How Equity Financing Relaxes Borrowing Constraints: Evidence from Private Equity*

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Abstract

We show that PE sponsors relax borrowing constraints by providing support in distress and injecting equity, allowing firms to borrow more at lower spreads, with lower seniority, and less reliance on collateral. Access to equity in distress reduces credit risk, facilitates investment and growth, and helps resolve distress. To isolate the causal effects of equity financing, we construct a shift-share instrument exploiting predetermined variation in sponsors' portfolio exposure to Covid-19 and hence in their capacity to support portfolio firms. Our findings highlight a complementarity between debt and equity: improved access to equity financing stimulates debt financing by expanding borrowing capacity.

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Over the past decades, private equity (PE) and leveraged buyouts (LBOs) have grown tremendously. Critics argue that PE funds, by increasing leverage in their portfolio companies, extract profits while leaving these firms with greater default risk and heightened vulnerability to financial distress.[1] Proponents argue that PE sponsors create value by actively engaging with their portfolio companies—for instance, through operational or governance engineering (Kaplan and Strömberg, 2009)—and provide support in distress resolution (Bernstein, Lerner, and Mezzanotti, 2019; Hotchkiss, Smith, and Strömberg, 2021).

In this paper, we show how PE sponsors' support in distress—and their equity injections in particular—are in fact crucial to enabling higher leverage by expanding borrowing capacity, that is, the supply of credit. We propose a novel shift-share instrument for the PE sponsors' support and provision of equity capital, based on Covid-19 as the shift, capturing market-wide distress, and sponsors' pre-determined portfolio exposure to Covid-affected industries as the share. Our approach compares, during Covid, PE-backed firms that differ in their sponsors' exposure to Covid and thus in their access to support and equity financing provided through sponsors, allowing us to identify the effects of equity financing on credit supply.

More broadly, using private equity as a laboratory, the paper demonstrates that improved access to equity financing and the presence of large, engaged shareholders can stimulate debt financing and investment by relaxing borrowing constraints. In particular, debt and equity can act as complements in a firm's capital structure, as shown theoretically in Hartman-Glaser, Mayer, and Milbradt (2025) or Bolton, Jiang, Wang, and Yang (2025).

For our analysis, we combine the Federal Reserve's Y-14 H.1 schedule (henceforth, Y-14 data) with PitchBook to construct a novel and comprehensive database of U.S. LBOs.[2] Our sample, spanning 2012-2024, includes over 4,000 PE-backed, bank-reliant U.S. firms, that obtained over 12,200 credit facilities in the entire cross-section. Our sample provides

[1] See, for instance, a recent recent Chicago Business Law Review article tilted "*The Dark Side of Private Equity*," or an article in The Financial Times from January 25, 2025, titled "*Leveraged to the hilt: PE-backed firms hit by wave of bankruptcies.*"

[2] The Y-14 data are collected as part of the Comprehensive Capital Analysis and Review (CCAR) process for bank holding companies and support Dodd-Frank stress tests, covering approximately 70–75% of total U.S. commercial and industrial (C&I) lending.

extensive coverage of middle-market firms and includes detailed, time-varying information at both the firm and the bank loan level.

A distinctive feature of our data is the detailed information on bank loan terms, including commitments, interest rates, collateral, and internal bank credit ratings. These data are central to our analysis, as they allow us to disentangle PE sponsors' effects on credit supply from demand-side channels. We conduct our main analysis at the loan level on a quarterly basis, regressing loan-level outcomes on indicators of PE sponsorship in the baseline and on measures of sponsor support in distress in our instrumental variable analysis.

We begin by establishing key differences between PE-backed and non-PE-backed firms in their financing structure. We find that PE-backed firms feature higher leverage — both in the cross section (comparing PE-backed and non-PE-backed firms with the same credit ratings) and in the time series (comparing the same firm before and after the buyout). In general, PE-backed firms rely more heavily on debt financing, also after the buyout.

We provide evidence consistent with a supply-side explanation behind PE-backed firms' greater reliance on debt financing. To this end, we examine firms' reliance on collateral in debt financing, focusing on their use of asset-based and cash flow-based loans (Lian and Ma, 2021). Asset-based loans are secured by explicit collateral that can be separated from the firm and liquidated independently. Cash flow-based debt, by contrast, is not explicitly collateralized—it is either unsecured or secured by the firm as a whole via a blanket lien—and therefore holds lower priority in bankruptcy relative to explicitly collateralized (asset-based) loans. We find that PE-backed firms rely less on collateral and more on cash flow-based debt than non-PE-backed firms. That is, lenders are willing to extend credit to PE-backed firms without explicit collateral. The fact that PE-backed firms simultaneously borrow more and rely less on collateral indicates a greater credit supply for PE-backed firms.

Regarding PE-backed firms' reliance on equity financing, we document that these firms commonly receive equity injections from their sponsors, to finance investment or to resolve distress. We provide evidence that many such injections are distress-driven: non-investment

grade PE-backed firms are more likely to receive injections and did so especially during Covid-19, relative to investment-grade PE-backed firms that are less likely to be in distress. We also show that PE-backed firms exhibit both greater debt issuance and greater equity issuance, consistent with a complementarity between debt and equity financing.

Our key contribution is to link these patterns and identify sponsor support in distress as a mechanism that expands credit supply, enabling firms to invest, grow, and resolve distress. Equity injections are a particularly important form of such support, which should expand borrowing capacity through two channels: first, by increasing the sponsor's skin in the game, reinforcing incentives to provide support and enhance firm performance; and second, by providing immediate recapitalization that alleviates distress, strengthens the balance sheet, or finances value-enhancing investment. Thus, access to equity financing effectively insures the debt claim, reducing credit risk. Overall, PE-backed firms' access to equity financing through sponsors is crucial in relaxing borrowing constraints.

To isolate the causal effects of equity financing and sponsor support on credit supply, we exploit plausibly exogenous variation in a sponsor's ability to support its portfolio firms using a shift-share instrumental variable approach. Specifically, we focus on the onset of the Covid-19 pandemic in early 2020, which constituted a period of market-wide distress and heightened liquidity needs (Chodorow-Reich, Darmouni, Luck, and Plosser, 2022).

For each PE-backed firm, we identify the firm's PE sponsor and construct a measure of the sponsor's exposure to the Covid shock based on its existing portfolio prior to the pandemic. This measure is calculated as the sum of the sponsor's pre-Covid deal size-weighted portfolio weight in each (NAICS-3) industry multiplied by the detrended year-over-year growth in industry revenues during Covid. A higher value indicates that the sponsor's portfolio was less adversely affected by Covid—meaning the sponsor is less "distracted" by other portfolio firms—and thus retains greater capacity to engage with and support the focal firm through equity injections.

Accordingly, for any PE-backed firms, we instrument its access to support and equity

injections during Covid-19 through its sponsor's exposure to Covid-19. The instrument is relevant: less negative sponsor exposure indeed raises the likelihood that a portfolio firm receives an equity injection. Moreover, sponsor exposure is calculated based on the sponsor's portfolio composition prior to the pandemic and is therefore plausibly exogenous conditional on the aggregate Covid-19 shock, supporting the validity of the exclusion restriction.[3] Taken together, the instrument captures exogenous variation in PE-backed firms' access to support and equity financing during Covid.

For the instrumental variable analysis, we focus only on the subsample of PE-backed firms. We include year-quarter and bank×rating fixed effects, effectively comparing loans by the same bank within the same internal rating category (i.e., with similar credit risk). We use the sponsor-level Covid-exposure measure in two ways: (1) in reduced-form specifications, it broadly proxies for sponsor-level support capacity across various channels, such as the sponsor's operational engineering, monitoring, or its capacity to provide equity financing; and (2) as an instrument for equity injections during Covid in a two-stage least squares framework. The latter approach allows us to isolate the causal impact of equity injections on firms' borrowing capacity. Importantly, both approaches yield similar findings. For brevity, we refer to the mechanism broadly as "sponsor support."

We find that sponsor support in distress raises PE-backed firms' reliance on debt financing and leverage (i.e., Debt/EBITDA) ratios. In particular, equity injections raise firms' propensity to obtain additional credit, along both the extensive margin (new loans) and the intensive margin (loan amounts). Note that this increased reliance on debt financing can reflect heightened credit demand or supply.

To disentangle demand- from supply-side explanations, we show that sponsor support is associated not only with a greater quantity of credit, but also with more favorable price

[3] A natural concern is that sponsors' negative Covid-19 exposure correlates with their portfolio firms' own exposure—for instance, due to industry specialization (Spaenjers and Steiner, 2024). However, this would bias our estimates *against* finding our result: more negatively exposed sponsors would be paired with more negatively exposed firms and thus become more likely to inject equity, weakening the correlation between less negative exposure and equity injections that we document.

terms (lower credit spreads) and non-price terms (lower seniority and reduced reliance on collateral). Following an equity injection, PE-backed firms borrow more at lower spreads, with reduced reliance on collateral and seniority: this indicates an outward shift in the credit supply curve (i.e., greater borrowing capacity) following equity injections.

Regarding non-price terms, we focus on firms' use of collateral and seniority in debt financing. The asset-based/cash flow-based and senior/junior distinctions discussed above share two important features: (1) cash flow-based debt, like junior debt, holds lower priority in bankruptcy relative to asset-based (senior) debt; and (2) granting seniority or pledging explicit collateral through asset-based debt entails (opportunity) costs for borrowers (Benmelech, Kumar, and Rajan, 2024). Interestingly, sponsor support in distress and equity injections are associated with greater use of junior debt and reduced reliance on asset-based debt, again pointing toward a supply-side explanation.

We further show that sponsor support and equity injections are associated with subsequent improvements in operating performance and reductions in credit risk—specifically, lower bank-estimated (ex-ante) probabilities of default and loss-given-default measures. Thus, sponsor support and equity injections help resolve firm-level distress, improving fundamentals and enhancing borrowing capacity. Sponsor support in distress also translates into real effects: PE-backed firms receiving greater support increase their investments and experience stronger sales growth, relative to PE-backed firms receiving less support. The increased investment may be facilitated by the injected equity capital, by relaxed borrowing constraints, or both, and may in turn feed back into further enhancing borrowing capacity.

Taken together, we show that equity financing and distress support provided by large, engaged shareholders—in our context PE sponsors, and more broadly institutional investors—relaxes firms' borrowing constraints, reduces credit risk, and facilitates greater debt financing and investment. Overall, our findings suggest that PE-backed firms' higher leverage reflects, in part, their higher credit supply, driven by their superior access to equity.

Related Literature. We contribute to the literature on corporate borrowing constraints

and debt structure, including empirical work by Rauh and Sufi (2010), Chodorow-Reich et al. (2022), Lian and Ma (2021), Weitzner, Swem, Titman, and Almazan (2025), and Benmelech et al. (2024) and seminal theories of Holmstrom and Tirole (1997) or Kiyotaki and Moore (1997). We contribute to this literature by showing that (i) improved access to equity financing and (ii) the presence of engaged large shareholders—in our context PE sponsors (who play an active role, as argued by Jensen (1989)), and more broadly institutional investors in public markets—can relax borrowing constraints (consistent with Gryglewicz, Mayer, and Morellec (2025)), facilitate distress resolution, and reduce default risk. Overall, our findings demonstrate that debt and equity financing can act as complements in a firm's capital structure, in line with the theory in Hartman-Glaser et al. (2025).[4]

A large literature studies the real and operational effects of private equity (see, among others, Boucly, Sraer, and Thesmar (2011); Lerner, Sorensen, and Strömberg (2011); Acharya, Gottschalg, Hahn, and Kehoe (2013); Davis, Haltiwanger, Handley, Jarmin, Lerner, and Miranda (2014); Bernstein and Sheen (2016); Gornall, Gredil, Howell, Liu, and Sockin (2021); Fracassi, Previtero, and Sheen (2022)). These papers typically focus on investment, growth, and employment, and operational or governance engineering as channels of value creation, also emphasized in Kaplan and Strömberg (2009) or Gryglewicz and Mayer (2022).

A broader contribution to the PE literature is the construction of an instrument for the effects of private equity and more specifically PE-backed firms' access to equity financing, exploiting sponsors' heterogeneous exposure to Covid-19. Our IV approach shares similarities with that in Kempf, Manconi, and Spalt (2017) and Liu, Low, Masulis, and Zhang (2020), who study the effects of distracted institutional investors on firm monitoring.[5] Analogously, higher Covid exposure renders PE sponsors "distracted," reducing their support for portfolio firms (for instance, via monitoring), and provision of equity financing. Different from Kempf et al. (2017) or Liu et al. (2020), our instrument directly captures variation in equity financing

[4] Weitzner et al. (2025) argue that going public can reduce borrowing constraints by mitigating asymmetric information, a mechanism distinct from the sponsor support and equity injections emphasized in our paper.

[5] Similarly, Abuzov (2025) constructs an instrument VC screening based on distracted VC partners.

for PE-backed firms, allowing us to study its effect on borrowing constraints.

Our paper complements studies of capital structure and leverage in LBOs (Axelson, Strömberg, and Weisbach, 2009; Axelson, Jenkinson, Strömberg, and Weisbach, 2013; Cohn, Mills, and Towery, 2014; Shive and Forster, 2021) and, more broadly, the effects of PE sponsors on debt financing (Demiroglu and James, 2010; Ivashina and Kovner, 2011; Badoer, Emin, and James, 2021; Haque, Mayer, and Wang, 2026). Our work contributes to this literature by showing how private equity and access to equity financing more broadly expand borrowing capacity, disentangling the supply-side effects driving PE-backed firms' heightened leverage from demand-side explanations.

Hotchkiss et al. (2021) examine PE sponsors' role in distress resolution, focusing on its outcomes. Our work instead focuses on the effects of private equity on financing constraints: (i) we show that relaxing borrowing constraints is a central mechanism in distress resolution; (ii) we provide causal evidence on the effects of sponsor support and equity injections in distress on borrowing constraints, investment, and performance.

Most closely related to our paper, Bernstein et al. (2019) study the performance and financial fragility of PE-backed firms in the UK during the global financial crisis (GFC) of 2008. Besides focusing on a different geographic region (i.e., the U.S.) and sample period (i.e., post-GFC), our paper differs in two key ways. First, we provide causal evidence, using a shift-share instrument, that sponsor support in distress and equity injections relax borrowing constraints. Second, our detailed loan-level data—including collateral, spreads, and seniority—allows us to disentangle supply and demand effects: while concurrent equity and debt issuance could reflect either increased supply or demand for financing, we show that equity injections and sponsor support drive greater debt financing by expanding its supply.

1 Data and Sample Characterization

We create a novel and large sample of PE-backed, bank-reliant, small and middle-market firms in the U.S. by merging two data sources: The Federal Reserve's Y-14 data, containing an extensive collection of commercial loans, and U.S. buyout deals from Pitchbook. The sample period is from 2012Q3 to 2024Q1.[6] Variable definitions are provided in Appendix A.

1.1 Private Equity Data from Pitchbook

We use Pitchbook to identify firms that underwent leveraged buyouts. Pitchbook is regarded as one of the most comprehensive databases for private equity buyouts in the U.S. (Gornall et al., 2021). We only focus on leveraged buyouts, and exclude all other types of PE deals (e.g., venture capital). Pitchbook's buyout data contain identifying information on sponsored portfolio companies, the name of the sponsor, deal size and deal closing dates allowing us to determine whether at a given point in time a firm is PE-backed (i.e., owned by a PE fund/sponsor). Importantly, we use Pitchbook to identify each sponsor's full history of deals, allowing us to construct sponsor-level (ex-ante) measures of exposure to the Covid-19 pandemic that affected various sectors differentially.

1.2 Credit data from the Federal Reserve's Y-14

We obtain detailed financial and accounting data for private firms from the Federal Reserve's FR Y-14Q H.1 collection for commercial loans (in short, the Y-14 data).[7] This dataset covers detailed information on all bilateral and syndicated loan facilities with committed amounts over $1 million held by Bank Holding Companies (BHCs) subject to the Federal Reserve's stress tests.[8] These reporting banks hold over 85% of total U.S. banking assets (Caglio, Darst,

[6] Although Y-14 data collection started from 2011Q3, we allow a phase-in period for the data collection and reporting quality to stabilize.

[7] For details on every variable contained in schedule H.1. and how banks are required to report information to the Federal Reserve, see the Table beginning in page 170 in the publicly available reporting form.

[8] A loan facility is a lending arrangement between a bank and a borrower that may encompass multiple loans of different types, such as credit lines or term loans. Banks categorize the facility type based on the

and Kalemli-Özcan, 2021) and account for roughly 70–75% of all commercial & industrial (C&I) lending (Minoiu, Zarutskie, and Zlate, 2021).

The Y-14 data provide a granular view of loan contracts across firms on a quarterly basis. Besides the amount of committed credit - an important proxy for credit supply - the dataset includes interest rates, maturity, collateral, lien structure, ex-ante estimates of loss given default (LGD), probability of default, loan-type (e.g., credit line or term loan), as well as banks' own internal credit ratings which allow us to control for borrower risk. The origination date allows us to separate new loans from existing ones each quarter. Information on collateral type allows us to identify loans backed by the liquidation value of assets from those backed by going-concern value of the firm (Lian and Ma, 2021; Jang, Kim, and Sufi, 2025). Information on lien structure allows us to identify junior or subordinated credit facilities relative to first lien or second lien senior secured credit.

Banks also report financial information for borrowers (reported annually, unlike the loan data which is reported quarterly). Borrower-level information include detailed income statement and balance sheet data. Our analysis relies relatively more on the quarterly loan-level data - which is more detailed and granular - but we also make use of the firm-level balance sheet data.[9]

Merging Y14 with Pitchbook. We merge information on PE-backed firms from Pitchbook with their financial information in the Y-14 data using a string matching algorithm outlined in Cohen, Dice, Friedrichs, Gupta, Hayes, Kitschelt, Lee, Marsh, Mislang, Shaton, et al. (2021), and then manually verify the accuracy of our match. The primary merge is based on borrower names, with secondary checks based on the borrower's industry and city. Further details of our data cleaning procedure are described in Appendix B.[10]

We are able to confidently match 4,542 portfolio companies post-buyout (i.e. at or after

loan type that represents the majority of total commitment amount.

[9]Borrower financials are available for roughly 60% of firms, with higher coverage among larger borrowers.

[10]For company-level matching, the algorithm uses a two-stage matching method that pairs traditional string matching techniques with probabilistic record linkage methods. We refer the interested readers to Cohen et al. (2021) for further details. An example of the R package for the company-level match can be found on Github.

the buyout date) to the Y-14. Out of these, 4,033 firms report financial information which we use throughout our formal analysis (some as outcome variables and others as controls), and thus forms the basis for our baseline analysis. Simple back of the envelope calculations reveal that these firms obtained 12,218 unique credit facilities from banks in the entire cross-section, and the aggregate book debt held by these firms exceed $500 Bn by the end of our sample period. To the best of our knowledge, this is one of the largest private equity samples that contain comprehensive post-buyout and time-varying balance sheet information and loan-level data.

1.3 Sample Characteristics and Summary Statistics

Table 1 presents firm level summary statistics for PE-backed and non-PE backed borrowers. Note that the Y14 data, due to its extensive coverage of private firms, also captures many small and medium enterprises and as a result the number of non-PE backed firms is substantially higher compared to PE-backed firms. We provide a a brief discussion of the summary statistics, before analyzing the key differences between PE-backed and non PE-backed firms for our setting in the next section.

We observe that PE-backed firms are substantially larger in terms of total assets. The mean asset value of PE-backed firms is $720 million, more than twice that of non-PE firms. Consistent with prior studies, we also observe PE-backed firms have much higher leverage ratios (Debt/EBITDA). Mean (median) leverage ratio if PE-backed firms is around 3.6x (3.0x), while it is 2.8x (1.8x) for non-PE firms. We observe PE backed firms have lower share of tangible assets, lower EBITDA but comparable sales growth. Finally, we observe that while median capital expenditure - measured as the year-on-year change in fixed assets - is relatively flat (0 percent), the mean is negative for PE-backed firms. This suggests some firms in the tail end of the distribution could be divesting their assets.

Table 2 reports loan level summary statistics for PE-backed and non-PE firms. Consistent with PE-backed firms being larger, we observe that loan commitment amount to

PE-backed firms are larger. In line with prior studies that show sponsor-backed firms tend to be riskier (Hotchkiss et al., 2021; Axelson et al., 2013), we see interest rate and bank estimated probability of default is higher for PE-backed loans. Finally, we observe PE-backed loans are more likely to be backed by the going-concern value of the firm (i.e. cash flow based) as opposed to the liquidation value of assets (asset-based).

2 Capital and Debt Structure in PE-Backed Firms

We highlight key differences between PE-backed and non PE-backed firms in terms of their capital and debt structure. To preview and summarize, PE-backed firms have higher leverage, exhibit generally an increased reliance on debt financing (also post-buyout), but rely less on collateral to back their debt financing. At the same time, they commonly receive equity injections from their PE sponsors after the buyout. In Section 3, we link these patterns and provide a unified explanation: PE sponsors enhance their portfolio firms' borrowing capacity by providing support in distress and access to equity financing.

2.1 Empirical Approach

We will present the key capital structure differences between PE-backed and non PE-backed firms primarily as regression results at the bank-loan or firm level. Our main regression specification reads:

$$y_{l,i,b,t} = \beta PE_{i,t} + X_{l,i,b,t} + FEs_{l,i,b,t} + \varepsilon_{l,i,b,t}. \tag{1}$$

Here, l denotes a loan made by bank b to borrower firm i. The loan-level (or firm-level) outcome $y_{l,i,b,t}$ is observed at date t, and all loan-level regressions are conducted at the quarterly level, consistent with the reporting frequency for loan-level outcomes. Since firm-level data is reported annually, regressions exploiting firm balance sheet data are naturally at the firm-year level. The indicator $PE_{i,t}$ captures whether firm i—and thus loan l—is PE-backed at time t. The coefficient of interest, β, measures differences between PE-backed

and non-PE-backed loans and borrowers.

We include year-quarter fixed effects, as well as bank×rating fixed effects to control for borrower risk: thus, we effectively compare loans made by the same bank to PE-backed and non PE-backed borrowers within the same bank-internal credit rating category. Indeed, several studies have shown that banks' (time-varying) internal credit assessments accurately reflect borrower risk (Claessens, Ongena, and Wang, 2024; Weitzner and Howes, 2023; Beyhaghi, Howes, and Weitzner, 2024). Thus, our approach ensures that the observed capital structure differences between PE-backed and non PE-backed firms do not merely reflect differences in credit risk. We further control for loan maturity, firm size (logarithm of total assets), and the share of tangible assets in total assets. Crucially, assets and their tangibility are key determinants of a firm's collateralizable assets.

2.2 Results

2.2.1 PE-Backed Firms Have Higher Leverage and Use More Debt

We begin by showing that, comparedt to non PE-backed firms, PE-backed firms exhibit higher leverage. A similar pattern is also documented in, for instance, Brown (2021); Hotchkiss et al. (2021). First, Figure 1 shows that leverage, measured as Debt/EBITDA, increases at the time of the buyout.[11] Importantly, leverage remains elevated after the buyout, indicating that the LBO results in a persistent increase in debt and a lasting change in capital structure, consistent with the evidence in Shive and Forster (2021).

Second, we estimate firm-level regressions with Debt/EBITDA ("leverage ratio") as the outcome variable, effectively comparing PE-backed and non PE-backed firms with similar levels of credit risk (as we include rating fixed effects). Table 3 presents the estimation results and shows that PE-backed firms are associated with higher leverage ratios across all three specifications. Indeed, the results are robust to excluding the Covid-19 year 2020 and

[11]The figure is restricted to four years post-buyout, as the typical deal has a holding period of approximately four to five years (Brown, 2021).

for PE-backed firms the year of the LBO.

Related, we show that PE-backed firms rely more heavily on debt financing even after the buyout. That is, the higher leverage is not merely driven by a one-time increase at the time of the buyout but reflects a persistent increase in reliance on debt financing. To this end, we estimate loan-level regressions of the form (1) to examine PE-backed firms' propensity to borrow more, relative to that of non PE-backed firms. Our outcome variables include an indicator for whether a given loan is newly originated at time t, which measures a borrower's propensity to obtain a new loan (the extensive margin), as well as the newly originated loan amount (the intensive margin).

Columns (1) and (2) of Table 4 show that PE-backed firms are more likely to obtain new loans and receive larger loan amounts than non-PE-backed firms with the same bank-internal credit rating. Similarly, Table 5 confirms these findings at the firm level, showing that PE-backed firms exhibit greater overall debt issuance. In short, PE-backed firms heavily rely on debt financing, and this pattern extends beyond the buyout event.

Because we control for credit risk using bank-internal ratings, the higher leverage and greater use of debt by PE-backed firms do not simply reflect increased risk-taking or elevated default risk. Conditional on credit risk, the higher leverage of PE-backed firms may instead reflect stronger demand for credit or a greater supply of credit, that is, an expansion of borrowing capacity. Importantly, on Section 3, we disentangle demand and supply: We show that PE sponsors enhance borrowing capacity and thus credit supply through active engagement and equity injections. Before turning to that analysis, we present additional evidence consistent with PE-backed firms' enhanced borrowing capacity.

2.2.2 PE-Backed Firms Rely Less on Collateral and Asset-Based Loans

We examine the debt structure of PE-backed firms, focusing on the use of collateral in debt financing, and specifically on firms' choice between asset-based and cash flow-based loans (Lian and Ma, 2021). Asset-based loans are explicitly collateralized/secured by assets

that can be separated from the firm and liquidated independently (such as real estate). By contrast, cash flow-based debt is not explicitly collateralized: it is either unsecured or secured by the firm as a whole through a blanket lien, that is, backed by the firm's going-concern value and future cash flows rather than by specific, separable assets.

Importantly, this structure implies that cash flow-based debt typically has lower priority in bankruptcy than asset-based debt. Along the spectrum of securities, cash flow-based debt is therefore more sensitive to firm performance and inherently riskier than asset-based debt. Moreover, asset-based debt—being explicitly secured—corresponds to more stringent debt terms, as it requires firms to pledge specific collateral, which is costly and potentially restrictive (Benmelech et al., 2024).

Our empirical analysis controls for firms' total assets and asset tangibility, which are key determinants of the collateral available to secure explicitly collateralized, asset-based debt. Conditional on these determinants of pledgeable collateral, the observed degree of collateralization is informative about a firm's borrowing capacity. Firms that rely less on collateral and asset-based debt—that is, those that use more cash flow-based debt—are likely less constrained by the liquidation value of their assets, as lenders are willing to extend credit without requiring explicit collateral. Such firms therefore exhibit greater borrowing capacity. By contrast, greater reliance on collateral suggests that creditors are only willing to extend additional credit against specific pledged assets. In this case, borrowing capacity appears more tightly constrained by asset liquidation values, and firms face tighter borrowing constraints.

Columns (4)–(6) of Table 4 examine PE-backed firms' reliance on cash flow-based debt and thus their use of collateral in debt financing, using three outcome variables: (A) an indicator for whether a given loan is a newly originated cash flow-based loan (column 3), (B) an indicator for whether a given loan is cash flow-based (column 4), and (C) the loan commitment size of cash flow-based loans (in logarithm, set to zero for asset-based loans) in column (5). Each outcome variable captures a firm's reliance on cash flow-based debt and,

inversely, its use of collateral in debt financing (i.e., its reliance on asset-based debt).

The results — presented in columns (3)-(5) — reveal that PE-backed firms exhibit a higher propensity to obtain cash flow-based loans and receive larger loan amounts of this type. This holds after controlling for credit risk and for the firms' total assets and their tangibility, all of which are key determinants of the total collateral firms can pledge. That is, PE-backed firms rely less on collateral in debt financing, which is consistent with them facing higher borrowing capacity.

One potential concern with interpreting collateral use as a proxy for borrowing capacity is that cash flow-based debt may be more prevalent among firms with low leverage and low default risk, while firms approaching distress may pledge collateral and rely more heavily on asset-based lending, as documented in Benmelech, Kumar, and Rajan (2022). In that case, a higher share of cash flow-based debt would not necessarily imply greater borrowing capacity. However, this concern is unlikely to drive our results.

Overall, PE-backed firms not only borrow more but also rely less on collateral when doing so. The fact that they simultaneously borrow more and rely less on collateral is consistent with an expanded supply of credit and greater borrowing capacity for PE-backed firms. Put differently, PE-backed firms are able to borrow to a greater extent against their cash flows and are therefore less constrained by the liquidation value of their tangible assets. Lenders appear willing to extend credit to PE-backed firms without requiring explicit collateralization. These findings suggest that PE backing expands borrowing capacity and credit supply.

2.2.3 PE-Backed Commonly Access Equity Financing

We next document the prevalence of (post-buyout) equity injections by PE sponsors, highlighting that PE-backed firms face greater access to equity financing than non-PE-backed firms. We measure equity injections on the extensive margin through a time-varying indicator variable which takes a value of one if a firm's change in equity minus profit is positive in a given year. As shown in Figure 2, such equity injections after the LBO are common, with

a substantial share of PE-backed firms receiving additional equity in any given year across most of our sample period. Importantly, Figure 2 excludes equity injections associated with the LBO transaction itself and focuses exclusively on post-buyout injections. The figure further distinguishes PE-backed borrowers by their credit rating, contrasting investment-grade and non-investment-grade borrowers.

Equity injections after the LBO likely reflect two main motives: (i) resolving financial distress, and (ii) funding add-on acquisitions, a common PE strategy. These channels are not mutually exclusive. Two patterns in Figure 2 suggest that a significant share of equity injections are linked to distress. First, across all years, equity injections are substantially more common among non-investment-grade borrowers than among investment-grade borrowers (notably, around 80% of PE-backed firms in our sample are non-investment-grade). Non-investment-grade firms are more likely to enter distress and require support from PE sponsors. Second, equity injections spiked sharply for non-investment-grade borrowers during the Covid-19 pandemic—a negative cash flow shock and period of aggregate distress for many firms—while remaining flat for investment-grade borrowers.

In this paper, we link equity injections to debt financing, showing that they relax borrowing constraints and point to a broader complementarity between debt and equity financing. That is, access to equity financing stimulates debt financing by relaxing borrowing constraints. Tables 5 and A1 provide preliminary evidence. Table 5 shows that PE-backed firms exhibit both higher debt issuance and a higher propensity to receive equity injections.

Table A1 considers the sample of PE-backed firms, examining their reliance on debt financing following equity injections. It shows that equity injections are associated with new debt financing: PE-backed firms receiving equity injections also exhibit a higher propensity to take out new loans. Table A1 also shows that equity injections are associated with an increased propensity to take out new cash flow-based loans, i.e., reduced reliance on collateral. In short, following equity injections, PE-backed firms borrow more and rely less on collateral.

Crucially, the increased reliance on debt financing following an equity injection may

reflect either higher credit demand or an expansion of credit supply. The occurrence of both equity injections and debt issuance around the same time could arise if firms face investment-driven financing needs, thus raising both debt and equity. Put differently, whether the firm receives an equity injection is endogenous, and reflects credit demand. In the next section, we disentangle supply from demand effects and exploit exogenous variation in firms' access to equity financing, showing how equity injections raise the supply of credit.

3 Equity Financing Expands Borrowing Capacity: Empirical Approach and Design

We have shown that PE-backed firms exhibit higher leverage and rely more intensely on debt financing. We argue that this reflects a supply-side mechanism whereby PE sponsors provide support in distress and equity financing to their portfolio firms, thereby relaxing borrowing constraints and facilitating greater borrowing. We next discuss the theoretical mechanisms driving this results, before turning to the empirical design and identification.

3.1 Theoretical Mechanism

In general, PE sponsors actively engage with their portfolio firms, for instance, through operational and governance engineering (Kaplan and Strömberg, 2009; Bernstein and Sheen, 2016; Gryglewicz and Mayer, 2022), monitoring, or, notably, by providing active support in distress resolution (Hotchkiss et al., 2021). All else equal, these activities — both during and outside periods of distress — should enhance firm performance and operations, and reduce credit risk, thereby expanding borrowing capacity.

A particularly important form of sponsor support is through the provision of equity financing, specifically, by injecting equity in distress situations. For PE-backed firms, the improved access to equity financing enhances borrowing capacity, a mechanism formalized theoretically in Hartman-Glaser et al. (2025). This enhanced credit supply can explain why

PE-backed firms have higher leverage and rely more on debt. Our instrumental variable analysis below zooms into this equity financing channel, exploiting exogenous variation in PE-backed firms' supply of equity financing from sponsors.

More in detail, access to equity equity financing increases borrowing capacity, both through the expectation/anticipation that equity financing can be raised during distress and through the realization of an equity injection. The expectation that sponsors will inject equity to resolve distress reduces the credit risk borne by lenders, making them more willing to lend and less likely to require collateral.

Realized equity injections expand borrowing capacity through two additional channels. First, they provide immediate recapitalization, alleviating financial distress and strengthening the firm's balance sheet. The equity capital injected might also be used to finance value-enhancing expenditures and investments, which raises the firm's value and thus borrowing capacity. Second, they increase the sponsor's skin in the game, reinforcing incentives to resolve distress, improve operations, and provide continued (equity) support if needed.

3.2 Empirical Design

Our key contribution is to identify sponsor support in distress—particularly through equity injections—as a mechanism that expands credit supply and enhances borrowing capacity. To this end, we exploit the onset of the Covid-19 pandemic (i.e., first three quarters of 2020) as a period of aggregate distress and heightened liquidity needs (Chodorow-Reich et al., 2022). We leverage plausibly exogenous variation in a sponsor's ability to support its portfolio firms during Covid-19 using a shift-share instrumental variable approach. While Covid-19 is the "shift," we next discuss the construction of sponsor exposure to Covid as the "share."

3.2.1 Sponsor Exposure to Covid

For each PE-backed firm, we identify its PE sponsor and construct a measure of the sponsor's exposure to the Covid-19 shock based on its pre-Covid portfolio composition across industries

differentially affected by Covid. Sponsors whose portfolios were more negatively exposed are effectively distracted, reducing their capacity to support the focal firm and inject equity.

To calculate industry-level portfolio weights, we use NAICS 3-digit industry classifications and all deals undertaken by a given sponsor between January 2017 and February 2020. A sponsor's portfolio weight in a given industry is the deal size-weighted share of deals in that industry.[12] Having determined these pre-Covid industry-level portfolio weights, we calculate the exposure to Covid-19 measure by summing each industry's portfolio weight multiplied by the detrended year-over-year revenue growth of that industry during Covid. Since most industries experienced revenue declines during Covid—and even those that continued to grow did so at rates below their pre-Covid trends, implying negative detrended growth—the exposure measure is typically negative, with more negative values indicating greater exposure. Our approach is similar to that in Chodorow-Reich et al. (2022), who examine banks' loan portfolios based on differential industry exposure to Covid-19, while we study sponsors' portfolios.

Crucially, the exposure measure is defined at the sponsor level; since each PE-backed firm i corresponds to a PE sponsor, we write $Exposure_i$ for the measure of how much firm's i sponsor is exposed to Covid-19 A higher value of $Exposure_i$ indicates, for a given PE-backed firm i, that the sponsor's portfolio was less adversely affected by Covid—meaning the sponsor is less "distracted" by other portfolio firms—and thus retains greater capacity to support the firm i and to provide equity financing to i.

3.2.2 Shift-Share Instrumental Variable for Sponsor Support

We use this measure of sponsor exposure within a shift-share instrumental variable framework, capturing exogenous variation in the supply of sponsor support and equity financing during Covid for PE-backed firms. In this context, $Exposure_i$ represents the pre-determined share, while the aggregate Covid shock serves as the shift, captured by the dummy $Covid_t$

[12] Deals with missing deal sizes are excluded from the calculation.

(equal to one for the first three quarters of 2020, and zero otherwise). The interaction term, $Exposure_i \times Covid_t$, serves as an instrument for firm i's access to sponsor support in distress and equity financing. Indeed, higher values of $Exposure_i \times Covid_t$ correspond to lower exposure and thus greater capacity to provide support and to inject equity.

A higher value of $Exposure_i \times Covid_t$ indicates that the sponsor's portfolio was less adversely affected by Covid, and thus that the sponsor retains greater capacity to support firm i, including through equity injections. Conversely, sponsors more negatively exposed to Covid were effectively "distracted" and had reduced ability to support their portfolio firms, whether through equity injections or other forms of engagement. We next discuss instrument relevance and the exclusion restriction.

Instrument Relevance. In our two-stage least squares regressions, the first stage provides direct evidence of instrument relevance. Sponsor exposure to Covid-19 is positively associated with the likelihood that a firm receives an equity injection (see, for example, Table 6). Put differently, a given PE-backed firm has better access to equity financing, when its sponsor is less adversely affected by Covid. Figure 3 offers a graphical illustration of this relationship, showing a strong positive association between less negative sponsor exposure (i.e., values closer to zero) and equity injections. Thus, we conclude the instrument is relevant.

In addition, we show in Section 4.3 that less negative sponsor exposure is associated with stronger operating performance and lower credit risk during Covid-19. This further corroborates the instrument's relevance in capturing sponsor support during distress, which may enhance firm value.

Exclusion Restriction. Regarding the exclusion restriction, our exposure measure is predetermined based on the sponsor's portfolio composition prior to the pandemic and is therefore plausibly exogenous, conditional on the aggregate Covid-19 shock.

A natural concern is that sponsors' negative Covid-19 exposure correlates with their portfolio firms' own exposure—for instance, due to industry specialization (Spaenjers and Steiner, 2024). However, this would bias our estimates *against* finding our result: more

negatively exposed sponsors would be paired with more negatively exposed firms and thus become more likely to inject equity, weakening the correlation between less negative exposure and equity injections on which we document. In other words, this effect would weaken the relevance of our instrument, i.e., the documented relevance of the instrument can be viewed as lower bound.

3.2.3 Regression Specification

Overall, the shift-share instrument from the previous subsection 3.2.2 captures exogenous variation in PE-backed firms' access to and supply of equity financing, as well as sponsor support more broadly. To isolate the effects of sponsor support on borrowing capacity, we focus on the subsample of PE-backed firms, effectively comparing those that receive significant distress support from their sponsors with those that do not.

Our regression specification, which is estimated primarily at the bank-loan level but is also extended to the firm level, becomes:

$$y_{l,i,b,t} = \beta \; Distress \; Support_{i,t} + X_{l,i,b,t} + FEs + \varepsilon_{l,i,b,t}, \tag{2}$$

where we include bank×rating fixed effects and year-quarter fixed effects, and control for loan maturity. $Covid_t$ equals one for the first three quarters of 2020 and zero otherwise. Crucially, the variable $Distress \; Support_{i,t}$ captures the sponsor's support for the portfolio firm in distress, where our distress event is the onset of Covid-19. We adopt the following two specifications.

First, in reduced-form specifications, the sponsor's portfolio exposure to Covid broadly proxies for PE-backed firms' access to sponsor support in distress, through various channels such as monitoring, operational engineering, or equity injections. Specifically, we set $Distress \; Support_{i,t} = Exposure_i \times Covid_t$. Again, this measure then captures variation in sponsor support through aforementioned channels.

Second, and most importantly, we use the sponsor-level exposure measure as an instrument for equity injections (i.e., access to equity financing) during Covid. We estimate two-stage least squares regressions, with the first and second stages given by:

$$\begin{aligned} Equ.\ Inj_{i,t} &= \beta_2\ Exposure_i \times Covid_t + X_{l,i,b,t} + FEs_{l,i,b,t} + \varepsilon_{l,i,b,t} \qquad \text{(First Stage)}, \\ y_{l,i,b,t} &= \beta_{iv}\ \widehat{Equ.\ Inj}_{i,t} + X_{l,i,b,t} + FEs_{l,i,b,t} + \epsilon_{l,i,b,t} \qquad \text{(Second Stage)}. \end{aligned} \tag{3}$$

In the first stage, we measure equity injections on extensive margin—an indicator for whether firm i receives an equity injection in period t. Section 5.1 shows that our results are robust to considering an intensive margin measure, namely the log dollar amount of equity injected in firm i in period t (set to zero if no injection occurs).

In the second stage, we regress loan or firm-level outcomes on instrumented equity injections. Crucially, this instrumental variable strategy based on two-stage least squares allows us to isolate the causal impact of PE sponsors' equity injections on firms' access to credit, borrowing capacity, investment, and subsequent performance. While the reduced-form specification captures a broad range of potential support channels, the IV approach isolates the effect operating specifically through equity injections.

Finally, as outcome variables, we use indicators for whether a loan is newly originated, whether it is newly originated and of a specific type (e.g., junior or cash flow-based), as well as intensive-margin measures such as newly issued loan amounts and outstanding loan amounts. We also examine loan spreads. We avoid controlling for variables that serve as outcomes in some specifications, but include controls for maturity, firm size, and asset tangibility. Firm size (total assets) and tangibility capture the firm's collateralizable assets and help account for the amount of debt supportable by tangible collateral.

We also conduct firm-level analyses with analogous specifications. The key difference is that firm-level outcomes, available at annual frequency, serve as the dependent variables.

4 Equity Financing Expands Borrowing Capacity: Estimation Results and Implications

When presenting and discussing the results, two points are worth emphasizing. First, any results on the effects of sponsor support on credit quantity hold on both on the extensive margin (the propensity to obtain new loans) and the intensive margin (loan amounts and total debt). Second, our findings are consistent across the two approaches used to exploit the instrument: (i) reduced-form specifications using sponsor exposure to Covid-19 as a broad proxy for sponsor support, and (ii) two-stage least squares specifications instrumenting equity injections as a specific support channel. For brevity, we refer to both approaches simply as sponsor support or sponsor support in distress, which may capture either broad support or the equity injection channel specifically.

4.1 Support in Distress Increases Borrowing

We begin by demonstrating that sponsor support in distress increases PE-backed firms' reliance on debt financing. Table 6 presents the results, with column (1) reporting the first-stage estimates. Columns (2) and (3) show that sponsor support is associated with a higher propensity to obtain new loans and with larger loan amounts, relative to other PE-backed firms that do not receive such support. These effects are present in both the IV and reduced-form specifications, and imply an overall increase in credit along both the extensive margin (the propensity to obtain new loans) and the intensive margin (new loan amounts).

At the firm level, we similarly find that sponsor support increases leverage ratios and bank credit. Table 7, columns (1)–(3), reports these results, with column (1) presenting the first-stage estimates. Sponsor support in distress raises both leverage ratios and the logarithm of total bank debt (in dollars). Overall, sponsor support in distress and, in particular, improved access to equity financing lead firms to borrow more and to take on more debt.

4.2 Credit Supply versus Demand

We find that sponsor support increases the quantity of credit, but this could in principle reflect both higher credit demand and an expanded credit supply. We disentangle these two explanations and provide evidence of a supply-side channel: PE sponsors relax borrowing constraints. Specifically, we show that sponsor support is associated with more favorable loan terms, both in terms of price (lower interest rates) and non-price terms (lower seniority and less reliance on collateral). The simultaneous increase in credit quantity and reduction in the effective cost of credit indicates an outward shift of the credit supply curve.

Price Terms: Interest Rates and Spreads. Table 6 shows that sponsor support is linked to lower interest rates. In particular, following an equity injection during distress, firms not only obtain additional credit but do so at lower rates. Because we include year-quarter fixed effects, we control for movements in the risk-free rate; thus, firms receive more credit at lower spreads after sponsor support during distress. That firms borrow more at lower prices following an equity injection suggests that equity injections raise the supply of credit.

Non-Price Terms: Collateral and Seniority. We next examine non-price loan terms, focusing on seniority and collateralization. We analyze the extent which PE-backed rely on loans that are junior or cash flow-based—that is, not secured by a specific asset. As discussed in Section 2, specifically Subsection 2.2.2, cash flow-based debt includes junior loans and secured loans backed by the firm's going-concern value (i.e., expected cash flows), but excludes loans secured by specific, separable assets real estate that can be liquidated independently; the latter are referred to as asset-based loans. The distinction between senior and junior debt is closely related to that between asset-based and cash flow-based debt in terms of priority and sensitivity to firm performance. Indeed, relative to senior (resp. asset-based) loans, junior (resp. cash flow-based) loans carry lower priority and are therefore more sensitive to firm performance and cash flows.

Debt terms that require firms to grant higher priority to lenders or to pledge specific

collateral typically represent more stringent non-price conditions and impose additional costs on borrowers (Benmelech et al., 2024), similar to higher spreads imposing direct monetary costs. That is, senior debt or asset-based debt are associated with more stringent non-price debt terms, which, all else equal, imply higher borrowing costs.

Overall, we find that sponsor support in distress is associated with less stringent non-price terms, further pointing to a supply-side channel: the simultaneous increase in credit quantities and easing of loan terms following equity injections is consistent with an outward shift in the credit supply curve. Equity injections allow firms to access credit without having to grant seniority or pledge explicit collateral, reflecting a greater willingness of lenders to supply credit. We now discuss our estimation results in greater detail.

First, Table 8 reports results on collateral and cash flow-based lending. Sponsor support and equity injections increase firms' reliance on cash flow-based loans along both the extensive and intensive margins, relative to other PE-backed firms with less or no such support. These findings are robust to focusing on new loan originations and their amounts, as well as overall reliance measured by cash flow-based loan commitment sizes. In sum, following sponsor support in distress, PE-backed firms are more likely to obtain credit without pledging explicit collateral—that is, they can borrow against future cash flows—relative to PE-backed firms that receive less support.

Second, Table 9 presents analogous results on seniority, distinguishing between junior and senior loans. We find that sponsor support increases firms' reliance on relatively junior loans along both margins. In particular, following an equity injection, firms are more likely to obtain new junior loans, and these junior loans are larger.

4.3 Firm Performance and Investment

4.3.1 Credit Risk

Our previous findings show that sponsor support in distress and equity injections increase firms' borrowing capacity. We now examine the specific channels through which distress

support translates into greater borrowing capacity. As discussed in Section 3.1, equity injections may expand borrowing capacity (i) by strengthening the firm's balance sheet and (ii) by increasing the sponsor's skin in the game, thereby enhancing incentives to improve firm performance. Both mechanisms reduce credit risk and should therefore benefit lenders. More broadly, value-enhancing sponsor support in distress through other channels should similarly reduce credit risk and expand credit supply.

To provide evidence on these mechanisms, we use banks' internal estimates of probability of default (PD) and loss given default (LGD), as reported in the Y-14 database, as outcome variables in our regression specifications. We also examine changes in PD to assess whether equity injections reduce default risk over time. Importantly, we continue to control for bank-internal credit ratings throughout, so the effects we identify on PD and LGD are not already captured by these ratings.

Table 10 shows that sponsor support during distress reduces firms' credit risk, as reflected in lower probabilities of default and reduced loss given default. Note that bank-internal ratings already capture baseline credit risk. Thus, our results indicate that equity injections further reduce both PD and LGD beyond what is reflected in ratings. Overall, the evidence suggests that sponsor support improves firm performance, lowers credit risk, and thereby expands borrowing capacity through a supply-side channel. Moreover, our findings suggest that sponsor support and equity injections have a causal impact on resolving distress.

4.3.2 Investment and Sales Growth

We demonstrate that sponsor support in distress has real effects: it enables firms to invest and grow during periods of distress. In order to examine investment and related firm-level outcomes, we switch to firm-level analysis, employing an analogous empirical strategy to that used above. (Note that since firm-level data are reported annually, the shift in frequency reduces the available variation, as Covid was a relatively short-lived shock.)

Column (4) of Table 7 shows that sponsor support is associated with higher capital ex-

penditures (Capex), that is, investment. Table 11 further shows that sponsor support during distress is associated with higher sales growth in addition to higher investment, consistent with improved firm performance and enhanced growth. This result is obtained under the reduced-form specification only. Overall, sponsor support in distress leads to higher investment and sales growth.

One interpretation of our findings is that the relaxation of borrowing constraints through PE sponsors enables firms to increase investment even during periods of distress. However, we emphasize that our analysis does not quantify the extent to which higher investment is driven by enhanced borrowing capacity specifically. Sponsor support can increase investment and growth through channels not directly related to borrowing capacity: for instance, a PE sponsor may add value to the firm, raising the return on investment and investment itself, which then feeds back into higher borrowing capacity. Or, similarly, the equity capital injected might be used for investment. Overall, we document that sponsor support and equity injections are associated with (i) enhanced borrowing capacity, (ii) greater reliance on debt, and (iii) higher investment and sales growth, without disentangling the extent to which (i)–(iii) causally affect one another.

4.3.3 PE Value Creation Channels and Borrowing Capacity

Our results provide causal evidence that PE sponsors' distress support and provision of equity financing create value through the following interconnected channels. First, sponsor support—through monitoring or operational engineering, for instance—can be directly value-enhancing, stimulating investment and growth. Second, it expands borrowing capacity, which is valuable in itself (by improving flexiblity and cost of debt) but also because it enables firms to invest and grow. Third, equity injections increase the sponsor's skin in the game, reinforcing incentives to provide continued support and improve firm value. Crucially, the additional investment unlocked through enhanced borrowing capacity feeds back into further expanding that capacity, potentially creating a virtuous cycle between sponsor support, firm

performance, and access to credit.

5 Robustness and Other Results

5.1 Equity Injections: Intensive Margin Measure

Our baseline employed a binary, extensive margin of equity injections, indicating whether a given firm receives an equity injection in a given year. We show that our results are robust to employing an intensive margin measure, capturing the dollar amount of equity received in a given year (in logarithms and set to zero if negative). See Table A2 for the results of our two-stage least squares estimation.

Table A2 shows that under the alternative, intensive margin measure the F-statistic is above 30, in that the instrument remains relevant. Further, observe that, following an equity injection, firms become more likely to take out new and larger loans (columns (2) and (3)) and borrow at lower interest rates (column (4)). Further, a larger equity injection raises the propensity to rely on cash flow-based debt, that is, reduces the reliance on collateral in debt financing, as shown in columns (5)-(7).

Overall, receiving an equity injections makes firms borrow more at more favorable price and non-price terms, indicating an increased credit supply, i.e., borrowing capacity. These effects are stronger, when the amount of equity financing obtained is larger.

5.2 Analysis on Outstanding Loan Sample

Our baseline analysis shows that receiving sponsor support in distress leads firms to take out additional credit in the form of new and larger loans. We now show that sponsor support is also leads firms to borrow more by expanding the commitment size on existing, outstanding loans. Changes to credit terms on outstanding loans may, for instance, arise due to debt renegotiation (e.g. Roberts and Sufi (2009)).

For this purpose, We conduct analysis using the sample of outstanding loans, showing

that in fact PE-backed firms receiving greater support tend to expand the commitment sizes on these loans. Table A3 confirms our baseline findings when focusing on the subsample of outstanding loans. We again find that sponsor support and equity injections are associated with increased loan amounts, and an increased reliance on cash flow-based debt (i.e., reduced reliance on collateral). The effect on the interest rate is negative too, as in the baseline, but turns insignificant.

Our results on outstanding loans show robustness. In particular, they alleviate concerns that our results merely reflect that equity injections are used to pay back outstanding loans, while new loans are issued to replace them.

5.3 Controlling for Firm Industry/Sector

Our key results rely on a sponsor-level measure of exposure to Covid-affected sectors. Since PE sponsors often specialize in certain industries (Spaenjers and Steiner, 2021), our analysis—which effectively compares PE-backed firms whose sponsors are differentially exposed to Covid-affected sectors—also exploits cross-industry variation. We therefore do not control for industry in our baseline specifications. In this section, we show that our key findings are robust to the inclusion of industry fixed effects.

Table A4 presents the results. After controlling for NAICS 3-digit industry fixed effects, sponsor support and equity injections continue to raise the propensity to obtain new loans—and new cash flow-based loans in particular. That is, following an equity injection, PE-backed firms borrow more and rely less on collateral, consistent with equity injections expanding borrowing capacity. As expected, some results lose statistical significance, since our shift-share instrument exploits heterogeneity in sponsors' exposure to Covid-affected industries, and industry fixed effects naturally absorb part of this variation

6 Conclusion

This paper shows that PE sponsors relax borrowing constraints by providing equity financing and support in distress , enabling PE-backed firms to borrow more at lower spreads, with lower seniority, and reduced reliance on collateral. In particular, following an equity injection, PE-backed firms borrow more on more favorable price and non-price terms, suggesting that improved access to equity financing expands the supply of credit. Furthermore, we find that access to equity financing in distress reduces credit risk, facilitates investment and growth, and helps resolve distress (Hotchkiss et al., 2021).

To isolate the causal effects of equity financing, we construct a shift-share instrument exploiting predetermined variation in sponsors' portfolio exposure to Covid-19 and hence in their capacity to support portfolio firms. Intuitively, the instrument captures exogenous variation in the supply of equity financing and sponsor support for PE-backed firms during distress. We show that PE-backed firms with greater access to support and equity financing increase their reliance on debt financing and invest more. More generally, our instrument can be viewed as capturing exogenous variation in PE sponsor engagement, and it can be applied in other settings too.

Our findings suggest that PE-backed firms' higher leverage reflects, in part, the greater credit supply they face relative to non-PE-backed firms, driven by their superior access to equity financing. Our paper thus bridges opposing views on private equity—namely, that PE sponsors simply over-lever their portfolio firms, leaving them vulnerable to distress, versus that PE sponsors create value. We show that these views are linked: sponsor support, especially through the provision of equity financing, enhances borrowing capacity, which in turn allows firms to sustain higher leverage

More broadly, our findings have implications for firms' capital structure and borrowing constraints. Using private equity as a laboratory, the paper demonstrates that improved access to (i.e., supply of) equity financing and the presence of large, engaged shareholders can stimulate debt financing and investment by relaxing borrowing constraints. In particular,

our findings suggest that debt and equity can act as complements in a firm's capital structure, consistent with Hartman-Glaser et al. (2025) or Bolton et al. (2025).

While we establish the debt-equity complementarity and the effects of large shareholders on borrowing capacity in the context of private equity, these findings should extend more broadly. Firms with better access to equity financing, such as public firms, should enjoy greater borrowing capacity. Moreover, large shareholders in public markets—such as institutional investors—engage in value-enhancing activities similar to those of PE sponsors, including monitoring (Kempf et al., 2017) and advising, which should likewise enhance borrowing capacity.

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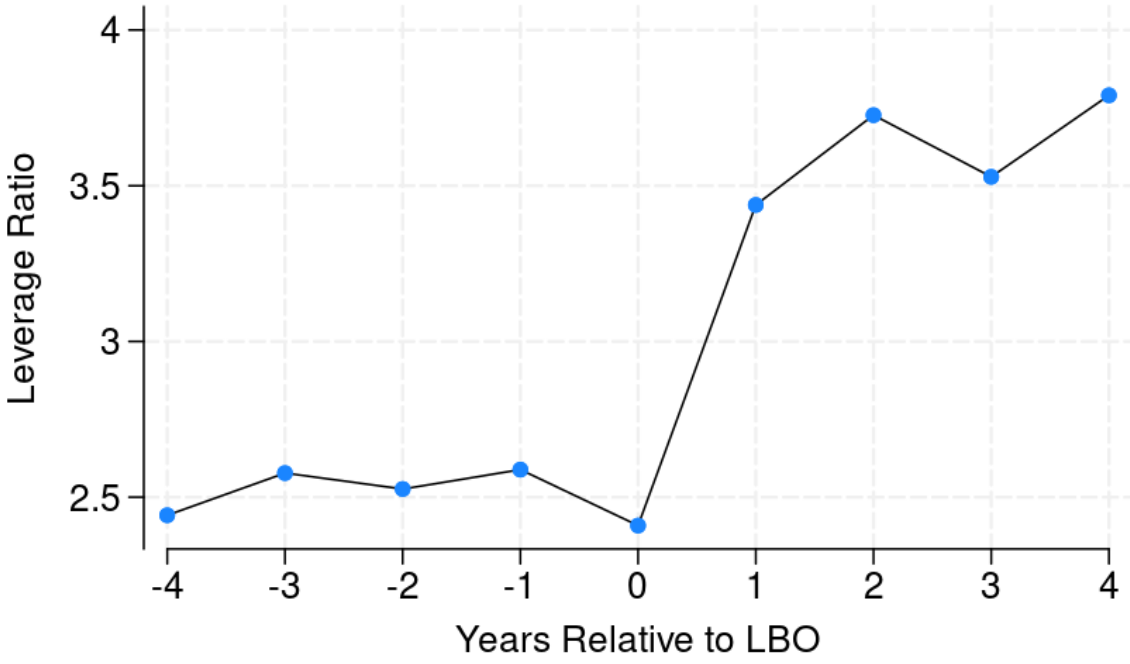
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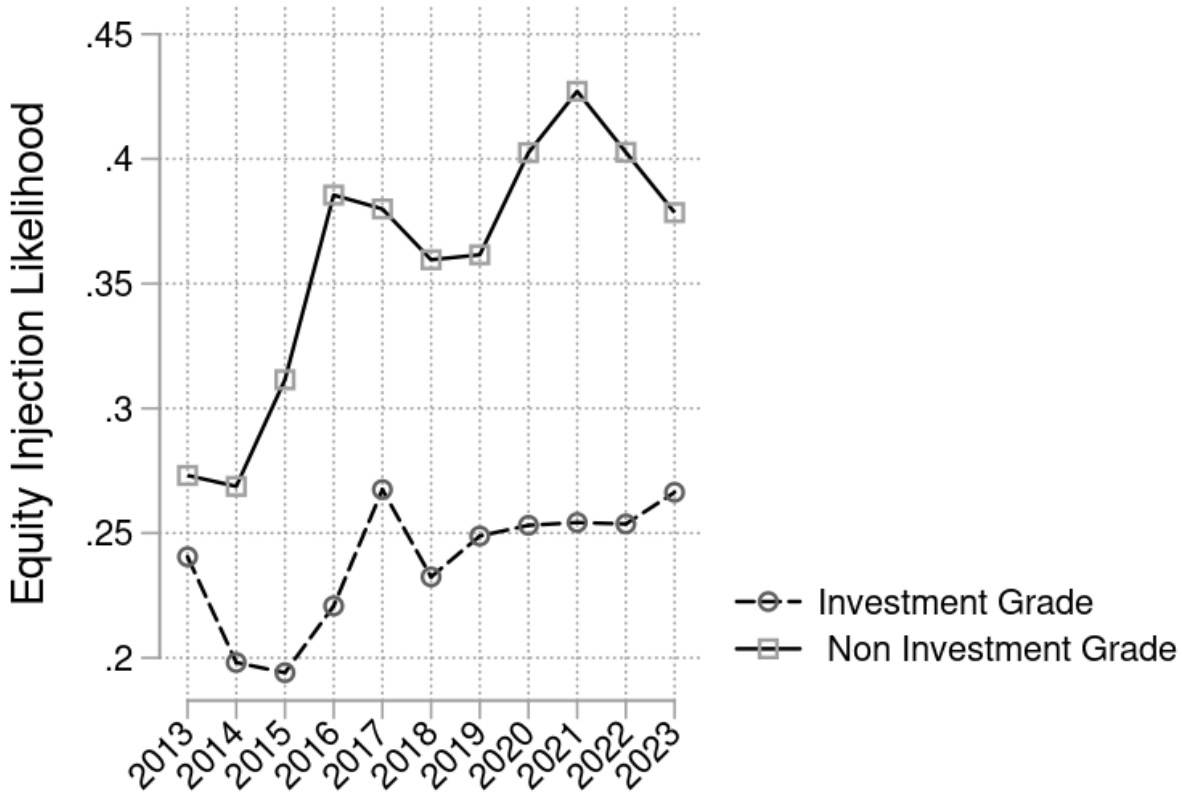
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Figure 1: Leverage Dynamics in PE-backed firms



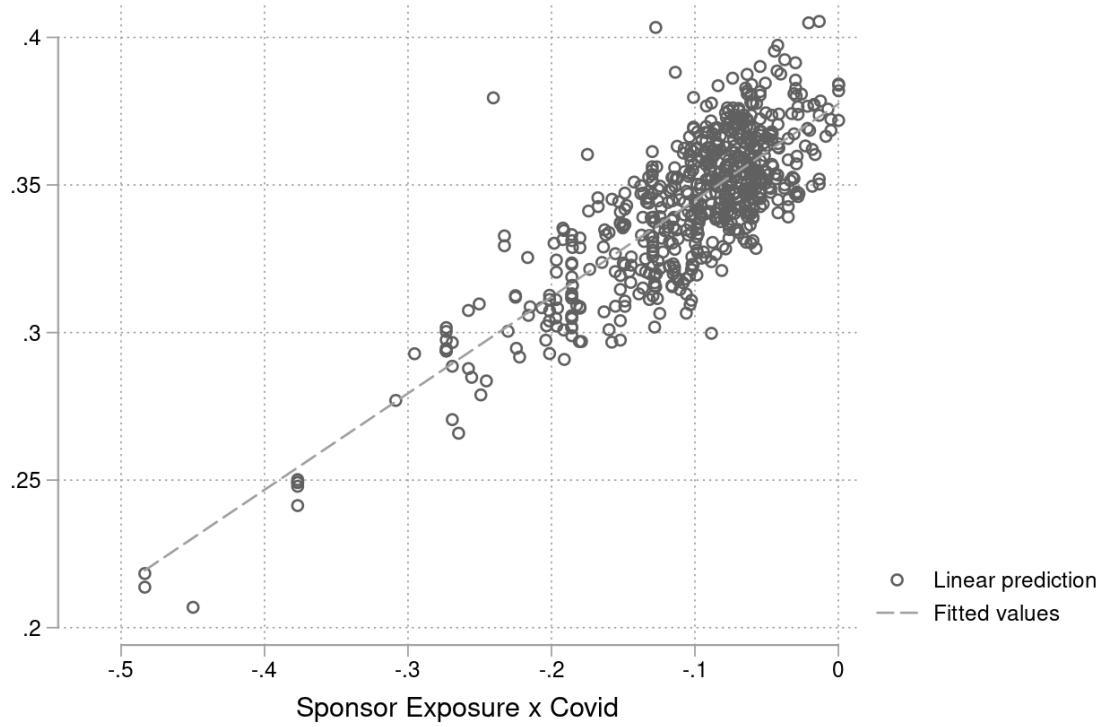
(a) *Notes: This figure reports (median) leverage ratios across the baseline sample of PE-backed firms in event years relative to its LBO year. Leverage ratio is the ratio of total debt to EBITDA. Data is at the firm and event-year level and sample period is from 2012 to 2024.*

Figure 2: Share of PE-backed Firms that received Equity Injections



(a) *Notes: This figure reports the share of PE-backed firms in the baseline sample that receive equity injection, split by investment grade and non-investment grade PE-backed borrowers. Non-Investment grade firms are defined as those with a credit rating of BB or worse, while firms with credit rating of BBB or higher are defined as investment grade. Equity injection is defined as a dummy taking value of 1 if a given firm's year-on-year change in equity minus profits is positive. The sample excludes the buyout year to remove effects of changes to equity due to the LBO.*

Figure 3: Sponsor Exposure and Likelihood of Equity Injection



(a) *Notes: This figure presents scatter plots of predicted probability of equity injection in the y-axis and the instrument* Sponsor Exposure x Covid. *Data is at the* firm x year *level. The regression that generated predicted probability regresses a dummy for realized equity injection as dependent variable, on* Sponsor Exposure x Covid *and lagged firm controls including firm size, cash ratio, debt ratio and year and borrower rating fixed effects. Standard errors are adjusted for two-way clustering at the firm and year level. To show results conditional on the covid shock, the scatter plots are restricted to calendar year 2020.*

Table 1: Firm-level Summary Statistics

Panel A: PE-backed Firms	N	Mean	SD	P50
Total Assets (USD Bn)	13,070	0.72	1.55	0.10
Debt/EBITDA	12,265	3.58	6.13	3.07
Debt/Asset	13,030	0.39	0.25	0.37
Tangibility Ratio	13,034	0.70	0.27	0.75
Liquidity Ratio	13,034	0.08	0.11	0.03
ROA	13,034	0.12	0.14	0.10
Capital Investment (%)	13,070	-0.61	10.01	0.00
Sales Growth	11,586	0.21	0.66	0.07
Sales/Asset	13,070	2.27	28.55	1.10
CF Debt Share	13,070	0.43	0.46	0.14
Panel B: Non-PE-backed Firms	**N**	**Mean**	**SD**	**P50**
Total Assets (USD Bn)	859,730	0.34	1.18	0.02
Debt/EBITDA	813,631	2.81	6.10	1.86
Debt/Asset	859,663	0.36	0.28	0.32
Tangibility Ratio	859,730	0.91	0.17	1.00
Liquidity Ratio	859,730	0.12	0.15	0.06
ROA	859,730	0.17	0.21	0.11
Capital Investment (%)	859,730	0.09	15.01	0.00
Sales Growth	651,204	0.22	0.77	0.05
Sales/Asset	859,730	2.81	27.16	1.95
CF Debt Share	859,730	0.35	0.46	0.00

(a) *Notes: This table reports summary statistics of the baseline sample. This sample is the merged FR Y-14Q Schedule H.1-Pitchbook sample from 2012 to 2024. Data is aggregated across firms and year. Panel A reports information for PE-backed firms, and Panel B is restricted to non-PE-backed firms.* Total Assets *represents the total assets of a firm in $ billions.* Debt/Asset *is the ratio of short- and long-term debt to total assets.* Debt/EBITDA *is total short and long term debt over EBITDA.* Tangibility Ratio *is the ratio of tangible assets to total assets.* Liquidity Ratio *is the ratio of cash & marketable securities to total assets.* ROA *is equal to EBIDTA divided by total assets.* Capital Investment *is the year-on-year change in fixed assets, scaled by total assets.* CF Debt Share *is equal to cash-flow-based debt as a share of total bank loans.*

Table 2: Loan-level Summary Statistics

Panel A: PE-backed loans	N	Mean	SD	P50
Commitment Amount (USD Mn)	127,384	25.4	50.5	10.0
Interest Rate (%)	127,384	5.3	2.7	4.8
Maturity (years)	119,428	5.4	2.7	5.0
Probability of Default (%)	109,179	5.1	13.6	1.3
$\mathbb{1}$(CF Debt)	127,384	0.4	0.5	0.0
CF Debt Commitment Amount (USD Mn)	127,384	13.0	39.7	0.0
Panel B: Non-PE-backed loans	**N**	**Mean**	**SD**	**P50**
Commitment Amount (USD Mn)	5,136,645	14.8	35.6	3.7
Interest Rate (%)	5,136,645	4.0	2.1	3.7
Maturity (years)	4,437,197	6.5	4.0	5.0
Probability of Default (%)	3,761,986	2.9	10.5	0.8
$\mathbb{1}$(CF Debt)	5,136,645	0.3	0.5	0.0
CF Debt Commitment Amount (USD Mn)	5,136,645	7.8	31.2	0.0

(a) *Notes: This table reports summary statistics of the baseline sample. This sample is the merged FR Y-14Q Schedule H.1-Pitchbook sample from 2012Q3 to 2024Q1. Data is at the loan x quarter level. Panel A reports information for PE-backed loans, and Panel B is restricted to non-PE-backed loans. Commitment Amount is the committed credit by a given bank in a given loan facility at time t. Interest Rate is the reported interest rate in a given loan. Maturity is the difference between the loan origination year-quarter and maturity quarter. Probability of Default is the bank-estimated ex ante probability of default of the borrower. Loss Given Default is the bank-estimated loss given default of a given loan facility. 1(CF Debt) takes a value of 1 if a given loan is cash flow based. CF Debt Commitment Amount is the loan commitment if a given loan is cash flow based, set to 0 if it is asset based.*

Table 3: PE vs Non PE : Leverage Ratio Outside Covid

Y: Debt-EBITDA Ratio	(1)	(2)	(3)
$PE_{i,t}$	0.461***	0.414**	0.545***
	(0.145)	(0.149)	(0.171)
R-squared	0.012	0.012	0.012
Rating FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Lagged Controls	Yes	Yes	Yes
Sample Excluded	-	Covid Year	LBO Year
N	454,844	416,308	453,629

* $p < .10$, ** $p < .05$, *** $p < .01$

(a) *Notes: This table reports the results of regression* (1)*, examining the differences in leverage ratio between PE-backed and non-PE backed firms outside Covid. Data is at the firm x year level and the sample period is 2012 to 2024.* $PE_{i,t}$ *is a time-varying indicator of PE-ownership. Column (1) estimates the regression on the full sample. Column (2) excludes calendar year 2020 from the estimation. Column (3) excludes each PE-backed firm's buyout year.* Leverage Ratio *is the ratio of total debt to EBITDA.* Rating FE *represents firm-level credit rating mapped from bank's internal credit rating using concordance mappings. All specifications control for firm size (natural log of total assets), debt/asset, cash/asset which enters the regressions with one-period lags. Standard errors, two-way clustered at the firm and year levels, are reported in parentheses.*

Table 4: PE vs Non PE : Cross Sectional Differences

	(1) 1(New Loan)	(2) New Loan Amount	(3) 1(New CF Loan)	(4) 1(CF loan)	(5) CF Loan Amount
$PE_{i,t}$	0.023***	0.393***	0.018***	0.085***	1.329***
	(0.003)	(0.046)	(0.002)	(0.005)	(0.074)
R-squared	0.047	0.047	0.041	0.228	0.289
Bank x Rating FE	Yes	Yes	Yes	Yes	Yes
Year-Qtr FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
N	5,238,040	5,238,040	5,238,040	5,238,040	5,238,040

* $p < .10$, ** $p < .05$, *** $p < .01$

(a) *Notes: This table reports the results of regression (1), examining the differences between loans to PE-backed and non-PE backed firms. Data is at the loan x quarter level and the sample period is 2012Q3 to 2024Q1.* 1(New Loan) *is a dummy taking value of 1 if a given loan is newly originated, 0 otherwise. New loans are defined as those that are less than or at most 180 days old.* New Loan Amount *is the amount of a newly originated loan, expressed in natural logs, set to 0 if the loan is not new.* 1(New CF Loan) *is a dummy taking value of 1 given a given loan is newly originated and is a cash flow based loan, 0 if not. Cash flow based loans are those where the collateral pledged is either a blanket lien or the loan is unsecured.* 1(CF Loan) *takes a value of 1 if a given loan - both old and new loans - is cash flow based, 0 otherwise.* CF Loan Amount *is the natural log of the loan amount if the loan is cash flow based, including both old and new loans, 0 if the loan is not cash flow based.* PE_{it} *is a time-varying measure of private equity ownership, taking value 1 if a loan is issued to a company that is owned by a private equity fund at date t, 0 otherwise.* Bank x Rating FE *represents a bank's internal credit ratings. All specifications control for firm size (natural log of total assets), asset tangibility and loan maturity. Standard errors, two-way clustered at the loan and year-quarter levels, are reported in parentheses.*

Table 5: PE vs Non PE : Firm-level Differences Outside Covid

	(1) Debt Issuance	(2) Equity Injection	(3) Debt Issuance	(4) Equity Injection	(5) Debt Issuance	(6) Equity Injection
$PE_{i,t}$	0.010***	0.095***	0.010***	0.093***	0.010***	0.086***
	(0.002)	(0.010)	(0.002)	(0.007)	(0.002)	(0.010)
R-squared	0.025	0.034	0.025	0.035	0.025	0.034
Rating FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Controls	Yes	Yes	Yes	Yes	Yes	Yes
Sample Excluded	-	-	Covid	Covid	LBO Year	LBO Year
N	452,452	452,452	413,990	425,274	451,257	463,506

* $p < .10$, ** $p < .05$, *** $p < .01$

(a) *Notes: This table reports the results of regression (1), examining the differences in new debt issuance and equity injection propensities between PE-backed and non-PE backed firms. Data is at the firm x year level and the sample period is 2012 to 2024. Column (1) and (2) estimates the regression on the full sample. Column (3) and (4) excludes calendar year 2020 from the estimation. Column (5) and (6) excludes each PE-backed firm's buyout year.* 1(Debt Issuance) *is the year-on-year change in total debt, scaled by firm assets.* Equity Injection *is a dummy taking value of 1 if year-on-year change in equity minus profit is positive, 0 if not.* PE_{it} *is a time-varying measure of private equity ownership, taking value 1 if a loan is issued to a company that is owned by a private equity fund at date t, 0 otherwise.* Rating FE *represents firm-level credit rating mapped from bank's internal credit rating using concordance mappings. All specifications control for firm size (natural log of total assets), debt/asset, cash/asset which enters the regressions with one-period lags. Standard errors, two-way clustered at the firm and year levels, are reported in parentheses.*

Table 6: Equity Injections and Access to Credit

Panel A: IV	𝟙(Equity Injection)	𝟙(New Loan)	New Loan Amount	Interest Rate
Sponsor Exposure × Covid	0.615***			
	(0.130)			
𝟙(Equity Injection)		0.276**	4.835**	-0.014*
		(0.132)	(2.143)	(0.008)
Regression Type	1st Stage	2nd Stage	2nd Stage	2nd Stage
F-stat (Kleibergen-Paap)	22.43			
Panel B: OLS		**𝟙(New Loan)**	**New Loan Amount**	**Interest Rate**
Sponsor Exposure × Covid		0.170*	2.972**	-0.009*
		(0.085)	(1.378)	(0.004)
Bank×Rating FE		Yes	Yes	Yes
Year-Qtr FE		Yes	Yes	Yes
Controls		Yes	Yes	Yes
N		70,470	70,470	70,470

(a) *Notes: This table reports the results of 2SLS estimation of Eq.* (3)*, examining how equity injection affects access to credit. Data is at the loan x quarter level and the sample period is 2012Q3 to 2024Q1. Panel A reports 2SLS estimates, while Panel B reports OLS estimates of the outcome variables regressed directly on the instrument using Eq.* (2)*.* Sponsor Exposure x Covid *represents a shift-share instrument where* Sponsor Exposure *(which represents the share component) is constructed as the sum, across NAICS 3-digit industries, of each sponsor's portfolio weight in that industry multiplied by the detrended year-over-year growth in industry revenues during COVID. To construct sponsor-level portfolio industry weights, all deals recorded in Pitchbook between 2017 and February 2020 are used, weighting each deal by deal size. A higher value of this measure indicates that the sponsor was less adversely affected by COVID through its existing portfolio companies.* Covid *(which represents the shift component) takes a value of 1 for the first three quarters of 2020, 0 otherwise.* 1(Equity Injection) *takes a value of 1 if a firm receives equity injection in year t, 0 otherwise.* 1(New Loan) *is a dummy taking value of 1 if a given loan is newly originated, 0 otherwise. New loans are defined as those that are less than or at most 180 days old.* New Loan Amount *is the amount of a newly originated loan, expressed in natural logs, set to 0 if the loan is not new.* Int. Rate *is the reported interest rate on a given loan at time t.* Bank x Rating FE *represents a bank's internal credit ratings. All specifications control for firm size (natural log of total assets), asset tangibility and loan maturity. Standard errors, two-way clustered at the loan and year-quarter levels, are reported in parentheses.*

Table 7: Equity Injections and Firm-Level Outcomes

Panel A: IV	$\mathbb{1}$(Equity Injection)	$Debt/EBITDA$	log (Bank Loan Amount)	Investment
Sponsor Exposure × Covid	0.285***			
	(0.072)			
$\mathbb{1}$(Equity Injection)		11.70**	2.905***	0.192***
		(3.745)	(0.550)	(0.054)
Regression Type	1st Stage	2nd Stage	2nd Stage	2nd Stage
F-stat (Kleibergen-Paap)	15.8			
Panel B: OLS		$Debt/EBITDA$	log (Bank Loan Amount)	Investment
Sponsor Exposure × Covid		3.335***	0.828***	0.055***
		(0.981)	(0.059)	(0.008)
Rating FE		Yes	Yes	Yes
Year FE		Yes	Yes	Yes
Lagged Controls		Yes	Yes	Yes
N		4,871	4,871	4,870

(a) *Notes: This table reports the results of 2SLS estimation of Eq.* (3)*, examining how equity injection affects access to credit. Data is at the firm x year level and the sample period is 2012 to 2024. Panel A reports 2SLS estimates, while Panel B reports OLS estimates of the outcome variables regressed directly on the instrument using Eq.* (2)*.* Sponsor Exposure x Covid *represents a shift-share instrument where* Sponsor Exposure *(which represents the share component) is constructed as the sum, across NAICS 3-digit industries, of each sponsor's portfolio weight in that industry multiplied by the detrended year-over-year growth in industry revenues during COVID. To construct sponsor-level portfolio industry weights, all deals recorded in Pitchbook between 2017 and February 2020 are used, weighting each deal by deal size. A higher value of this measure indicates that the sponsor was less adversely affected by COVID through its existing portfolio companies.* Covid *(which represents the shift component) takes a value of 1 for 2020, 0 otherwise.* 1(Equity Injection) *takes a value of 1 if a firm receives equity injection in year t, 0 otherwise.* Debt/EBITDA *is the ratio of total short and long term debt to earnings before interest taxes depreciation and amortization.* Log (Bank Loans) *is total bank loans a given firm has in year t expressed in logs.* Investment *is the year-on-year growth in fixed assets scaled by total assets.* Rating *FE refers to firm-level credit risk ratings. All specifications control for firm size (natural log of total assets), debt/asset ratio and cash/assets ratio, which enter the regressions with one period lags. For computational efficiency, all control variables are residualized before estimating the main model. Standard errors, two-way clustered at the firm and year levels, are reported in parentheses.*

Table 8: Equity Injections and Access to Cashflow Based Loans

Panel A: IV	𝟙(Equity Injection)	𝟙(New CF Loan)	New CF Loan Amt	Any CF Loan Amt
Sponsor Exposure × Covid	0.615***			
	(0.130)			
𝟙(Equity Injection)		0.187**	3.197**	10.054**
		(0.077)	(1.269)	(3.242)
Regression Type	1st Stage	2nd Stage	2nd Stage	2nd Stage
F-stat (Kleibergen-Paap)	22.43			
Panel B: OLS		**𝟙(New CF Loan)**	**New CF Loan Amt**	**Any CF Loan Amt**
Sponsor Exposure × Covid		0.115**	1.966**	6.181**
		(0.052)	(0.858)	(1.775)
Bank×Rating FE		Yes	Yes	Yes
Year-Qtr FE		Yes	Yes	Yes
Controls		Yes	Yes	Yes
N		70,470	70,470	70,470

(a) *Notes: This table reports the results of 2SLS estimation of Eq.* (3)*, examining how equity injection affects access to cash-flow based credit. Data is at the loan x quarter level and the sample period is 2012Q3 to 2024Q1. Panel A reports 2SLS estimates, while Panel B reports OLS estimates of the outcome variables regressed directly on the instrument using Eq.* (2). Sponsor Exposure x Covid *represents a shift-share instrument where* Sponsor Exposure *(which represents the share component) is constructed as the sum, across NAICS 3-digit industries, of each sponsor's portfolio weight in that industry multiplied by the detrended year-over-year growth in industry revenues during COVID. To construct sponsor-level portfolio industry weights, all deals recorded in Pitchbook between 2017 and February 2020 are used, weighting each deal by deal size. A higher value of this measure indicates that the sponsor was less adversely affected by COVID through its existing portfolio companies.* Covid *(which represents the shift component) takes a value of 1 for the first three quarters of 2020, 0 otherwise.* 1(Equity Injection) *takes a value of 1 if a firm receives equity injection in year t, 0 otherwise.* 1(New CF Loan) *is a dummy taking value of 1 if a given loan is newly originated, 0 otherwise. New loans are defined as those that are less than or at most 180 days old.* New CF Loan Amt *is the natural log of loan commitment amount for newly originated cash flow loans, set to 0 if the loan is not new or is not cash flow based.* Any CF Loan Amt *is the natural log of the loan amount if the loan is cash flow based, including both old and new loans, set to 0 if the loan is not cash flow based.* Bank x Rating FE *represents a bank's internal credit ratings. All specifications control for firm size (natural log of total assets), asset tangibility and loan maturity. Standard errors, two-way clustered at the loan and year-quarter levels, are reported in parentheses.*

Table 9: Equity Injections and Access to Subordinated Credit

Panel A: IV	𝟙(Equity Injection)	𝟙(New Junior Loan)	New Junior Loan Amount
Sponsor Exposure × Covid	0.620***		
	(0.120)		
𝟙(Equity Injection)		0.136*	2.204*
		(0.072)	(1.199)
Regression Type	1st Stage	2nd Stage	2nd Stage
F-stat (Kleibergen-Paap)	26.51		
Panel B: OLS		**𝟙(New Junior Loan)**	**New Junior Loan Amount**
Sponsor Exposure × Covid		0.084*	1.367*
		(0.046)	(0.766)
Bank FE		Yes	Yes
Year-Qtr FE		Yes	Yes
Controls		Yes	Yes
N		70,555	70,555

(a) *Notes: This table reports the results of 2SLS estimation of Eq.* (3)*, examining how equity injection affects access to credit. Data is at the loan x quarter level and the sample period is 2012Q3 to 2024Q1. Panel A reports 2SLS estimates, while Panel B reports OLS estimates of the outcome variables regressed directly on the instrument using Eq.* (2). Sponsor Exposure x Covid *represents a shift-share instrument where* Sponsor Exposure *(which represents the share component) is constructed as the sum, across NAICS 3-digit industries, of each sponsor's portfolio weight in that industry multiplied by the detrended year-over-year growth in industry revenues during COVID. To construct sponsor-level portfolio industry weights, all deals recorded in Pitchbook between 2017 and February 2020 are used, weighting each deal by deal size. A higher value of this measure indicates that the sponsor was less adversely affected by COVID through its existing portfolio companies.* Covid *(which represents the shift component) takes a value of 1 for the first three quarters of 2020, 0 otherwise.* 1(Equity Injection) *takes a value of 1 if a firm receives equity injection in year t, 0 otherwise.* 1(New Junior Loan) *is a dummy taking value of 1 if a given new loan is a junior (subordinated) credit, 0 otherwise. New loans are defined as those that are less than or at most 180 days old. Junior loans are defined as those with priority structure as senior unsecured or contractually subordinated.* Bank x Rating FE *represents a bank's internal credit ratings. All specifications control for firm size (natural log of total assets), asset tangibility and loan maturity. Standard errors, two-way clustered at the loan and year-quarter levels, are reported in parentheses.*

Table 10: Equity Injections, Default Probability and Loss Given Default

Panel A: IV	$\mathbb{1}$(Equity Injection)	Δ PD	PD	Δ LGD
Sponsor Exposure × Covid	0.665***			
	(0.135)			
$\mathbb{1}$(Equity Injection)		-0.028*	-0.019***	-0.034**
		(0.015)	(0.007)	(0.016)
Regression Type	1st Stage	2nd Stage	2nd Stage	2nd Stage
F-stat (Kleibergen-Paap)	24.40			
Panel B: OLS		Δ PD	PD	Δ LGD
Sponsor Exposure × Covid		-0.019**	-0.013***	-0.023**
		(0.009)	(0.003)	(0.009)
Bank×Rating FE		Yes	Yes	Yes
Year-Qtr FE		Yes	Yes	Yes
Controls		Yes	Yes	Yes
N		60,031	60,031	59,666

(a) *Notes: This table reports the results of 2SLS estimation of Eq.* (3)*, examining how equity injection affects access to credit. Data is at the loan x quarter level and the sample period is 2012Q3 to 2024Q1. Panel A reports 2SLS estimates, while Panel B reports OLS estimates of the outcome variables regressed directly on the instrument using Eq.* (2)*.* Sponsor Exposure x Covid *represents a shift-share instrument where* Sponsor Exposure *(which represents the share component) is constructed as the sum, across NAICS 3-digit industries, of each sponsor's portfolio weight in that industry multiplied by the detrended year-over-year growth in industry revenues during COVID. To construct sponsor-level portfolio industry weights, all deals recorded in Pitchbook between 2017 and February 2020 are used, weighting each deal by deal size. A higher value of this measure indicates that the sponsor was less adversely affected by COVID through its existing portfolio companies.* Covid *(which represents the shift component) takes a value of 1 for the first three quarters of 2020, 0 otherwise.* 1(Equity Injection) *takes a value of 1 if a firm receives equity injection in year t, 0 otherwise.* Δ PD *is the quarterly change in probability of default.* Δ LGD *is the quarterly change in loss given default.* Bank x Rating FE *represents a bank's internal credit ratings. All specifications control for firm size (natural log of total assets), asset tangibility and loan maturity. Standard errors, two-way clustered at the loan and year-quarter levels, are reported in parentheses.*

Table 11: Additional Firm Outcomes

	(1) Sales Growth	(2) Sales Growth	(3) Profitability	(4) Profitability
Sponsor Exposure x Covid	0.246**	0.147***	0.008	-0.024**
	(0.081)	(0.032)	(0.016)	(0.011)
R-squared	0.086	0.117	0.328	0.355
Rating FE	Yes		Yes	
Year FE	Yes		Yes	
Rating x Year FE		Yes		Yes
Lagged Controls	Yes	Yes	Yes	Yes
N	4,921	4,358	4,907	4,339

* $p < .10$, ** $p < .05$, *** $p < .01$

(a) *Notes: This table reports the results of estimating Eq. (2), examining how sponsor's ability to engage with portfolio firms affected firm-level outcomes during covid. Data is at the firm-year level and the sample period is 2012 to 2024.* Sponsor Exposure *is constructed as the sum, across NAICS 3-digit industries, of each sponsor's portfolio weight in that industry multiplied by the detrended year-over-year growth in industry revenues during COVID. To construct sponsor-level portfolio industry weights, all deals recorded in Pitchbook between 2017 and February 2020 are used, weighting each deal by deal size. A higher value of this measure indicates that the sponsor was less adversely affected by COVID through its existing portfolio companies.* Covid *takes a value of 1 for the year 2020, 0 otherwise.* Sales Growth *is the yearly percentage growth in sales.* Profitability *is the ratio of net income to total assets.* Rating *FE refers to firm-level credit risk ratings. All specifications control for firm size (natural log of total assets), debt/asset ratio and cash/assets ratio, which enter the regressions with one period lags. Standard errors, two-way clustered at the firm and year levels, are reported in parentheses.*

Appendix

A Variable Definitions

We provide definitions of our main variables below. The item numbers of the data fields refer to Schedule H1 of the Y-14Q data Schedule H1 of the Y-14Q data on the Federal Reserve's website.

- Loan Commitment Amount: Total amount of committed credit for a given loan.
- New Loan: Indicator equal to 1 if a loan is not more than 180 days old.
- New Loan Amount: Commitment amount of a new loan, expressed in logs, set to 0 if the loan is not new.
- Interest Rate: Bank reported interest rate on a given loan.

  Junior/Subordinated Loan: Indicator equal to 1 if a loan is classified as senior unsecured or contractually subordinated.
- Loan Maturity: Computed as the difference between loan maturity date and loan origination date (expressed in years)
- Probability of Default: Bank reported estimate of 1-year ahead probability of default.

  Loss Given Default: Bank reported (ex ante) estimate of loss given default.
- Loan Risk Rating: Captures a loan's credit risk and default probability. Time-varying loan risk ratings are reported by each Y-14 Bank holding Company, and are typically a function of firm characteristics and aggregate conditions.
- Cash flow-based debt: Debt based on the value of cash flow from the firm's continuing operations or going-concern value. Takes value of 1 if collateral is classified as a blanket lien on all assets or is unsecured.
- Asset-based debt: Debt based on liquidation value of specific assets such as real estate, equipment, inventory, receivables, cash etc.
- Cash Flow Debt Share: Total Cash Flow Debt/Total Assets
- New Cash Flow Loan: Indicator equal to 1 if a new loan is cash flow based.
- Firm Size: Natural Logarithm of book value of current year assets, i.e., the logarithm of book assets
- Profitability: Net Income/Total Assets
- Capital Investment: Year-on-Year change in fixed assets, scaled by total assets.
- Debt Ratio: (Short term debt + Long term debt)/Total Assets
- Tangibility: Tangible Assets/Total Assets
- Leverage Ratio: (Short term debt + Long term debt)/EBITDA
- Total Bank Credit: Total Commitments of all banks to a given firm.
- Liquidity: Cash and Marketable Securities/Total Assets

- Equity Injection: Indicator variable taking value 1 if change in equity minus profit in a given firm-year is positive.
- Sponsor Exposure: Sponsor-level pre-Covid exposure to covid-affected sectors. To construct industry-level portfolio weights, we use NAICS 3-digit industry classifications and all deals undertaken by a given sponsor between January 2017 and February 2020. A sponsor's portfolio weight in a given industry is the deal size-weighted share of deals in that industry. Exposure is then measured by summing each industry's portfolio weight multiplied by the detrended year-over-year revenue growth of that industry during Covid.

B Y-14 Data Cleaning

- We roll up loans to subsidiaries to the parent company-level if banks report parent company rather than subsidiary financial information. Following Greenwald, Krainer, and Paul (2021) and Chodorow-Reich et al. (2022), we identify distinct firms using Taxpayer Identification Number, allowing us to link the same firm across banks and over time. This addresses the issue that the same firm can borrow from multiple banks and banks have idiosyncratic differences in how they name a particular borrower.
- Observations with negative or zero values for committed exposure, negative values for utilized exposure, and with committed exposure less than utilized exposure are excluded (there are very few such errors).
- We drop all facility records with origination dates before 1990 or maturities greater than 30 years to minimize the influence of potential data entry errors.
- To ensure data accuracy in interest rate calculations, we exclude observations with interest rates below 0.5 percent or above 50 percent to minimize the influence of potential data entry errors.
- The raw firm-level data is winsorized at the 2.5 and 97.5 percent levels. In addition, to remove outliers and likely data errors which are not addressed by winsorization, leverage ratio, sales growth, debt issuance and investment are trimmed at the 1 and 99 percent.
- Following Brown, Gustafson, and Ivanov (2021), financial statement information is excluded if the financial statement date is missing or comes later than the data report date. Also excluded are other likely data errors by requiring that for each firm and financial statement date: (i) EBITDA does not exceed net sales, (ii) fixed assets exceed total assets, (iii) cash and marketable securities do not exceed total assets, (iv) long-term debt does not exceed total liabilities, (v) short-term debt does not exceed total liabilities, (vi) tangible assets do not exceed total assets, (vii) current assets do not exceed total assets, and (viii) current liabilities do not exceed total liabilities.

Table A1: OLS Estimates with Endogenous Regressor

	(1) 1(New Loan)	(2) New Loan Amount	(3) Int. Rate	(4) 1(New CF Loan)	(5) 1(CF loan)	(6) CF Loan Amount
Equity Injection	0.042***	0.698***	0.001***	0.017***	-0.008	-0.121
	(0.006)	(0.091)	(0.000)	(0.004)	(0.008)	(0.125)
R-squared	0.076	0.071	0.557	0.089	0.344	0.011
Bank x Rating FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes
N	70,470	70,470	70,470	70,470	70,470	70,470

* $p < .10$, ** $p < .05$, *** $p < .01$

(a) *Notes: This table reports the results of regression regressing various loan - level outcomes on* 1(equity injection)*, the key endogenous regressor which is a dummy taking value of 1 if a firm receives equity injection, 0 otherwise. Data is at the firm x year level and the sample period is 2012 to 2024.* 1(New Loan) *is a dummy taking value of 1 if a given loan is newly originated, 0 otherwise. New loans are defined as those that are less than or at most 180 days old.* New Loan Amt *is the amount of a newly originated loan, expressed in natural logs, set to 0 if the loan is not new.* Int. Rate *is the reported interest rate on a given loan at time t.* 1(New CF loan) *is an indicator if a new loan is cash flow based, 0 if not.* 1(CF loan) *is an indicator if any loan (new or old) is cash flow based.* CF loan amt *is the natural log of a cash flow based loan, set to 0 if the loan is not cash flow based.* Bank x Rating FE *represents a bank's internal credit ratings. All specifications control for firm size (natural log of total assets), asset tangibility and loan maturity. Standard errors, two-way clustered at the firm and year levels, are reported in parentheses.*

Table A2: IV: Intensive Margin Measure of Equity Injection

	(1) Equity Inj.	(2) 1(New Loan)	(3) New Loan Amt	(4) Int. Rate	(5) 1(New CF Loan)	(6) 1(CF loan)	(7) CF Loan Amt
Sponsor Exposure x Covid	11.720***						
	(2.036)						
Equity Inj.		0.014**	0.253**	-0.001*	0.01**	0.031***	0.527***
		(0.007)	(0.112)	(0.0004)	(0.005)	(0.009)	(0.162)
Regression Stage	1st	2nd	2nd	2nd	2nd	2nd	2nd
F-stat (Kleibergen-Paap)	33.12						
Bank x Rating FE		Yes	Yes	Yes	Yes	Yes	Yes
Year-Qtr FE		Yes	Yes	Yes	Yes	Yes	Yes
N		70,470	70,470	70,470	70,470	70,470	70,470

* $p < .10$, ** $p < .05$, *** $p < .01$

(a) *Notes: This table reports the results of 2SLS estimation of Eq.* (3)*, examining how equity injection affects access to credit. Data is at the loan x quarter level and the sample period is 2012Q3 to 2024Q1. Panel A reports 2SLS estimates, while Panel B reports OLS estimates of the outcome variables regressed directly on the instrument using Eq.* (2). Sponsor Exposure x Covid *represents a shift-share instrument where* Sponsor Exposure *(which represents the share component) is constructed as the sum, across NAICS 3-digit industries, of each sponsor's portfolio weight in that industry multiplied by the detrended year-over-year growth in industry revenues during COVID. To construct sponsor-level portfolio industry weights, all deals recorded in Pitchbook between 2017 and February 2020 are used, weighting each deal by deal size. A higher value of this measure indicates that the sponsor was less adversely affected by COVID through its existing portfolio companies.* Covid *(which represents the shift component) takes a value of 1 for the first three quarters of 2020, 0 otherwise.* (Equity Inj.) *is the natural log of the dollar amount of equity injection, set to 0 if no injection occurs.* 1(New Loan) *is a dummy taking value of 1 if a given loan is newly originated, 0 otherwise. New loans are defined as those that are less than or at most 180 days old.* New Loan Amt *is the amount of a newly originated loan, expressed in natural logs, set to 0 if the loan is not new.* Int. Rate *is the reported interest rate on a given loan at time t.* 1(New CF loan) *is an indicator if a new loan is cash flow based, 0 if not.* 1(CF loan) *is an indicator if any loan (new or old) is cash flow based.* CF loan amt *is the natural log of a cash flow based loan, set to 0 if the loan is not cash flow based.* Bank x Rating FE *represents a bank's internal credit ratings. All specifications control for firm size (natural log of total assets), asset tangibility and loan maturity. Standard errors, two-way clustered at the loan and year-quarter levels, are reported in parentheses.*

Table A3: Equity Injections and Existing Loans

Panel A: IV	𝟙(Equity Injection)	Loan Amount	CF Loan Amount	Int. Rate
Sponsor Exposure × Covid	0.577***			
	(0.122)			
𝟙(Equity Injection)		2.229***	10.372**	-0.015
		(0.706)	(3.816)	(0.009)
Regression Type	1st Stage	2nd Stage	2nd Stage	2nd Stage
F-stat (Kleibergen-Paap)	22.10			
Panel B: OLS		**Loan Amount**	**CF Loan Amount**	**Int. Rate**
Sponsor Exposure × Covid		1.287***	5.991***	-0.009*
		(0.290)	(1.793)	(0.004)
Bank×Rating FE		Yes	Yes	Yes
Year-Qtr FE		Yes	Yes	Yes
Controls		Yes	Yes	Yes
N		58,701	58,701	58,701

(a) *Notes: This table reports the results of 2SLS estimation of Eq.(3), examining how equity injection affects access to credit. Data is at the loan x quarter level and the sample period is 2012Q3 to 2024Q1. Panel A reports 2SLS estimates, while Panel B reports OLS estimates of the outcome variables regressed directly on the instrument using Eq. (2). Existing loans are defined as those that are not new loans. Data is at the loan-quarter level and the sample period is 2012Q3 to 2024Q1.* Sponsor Exposure x Covid *represents a shift-share instrument where* Sponsor Exposure *(which represents the share component) is constructed as the sum, across NAICS 3-digit industries, of each sponsor's portfolio weight in that industry multiplied by the detrended year-over-year growth in industry revenues during COVID. To construct sponsor-level portfolio industry weights, all deals recorded in Pitchbook between 2017 and February 2020 are used, weighting each deal by deal size. A higher value of this measure indicates that the sponsor was less adversely affected by COVID through its existing portfolio companies.* Covid *(which represents the shift component) takes a value of 1 for the first three quarters of 2020, 0 otherwise.* 1(Equity Injection) *takes a value of 1 if a firm receives equity injection in year t, 0 otherwise.* Loan Amount *is the natural log of a loan amount at time t.* CF Loan Amount *is the natural log of the loan amount if the loan is cash flow based, set to 0 if the loan is not cash flow based.* Int. Rate *is the reported interest rate on a given loan.* Bank x Rating FE *represents a bank's internal credit ratings. All specifications control for firm size (natural log of total assets), asset tangibility and loan maturity. Standard errors, two-way clustered at the loan and year-quarter levels, are reported in parentheses.*

Table A4: Equity Injections and Access to Credit - Robustness with Sector Fixed Effect

Panel A: IV	𝟙(Equity Injection)	𝟙(New Loan Amt)	New CF Loan Amt
Sponsor Exposure × Covid	0.574***		
	(0.133)		
𝟙(Equity Injection)		4.219*	2.613*
		(2.319)	(1.381)
Regression Type	1st Stage	2nd Stage	2nd Stage
F-stat (Kleibergen-Paap)	18.6		
Panel B: OLS		**𝟙(New Loan Amt)**	**New CF Loan Amt**
Sponsor Exposure × Covid		2.424*	1.501*
		(1.388)	(0.868)
Bank x Rating FE		Yes	Yes
Year-Qtr FE		Yes	Yes
Sector FE		Yes	Yes
Controls		Yes	Yes
N		70,433	70,433

(a) *Notes: This table reports the results of 2SLS estimation of Eq.* (3)*, examining how equity injection affects access to credit. Data is at the loan x quarter level and the sample period is 2012Q3 to 2024Q1. Panel A reports 2SLS estimates, while Panel B reports OLS estimates of the outcome variables regressed directly on the instrument using Eq.* (2). Sponsor Exposure x Covid *represents a shift-share instrument where* Sponsor Exposure *(which represents the share component) is constructed as the sum, across NAICS 3-digit industries, of each sponsor's portfolio weight in that industry multiplied by the detrended year-over-year growth in industry revenues during COVID. To construct sponsor-level portfolio industry weights, all deals recorded in Pitchbook between 2017 and February 2020 are used, weighting each deal by deal size. A higher value of this measure indicates that the sponsor was less adversely affected by COVID through its existing portfolio companies.* Covid *(which represents the shift component) takes a value of 1 for the first three quarters of 2020, 0 otherwise.* 1(Equity Injection) *takes a value of 1 if a firm receives equity injection in year t, 0 otherwise.* 1(New Junior Loan) *is a dummy taking value of 1 if a given new loan is a junior (subordinated) credit, 0 otherwise. New loans are defined as those that are less than or at most 180 days old. Junior loans are defined as those with priority structure as senior unsecured or contractually subordinated.* 1(CF Loan) *takes a value of 1 if a given loan - both old and new loans - is cash flow based, 0 otherwise.* CF Loan Amount *is the natural log of the loan amount if the loan is cash flow based, including both old and new loans, 0 if the loan is not cash flow based.* Bank x Rating FE *represents a bank's internal credit ratings. All specifications control for firm size (natural log of total assets), asset tangibility and loan maturity. Standard errors, two-way clustered at the loan and year-quarter levels, are reported in parentheses.*