity expansions on credit lines. Section 3.1 and Section 3.2 presents results on credit-line and total firm-level borrowing, respectively.

3.1 Credit-Line Debt Capacity and Borrowing

The First-Stage Effect Debt Capacity. The random assignment $\mathbb{Z}_i$ had a large and monotonic effect on debt capacity. The first row of Table 3 reports these results, estimated using Equation 1. Column 2 shows that treated firms' debt capacity on business credit lines increased by 2,351 TRY by the end of the first year of the experiment. This represents a sizable effect – roughly a 50 percent increase in borrowing power relative to pre-experimental debt limits shown in Column 1. Columns 3 and 4 indicate that this increase persisted through the end of the third year of the experiment.

Credit-Line Debt. Treated firms increased their borrowing on credit lines immediately following the capacity expansion. Columns 2-4 of the second row in Table 3 report cumulative ITT estimates. After 12 months, treated firms borrowed 820 TRY more than the control group—a 52 percent increase relative to the pre-experimental mean reported in Column 1. The short-run effect may reflect intertemporal substitution if firms are pulling expenditures forward. However, Columns 3 and 4 show that borrowing effects persist: treated firms borrowed 1,296 TRY more after three years. Figure 2 illustrates the FS and ITT effects graphically.

Combining the FS and ITT estimates, Column 5 indicates that treated firms borrowed 35 cents per lira increase in debt capacity in the short run. In the longer run, firms borrowed 39 cents per lira after two years and 51 cents after three years, implying a sustained increase in credit-line borrowing. Column 8 shows that, on average, firms annually drew down 24 cents per lira increase in debt capacity over the three-year period. Overall, the results indicate a large and persistent rise in credit-line borrowing.

Section A describes additional evidence that my findings are robust to adjusting for inflation, firm selection, and balance shifting. Examples include: (1) using real TRY and US dollars to ensure that our results are not driven by inflation or exchange rate fluctuations, (2) re-weighting our sample to match the utilization distribution of the universe of Turkish firms to assess generalizability, and (3) restricting the sample to firms that only bank with our bank to address potential substitution effects.

3.2 Total Debt and Cash Balances

We examine how debt capacity affects firms' total debt and cash holdings. While firms may increase borrowing on business credit lines, total debt may remain unchanged if they simply substitute credit-line borrowing for other forms of debt. Alternatively, firms may draw down funds to accumulate cash reserves rather than finance growth-related spending. Prior research suggests that firms often allocate costly external finance toward building liquidity – particularly when external funding is temporarily cheap or when the shadow value of internal funds is high (Eisfeldt and Muir, 2016).

Capacity expansion increased firm-level borrowing and had no effect on firms' cash

holdings. Table 4 presents ITT (Columns 2-4) and TE (Columns 5-7) estimates for total debt and cash holdings. Firms gradually levered up, with total debt rising by 1.14 TRY per dollar of expanded capacity after Y1 and reaching a cumulative effect of 2.02 TRY per dollar by Y3. This pattern suggests that firms expanded overall borrowing rather than substituting credit line debt for other debt types, consistent with the view that credit line debt complements other financing sources (Rauh and Sufi, 2010). The second row of Table 4 confirms that capacity expansion had no effect on firms' cash balances, implying that firms did not draw down credit lines to accumulate liquidity.

Default Probability. Although treated firms increased borrowing following the capacity expansion, they were no more likely to experience financial distress. Figure 3 shows that over the three years after the intervention, treated and control firms were equally likely to enter distress, with control firms exhibiting slightly higher delinquency rates in the third year. These patterns suggest that treated firms were able to deploy the additional credit productively and generate high returns. We examine this interpretation in the next section.

4 Firm-Level Real Effects

Next, we examine the impact of capacity expansion on firm-level spending and growth. Section 4.1 examines investment and spending, and Section 4.2 presents findings on sales, profits, and productivity.

4.1 Investment and Spending

Treated firms increased investment in customer capital, physical capital, and operating expenses. Column 2 of Table 5 shows that, in the short run, firms allocated roughly 14 percent of their additional spending to professional business services aimed at acquiring new customers – such as advertising and marketing (He et al., 2025) – 36 percent to physical investment, and the remaining 50 percent to operating expenses. In the long run, about 19 percent of the cumulative increase in spending was devoted to customer capital, 23 percent to physical investment, and 58 percent to operating expenses. The increase in physical investment is sizable: annualizing the long-term

response of 4,402 TRY implies an annual rise of 1,467 TRY ($\frac{4,402}{3}$), corresponding to a 36 percent increase relative to the pre-experimental mean reported in Column 1. The magnitude of the investment response is economically meaningful and plausible given the scale of the firms in our sample. Figure A.4 illustrates examples of investment goods firms could have purchased in 2016 (three years after the experiment) with the estimated Year-3 effect – for instance, an industrial refrigerator or an industrial dishwasher paired with a jumbo teapot.

In terms of treatment effects, Column 7 show that spending rose across all three categories, with firms cumulatively spending \$1.50 to professional business services (advertising, marketing, etc), \$1.83 to investment (machinery, equipment, etc), and \$4.57 to operating expenses per dollar increase in debt capacity over the long run. Column 8 shows that, on average over the three-year period, firms spent 0.43, 0.79, and 1.41 liras per lira increase in debt capacity per year. Overall, firms utilized expanded debt capacity to invest in productive capital and scale up operations. We next examine whether this increase in investment translated into higher sales and profits.

4.2 Firm Growth: Sales, Profits, and Productivity

The experiment led to significant increases in sales, profits, and productivity. Columns 2-4 of Table 6 show that treated firms cumulatively earned 25,482 TRY more than the control group after three years. This increase is economically large, corresponding to 35 percent (8,494 TRY) annual increase compared to the baseline mean. Similarly, profits increased by 13,807 TRY after three years, representing a 26 percent annual increase compared to the baseline mean, or 4,602 TRY. In terms of treatment effects, Column 7 indicates that firms cumulatively generated \$7.19 in sales and \$3.90 in profits per dollar of increased debt capacity after three years. The third row shows that total factor productivity (TFP) – measured as the residual from a regression of log sales on log capital stock, controlling for time effects – increased by 50 log points per log point increase in debt capacity after three years. Overall, these results suggest that expanding firms' debt capacity not only scales up operations but also leads to productivity gains.

Our estimated effects are sizable but plausible given the scale of firms in our sample. Given that the average pre-experimental profit growth rate was 12 percent, our

estimated increase in profits is roughly twice the mean growth rate. Put differently, the estimated effect is comparable to one standard deviation of the annual profit growth rate prior to the experiment (34 percent) and is of the same order of magnitude as moving a firm from the bottom to the top quartile (18 percent). Second, the 8,494 TRY annual effect on sales translates to firms' ability to sustain operations for 20 days without generating any income, based on their pre-experimental monthly business expenses. Given that firms, on average, held 34 days of cash buffer before the experiment, the increase in sales lengthened their runway to absorb unexpected cash flow shocks by 58 percent.

5 Heterogeneous Treatment Effects

So far, we have shown that expanding firms' debt capacity on business credit lines generates large and persistent increases in borrowing, investment, and growth. This section examines which firms drive these effects. Section 5.1 documents heterogeneity across firms based on pre-experimental characteristics, while Section 5.2 explores possible mechanisms.

5.1 Firms with Low Ex-Ante Default Risk

To shed light on the mechanisms underlying the large average treatment effects, we examine which firms exhibit the largest growth responses. Canonical macroeconomic models with financial frictions predict that firms operating closest to their borrowing constraints – or with the least access to external finance – should display the strongest responses, as they gain most from an expansion in debt capacity. We test this prediction by splitting the sample according to pre-experimental characteristics that proxy for firms' baseline profitability and financial constraints. Reported treatment effects are averaged over the three-year experimental horizon and expressed in annual terms.

Firms farther from their debt limits generate larger gains than those operating near them. Columns 1 and 2 of Table 7 show that firms with below-median utilization of their credit lines – those farther from their debt limits – exhibit significantly stronger growth responses than firms with above-median utilization ratios. On average, low-utilization firms generate 3.52 liras in additional sales for each lira increase in debt

capacity per year, whereas high-utilization firms show a statistically insignificant effect of 0.17. The difference between the two groups is statistically significant ($p = 0.02$). Consistent with the sales response, Panels B and D show that low-utilization firms also experience larger gains in profitability and productivity – 2.9 liras in additional profits per lira increase in debt capacity and a 0.99 log-point increase in productivity per log-point increase in debt capacity. These results are particularly striking given that investment effects are similar across the two groups.

Firms with low pre-experimental utilization ratios not only exhibit larger treatment effects but also account for most of the average treatment effect. To quantify this, we decompose the average treatment effect into the components attributable to each subgroup. While heterogeneous treatment effects capture variation across groups, they do not indicate whether large subgroup-specific effects translate into average importance, which depends on both effect magnitude and the subgroup’s relative weight in the sample.¹¹ Panel A shows that 98 percent of the average treatment effect arises from the sales growth of low-utilization firms, indicating that these firms drive nearly the entire average response.

The main finding – that firms with lower ex-ante default risk drive the results – remains robust to alternative proxies for financial standing and productivity. Columns 3-8 of Table 7 report estimates for subsamples defined by pre-experimental liquidity, indebtedness, and risk-adjusted returns. Across all proxies, firms with higher liquidity, lower leverage, and higher risk-adjusted returns exhibit the strongest growth responses and contribute disproportionately to the average treatment effect. We also examine heterogeneity along other dimensions, including firm and owner age, firm size, and whether the firm has exclusive banking relationship with our bank. The results, reported in Tables A.8 and A.9, show no clear evidence of differential treatment effects along these dimensions.

5.2 Potential Explanations

Precautionary Motives. What is the nature of financing friction that limits the growth of firms with low ex-ante default risk? We hypothesize that precautionary motives –

¹¹See Section A for details on the decomposition procedure.

the desire to preserve unused borrowing capacity as insurance against shocks to cash flow or financing conditions – may explain why firms with low default risk and ample financial slack exhibit large growth responses. As suggested by Modigliani and Miller (1963), firms may maintain a "reserve borrowing capacity" to buffer against volatility in cash flows or financing access.

We test the relevance of this interpretation by conducting a cross-sectional analysis correlating firm-level volatility measures with utilization rates. To ensure that utilization behavior is not confounded by treatment effects, the sample is restricted to control firms unaffected by the capacity expansion. As a first step, we construct proxies for expense, cash-flow, and financing volatility, σ_i^k , where $k \in (\text{expense, sales, financing})$:

$$\sigma_i^k = Std.Dev(\eta_{i,t})$$

$$\eta_{i,t} = Y_{i,t} - \widehat{Y}_{i,t}$$

where the predicted mean value, $\widehat{Y}_{i,t}$, uses coefficients from the regression

$$Y_{i,t} = \alpha_i + \gamma_t + \varepsilon_{i,t}$$

Intuitively, σ_i^k captures the idiosyncratic variation in k after removing predictable components such as time-invariant firm characteristics (firm fixed effect) and seasonality (time fixed effects). We compute σ_i^k using pre-experiment data and correlate this measure with post-experiment utilization rates to assess how past volatility shapes subsequent credit-line usage.

We provide suggestive evidence that firms facing greater volatility in cash flows or financing conditions use their credit lines more cautiously. Specifically, column 1 of Table A.10 indicates that a one standard deviation increase in unpredictable expenses, cash flow, and financing volatility reduces utilization rates by 1.04, 1.56, and 5.57 percent, respectively. Columns 2 and 3 show similar results, with higher volatility increasing the likelihood that a firm uses below 25th and 50th percentile utilization ratio. Financing volatility has the strongest negative correlation with utilization rates, suggesting that uncertainty in funding can incentivize firms to hold large financial buffers. Columns 4-6 shows that these findings remain robust even after controlling

for other firm characteristics (e.g., firm size or age), that may explain utilization ratio.

While the cross-sectional evidence is suggestive, the precautionary motive is particularly plausible given the substantial personal financial exposure that business owners face in the event of bankruptcy. In Turkey, business loans typically require personal guarantees, effectively imposing unlimited liability on owners. Upon default, lenders can seize both personal and business assets, fostering risk-averse behavior.¹² Consistent with this interpretation, a simple calibration of a static model of optimal investment under cash flow uncertainty suggests that firms substantially overestimate their likelihood of default. The model-implied perceived default risk, inferred from observed borrowing responses, is 67 percent higher than actual default risk for the full sample and 140 percent higher for the low-utilization subsample. See Appendix B for details.

Alternative Explanations. There are alternative explanations beyond precautionary motives that may account for the observed heterogeneity. One possibility is lumpiness in investment. Because firm investment often occurs in large, infrequent increments (Cooper et al., 1999), the large average effects could reflect productive, low-risk firms undertaking previously infeasible lumpy projects once debt capacity expanded. We define a lumpy investment as spending within the first 12 months of the experiment in a specific category – such as equipment or electronics – that exceeds a firm’s unused debt capacity at baseline. However, only 4 percent of firms engage in lumpy investments, indicating that the observed investment response to capacity expansion is not primarily driven by lumpiness in investments.

Another possibility is that lender-initiated capacity expansions "encourage" firms by signaling lender confidence in their profitability. To test this possibility, we examine treatment effect heterogeneity by the number of capacity changes firms experienced before the intervention. Intuitively, firms receiving an expansion for the first time should be most responsive if signaling plays a role. However, we find little evidence consistent with this hypothesis. Columns 3-6 of Table A.9 show no significant heterogeneity in borrowing across firms with below- or above-median frequencies of prior

¹²The unlimited liability is not unique to Turkey: even in the U.S., most unsecured business loans require personal guarantees, and government-backed loans, such as the Small Business Administration (SBA)’s loan guarantees, are not dischargeable even in personal bankruptcy.

capacity expansions or reductions. While these results do not fully rule out alternative mechanisms, they provide little empirical support for the signaling interpretation.

6 Discussion of Results

We connect our findings to past work and discuss implications for the literature.

Relation to Past Work. Table A.11 summarizes selected estimates from prior studies that are comparable to our estimates of the investment and sales response to changes in financing conditions. We find that treated firms increased investment by 0.79 liras per lira increase in debt capacity, expressed at an annual rate over three years. This magnitude is comparable to Gertler and Gilchrist (1994) (≈ 1) but considerably larger than other studies, which report values ranging from 0.07 to 0.42. Similarly, our estimated sales response – 2.75 liras per lira increase in debt capacity – is substantially larger than prior estimates that range between 0.3 to 0.83. Figure 4 shows visual evidence.

There are three reasons why our estimates likely differ from those in previous studies. First, our sample consists of smaller firms than those typically analyzed. While Gertler and Gilchrist (1994) and Crouzet and Mehrotra (2020) also focus on small firms, most other studies examine publicly traded corporations with substantially greater access to capital markets than the small, privately held firms in our sample. This conjecture is consistent with Caglio et al. (2021), which show that private firms respond about four times more strongly to monetary policy shocks than public firms, highlighting the heightened sensitivity of smaller, privately held firms to financing conditions.¹³ Second, whereas prior studies primarily examine developed economies such as the U.S., our setting – Turkey – features a significantly tighter credit supply and less-developed financial institutions. Firms in this environment likely face greater financing frictions, amplifying their sensitivity to changes in financing conditions.

A third reason our estimates may differ is attenuation bias arising from measurement error in proxies for financing constraints. Since the financial constraints a firm

¹³Caglio et al. (2021) use the Federal Reserve’s FR Y-14 data, which include firms of diverse sizes, to examine how the effects of monetary policy vary with the type of collateral pledged. See their Table 7 for estimates across different firm types.

faces are not directly observable, a widely-used approach is relying on indirect proxies based on balance-sheet indicators, such as leverage, liquidity, or dividend payouts. Panel C of Table 8 shows that such proxies substantially attenuate estimated effects of financing frictions. Column 1 reports the relationship between changes in total debt and firm outcomes; the magnitude of the investment response, for example, declines by about 86 percent – from 0.79 to 0.11. Figure 4 presents a side-by-side comparison of our RCT-based estimate and the estimate based on a balance-sheet proxy. As a benchmark, Column 2 presents estimates based on changes in debt capacity. Although OLS estimates are somewhat smaller than IV estimates due to imperfect compliance, the magnitudes obtained from exogenous capacity expansions are comparable to those reported in our main results (Column 8 of Tables 5 and 6). Because per-dollar effects may be confounded by differences in firm scale, we re-estimate the specification using standardized units. Columns 3 and 4 show that the same qualitative pattern holds when the estimates are expressed in standard deviation terms.

Implications for the Literature. A possible explanation for why balance-sheet-based proxies attenuate the estimated magnitude of financing effects on firm growth is that firm growth is not necessarily accompanied by greater borrowing. Panels A and B of Table 8 reports heterogeneous treatment effects on total and credit-line borrowing by ex-ante default risk, using the same measures as in Table 7. Across indicators such as pre-experimental utilization, liquidity, and indebtedness, higher-default-risk firms expand borrowing more than their lower-risk counterparts. As shown in Section 5, firms with below-median utilization – those driving most of the sales growth – display a statistically insignificant borrowing response of 0.29 liras per lira increase in debt capacity. In contrast, firms with above-median utilization, which do not generate sales gains, exhibit a statistically significant borrowing increase of 2.6 liras per lira increase in debt capacity.

The finding that firms driving most of the growth do not necessarily borrow more helps explain why balance-sheet-based proxies of financing constraints may understate the true impact of financing. The nature of the friction differs across firms: high-default-risk firms expand borrowing when debt capacity increases, consistent with standard models of binding borrowing constraints, whereas for low-default-risk firms,

the friction is precautionary – additional capacity provides insurance against downside risk, even if this insurance is not ultimately exercised. In this sense, expanded debt capacity relaxes financing frictions for both groups, but the constraints limiting their growth before the intervention were of different types. This insight helps reconcile the seemingly contrasting conclusions of Gertler and Gilchrist (1994) and Crouzet and Mehrotra (2020). If both low- and high-default-risk firms respond to financing conditions – the former by expanding output and the latter by increasing borrowing – then standard balance-sheet measures of borrowing may not fully capture differences in the cyclicalities of small versus large firms, even when those differences are driven by financing frictions.

Overall, our evidence highlights the pitfalls of using balance-sheet-based proxies to identify financing constraints. We provide experimental evidence that measures based on realized borrowing can substantially attenuate the true degree of financing frictions because the firms generating the largest growth responses do not necessarily borrow more. Our results therefore suggest that borrowing capacity, rather than realized borrowing, offers a more reliable measure of financing effects, as many firms – particularly those with the strongest growth responses – expand without fully utilizing their available credit. Therefore, the attenuation is not just a measurement issue with imperfect proxies, which has been argued by Farre-Mensa and Ljungqvist (2016), but also capturing heterogeneity in the nature of friction that different firms face.

7 Conclusion

Understanding the magnitude of financing effects and which firms generate large growth responses is central to evaluating macroeconomic models with financial frictions. In a field experiment that randomly expanded firms' debt limits on credit lines, we find large and persistent increases in investment, sales, and productivity. The growth responses are strongest among firms with low ex-ante default risk – those with low debt burdens and high distance to debt limits – even though these firms do not necessarily borrow more when capacity expands. These findings support the long-standing view that financial frictions are a first-order factor for small firms and suggest that precautionary motives – the desire to insure against future cash-flow or

default risks – may constrain growth among the firms with the greatest growth potential.

Although we provide clean, well-identified experimental evidence, some caution is warranted in interpreting our results. First, the extent to which our results generalize to developed economies such as the U.S. is an open question. Nonetheless, the findings may offer broader insights, as bank-dependent small firms – the focus of our study – account for 46 percent of private-sector employment and 44 percent of GDP in the United States (SBA, 2024). Second, while our long-run estimates have a causal interpretation in that these effects would not have materialized without the experiment, we cannot isolate the specific factors driving improved firm performance over time. Long-run effects likely reflect various margins firms adjusted over time, such as investment and other forms of borrowing. Third, our study focuses on established firms in good financial standing, well-positioned for growth. Whether our findings hold up to firms already in financial distress or new firms seeking initial credit access remains an open question.

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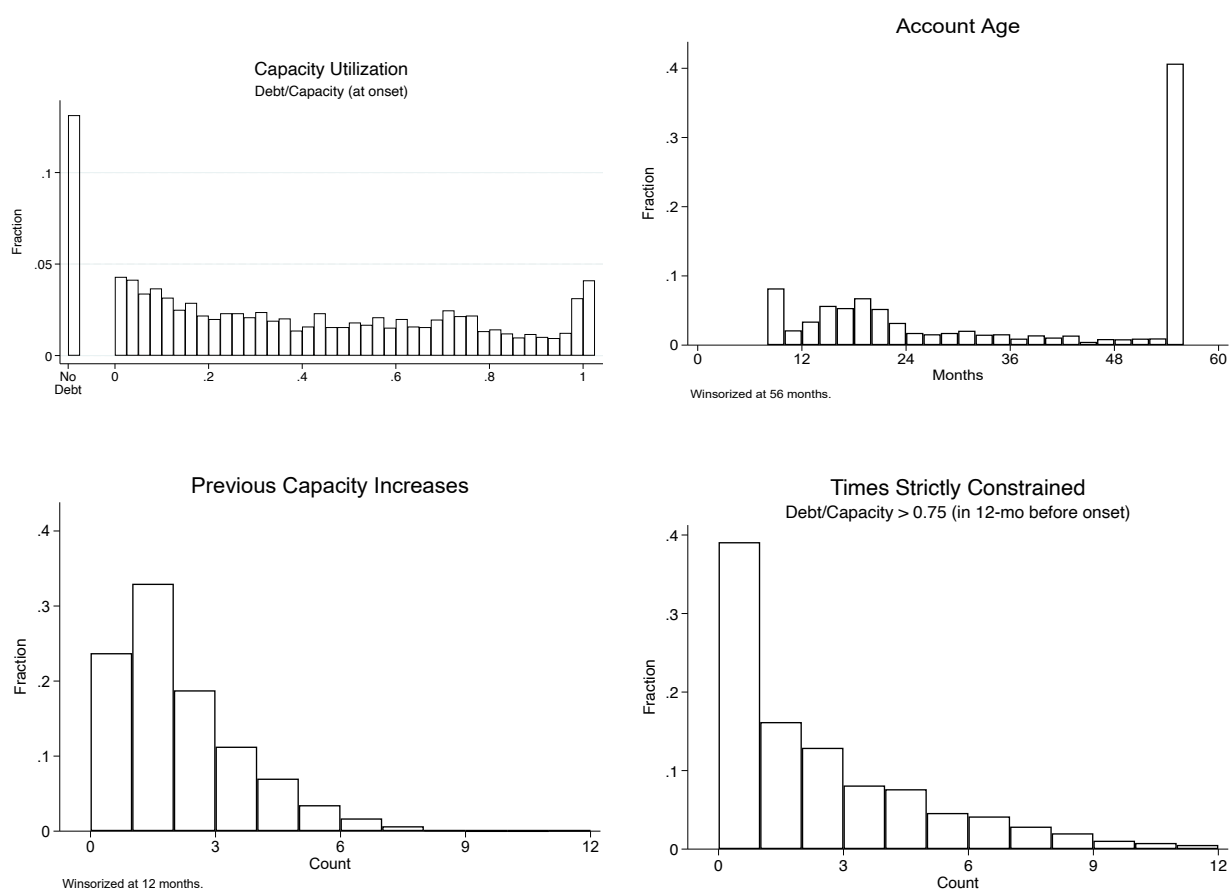
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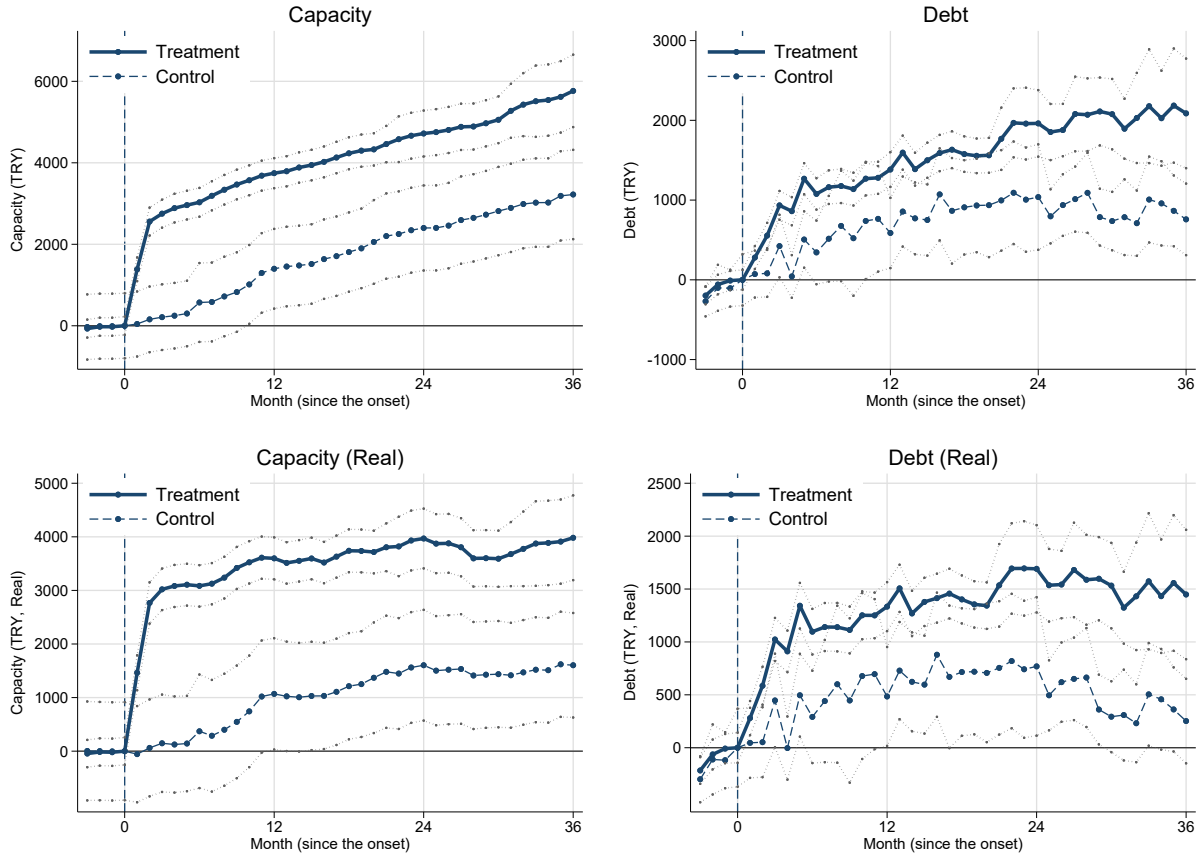
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Figure 1: Pre-Experimental Credit Line Characteristics



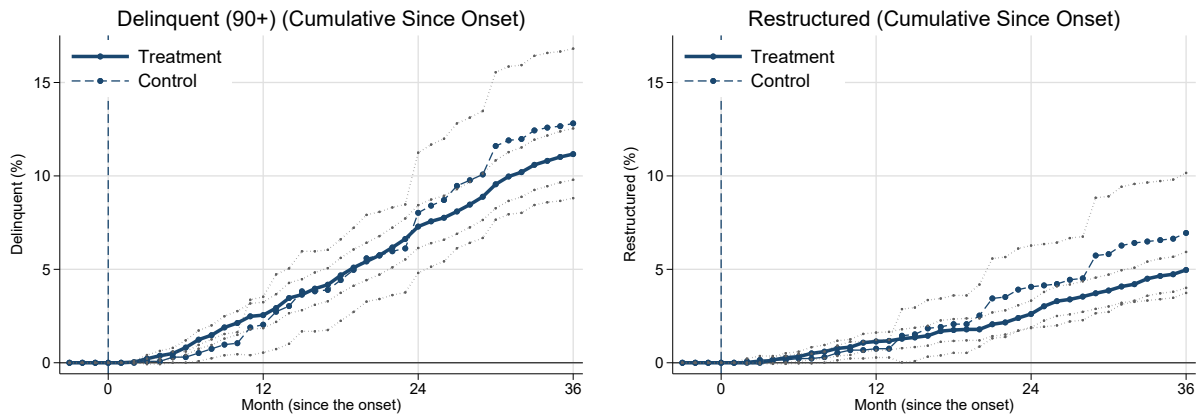
Note. This figure presents histograms of pre-experimental credit line account and firm characteristics. The top-left panel shows the distribution of utilization rates at the onset of the experiment, defined as outstanding debt balances divided by debt capacity. The top-right panel displays the histogram of account age, measured as the number of months an account had positive debt capacity (top-truncated at 60 months). The bottom-left panel illustrates the frequency of (non-experimental) debt capacity increases, capturing both lender- and borrower-initiated limit adjustments. The bottom-right panel depicts the histogram of the number of times a firm faced binding constraints, defined as having a utilization ratio above 75 percent.

Figure 2: Event Study: Effects of Debt Capacity



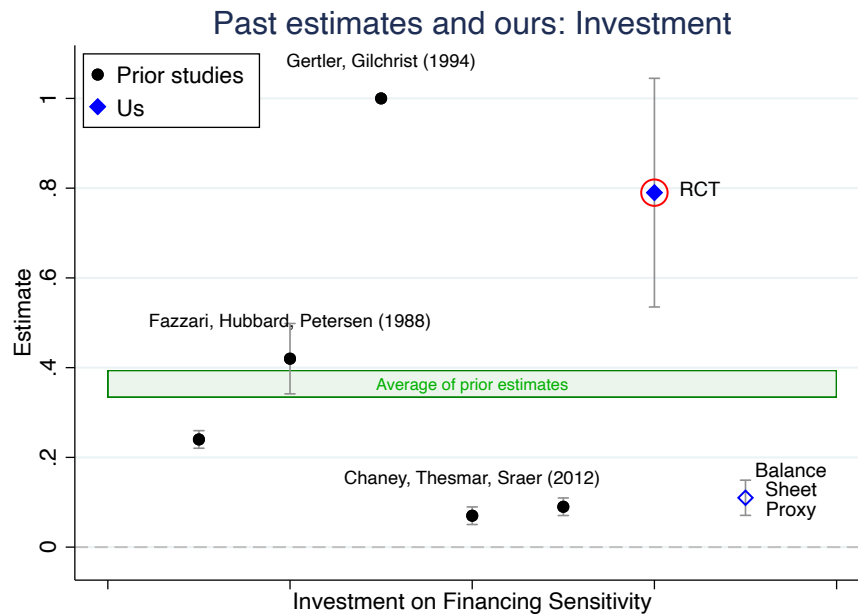
Note. The top left figure plots the evolution of debt capacity since the onset (i.e., first-stage) and the top right figure plots that of credit line debt (i.e., intent-to-treat). The bottom figures plot the same outcomes but in real Turkish TRY. Real levels are calculated using the implicit price deflator for personal consumption expenditures. The y-axis is normalized to have levels equal to zero at the onset of the experiment. Dashed lines indicate 95% confidence intervals for the estimate of the mean.

Figure 3: Event Study: Share of Firms in Distress and Renegotiation



Note. Figures plot the share of businesses with non-performing (i.e., "delinquent") loans and with restructured debt by treatment status over 36 months since the onset of the experiment. A firm is considered to be non-performing if payments have not been made for 90 days or more. Outcomes are normalized to have levels equal to zero at the onset of the experiment. Blue dashed line denotes the onset of the experiment. Dotted lines denote 95% confidence intervals.

Figure 4: Magnitude Comparison: Investment Response



Note. This figure plots coefficient estimates and 90% confidence intervals for the investment response to changes in financing status across prior studies and our sample. Black dots denote estimates from prior studies, blue diamonds denote estimates from our sample, and the red circle denotes our RCT estimate, averaged over three years and expressed at an annual rate. The hollow blue diamond labeled "Balance Sheet Proxy" reports the estimate obtained when total debt changes are used as a proxy for financing status. The green horizontal bar indicates the average of prior estimates.

Table 1: Summary Statistics

	N (1)	Mean (2)	SD (3)	p10 (4)	p25 (5)	p50 (6)	p75 (7)	p90 (8)
<i>A. Credit Line</i>								
Capacity (TRY)	3,169	4,662	5,374	800	1,250	3,000	5,700	10,700
Debt (TRY)	3,169	1,569	2,626	0	190	784	1,891	3,690
Debt-to-Capacity	3,169	0.39	0.33	0.00	0.07	0.33	0.69	0.91
Unused Capacity (TRY)	3,169	3,093	4,420	137	500	1,500	3,802	7,399
Transactions (TRY)	3,169	1,050	1,968	0	77	389	1,163	2,754
<i>B. Firm & Owner</i>								
Has a Liquid Assets?	3,169	0.59	0.49	0	0	1	1	1
Cash Balances (TRY)	1,883	1,248	4,340	0	0	2	180	1,613
Has Other Debt?	3,169	0.61	0.49	0	0	1	1	1
Total Debt (TRY)†	3,169	13,329	18,400	102	828	5,924	16,652	44,352
Sales (TRY)*	551	24,416	18,356	10,742	12,750	17,724	26,950	47,737
Profits (TRY)*	551	17,565	12,910	8,412	9,678	12,675	19,269	35,196
Owner's Age	3,169	39	10	27	31	37	46	54
Firm Age (5 years+)	3,169	0.41	0.49	0	0	0	1	1

Note. Statistics based on the month before the experiment. Nominal variables expressed in Turkish Lira (TRY). Statistics represent raw distribution not adjusted by strata. All variables are measured in monthly frequency, except for † and *, which denote quarterly and annual frequency.

Table 2: Covariate Balance

	All Sample			Firms with Sales		
	Control Mean (1)	Z (2)	p-value (3)	Control Mean (4)	Z (5)	p-value (6)
Capacity	4,934	-452 (423)	0.29	3,353	523 (504)	0.30
Debt	1,650	-53 (176)	0.76	1,471	-52 (344)	0.88
Utilization	0.40	0.00 (0.02)	1.00	0.41	0.02 (0.05)	0.72
Exclusive Banking	0.74	0.00 (0.03)	0.93	0.59	-0.01 (0.07)	0.93
Owner's Age	38	0 (1)	0.88	33	1 (1)	0.44
Total Debt*	10,829	649 (898)	0.47	10,879	-474 (2,696)	0.86
Has Other Debt*	0.59	-0.04 (0.03)	0.16	0.67	-0.05 (0.08)	0.51
Sales*	23,481	1,595 (2,582)	0.54	23,481	1,595 (2,582)	0.54
Profit*	16,604	1,637 (1,827)	0.37	16,604	1,637 (1,827)	0.37
Sample Size	755	2,414	3,169	119	432	551

Note. This table reports covariate balance between treated and control firms prior to the experiment. Columns 1 and 4 present sample means using data from the onset of the experiment or, when unavailable, from the last observation before the experiment (*). Columns 2 and 5 report treatment-control differences, and Columns 3 and 6 report the corresponding p -values. Nominal variables are expressed in Turkish lira (TRY). Columns 1–3 use the full sample of 3,169 participants, while Columns 4–6 restrict the sample to 551 firms with available sales information.

Table 3: Effects on Capacity and Debt

	Baseline	First-Stage & Intent-to-Treat			Treatment Effect			Avg. Effect
	Level (1)	Y1 (2)	Y2 (3)	Y3 (4)	Y1 (5)	Y2 (6)	Y3 (7)	(Annualized) (8)
Capacity	4,662	2,351 (240)	2,334 (383)	2,543 (547)				
Debt	1,569	820 (280)	912 (413)	1,296 (424)	0.35 (0.11)	0.39 (0.16)	0.51 (0.11)	0.24 (0.05)

Note. This table reports first-stage (FS), intent-to-treat (ITT), and treatment effect (TE) estimates over varying horizons following the experiment derived from Equation (1). The first row, Capacity, reports FS effects, and the second row, Debt, reports ITT effects. Column 1 presents pre-experiment means of the outcome variables. Columns 2–7 show cumulative FS, ITT, and TE estimates, while column 8 reports average effects over three-years expressed as annualized rates. For example, the "Y3" columns display cumulative changes in capacity and debt by the end of Year 3, whereas column 8 reports the average effect over the three years, expressed in annualized rates. FS and ITT estimates are expressed in Turkish lira (TRY). The Wald estimator of the TE, calculated as the ratio of the FS to ITT estimates, measures the change in Y per one-lira increase in debt capacity. Standard errors are in parentheses.

Table 4: Effects on Total Debt and Cash Balances

	Baseline	Intent-to-Treat			Treatment Effect			Avg. Effect
	Level	Y1	Y2	Y3	Y1	Y2	Y3	(Annualized)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total Debt	13,329	2,994 (878)	4,615 (1,263)	5,252 (1,325)	1.14 (0.36)	1.74 (0.55)	2.02 (0.61)	0.89 (0.17)
Cash Balances	1,248	-56 (586)	-216 (334)	–	-0.02 (0.21)	-0.08 (0.12)	–	-0.03 (0.11)

Note. This table reports intent-to-treat (ITT) and treatment effect (TE) estimates on firms' total debt and cash balances over varying time horizons following the experiment. Column 1 presents pre-experiment means of the outcome variables. Columns 2-7 show cumulative ITT and TE estimates, while column 8 reports average effects over three-years expressed as annualized rates. For example, the "Y3" columns display the cumulative changes in the outcome by the end of Year 3 since the experiment, whereas Column 8 reports the average effect over the three years, expressed in annualized rates. Estimates are obtained from running Equation 2, where the treatment assignment Z is weighted by each firm's exposure to the experiment, measured as the pre-experimental share of credit line debt capacity to total debt. Total debt is available at quarterly intervals but is not available beyond the first quarter of Y3, so Y3 refers to cumulative debt up until that point. Cash balances refer to firms' liquid cash balances on business checking account, and it is not available beyond Y2. Standard errors are shown in parentheses.

Table 5: Effects on Investment and Other Business Expenses

	Baseline	Intent-to-Treat			Treatment Effect			Avg. Effect
	Level	Y1	Y2	Y3	Y1	Y2	Y3	(Annualized)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Business Services	673	994 (275)	2,215 (530)	3,598 (831)	0.38 (0.09)	0.84 (0.18)	1.50 (0.34)	0.43 (0.06)
Investment	3,121	2,607 (629)	3,941 (1,113)	4,402 (1,772)	0.99 (0.24)	1.49 (0.41)	1.83 (0.73)	0.79 (0.13)
Operating Expenses	5,313	3,654 (1,205)	7,110 (2,461)	10,983 (3,676)	1.39 (0.41)	2.69 (0.89)	4.57 (1.43)	1.41 (0.26)

Note. This table reports intent-to-treat (ITT) and treatment effect (TE) estimates on firm expenses over varying time horizons following the experiment. Column 1 presents pre-experiment means of the outcome variables. Columns 2-7 show cumulative ITT and TE estimates, while column 8 reports average treatment effects over three-years expressed as annualized rates. For example, the "Y3" columns display the cumulative changes in the outcome by the end of Year 3 since the experiment, whereas Column 8 reports the average effect over the three years, expressed in annualized rates. Estimates are obtained from running Equation 2, where the treatment assignment Z is weighted by each firm's exposure to the experiment, measured as the pre-experimental share of credit line debt capacity to total debt. Business services capture expenses on professional services such as advertising, marketing, IT, security, etc. Investment captures capital expenses on durable equipment or machinery. Operating expenses include all other expenses. Standard errors are shown in parentheses.

Table 6: Effects on Sales, Profits, and Productivity

	Baseline	Intent-to-Treat			Treatment Effect			Avg. Effects
	Level	Y1	Y2	Y3	Y1	Y2	Y3	(Annualized)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sales	24,416	8,934 (3,300)	17,951 (7,340)	25,482 (12,824)	3.33 (1.15)	5.30 (1.86)	7.19 (3.21)	2.75 (0.60)
Profits	17,565	4,191 (2,209)	8,584 (4,863)	13,807 (8,510)	1.56 (0.80)	2.53 (1.32)	3.90 (2.26)	1.36 (0.42)
TFP	-0.04	0.14 (0.08)	0.15 (0.08)	0.16 (0.09)	0.47 (0.27)	0.47 (0.26)	0.50 (0.29)	0.48 (0.16)

Note. This table reports intent-to-treat (ITT) and treatment effect (TE) estimates on firm sales, profits, and productivity over varying time horizons following the experiment. Column 1 presents pre-experiment means of the outcome variables. Columns 2-7 show cumulative ITT and TE estimates, while column 8 reports average treatment effects over three-years expressed as annualized rates. For example, the "Y3" columns display the cumulative changes in the outcome by the end of Year 3 since the experiment, whereas Column 8 reports the average effect over the three years, expressed in annualized rates. Estimates are obtained from running Equation 2, where the treatment assignment Z is weighted by each firm's exposure to the experiment, measured as the pre-experimental share of credit line debt capacity to total debt. Sales and profits are reported at fiscal-year intervals and do not align precisely with the calendar year of the experiment. "Y1" refers to the first data point available within the first fiscal year following the experiment, and subsequent "Y" labels correspond to outcomes after each respective fiscal year. TFP is calculated as the residual from a regression of log sales on log capital stock, controlling for time effects, where capital stock is constructed using the perpetual inventory method based on investment spending. For TFP regressions, the first stage is estimated in logs to ensure consistency of units and average effects – rather than cumulative effects – are reported in Columns 2 through 7. These outcomes are reported for 551 firms.

Table 7: Heterogeneous Treatment Effects:
Ex-Ante Default Risk

Treatment Effect	Utilization		Liquidity		Net Debt		Risk-Adj Returns	
	<i>Low</i> (1)	<i>High</i> (2)	<i>Low</i> (3)	<i>High</i> (4)	<i>Low</i> (5)	<i>High</i> (6)	<i>Low</i> (7)	<i>High</i> (8)
<i>A. Sales</i>								
Sales	3.52 (0.74)	0.17 (1.18)	1.07 (2.31)	3.05 (0.75)	4.27 (0.79)	-2.87 (2.88)	0.28 (1.52)	4.58 (0.73)
P-value for diff	0.02		0.44		0.02		0.02	
Decomp (%)	98.4	1.6	3.8	96.2	95.0	5.0	5.3	94.7
<i>B. Profits</i>								
Profits	1.64 (0.53)	0.35 (0.65)	2.68 (1.39)	1.33 (0.53)	2.46 (0.55)	-1.84 (1.80)	-1.14 (1.06)	2.9 (0.54)
P-value for diff	0.13		0.39		0.02		0.001	
Decomp (%)	93.1	6.9	18.7	81.3	94.4	5.6	26.9	73.1
<i>C. Investment</i>								
Investment	0.83 (0.15)	0.51 (0.24)	0.61 (0.52)	0.91 (0.23)	0.85 (0.23)	1.47 (0.61)	0.84 (0.66)	0.73 (0.14)
P-value for diff	0.28		0.61		0.34		0.87	
Decomp (%)	63.3	36.7	19.2	80.8	53.5	46.5	51.7	48.3
<i>D. TFP</i>								
TFP	1.03 (0.36)	0.02 (0.15)	0.14 (0.23)	1.23 (0.50)	2.2 (0.88)	0.22 (0.35)	-0.45 (0.44)	0.99 (0.26)
P-value for diff	0.01		0.05		0.01		0.01	
Decomp (%)	97.0	3.0	10.1	89.9	95.3	4.7	26.9	73.1

Note. This table presents heterogeneous treatment effects by pre-experimental firm characteristics. Treatment effects represent average effects over the three years following the experiment, expressed in annualized rates, consistent with Column 8 in Tables 3 through 6. Each treatment-effect heterogeneity regression reports the treatment effects, the p-value for the difference between groups, and the share of the overall treatment effect explained by subgroup g , expressed as absolute shares, "Decomp (%)". See Appendix A for details on the computation of absolute shares. Utilization refers to the ratio of interest-accruing debt to credit-line limits. Risk-adjusted returns are defined as the average profit margin (profits/sales) scaled by its standard deviation. For both risk-adjusted returns and utilization, "low" and "high" denote firms below or above the pre-experimental median of these characteristics. "Low" ("High") liquidity refers to firms having both above-median (below-median) utilization and below-median (above-median) pre-experimental cash liquidity. "Low" ("High") net debt refers to firms with both below-median utilization and below- (above-) median relative net debt positions, where relative net debt is defined as net debt (total debt minus cash) scaled by total financial capacity, measured as the sum of cash and total debt. Standard errors reported in parentheses.

Table 8: Implications for the Literature

Treatment Effect	Utilization		Liquidity		Net Debt		Risk-Adj Returns	
	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)	Low (7)	High (8)
A. Credit line debt								
Credit Line Debt	0.18 (0.07)	0.33 (0.06)	0.27 (0.07)	0.11 (0.09)	0.02 (0.09)	0.29 (0.07)	0.46 (0.17)	0.03 (0.07)
P-value for diff	0.09		0.09		0.01		0.03	
Decomp (%)	36.9	63.1	48.4	51.6	13.3	86.7	94.0	6.0
B. Total debt								
Total Debt	0.29 (0.19)	2.61 (0.52)	2.96 (0.71)	0.2 (0.21)	0.18 (0.21)	3.5 (1.13)	-0.12 (0.58)	0.67 (0.34)
P-value for diff	0.		0.00		0.00		0.26	
Decomp (%)	11.6	88.4	83.0	17.0	10.5	89.5	14.1	85.9
C. Implications for the Literature								
	Per dollar increase in Total Debt (1)		Limit (2)		Per SD increase in Total Debt (3)		Limit (4)	
Sales	0.38 (0.12)		2.27 (0.19)		0.18 (0.05)		0.77 (0.06)	
Profits	0.21 (0.08)		0.90 (0.14)		0.15 (0.06)		0.47 (0.07)	
Investment	0.11 (0.02)		0.49 (0.03)		0.11 (0.02)		0.36 (0.02)	

Note. Panels A and B report treatment effects on total debt and credit-line debt. See Table 7 for details on subgroup definitions. Panel C reports the coefficient β from the regression $Y_{i,t} = \alpha + \beta dX + f_s + \gamma_t + \epsilon_{i,t}$, where dX (listed in column headers) denotes annual changes in total debt or credit-line debt limits. The coefficient β measures the average change in sales, profits, or investment (in liras) per one-lira increase in total debt (column 1) or debt limit (column 2). Because the debt-limit changes represent observed changes rather than experimentally-induced changes, the estimates may differ from those obtained using the instrumental-variable specification. Columns 3 and 4 present corresponding estimates expressed in standard-deviation units. All regressions include time and strata fixed effects.

A Robustness

We provide a battery of robustness checks to ensure that our main TEs are not simply driven by inflation, nature of firms we study, and balance shifting. In Panel A of Table A.7, we conduct robustness tests using US dollars and real TRY to ensure that fluctuations in the exchange rate or inflation do not drive our results. The first row uses the dollar value of debt as a left-hand-side variable. The second row uses the real value of debt as a left-hand-side variable, deflated using the price deflator for personal consumption expenditures. The estimates remain quantitatively consistent compared to our main short-run estimate of 35 cents.

We ensure that our results are not specific to the population of firms we study and do not simply reflect a large number of very small firms exhibiting large drawdown responses. In the first row of Panel B, we reweight the sample to match the distribution of the universe of Turkish firms in terms of capacity utilization rate. In the second row, we restrict our analysis to the largest 5% of firms in our sample that look like a median firms in the economy in terms of average debt capacity. The sample re-weighting generates quantitatively similar estimates, and restricting our sample to the largest firms in the sample deliver estimates that are even larger than our baseline estimate of 35 cents.

An important concern is that our estimates may capture firms' propensity to substitute financing elsewhere. In this case, the large drawdown response would reflect a substitution between financing that does not lead to real effects. However, Section 4 shows that treatment assignment leads to higher total and other debt beyond credit line debt and generate real effects. In addition, Panel C of Table A.7 further documents that our treatment effect does not simply reflect substitution across accounts. The first row reports treatment effects restricting the 74 percent of firms that do not have a bank account elsewhere, and the second row restricts the sample to 41 percent of firms that do not have a cash account at our bank. Both sample restrictions deliver estimates quantitatively similar to our baseline estimates. Overall, our estimates do not appear to reflect balance shifting across accounts.

Decomposition of the IV Treatment Effect by Subgroup

At time t , consider the outcome equation

$$Y_{it} = \alpha + \beta L_{it} + \gamma' X_{it} + u_{it}, \quad L_{it} \sim Z_{it}, \quad (4)$$

where L_{it} is the endogenous regressor, Z_{it} is a valid instrument, and X_{it} are exogenous controls. The 2SLS coefficient $\hat{\beta}$ captures the pooled treatment effect (TE) at time t .

To allow for heterogeneity by subgroup $G_i \in \{0, 1\}$, we estimate the interacted specification

$$Y_{it} = \alpha + \beta_0 (L_{it} \cdot 1\{G_i = 0\}) + \beta_1 (L_{it} \cdot 1\{G_i = 1\}) + \delta G_i + \gamma' X_{it} + u_{it}, \quad (5)$$

instrumenting $(L_{it} \cdot 1\{G_i = g\})$ with $(Z_{it} \cdot 1\{G_i = g\})$ for $g = 0, 1$. This yields subgroup-specific IV estimates $\hat{\beta}_0$ and $\hat{\beta}_1$.

The pooled 2SLS coefficient $\hat{\beta}$ can be written as a weighted average of the subgroup estimates:

$$\hat{\beta} = w_0 \hat{\beta}_0 + w_1 \hat{\beta}_1, \quad (6)$$

where the weights are determined by the amount of variation in L_{it} that the instrument generates within each subgroup:¹

$$w_g = \frac{\sum_{i: G_i=g} w_i \hat{L}_{it} L_{it}}{\sum_i w_i \hat{L}_{it} L_{it}}, \quad g \in \{0, 1\}.$$

Here w_i are the sampling weights, and $\hat{L}_{it}$ are the fitted values from the first-stage regression of L_{it} on Z_{it} and exogenous controls. Intuitively, groups in which the instrument explains more variation in L_{it} receive larger weight.

We define the contribution of subgroup g to the pooled TE as

$$C_g = w_g \hat{\beta}_g, \quad (7)$$

¹Note that unlike in OLS, the 2SLS coefficient is not a simple average of subgroup effects weighted by sample proportions. Instead, it is a weighted average where the weights depend on how much *fitted variation* in the endogenous variable the instrument generates within each subgroup. Formally, $w_g \propto \sum_{i: G_i=g} w_i \hat{L}_{it}^2$, i.e. the weighted variance of the fitted first-stage component in group g . See Angrist and Imbens (1995) and Angrist and Pischke (2009, ch. 4) for discussion.

and the share of the overall TE explained by subgroup g as

$$S_g = \frac{C_g}{\hat{\beta}}. \quad (8)$$

By construction,

$$\hat{\beta} = C_0 + C_1, \quad S_0 + S_1 = 1. \quad (9)$$

B Investment with Borrowing Constraint and Uncertainty

Consider a firm choosing investment I to maximize its profits:

$$\begin{aligned} \max_I \quad & F(L - I; \lambda) \cdot (1 + R)\pi(I) - I \\ \text{s.t.} \quad & I \leq L \end{aligned}$$

where R denotes the return on capital, L denotes debt capacity (i.e., borrowing limit), and $\pi(I)$ denotes the concave production function. Let a firm face a random cost overrun $\rho > 0$ with cumulative distribution function $F(\cdot; \lambda)$, where λ captures the degree of uncertainty. The firm does not survive if total cost $I + \rho > L$. Thus, the probability of survival is given by $\mathbb{P}(\rho \leq L - I) = F(L - I; \lambda)$. The first-order condition for I^* satisfies:

$$(1 + R) \left[\underbrace{F(L - I^*; \lambda) \cdot \frac{\partial \pi}{\partial I}(I^*)}_{\text{Expected marginal profit}} - \underbrace{F'(L - I^*; \lambda) \cdot \pi(I^*)}_{\text{Risk-adjustment term}} \right] = 1 \quad (10)$$

Thus, in an investment model with cash flow uncertainty, capacity expansions can increase firms' borrowing/investment, as a higher L provides a greater buffer against cost overruns and improve survival probability:

$$\frac{dI^*}{dL} = - \frac{(1 + R) [F'(L - I^*) \cdot \pi'(I^*) - F''(L - I^*) \cdot \pi(I^*)]}{(1 + R) [F(L - I^*) \cdot \pi''(I^*) - 2F'(L - I^*) \cdot \pi'(I^*) + F''(L - I^*) \cdot \pi(I^*)]} > 0$$

The numerator, capturing the marginal benefit of increasing L , is positive because higher debt capacity raises survival probability, $F'(L - I^*) > 0$ and the distribution of cost overrun decreases in the tail (i.e., $F''(L - I^*)$ is small). The denominator, reflecting the cost of increasing investment, is negative due to the concavity of the production function ($\pi''(I^*) < 0$) and the decline in survival probability with higher I ($F'(L - I^*) < 0$). As a result, $\frac{dI^*}{dL} > 0$, which in

turn raises profits:

$$\frac{d\pi^*}{dL} = F_L \cdot (1 + R)\pi(I^*) + [(1 + R)(F \cdot \pi_I - F_L \cdot \pi) - 1] \cdot \frac{dI^*}{dL} > 0$$

B.1 Economic Magnitudes

We apply simple functional form assumptions to the model above to assess whether the degree of conservatism we observe in the data is sensible. Specifically, given reasonable assumptions about returns to capital, debt capacity, and cash flow risk, what level of capacity utilization and sensitivity to capacity expansion should we expect based on theory? And for the observed response from capacity expansion, $\frac{dI^*}{dL}$, what is firms' perceived risk of default?

We assume a log production function, $\pi(I) = \log(1 + I)$, and model uncertain cost overruns as $\rho > 0 \sim \exp(1/\lambda)$, where $\lambda > 0$ governs the degree of uncertainty incurred after the firm makes its investment decision, I . Higher λ implies greater risk of cost overrun:

$$\max_{I \in [0, L]} \underbrace{(1 - e^{-\frac{(L-I)}{\lambda}})}_{\text{Probability of survival}} \cdot \underbrace{(1 + R) \log(1 + I)}_{\text{Revenue if the firm survives}} - I$$

The first-order condition is given by:

$$\frac{dV}{dI} = \frac{1}{\lambda} e^{-\frac{(L-I)}{\lambda}} \cdot (1 + R) \log(1 + I) + \left(1 - e^{-\frac{(L-I)}{\lambda}}\right) \cdot \frac{1 + R}{1 + I} - 1 = 0 \quad (11)$$

Deriving $\frac{dI^*}{dL}$ from the First-Order Condition Consider the firm's first-order condition shown in Equation 11

$$\Phi(I, \lambda, L) = \frac{dV}{dI} = 0$$

We implicitly differentiate $\Phi(I(L), \lambda, L) = 0$ with respect to L to obtain $\frac{dI^*}{dL}$:

$$\frac{d\Phi}{dL} = \frac{\partial \Phi}{\partial L} + \frac{\partial \Phi}{\partial I} \cdot \frac{dI}{dL} = 0 \quad \Rightarrow \quad \frac{dI^*}{dL} = -\frac{\frac{\partial \Phi}{\partial L}}{\frac{\partial \Phi}{\partial I}}$$

The partial derivative with respect to L is:

$$\frac{\partial \Phi}{\partial L} = -\frac{1}{\lambda^2} e^{-\frac{L-I}{\lambda}} (1 + R) \log(1 + I) + \frac{1}{\lambda} e^{-\frac{L-I}{\lambda}} \cdot \frac{1 + R}{1 + I}$$

The partial derivative with respect to I is:

$$\frac{\partial \Phi}{\partial I} = \frac{1}{\lambda^2} e^{-\frac{L-I}{\lambda}} (1+R) \log(1+I) + \frac{2}{\lambda} e^{-\frac{L-I}{\lambda}} \cdot \frac{1+R}{1+I} - \left(1 - e^{-\frac{L-I}{\lambda}}\right) \cdot \frac{1+R}{(1+I)^2}$$

Therefore, the optimal investment I^* is given by:

$$\frac{1}{\lambda} e^{-\frac{L-I}{\lambda}} \cdot (1+R) \log(1+I) + \left(1 - e^{-\frac{L-I}{\lambda}}\right) \cdot \frac{1+R}{1+I} = 1 \quad (12)$$

and the expression for $\frac{dI^*}{dL}$ is:

$$\frac{dI^*}{dL} = - \frac{-\frac{1}{\lambda^2} e^{-\frac{L-I}{\lambda}} (1+R) \log(1+I) + \frac{1}{\lambda} e^{-\frac{L-I}{\lambda}} \cdot \frac{1+R}{1+I}}{\frac{1}{\lambda^2} e^{-\frac{L-I}{\lambda}} (1+R) \log(1+I) + \frac{2}{\lambda} e^{-\frac{L-I}{\lambda}} \cdot \frac{1+R}{1+I} - \left(1 - e^{-\frac{L-I}{\lambda}}\right) \cdot \frac{1+R}{(1+I)^2}}$$

Equation 12 allows us to solve the optimal I^* for a given set of L , R , and λ . Table A.12 summarizes the calibration results. Columns 1-3 report estimates for the full sample, and Columns 4-6 restrict the sample to the low-utilization group. Panel A presents the values of L , R , and λ , along with a description of how each parameter is obtained from the data. We select λ to best match the three-year default rate observed in the data.

Firms respond much more strongly than the model would suggest. Panel B then compares the model-generated sensitivity with the experiment-based sensitivity reported, for the given set of R , L , and λ . In other words, this panel shows the magnitude of our experiment-generated effect relative to the model's prediction, given the observed rate of return, limit, and default rate to assess the size of the magnitude. Column 2 shows that the experiment-generated three-year response is 0.55, compared with a model-predicted sensitivity of only 0.29, indicating that firms respond much more strongly than the model would suggest. A similar pattern appears in the low-utilization sample (Columns 5 and 6). These results imply that firms behave as if they are substantially more risk averse, or equivalently, that they perceive the risk of cost overruns to be higher than it actually is.

To assess how much higher firms' perceived risk is relative to actual risk, Panel C compares the model-generated λ (i.e., perceived cost-overrun uncertainty) with the λ that best matches the observed default rate, conditional on R , L , and the sensitivity ($\frac{dI^*}{dL}$) reported in Panel A. Column 2 shows that the actual cost-overrun uncertainty is $\lambda = 0.34$, which corresponds to the observed three-year default rate of 13.3%. By contrast, the model-implied perceived default rate for the observed sensitivity is 0.22, indicating that firms perceive their default risk to be about 67% greater than it actually is. The discrepancy is even larger (140%) for the low-

utilization sample (Columns 5 and 6), consistent with the interpretation that firms far from their debt limits overestimate default risk and thus have greater growth potential when additional financing becomes available.

Figure A.1: Experimental Timeline

Selection

Participants ($N=3,169$)
pre-approved for increase ΔL_i

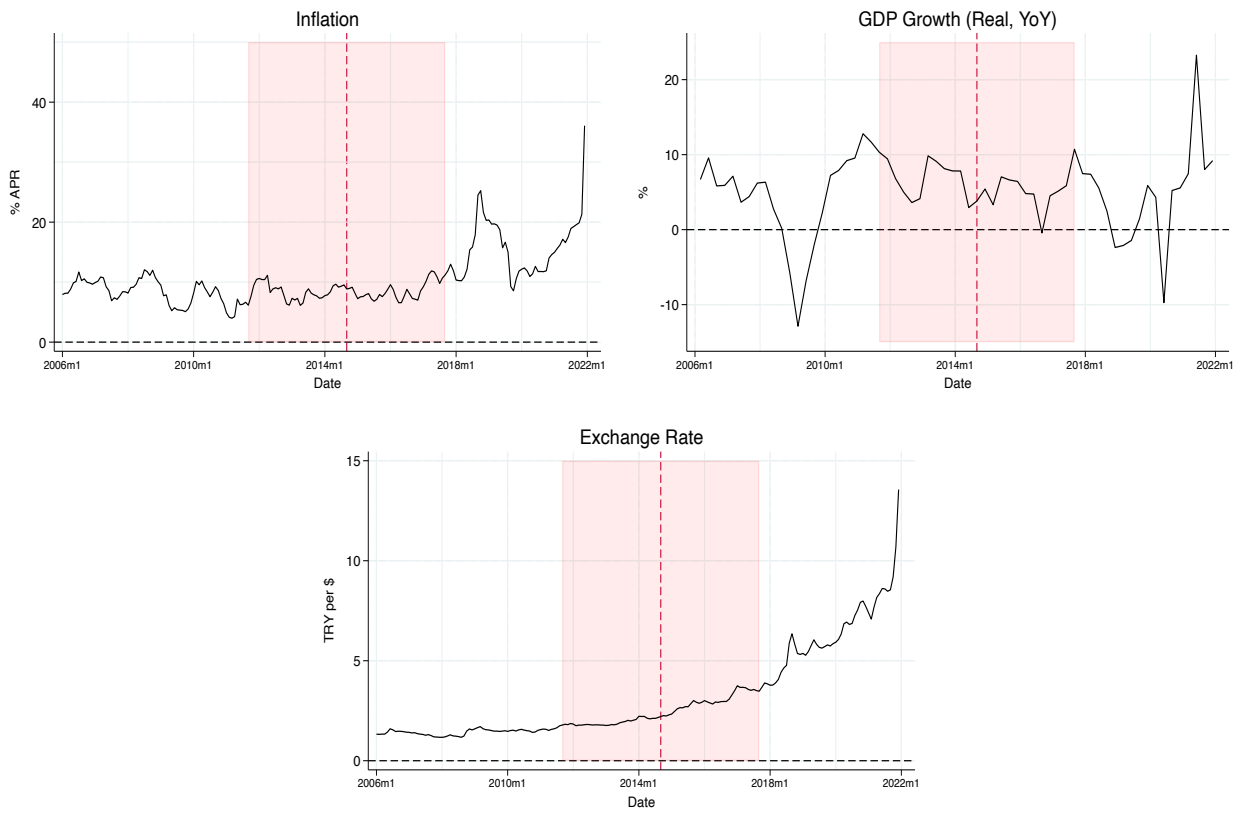
→ **Randomization** → **Intervention**

$Z_i \in \{0, 1\}$

$Z_i = 1$: Treatment ($N=2,414$)
pushed ΔL_i
 $Z_i = 0$: Control ($N=755$)
withheld from ΔL_i

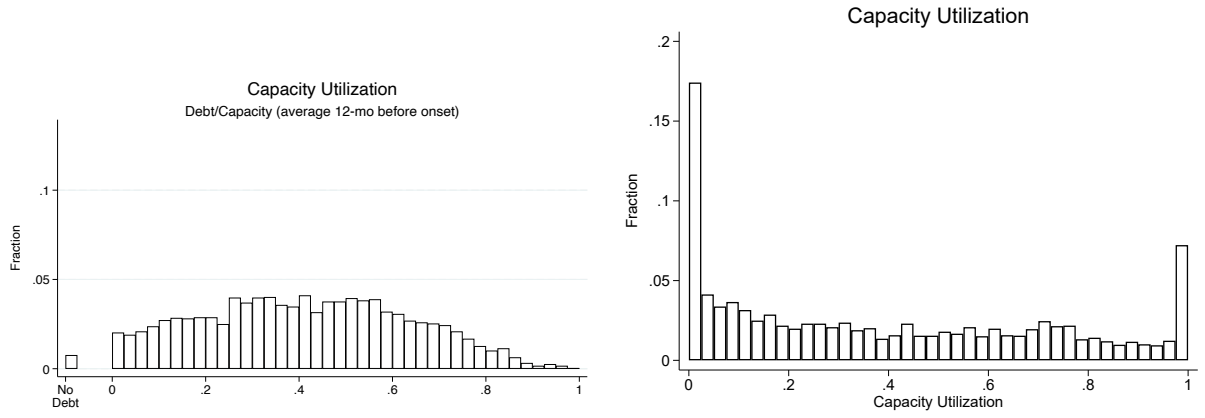
Note. This figure summarizes our randomization timeline.

Figure A.2: Macroeconomic Environment in Türkiye



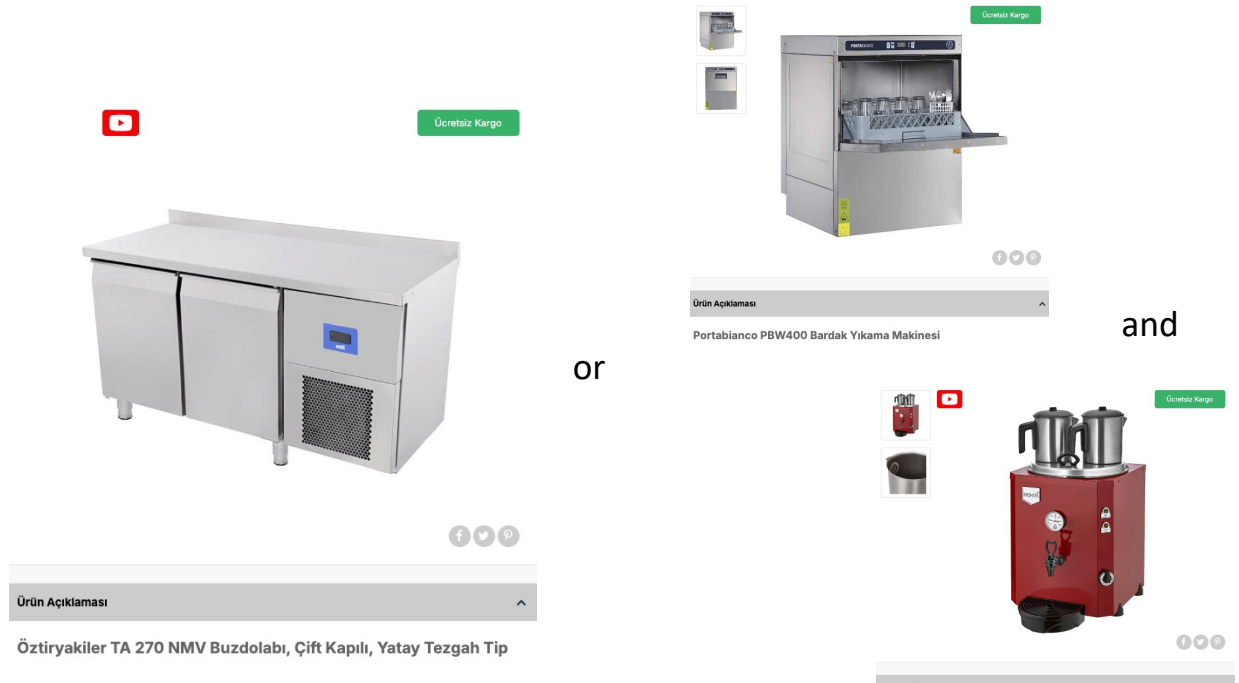
Note. Figures plot annual inflation, GDP growth, and USD/TRY exchange rate. In each panel, the dotted line denotes the onset of our experiment (2014m9), and the highlighted area in pink denotes our sample period. Source: Turkstat via Türkiye Data Monitor.

Figure A.3: Histogram of Pre-Experimental Capacity Utilization



Note. The figures show histograms of capacity utilization. The left panel displays the average utilization over the 12 months before the experiment, while the right panel shows the average over the entire pre-treatment period.

Figure A.4: Examples of Firm Investment Based on Y3 Investment ITT



Note. This figure shows examples of durable goods one can buy with Y3 ITT investment response reported in Table 5 in 2017 TRY. The left chart shows an industrial refrigerator. The right chart shows an industrial dishwashing equipment and a jumbo tea pot.

Table A.1: Macroeconomic Indicators

	Turkey (1)	SE. Europe GR, BG, RO (2)	S. Europe IT, ES, PT (3)	Lat. Am MX, BR, AR (4)	EU 28 (5)	US (6)
GDP per capita (PPP)	24.6	23.5	35.4	19.5	39.9	57.3
GDP Growth (annual %)	4.9	1.9	0.7	0.3	1.6	2.3
Poverty	2.2	6.9	1.6	7.6	–	1.5

Note. This table compares Türkiye (TR) with selected geographic and economic peer groups, as well as the European Union 28 (EU28) and the United States (US). Peer groups include Southeast Europe (Greece, Bulgaria, and Romania), Southern Europe (Italy, Spain, and Portugal), and Latin America (Mexico, Brazil, and Argentina). GDP per capita (PPP) is reported in constant 2017 international dollars. Poverty is measured as the headcount ratio at \$3.65 per day (2017 PPP), expressed as a percentage of the population. Source: World Bank and OECD.

Table A.2: Sectoral Breakdown

Sector	Fraction
Services	15 %
Construction	13 %
Food	9 %
Consumer Goods Wholesale/Retail	8 %
Textile	7 %
Construction Materials	5 %
Durable Retail	4 %
Electrical and Optical	3 %
Metal	3 %
Transport	3 %
Forestry	3 %
Petroleum	3 %
Industrial Machinery	3 %
Tourism	3 %
Transportation	3 %

Note. This table presents the sectoral breakdown of our bank's business credit line customers. We report sectors that make up at least 3 percent of the universe, and these sectors account for 85 percent of the total. Construction includes builders, contractors, and renovators; and construction materials include producers and retailers of cement, bricks, ceramic and tiles, kitchen and bathroom accessories, glass and glass products, etc. Services include education, health, restaurants, insurance, cleaning, security, advertising, beauty, and financial services. Food includes bakers, butchers, fishmongers, and produce shops.

Table A.3: Variable Definition

Variable Name (1)	Definition (2)	Source (3)	Frequency (4)
<i>A. Credit Line-Level</i>			
Capacity (TRY)	Credit limit on business credit line account	Our bank	Monthly
Debt (TRY)	Interest-accruing credit line debt carried over periods	Our bank	Monthly
Debt-to-Capacity	Debt divided by capacity	Our bank	Monthly
Unused Capacity (TRY)	Credit line capacity minus debt	Our bank	Monthly
Transactions (TRY)	Total outflow transactions on credit lines.	Our bank	Monthly
<i>B. Firm & Owner-Level</i>			
Has a Liquid Assets?	Indicator for whether the firm has a checking account at our bank	Our bank	Monthly
Liquid Balances (TRY)	Amount of liquid cash held in the business checking account	Our bank	Monthly
Has Other Debt?	Indicator for whether the firm has any debt issued by any other bank	Credit Registry	Quarterly
Total Debt (TRY)	Total outstanding debt at all banks	Credit Registry	Quarterly
Profits (TRY)	Total revenue minus total costs; only non-negative values are reported	Tax Filings	Annual
Sales (TRY)	Profits plus total outflow transactions on our bank's credit line	Our Bank & Tax Filings	Annual
Owner's Age	Age of the business owner	Our bank	Monthly

Note. This table reports variable definition, data source, and frequency. Panel A reports credit-line level outcomes. Panel B reports firm-level outcomes. The credit registry data (Memzuç) is maintained by the Central Bank of Turkey and includes information on the total debt issued to firms, including those from banks other than ours.

Table A.4: Comparison of Firms with and without Sales and Profits Information

	No Sales (1)	Has Sales (2)	p-value (3)
Capacity	3,928	222 (559)	0.69
Debt	1,474	-249 (174)	0.15
Utilization	0.39	-0.04 (0.03)	0.17
Exclusive Banking	0.78	-0.23 (0.04)	0.00
Owner's Age	39	-5.2 (0.79)	0.00
Total Debt	11,270	-499 (1,387)	0.72
Has Other Debt	0.55	0.09 (0.04)	0.02
Sample Size	2,618	551	3,169

Note. This table compares pre-experiment characteristics of firms with and without sales information.

Table A.5: Transaction Categories and Aggregation

Type (1)	Group (2)	Category (3)	Subcategory Examples (4)
<i>A. Professional Business Services</i>			
Services	Business Svcs	Advertising, consulting, misc biz svcs	Ads, consulting, marketing, IT, security
Auto	Auto Repair	Auto parts replacement	Replacement of tires, spare parts
<i>B. Investment</i>			
Durable	Electronics/Machinery	Appliances, electronics, furniture	Major appliances, computer, cell phones, equipment, furniture, building materials
<i>C. Operating Expenses</i>			
Cash	Cash	Cash advance	–
Nondur	Gas & Auto	Fuel, auto repair	Gas, car wash, protection
Nondur	Nondur Retail	Retail, recreation, restaurants, hobbies, stationary	Department store, sports activities, restaurant, printing, office supplies
Services	Insurance/Travel/Other Services	Insurance, travel, health, education	Insurance, hotel, resorts, car rental, schools, hospitals, laboratories
Services	Utilities	Utilities	Natural gas, electricity, water, telecomm

Note. This table reports examples of detailed spending categories.

Table A.6: Benchmarking: Universe of Incorporated Firms in Turkey

	p5 (1)	p25 (2)	p50 (3)	p75 (4)	p95 (5)	Number of Firms (6)
<i>Panel A. All Firms excluding Top 5%</i>						
Capacity	1,480	10,000	26,500	75,418	337,414	3,439,077
Debt	0	0	588	24,200	124,200	3,439,077
Utilization	0.00	0.00	0.03	0.54	1.00	3,439,077
Total Debt	189	41,038	251,716	953,896	4,394,798	597,058
Profits	-144,968	-8,619	2,727	30,924	252,534	597,058
<i>Panel B. All Firms below p50</i>						
Capacity	668	4,500	10,000	20,000	25,000	1,719,477
Debt	0	0	0	1,805	15,000	1,719,477
Utilization	0.00	0.00	0.00	0.27	1.00	1,719,477
Total Debt	0	6,002	47,135	134,577	251,716	314,241
Profits	-64,937	-7,978	-41	9,942	89,948	314,241
<i>Panel C. Our Sample</i>						
Capacity	500	1,250	3,000	5,700	17,100	3,169
Debt	0	190	754	1,891	5,852	3,169
Utilization	0.00	0.07	0.33	0.69	1.00	3,169
Total Debt	0	828	5,924	16,652	67,329	3,169
Profits	7,692	9,678	12,675	19,269	50,820	551

Note. This table reports benchmarking statistics for the universe of incorporated businesses in Turkey. Statistics reported in Panels A and B are obtained from the Central Bank of Türkiye's credit registry and corporate tax datasets. Credit line outcomes (capacity, debt, utilization) are based on the month before the experiment and firm-level outcomes (total debt and profits) are based on the year of the experiment. Panel A excludes firms in the top 5% of the size distribution, or firms that are likely to be publicly-traded. Panel B reports the distribution of all firms in the bottom half of the size distribution.

Table A.7: Short-Run Effects on Capacity and Debt Robustness

	Y		N (1)	$3m$ (2)	$6m$ (3)	$12m$ (4)
	Δ Debt	Main IV Estimate as in Table 3	3,169	0.21 (0.08)	0.31 (0.09)	0.35 (0.11)
<i>Panel A:</i> Real Terms	Δ Debt	USD Terms Debt in U.S. Dollars	3,169	0.21 (0.08)	0.30 (0.09)	0.33 (0.12)
		Real Terms Debt deflated by CPI	3,169	0.21 (0.08)	0.31 (0.09)	0.34 (0.11)
<i>Panel B:</i> External Validity	Δ Debt	Weighted for External Validity to Match Private Firm Universe	3,169	0.18 (0.08)	0.32 (0.08)	0.31 (0.10)
		Subsample Largest 5% by Capacity to Match the Median Private Firm in Universe	156	0.39 (0.09)	0.46 (0.12)	0.49 (0.13)
<i>Panel C:</i> Balance Shifting	Δ Debt	Subsample No Account on Other Banks Ensure no shifting on Other Banks	2,352	0.24 (0.08)	0.35 (0.09)	0.39 (0.11)
	Δ Debt	Subsample No Cash Account Ensure no shifting on Cash	1,286	0.23 (0.09)	0.30 (0.10)	0.40 (0.12)

Note. This reports treatment effect robustness over different time horizons after the onset of the experiment. The first row reports IV estimates as shown in Table 3. Panel A reports estimates in U.S. dollars and real Turkish Liras. Real terms are deflated using the price deflator for Consumer Price Index. The first row of Panel B reports estimates reweighting the experimental sample to match the distribution of the universe of private firms in Türkiye using utilization bins reported in Table A.6. The second row of Panel B reports estimates restricting the sample to the largest 5 percent of firms using capacity utilization. The first two rows of Panel C reports estimates restricting the sample to subsample with no account at other banks (first row) and to those with no checking account at our bank (second row). Robust standard errors clustered at the business-level and reported in parentheses. Month-end exchange rate converting TRY to USD was obtained from Datastream.

Table A.8: Heterogeneous Treatment Effects:
Firm and Owner Demographics

Treatment Effect	Owner Age		Firm Age		Exclusive Banking	
	<i>Young</i> (1)	<i>Old</i> (2)	<i>Young</i> (3)	<i>Old</i> (4)	<i>No</i> (5)	<i>Yes</i> (6)
<i>A. Sales</i>						
Sales	2.76 (0.92)	2.71 (0.65)	3.05 (0.96)	2.31 (0.79)	3.81 (1.04)	2.36 (0.71)
P-value for diff	0.97		0.56		0.25	
Decomp (%)	72.9	27.1	35.9	64.1	60.0	40.0
<i>B. Profits</i>						
Profits	1.66 (0.67)	0.97 (0.38)	2.18 (0.67)	0.76 (0.58)	2.27 (0.71)	0.92 (0.51)
P-value for diff	0.364		0.12		0.12	
Decomp (%)	81.9	18.1	55.0	45.0	69.6	30.4
<i>C. Investment</i>						
Investment	1.03 (0.25)	0.62 (0.13)	0.49 (0.21)	0.81 (0.15)	0.28 (0.26)	0.93 (0.16)
P-value for diff	0.15		0.22		0.03	
Decomp (%)	71.1	28.9	39.2	60.8	9.3	90.7
<i>D. TFP</i>						
TFP	0.33 (0.20)	0.71 (0.23)	0.36 (0.14)	0.54 (0.31)	0.79 (0.44)	0.4 (0.19)
P-value for diff	0.23		0.63		0.44	
Decomp (%)	72.5	27.5	49.6	50.4	63.4	36.6

Note. This table presents heterogeneous treatment effects by pre-experimental firm and owner characteristics. Treatment effects represent average effects over the three years following the experiment, expressed in annualized rates, consistent with Column 8 in Tables 3 through 6. Each treatment-effect heterogeneity regression reports the treatment effects, the p-value for the difference between groups, and the share of the overall treatment effect explained by subgroup g , expressed as absolute shares, "Decomp (%)". See Appendix A for details on the computation of absolute shares. "Young" and "Old" owner and firm ages report to below and above-median owner and firm ages before the experiment. Exclusive banking refers to whether a firm has exclusive banking relationship with our partner bank or not. Standard errors reported in parentheses.

Table A.9: Heterogeneous Treatment Effects:
Encouragement

Treatment Effect	Prior Increases		Prior Reductions		Firm Size	
	≤ 1 (1)	> 1 (2)	<i>Never</i> (3)	≥ 1 (4)	<i>Small</i> (5)	<i>Large</i> (6)
<i>A. Sales</i>						
Sales	2.48 (1.36)	2.92 (0.66)	2.17 (1.32)	2.49 (0.74)	3.78 (1.02)	3.87 (0.65)
P-value for diff	0.78		0.83		0.94	
Decomp (%)	27.6	72.4	28.5	71.5	32.7	67.3
<i>B. Profits</i>						
Profits	0.66 (0.79)	1.65 (0.49)	1.83 (0.96)	0.97 (0.54)	2.88 (0.74)	1.51 (0.41)
P-value for diff	0.303		0.44		0.12	
Decomp (%)	15.3	84.7	46.4	53.6	48.7	51.3
<i>C. Investment</i>						
Investment	0.64 (0.15)	0.81 (0.22)	0.85 (0.22)	0.66 (0.17)	0.16 (0.20)	1.72 (0.21)
P-value for diff	0.52		0.49		0.00	
Decomp (%)	35.3	64.7	53.5	46.5	6.3	93.7
<i>D. TFP</i>						
TFP	0.17 (0.19)	0.84 (0.29)	0.45 (0.24)	0.42 (0.22)	0.74 (0.27)	1.3 (0.40)
P-value for diff	0.06		0.95		0.26	
Decomp (%)	28.4	71.6	58.9	41.1	44.4	55.6

Note. This table presents heterogeneous treatment effects by pre-experimental firm and owner characteristics. Treatment effects represent average effects over the three years following the experiment, expressed in annualized rates, consistent with Column 8 in Tables 3 through 6. Each treatment-effect heterogeneity regression reports the treatment effects, the p-value for the difference between groups, and the share of the overall treatment effect explained by subgroup g , expressed as absolute shares, "Decomp (%)". See Appendix A for details on the computation of absolute shares. Prior increase and reductions refer to whether a firm experienced below-median or above-median limit increases or decreases before the experiment. "Small" and "Large" firm size refers to firms with below- and above-median pre-experimental total debt. Standard errors reported in parentheses.

Table A.10: Drivers of Utilization

	No Controls			Controls		
	Util (1)	1(Util < p25) (2)	1(Util < p50) (3)	Util (4)	1(Util < p25) (5)	1(Util < p50) (6)
<i>Precautionary Motives</i>						
$\sigma^{Expense}$	-1.04 (0.26)	0.02 (0.01)	0.04 (0.01)	-1.33 (0.25)	0.03 (0.01)	0.04 (0.01)
$\sigma^{Cash\ flow}$	-1.56 (0.22)	0.06 (0.00)	0.01 (0.01)	-1.00 (0.23)	0.06 (0.00)	0.02 (0.01)
$\sigma^{Financing}$	-5.57 (0.21)	0.14 (0.00)	0.12 (0.01)	-5.03 (0.21)	0.125 (0.00)	0.117 (0.01)
<i>Firm & Owner Characteristics</i>						
ln(Expense)				9.93 (0.41)	-0.11 (0.01)	-0.03 (0.01)
ln(Sales)				-4.83 (0.34)	0.02 (0.01)	-0.01 (0.01)
ln(Total Debt)				3.739 (0.30)	0.02 (0.01)	-0.15 (0.01)
1(Freq Limit Ch)				-0.27 (0.23)	-0.03 (0.00)	0.02 (0.01)
1(Firm Old)				-0.74 (0.23)	0.01 (0.01)	0.00 (0.01)
1(Owner Old)				-0.85 (0.21)	0.00 (0.00)	0.02 (0.01)
R2	0.089	0.131	0.074	0.209	0.172	0.137

Note. This table presents a cross-sectional analysis of the factors influencing firms' utilization rates. The analysis is limited to the control group. The dependent variables include the utilization rate (multiplied by 100) and indicators for whether a firm's utilization rate falls below the 25th and 50th percentiles in the post-experiment period. All explanatory variables are measured using data from the pre-experiment period. Precautionary motives are defined as unexpected volatility in expenses, sales, and financing (i.e., total debt), after adjusting for seasonality and firm-specific, time-invariant characteristics. σ^x represents the standard deviation of residuals from a regression of a firm's X (e.g., cash flows) on time dummies and firm fixed effects. Firm characteristics include measures of size (log of expenses, sales, and total debt), the frequency of credit line limit increases before the experiment, and whether the firm or its owner is above the median age. The explanatory variables are standardized and therefore the estimates can be interpreted as the implied change in the outcome for a one standard deviation change in the explanatory variable.

Table A.11: Magnitudes

Paper	Data (1)	Definition of constrained (2)	Description (3)	Min Estimate (4)	Max Estimate (5)	Source (6)
<i>A. Investment</i>						
FHP (1988)	QFR	Dividend/Income Ratio <0.1	Investment on CF sensitivity	0.24 (0.01)	0.42 (0.04)	Table 5
GG (1994)	QFR	Firm Size <30th percentile of sales	Investment on coverage ratio		1.00 –	Table 7, diff btwn small and large
CTS (2012)	Compustat	Firm Size <30th percentile of sales	Investment on real estate value	0.07 (0.01)	0.09 (0.01)	Table 5 Table 7 small firms
AK (2025)	Privately-held Turkish Firms	Firm Size <30th percentile of debt	Investment on credit line limit increase		0.79 (0.13)	Table 5
<i>B. Sales</i>						
CM (2020)	QFR Microdata	Book asset in the bottom 99 percent	Sales growth on balance sheet proxies	0.30 (0.16)	0.83 (0.02)	Table 9, Col 1 and 4
AK (2025)	Privately-held Turkish Firms	Firm Size <30th percentile of debt	Sales growth on credit line limit increase		2.75 (0.60)	Table 6

Note. This table compares estimated magnitudes from prior studies and the present paper. Each row reports the definition of financially constrained firms, data source, outcome description, and the range of estimated effects. Panel A summarizes investment effects, and Panel B summarizes sales effects. Fazzari et al. (1988), Gertler and Gilchrist (1994), Chaney et al. (2012), and Crouzet and Mehrotra (2020) are denoted as "FHP", "GG", "CTS", and "CM", respectively. This paper is denoted as "AK".

Table A.12: Assessing Economic Magnitudes

	All Sample			Low Utilization		
	Parameters (1)	Data (2)	Model (3)	Parameters (4)	Data (5)	Model (6)
<i>A. Calibrated Parameters and Description</i>						
<i>R</i>	0.275			0.460		
<i>Profits scaled by business expense, pre-experiment</i>						
<i>L</i>	0.754			1.050		
<i>Capacity scaled by business expense, pre-experiment</i>						
<i>λ</i>	0.338			0.324		
<i>Chosen to match the observed Y3 default rate</i>						
<i>dI^*/dL</i>	0.545			0.390		
<i>Y3 treatment effect reported in Table 2</i>				0.390		
<i>B. Model-Implied dI^*/dL, given observed R, L, λ</i>						
<i>dI^*/dL</i>		0.545	0.292		0.390	0.217
<i>C. Model-Implied λ, given observed $R, L, dI^*/dL$</i>						
<i>λ</i>		0.338	0.499		0.324	0.576
<i>Default Rate</i>		0.133	0.221		0.082	0.197
<i>Ecog. Sig</i>			1.67			2.40

Note. This table compares model-implied and observed values of sensitivity dI^*/dL and cost-overrun risk, λ . Panel A reports the model parameters, with the corresponding data-based calculations described in italics. R and L are scaled by business expenses, which serve as a proxy for firm assets. λ was chosen to match the observed Y3 default rate in respective samples, and dI^*/dL is our experiment-based sensitivity reported in Table 3. All parameters are reported in annual rate. Panel B compares model-implied versus observed sensitivity. Model-implied sensitivity is calculated by solving for I^* using Equation 12, given the values of R, L , and λ listed in Panel A. Panel C compares model-implied versus observed (perceived) cost overrun uncertainty, λ , for given values of R, L , and dI^*/dL listed in Panel A. The Ecog. Sig. row reports the perceived default risk relative to the model-implied default risk. For example, column 3 reports that the perceived risk is 1.67 times larger than the actual default risk (0.221/0.133). Columns 1-3 report values using all sample and columns 4-6 report values for the low-utilization sample (firms with below median utilization pre-experiment) analyzed in Table 7.