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How Did the MSLP Borrowers Fare Before and During COVID-19?

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This policy brief uses Dun & Bradstreet (D&B) data to assess whether the Main Street Lending Program (MSLP) borrowers were in worse financial health than their peers before COVID-19 hit the economy hard in March 2020 or suffered worse deterioration afterward. The findings can help us better understand why these firms sought to obtain MSLP loans. We find that MSLP borrowers tend to be larger than their peer firms (that is, firms in the same industry and state). Within the same size group, MSLP borrowers are on average younger than their peers. Borrowers tended to have a slightly higher predicted risk of failure than their peers in March 2020. Their failure risk grew somewhat more than their peers' risk from March to the month when their MSLP loan request was submitted. These firms' relative performance in 2020 appears to be little correlated with their relative performance over the corresponding months in 2019. MSLP borrowers had worse actual delinguency records in March 2020, as well as more deterioration than their peers from March to the month of the MSLP loan submission. For the subset of borrowers with business spending data available from D&B, spending was on average higher in March 2020 than their peer companies' spending, and it fell somewhat less from March to the MSLP loan submission month. Taken together, our findings suggest that these firms borrowed from the MSLP because 1) their greater growth or survival potential, and hence relationship value, made lenders willing to lend to them, and 2) their higher credit risk made the MSLP attractive, as it enabled the borrowers to pay a lower price or obtain more credit than they would have otherwise.

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1 Introduction

The US economy experienced an unexpected, massive adverse shock in early 2020 due to COVID-19. The Federal Reserve launched several credit facilities to stabilize the financial markets and, ultimately, to support the flow of credit to households and nonfinancial businesses. Among these credit facilities, the Main Street Lending Program (MSLP) was uniquely targeted at small and mid-sized businesses, which generally have no access to the bond market and thus rely on bank loans as their source of credit. The MSLP was designed to purchase participation in bank loans made to eligible borrowers. As Fed Chairman Jerome Powell and Boston Fed President Eric Rosengren both noted, the MSLP was by far the most challenging of the Fed's credit programs because bank loans are customized, unlike the more standardized corporate bonds purchased by other Fed facilities.¹ It is thus important to understand why certain firms became borrowers while other comparable firms, such as those of similar size and operating in the same industry as borrowers or the same geographic location or both, did not. For example, were the truly small businesses able to borrow? Were the borrowers more risky than other firms, controlling for size, industry, and location?

Since the MSLP operated by purchasing eligible loans underwritten by banks, whether a firm became an MSLP borrower was jointly determined by the firm's need for credit and a bank's decision to extend credit but only under the MSLP. For this outcome to be the bank's optimal decision, intuition suggests that the firm would likely have been sufficiently viable to benefit from the injection of the new funding but too risky to qualify for a private loan of comparable terms. Fully characterizing this joint optimization problem is clearly challenging and beyond the scope of this policy brief. Instead, this study focuses on one aspect of this problem: how MSLP borrowers compare with their peer companies that were also eligible for the MSLP (based on the scale of the operation) but did not borrow. This information can provide useful clues to the factors that influenced the firms' and banks' decisions. It can also help evaluate whether the program reached the subset of businesses its design was meant to target. Such understanding can in turn help suggest changes to the parameters that would make them more suitably tailored should a similar program be called for in the future.

Evaluating how the MSLP borrowers' financial health compares with that of their peer businesses is made difficult by the fact that virtually all of those firms eligible for the MSLP, along with their peers, are private companies about which limited information is available. We therefore turn to the Dun & Bradstreet (D&B) database, which offers the most compre-

¹For instance, in an interview with Alan Blinder of Princeton University on May 29, 2020, Chairman Powell remarked that the MSLP "is far and away the biggest challenge of any of the 11 facilities that we've set up."

hensive coverage of private US firms, especially those smallest firms that are proprietorships or have only a few employees.

This policy brief is intended to be the first installment in a series of analyses of MSLP borrowers using the D&B database. We start by focusing on some key attributes of MSLP borrowers, including employment, firm age, creditworthiness, financial health, and business vitality. Employment is a basic variable that was not collected directly by the MSLP Special Purpose Vehicle (SPV), although it was one of the two criteria for deciding whether a firm was eligible for an MSLP loan; hence, the D&B data fill in this void. In addition, we examine a few categories of key indicators, such as risk scores, payment records, and total business-to-business (B2B) spending, to begin assessing the financial soundness of MSLP borrowers before the onset of the pandemic. We next explore how these firms fared afterward, comparing their performance change in 2020 with the change over the corresponding months in 2019 to evaluate whether they were already showing signs of deterioration relative to their peers prior to the pandemic or if they were largely victims of the pandemic.

To understand why these firms sought credit from the MSLP, it is likely more helpful to assess their financial health *relative* to otherwise comparable firms, measured as those in the same size group, industry, and location. Such comparative analysis is perhaps especially useful, or even necessary, with the D&B data, which do not contain balance sheet or income statement variables that lenders typically use to estimate the absolute level of credit risk. The focus of our analysis is therefore the relative performance of the MSLP borrowers vis-á-vis that of their peers, both before the onset of the pandemic and in the aftermath. These comparisons should offer clues as to which factors (such as a weakened ability to pay bills) may have prompted these firms to seek MSLP funding. Going forward, the relative performance of the MSLP borrowers will be the basis for evaluating the efficacy of the MSLP in terms of providing liquidity to alleviate financial strains on firms and subsequently helping to support the recovery of real economic activity.

This analysis is also intended to complement several existing studies of the MSLP. Morgan and Clampitt (2021) discuss the main design features of the MSLP and show that the program's ultimate volume exceeded several other Federal Reserve credit market facilities. Bräuning and Paligorova (2021) also find that the amount of credit extended by the MSLP was considerable—reaching about 60 percent of the volume of loans made by the large banks to borrowers of comparable size and leverage. Minoiu, Zarutskie, and Zlate (2021) study banks' participation in the MSLP and find that banks with assets of \$1 billion to \$50 billion originated close to 60 percent of the loans by volume. They further find a positive spillover effect of the MSLP: The more active lenders seem to have also made more C&I loans using their own capital. Bräuning et al. (2021) show that more MSLP loans went to businesses located in states with more severe declines in commercial activity and higher infection rates. Furthermore, more loans were extended when the need in a state rose due to an increase in the COVID-19 infection rate.

2 How Did MSLP Borrowers Stack Up against Peers?

This section first presents statistics for the baseline level of the variables of interest—starting with employment—before COVID-19 hit, which is dated as March 2020. This timing of the pre-pandemic baseline level was chosen based on supporting data work that shows D&B tends to incorporate changes in a business's condition into its data with a lag, so that, for example, employee count and credit scores mostly peaked in March 2020. We then report the change in these indicators from March 2020 to the month in which the MSLP loan request was submitted for a given firm to evaluate how conditions at each firm had evolved from when the pandemic was declared until the time when the firm sought MSLP credit. Given the typical lag in the D&B data and the anecdotal accounts of lenders needing approximately four weeks to prepare the paperwork for submission to the MSLP SPV, data reported for the month of the loan submission roughly represent the condition that prevailed around the time that a firm applied to its lender.² The slow-moving nature of the D&B data is also a major reason why we choose to focus on a multi-month change for our analysis, given that there is often no change over two consecutive months for the majority of firms.

To create a baseline for comparison with the changes in 2020, we also compute the changes in these indicators over the corresponding months in 2019 (to minimize the influence of any seasonality).³ This pre- versus post-COVID-outbreak comparison should reveal any systematic variation in the behavior of MSLP firms in 2020 relative to the most recent "normal" year. For example, in cases where some MSLP firms' performance deteriorated relative to their peers' performance in 2020, this setup enables us to tell whether the deterioration was a continuation of the "pre-existing condition"; that is, whether the firms already exhibited signs of relative decline prior to the pandemic. As noted, intuitively, we would expect MSLP borrowers not to be so risky that they were no longer viable, but more risky than some peers that were sufficiently creditworthy to obtain private loans at below the MSLP interest rate.

²Section 3 below will show that it makes little difference whether the earliest submission date or the origination date is used to approximate the application date. The four loans with official submission dates in January 2021 are grouped with the loans submitted in December 2020, the final month of D&B data used in this study.

 $^{^{3}}$ As a robustness check to guard against possible residual seasonality, we also check an alternative measure of the pre-pandemic change, from March 2019 to March 2020. The results remain qualitatively the same.

2.1 Data Preparations

Identifying MSLP Borrowers in the D&B Database

We rely primarily on the name-matching algorithm compiled by D&B to identify the MSLP borrowers' DUNS numbers (Data Universal Numbering System, the unique identifier in the D&B database). For this analysis, we consider only borrowers whose loans were purchased by the SPV.⁴ Among these, we omit the handful of nonprofit organizations and focus on the for-profit borrowers.⁵

This analysis uses the MSLP data as of Jan. 8, 2021, when the MSLP was formally closed.⁶ We are able to find in the D&B database the vast majority of the 1,813 accepted borrowers.⁷ Out of these, we are able to find 1,749 headquarters-level DUNS identifiers with a sufficiently high confidence level of match quality.

Among these firms, 90 were not in the D&B database in March 2020 and therefore cannot be used to conduct the analysis of changes since then. Furthermore, we remove 49 borrowers from our analysis because they have a modeled employment value of zero.⁸ After these exclusions, we are left with 1,605 firms in the sample. (See the Appendix [section 1] for more details of the name-matching process and the associated data issues; Table A.1 summarizes the matching output and reports the reasons for mismatched cases.)

Defining Peer Groups for MSLP Borrowers

Since the MSLP borrowers operate at different scales and in different industries and localities, it is more informative to compare these firms with their peers when assessing their conditions. Such relative comparison is especially important during this period because the pandemic exerted a more severe impact on personal-contact service industries than on other industries, and social-distancing rules were imposed to varying degrees and at different times across states.⁹ Moreover, MSLP eligibility required that a business had been established before March 13, 2020, and employed 15,000 or fewer workers or had 2019 annual revenues

⁴Most of the firms whose loan submissions were rejected at one point eventually had them approved.

⁵Of the total of 1,813 distinct DUNS we are able to match, only 15 are nonprofit organizations.

⁶Virtually all the loans were submitted to the SPV portal by the deadline set for loan submissions (3 a.m. EST on Dec. 15, 2020) to ensure all the loans would be funded by the original, year-end deadline for the MSLP. A handful had to be resubmitted because documents were incomplete initially.

 $^{^{7}}$ A total of 1,830 loans were approved, corresponding to 1,804 distinct borrower IDs, as 26 firms each borrowed two loans. These are mapped to 1,813 distinct DUNS, as some borrower IDs are mapped to multiple DUNS. For these borrowers, the current analysis considers only the timing of their first MSLP loan.

⁸According to D&B, a modeled employment of zero generally indicates the data on the firm are insufficient for any measures to be reliable, often because the firm's history is too short.

⁹Within-state differences in containment measures (such as greater restrictions imposed in some cities) and different trajectories and severities of COVID-19 infections will be considered in future analyses.

of \$5 billion or less.¹⁰ (Businesses that satisfy these requirements will henceforth be referred to as size-eligible.) We therefore define a peer group for every MSLP borrower that accounts for these dimensions and measure the MSLP borrower's relative performance accordingly.

To gauge a firm's relative size in terms of employee count, we define the peers for a given MSLP borrower as the size-eligible firms operating in the same state and in the same industry based on the North American Industry Classification System (NAICS) at the threedigit level (which is the level reported in the MSLP data). For the baseline analysis, we use a firm's industry code according to D&B to maintain consistency between MSLP firms and their peers.¹¹ Two types of employment data are available: For about one-quarter of all firms, D&B has collected the actual number of employees, whereas the value is estimated (or modeled) for the rest of the firms.¹² The general pattern is that the smallest businesses (especially those with fewer than 10 employees, as can be seen in Figure 1) and young businesses (those established in 2017 or later, as can be seen in Table A.3 in the Appendix) are more likely to have only estimated or modeled values for employment. For most of our subsequent analysis, we use all non-zero employment data, be they actual or estimated, since actual employee counts in a given month can be rather outdated and not much more accurate than estimated figures.

For all the other attributes, our peer group definition also accounts for the employment scale: The peer group for each MSLP borrower is defined as the set of size-eligible firms within the same two-digit NAICS industry, the same state, and the same employment size bin.¹³ The employment size bins are defined as follows: 1) as many as 10 employees, 2) 11 to 100 employees, 3) 101 to 250 employees, 4) 251 to 500 employees, 5) 500 to 1,000 employees, and 6) 1,000-plus employees.¹⁴ As for the analysis of employment, in an unreported robustness check of the analysis of these other variables, we also construct an alternative peer group

¹⁰By including only those active firms that were in the database as of March 2020, our analysis satisfies the establishment-date restriction, since it always takes more than one month for a new business to show up in the database. Among the tiny subset of firms (about 1,800) with more than 15,000 employees, we exclude those firms with more than \$5 billion in revenue and those that are missing revenue data. We cannot restrict peer firms based on the leverage-ratio limit in the MSLP because D&B lacks balance-sheet and income-statement data.

¹¹The issue of inconsistent industry codes from the two data sources will be examined in the next section.

¹²Note, however, that the actual employment data are updated only with a variable (and often long) lag, and at different times for any given firm depending on the arrival of data. This means that the actual employee count in any given month of data is more likely than not to be out of date to varying degrees across firms. D&B also makes no distinction between full- and part-time employees.

¹³Because of the added constraint on employee count, we use two-digit NAICS industry level here to ensure a reasonable minimum sample size for each peer group.

¹⁴Table A.2 in the Appendix lists the distribution of the number of firms within each peer group for March 2019 and March 2020. Table A.3 then reports, for each employment size bin, the number of MSLP firms, along with their mean and median employee counts, as well as the share of firms established after 2017, before 2010, or in the interim years.

for each MSLP borrower using only firms reporting actual employment. The unsurprising pattern is that using firms with an actual employee count generally leads to much smaller peer groups consisting of larger firms.¹⁵ Hence, the dispersion is noticeably larger with the more expansive definition of peer groups that uses all firms with any kind of employment data, and the MSLP firms' percentile ranks tend to be higher vis-á-vis these peers. But their relative ranks in terms of changes since March 2020 are not consistently different when compared with either set of peers.

2.2 Employment Distribution of MSLP Borrowers

Figure 1 depicts the employment as of 2020:M3 according to D&B against the sales as of 2019:Q4 reported by the MSLP borrowers (with both in log scale).¹⁶ In total, around 161,000 workers were employed in the 1,605 firms in the sample, or an average of 100 employees per firm. Employment and sales are clearly positively correlated, although the relationship is somewhat dispersed (for example, among the firms with two employees, revenue can differ by as many as six log points).¹⁷ The majority of these firms have fewer than 500 employees and thus satisfy the small-business criterion.¹⁸ This shows that most of the MSLP borrowers are far smaller than the maximum scale permitted by the program. It is again clear that smaller firms (especially those with fewer than 10 employees, corresponding to a log value of 2.3) tend to have only imputed data for employment, which are also more concentrated around some benchmark levels such as 5, 10, and multiples of 10.

Figure 2 presents the scatterplots and histograms of the distribution of employment and age of the MSLP borrowers as of March 2020 against the respective percentile rank of each firm when compared with its peers. These plots make clear that a given raw value of employment (or age) can correspond to quite different percentile ranks depending on the firm's industry and state, although there is a loosely positive (but highly concave) mapping between the raw value and the rank of a firm. In terms of employment, more than one-third of the firms are ranked in the highest decile, with employee counts ranging from three to more

¹⁵Table A.2 in the Appendix reports the distribution of the number of firms within each peer group when all firms with any non-zero employee counts are used; the median number of peer firms is more than 700. By comparison, the median number of peer firms when only those with actual employee data are used is 584.

¹⁶Sales are missing for close to 90 percent of the firms in the D&B database. Given how slow employment is updated by D&B, as evidenced below in the high fraction of zero changes, the March 2020 employee count for most firms in the D&B database probably reflects the approximate average level of their employment during 2019.

 $^{^{17}}$ The dispersion is partly driven by different capital intensity and productivity levels across industries and firms. At the two-digit NAICS level, the correlations range from 0.2 to 0.8. Moreover, measurement errors embedded in the D&B data add noise.

¹⁸We are in the process of matching these MSLP borrowers to their borrowing under the Paycheck Protection Program and will incorporate that information in future analysis.

than 500. In terms of age, nearly 40 percent of the firms were established within the last 10 years; nearly 30 percent are ranked in the lowest age decile, and another 20 percent are in the second-lowest decile.¹⁹ Nearly half of the MSLP firms in the sample are ranked above the median by employment but below the median by age, even though firm size and age are broadly positively correlated (as reflected in Table A.3 in the Appendix). This suggests that, controlling for size just before the pandemic hit, an unusually large share of the MSLP firms had experienced faster growth relative to their peers.

Figures 3a and 3b plot, respectively, the employment growth rates from March 2020 to the MSLP loan submission month against the employment level in March 2020 and against the growth over the corresponding months in 2019. It shows several increases and decreases in employment among firms with as many as 50 employees and a handful of mostly decreases among larger firms. For the vast majority of MSLP firms, however, there is no change in employment (whether it is measured using actual or imputed employment data). Moreover, the same pattern of predominantly zero changes is also observed over the matched months in 2019.²⁰ In fact, the same pattern of predominantly zero changes is present among all the D&B firms used in our analysis (as can be seen in Figure A.1 in the Appendix). This is consistent with our understanding that D&B employment data are mostly updated with a long (and variable) lag. This suggests that the D&B data are not suitable for studying rapid changes in employment brought on by the pandemic or for timely tracking of its evolution going forward.

We next evaluate how MSLP borrowers fared *relative* to their peers within the same state, two-digit NAICS industry, and employment-size bin in terms of both the level and the change in overall viability, financial health, payment delinquency, and B2B spending.

2.3 Risk Scores of MSLP Borrowers

This section summarizes the *relative* rank of the three main risk scores among MSLP borrowers vis-á-vis their peers in March 2020 (see the Appendix for more details about these scores—the viability score, the financial stress score, and the commercial credit score) and the changes from then to the month in which a firm submitted its loan request to the MSLP SPV. We present the results based on the percentile ranks of all the MSLP firms with valid

¹⁹We use the year of establishment according to D&B data in computing firm age. For over 600 firms, this establishment year differs by more than two years from the year reported by the MSLP borrower. Using the latter would result in an even younger distribution of firm age because the MSLP-reported date tends to be later than the D&B-recorded date.

 $^{^{20}}$ We omit the figure displaying the percentile ranks of employment growth, because it is not that meaningful.

D&B employment data.²¹ To provide a sense of the raw values of each variable at a given percentile in the distribution among the peer companies, we present in the Appendix the range of values at a few selected percentiles in the distribution of both the *levels* and the *changes* of the scores across the peer groups, each of which is formed around one MSLP borrower.²²

First, Figure 4 presents MSLP borrowers' relative percentile rank of the viability score, which is the most comprehensive measure of a firm's ability to sustain its operations and fulfill its obligations. In Panel 4a, the hollow navy bars of the histogram depict the rank distribution of the level in March 2020, while the light blue bars depict the rank distribution of changes in the score from March 2020 to the month of the MSLP loan submission.²³ The figure shows that the MSLP firms tend to have slightly below-average viability scores in March (mostly due to the highest share being in the lowest decile, the hollow navy bars), meaning a slightly higher risk of going out of business when compared with their peers.²⁴

Moreover, Panel 4a indicates that from the time the pandemic hit in March 2020 to before a firm applied for MSLP credit, more MSLP borrowers were exhibiting worse changes than were exhibiting better changes relative to their peers (the light blue bars), as the bottom decile again accounts for the highest share, and the overall share in the bottom four deciles exceeds that in the top four deciles. The bimodal shape of the distribution deserves some elaboration: It is largely the result of slower-moving viability scores among the peer firms than among MSLP firms, in that on average 30 percent of the peers but only 13 percent of MSLP firms experienced no change in their viability scores. Hence, even mildly negative changes tend to correspond to ranks in the low deciles, while mildly positive changes correspond to the high deciles.²⁵

²¹In unreported results, we explore if there is a discernibly different pattern when the firms are distinguished by the type of employment data. The general pattern is that those MSLP firms with actual employment data (that is, relatively larger and older firms) tend to have average rankings of risk scores vis-á-vis their peers, whereas the MSLP firms with modeled employment data (that is, relatively smaller and younger firms) tend to have fared worse than their peers after the onset of the pandemic.

 $^{^{22}}$ For example, the 10th percentile of the viability score among the peers for MSLP borrower A may be 440 while the 10th percentile among the peers for borrower B is 460. We plot the interquartile range, the median, and mean of these values. The range of values at each percentile of changes in the viability score is displayed likewise.

 $^{^{23}\}mathrm{This}$ color scheme will be used for all the subsequent relative rank charts.

 $^{^{24}}$ As an example, the range of values at the 10th percentile of the viability score among the MSLP firms' peers (by size bin, industry, and state) spans from around 450 to 490, and from around 550 to 600 at the 90th percentile.

²⁵This is because, given a tie, such as zero change, all the observations with that value are assigned the starting percentile corresponding to that value. Take changes in the viability score, for example. About 40 percent of the changes among peer companies are negative, 30 percent are zero, and 30 percent are positive. Thus, those MSLP firms (about one-half) with a negative score change are ranked below the 40th percentile, while most of the remainder (one-third) had a positive change and are ranked above the 70th percentile, and relatively few are ranked in the middle three deciles.

Panel 4b plots the distribution of the percentile rank of changes in 2020 (over the postpandemic-onset months as specified above) against the rank of changes over the same months in 2019.²⁶ Not surprisingly, the distributions in both years exhibit a similar bimodal shape, for the reasons noted above. Moreover, MSLP borrowers' viability-score changes also appear to be somewhat worse than average in 2019. Other than this similarity, however, a firm's rank in score changes in 2019 is minimally correlated with its rank in 2020.²⁷ In fact, a nontrivial fraction of MSLP borrowers with worse-than-average viability-score changes in 2019 saw their scores evolve better than average in 2020, and vice versa. This pattern may suggest that at least some of the factors influencing these firms' viability scores in 2020 differ from those operating in 2019, although a slight majority of the firms saw their scores worsen by a more-than-average degree in both years.²⁸

Figures A.3 and A.4 in the Appendix present, respectively, MSLP firms' relative ranks in terms of the financial stress score (FSS, which measures inversely the risk of financial distress over the next 12 months) and the commercial credit score (CCS, which predicts firms' ability to pay bills over the next 12 months). The MSLP firms' relative performance exhibits patterns broadly similar to those of the viability score.²⁹ Specifically, in March 2020, MSLP firms had a somewhat worse FSS than their peers (the hollow navy bars in Panel A.3a) but a more comparable CCS (Panel A.4a).³⁰ From March 2020 to the month of the loan submission, both scores (especially the FSS) deteriorated slightly more on net among MSLP firms than among their peers (the light blue bars in Panels A.3a and A.4a), with both again exhibiting a bimodal distribution.³¹ Moreover, the MSLP firms' FSS and CCS changes over the corresponding months in 2020 versus in 2019 are minimally correlated at the firm level, and on net somewhat worse in 2020 (plots omitted for brevity).

 $^{^{26}\}mathrm{We}$ lose 279 firms in this sample because new firms as of 2019 according to D&B are excluded.

 $^{^{27}}$ The low correlation can also be seen in Table A.5.

²⁸For comparison, the distributions of viability-score changes across the two years are also similar among the peer firms, as shown in Figure A.2, which depicts the range of values at a given percentile of the score changes among the peer firms over the corresponding months in 2019 (the left panel) and in 2020 (the right panel). The score changes over the two years are also minimally correlated among the peer firms (with a coefficient of -0.1). On the other hand, as a sign of the pandemic's adverse impact, a wider dispersion of declines at the low (10th) percentile and smaller increases at the high (90th) percentile are observed in 2020 when compared with 2019.

²⁹This is perhaps not too surprising since the three scores are fairly correlated, with a correlation coefficient of around 0.6 between any two scores' raw value as of March 2020, as seen in Table A.4. The correlations of the variables' percentile ranks are lower but qualitatively similar.

³⁰The sample for the FSS and the CCS is smaller by close to 100 than for the viability score because D&B requires more data to compute these two scores.

³¹Figures A.3b and A.4b in the Appendix display, respectively, the range of values at a given percentile among the MSLP firms' peers of the FSS and the CCS changes over the corresponding months in 2020 (the right panel) versus 2019 (the left panel). The distributions are again similar in the two years, except for more declines at the low (10^{th}) percentiles in 2020 than in 2019, and slightly more variability for the CCS in the extreme percentiles than the FSS and the viability score.

Taken together, all three risk scores reveal fairly similar patterns about the relative health of those firms that borrowed from the MSLP. They all show that these firms were, on average, somewhat less viable, more at risk of becoming delinquent on their bills, or suffering more from other forms of financial distress than firms of a similar size and operating in the same industry and state. Moreover, the risk scores all deteriorated somewhat more on net among MSLP firms than among their peers.

These findings can help explain why these firms applied for credit from the MSLP: Their worse-than-average conditions would have made it more expensive for them to obtain credit in the private market, or they would have faced constraints on the amount of credit available. It should also be noted that these risk scores exhibit changes after March 2020 that are somewhat more visible than the changes to the number of employees, indicating that these D&B variables are likely more useful for gauging the change in a firm's condition on a more timely basis, especially since they are available for a large share of the firms in the database.

2.4 Payment Score and Delinquency Records

This section reports the relative rank of MSLP firms' 24-month Paydex score, which summarizes how timely a firm has been paying its bills, and its change from March 2020 to the MSLP loan submission month versus the change over the corresponding months in 2019.³² Unlike the model-based forward-looking risk scores, the Paydex score is a backward-looking measure of a firm's actual payment behavior. For more timely signals of firms' payment performance, we then examine a few of the payment records over the preceding three months.³³ We focus on the portion of account balances that are 31-plus days past due over the most recent three months, since these exhibit more non-zero values, although the qualitative patterns are similar for the portion of account balances that are 61-plus and 91-plus days past due (with the latter considered severely delinquent).

Figure 5a depicts the distribution of the MSLP firms' Paydex score percentile ranks in March 2020 (the hollow navy bars) and the ranks of the score changes (the light blue bars) after March. It appears that the MSLP firms' payment records over the preceding 24 months were better than average. In terms of the relative changes from March 2000 to the MSLP submission month, many are middling but about one-half are in the top three deciles. Figure 5b shows that the relative Paydex-score changes in 2020 are distributed rather similarly to, albeit slightly better than, changes over the corresponding months in 2019. By comparison,

³²The lower the score, the later the company pays its bills. D&B assigns the Paydex score only if there are sufficient data on payment records for a company. Thus, compared with the three risk scores, Paydex is available for a much smaller subset of firms.

³³These payment records underlie the computation of the Paydex score and will in time influence the 24-month Paydex score.

at the firm level, the Paydex-score changes in the two years are weakly more correlated than the risk-score changes. ³⁴

In contrast, these MSLP firms' payment records over the more recent past are worse than average. Figure 6a shows that in March 2020, MSLP firms tended to have a higherthan-average portion of account balances that were 31-plus days past due, and that portion rose more on average among these MSLP firms than among their peers.³⁵ Rather similar patterns are observed in March 2020 for the portions of account balances that are 61-plus days or 91-plus days past due over the most recent three months, as well as their changes from March 2020 to the MSLP loan submission month (not shown for brevity).

The message from the longer-horizon Paydex score and the more recent payment records appears to be that MSLP firms were somewhat better than average at paying their bills over the preceding two years, but they fell behind in the more recent period immediately before the onset of the pandemic. Once the pandemic began, their payment records worsened somewhat more than those of their peers.

2.5 Total Business Spending

The final group of indicators gauge the degree of activity at a business. We focus on the total B2B spending by a business over the preceding six months, which is a direct measure of the level at which a business operates.

Figure 7a shows that in March 2020, relative to their peers, MSLP firms that *reported positive spending* had higher levels of spending than their peers (the hollow navy bars). At the same time, 65 percent of the MSLP firms and 88 percent of the peers had zero or missing spending over the preceding six months as recorded in March 2020, and thus they are excluded from this figure. Taken together, the data indicate that MSLP firms as a whole had higher-than-average spending in March 2020. Panel 7a also reveals that among those firms reporting positive spending in both March 2020 and the month of their MSLP loan submission, spending held up better than it did among their peers.³⁶ The simple correlation coefficient (0.27) indicates a weakly positive relationship between the percentile

³⁴The positive correlation would be expected because one year of payment records is common to the 24month Paydex score in two consecutive years. Figure A.5 in the Appendix depicts the range of values at a given percentile among the MSLP firms' peers of the Paydex-score changes after March 2020 and over the corresponding months in 2019. The distribution of changes in the two years is broadly comparable, although the Paydex-score declines are larger than the risk-score declines in 2020 than they are in 2019.

³⁵Figure A.6 depicts the range of values at a given percentile among the MSLP firms' peers of the fraction of account balances 31-plus days past due from March 2020 to the month of the MSLP loan submission and over the corresponding months in 2019, respectively.

³⁶The growth rate of spending cannot be computed for about 50 firms, because they did not report spending in both months.

rank of spending and that of the portion of debt balance past due, suggesting that the high spending by some firms may have been partly supported by slow payment.³⁷ By comparison, there is no positive correlation between the change in these two variables. Figure 7b depicts the spending growth after March 2020 against the growth over the corresponding months in 2019.³⁸ The growth rates of spending in these two years are somewhat correlated at the firm level: This subset of the MSLP firms tended to experience faster-than-average spending growth in both years.

We also examine two other indicators that indirectly measure how active a business has been based on the number of sources reporting data on the business and the number of signals from these sources.³⁹ These indicators impart a message that is roughly similar to that of total spending: The MSLP firms tend to have a larger number of data sources and exhibited a larger number of strong business activity signals in March 2020, and the indicators deteriorated less among them than among their peers after March 2020. (For brevity, these results are omitted.)

Finally, we compare the relative performance of those firms borrowing under the MSLP's New Loan Facility (NLF) versus those borrowing under the program's Priority and Expanded Loan Facility (PLF and ELF), because the latter permitted a higher leverage limit (an adjusted debt-to-EBITDA ratio of 6) than the NLF (an adjusted debt-to-EBITDA ratio of 4) and generally had larger borrowers. We find that the percentile ranks of these two groups of borrowers are highly similar in terms of both the level in March 2020 and the change from then to the loan submission month. The NLF borrowers exhibit minimally better relative performance in a few measures, such as the viability score. (The details are likewise omitted.)

Taken together, the patterns over these variables suggest that some MSLP firms maintained their level of business activity better than their peers did, even though this is not necessarily reflected in the risk scores; sometimes they maintained it at the expense of payment performance. The high activity level is consistent with the intuition that MSLP borrowers had good growth prospects and thus the lending banks, which still would have to bear a portion of the loss should the borrower default, would have expected the firms to return to adequate profitability once the pandemic ends. This would generally mean that the borrowers were not too risky judging by their long-term prospects. On the other hand, MSLP borrowers were not so healthy that they would qualify for a bank loan of a similar

³⁷There is a stronger correlation between the raw values of spending and past-due debt, suggesting that this is more at the industry level (so that the correlation is weak in terms of firms' within-industry percentile ranks). We are further exploring this issue.

 $^{^{38}}$ We further lose more than 50 percent of the firms that reported positive spending in March 2020 because they were established after 2018 and thus are excluded from this subsample.

³⁹One advantage of these indicators is that they are available for a larger set of firms. See the Appendix for details on these indicators.

size or on terms similar to those offered by the MSLP, as evidenced by their problematic delinquency records.

3 Robustness

This section examines how robust the above findings are under a few different data treatments, some of which address potential inconsistencies across data sources. In general, we conclude that our findings hold up fairly well qualitatively under these adjustments.

3.1 Three-Year Changes Prior to COVID-19

To verify that our assessment of the MSLP firms' financial health prior to the COVID-19 pandemic is not due to unusual developments over 2019, we also examine the change or growth rate of the variables of interest over a three-year period through March 2020. Figure 8a depicts the overlaid histograms of the percentile ranks of one-year (red hollow bars) versus three-year (light blue bars) changes in the MSLP firms' viability scores. The overall pattern is basically the same, with a minor redistribution in the middle deciles that results in a slightly higher average percentile rank based on the three-year changes before the onset of COVID-19. Because pre-2019 data are unavailable for 152 firms, the navy bars depict the one-year change for the full sample analyzed in Section 2 to ascertain that there is no obvious selection bias due to the subsample with the longer history of data. For the same purpose, Figure 8b compares the percentile ranks of the score changes from March 2020 to the MSLP submission month for the full sample with those for the longer-history subsample and shows they again exhibit nearly the same distribution. In sum, the one-year pre-Covid relative developments at MSLP firms vis-à-vis their peers are highly representative of the firms' relative position over the three years leading up to the COVID-19 outbreak.⁴⁰

3.2 Date of Application for the MSLP

A firm sought credit during the COVID-19 pandemic presumably due to the disruptions to its operations and thus cash flow from the start of the outbreak up to the time of the loan application.⁴¹ Thus, to understand the "why" in terms of credit demand, ideally we would examine changes in a firm's circumstances from March 2020 to the date of the loan

 $^{^{40}}$ We find fairly similar patterns in the corresponding comparisons of the other variables. Those results are omitted due to space considerations.

⁴¹As noted above, whether a firm borrowed from the MSLP was jointly determined by the firm's need for credit and a lender's decision to lend under the MSLP. This joint decision is left for future studies.

application. In the above analysis, we use the eventual successful MSLP submission date to approximate this timing. But the submission date is later than the loan application date by varying lengths. Anecdotal evidence suggests that it takes a bank three to four weeks to prepare the necessary documents to underwrite a loan. If the bank agreed to make a loan to the firm but only through the MSLP, it then took at least a few more days to successfully submit the loan to the Main Street Lending SPV. In some cases where the lender submitted either wrong or incomplete data, it took an additional week or more for the submission to finally succeed. The time that elapsed due to this process introduces measurement errors into our estimate of the pandemic-induced changes in conditions that led firms to seek credit through the MSLP.⁴² In this section, we examine how much our results above change if we instead use a comparatively more precise proxy for the loan application date—the earliest date in the database associated with a loan, be it the first submission date or the first origination date.⁴³ For most of the loans, this modification does not alter the period over which the post-pandemic window is defined, because the revised date falls in the same month as the successful submission date used in our earlier analysis.

3.3 Industry Classification

Lastly, we examine if or how the above findings are affected by the discrepancy in the industry classification according to D&B versus what is reported by MSLP borrowers. Some differences are to be expected for those multi-sectoral-product firms, since different data providers, lacking revenue data by product line, may place emphasis on different products and thus industries.⁴⁴ In addition, some firms' operations evolve over time and cross industry lines (for example, IBM shifting from hardware production to consulting services), and data providers likely differ in when, or even whether, they update the firms' industry classifications. Out of the 1,753 borrowers included in our analysis above, 673 have industry codes at the two-digit NAICS level that differ in these two data sets, while 469 have industry codes that differ even at the one-digit NAICS level.

As discussed above, each MSLP borrower is compared with its peers as defined at the

⁴²The extra time preparing the loan is, however, unlikely to result in bias, since it is hard to imagine that the loan application by itself would quickly alleviate the difficulties caused by the pandemic, such as being late with bills due to the lack of income or falling risk scores.

⁴³In actuality, the elapsed time between the origination and application dates also depends on the type of submission to the MSLP. For the majority of MSLP loans, the lender first obtained a commitment letter from the SPV and originated the loan afterward, while for the rest, the lender underwrote the loan first and then sold the participation to the SPV. So, more time would elapse between application and origination in the former case than in the latter.

⁴⁴These complexities are not confined to large firms. Many small firms engage in manufacturing products (such as food items) that they then sell both as retail items and as mail-order items, so that NAICS 31, 44, and 45 are all applicable codes.

two-digit NAICS level, so these firms' percentile ranks in terms of viability score etc. can potentially differ if they are compared with peer firms in a different industry. This likelihood is comparatively higher if a firm is moved from an industry adversely affected by COVID-19 to one that is minimally affected or not affected, and vice versa. We find that 212 MSLP borrowers are classified as adversely affected by the pandemic according to their D&B industry codes but minimally affected according to the MSLP industry codes, and the opposite applies to 159 borrowers.

We thus compile two alternative versions of industry codes: 1) codes as reported by MSLP firms, and 2) the MSLP codes supplemented by D&B codes in cases where the former are missing or unclassified and, if a firm is a Paycheck Protection Program (PPP) borrower, further supplemented by the PPP industry code in cases where the first two are missing, so as to maximize the number of valid industry codes. Figure 9 depicts the scatterplot (with spending growth in panel 9a and viability score in panel 9b) comparing the MSLP borrowers' ranking using the D&B two-digit NAICS codes (our baseline) versus using the two alternative industry codes for those borrowers whose two-digit NAICS codes differ between either pair. It is clear that the percentile ranks are highly correlated (with correlation coefficients around 0.98 for viability score and above 0.897 for spending growth). The correlations for the other variables analyzed above between the percentile ranks based on the baseline and the alternative industry codes are all quite high, ranging from 0.897 to 0.999. In sum, these statistics show that the discrepancy in industry codes, albeit somewhat common, does not alter the qualitative pattern found in the previous section.

4 Policy Implications of the Findings

When all of the above findings are considered collectively, the following pattern seems to emerge. A nontrivial fraction of MSLP borrowers are fairly small and, perhaps as importantly, young firms. Partly for this reason, MSLP firms on average had slightly lower-thanaverage risk scores before the onset of the COVID-19 crisis; that is, they were deemed to have higher predicted delinquency risk as well as higher risk of ceasing operations in general. By comparison, those MSLP firms that are relatively larger or older and thus provide consistent payment data were, in fact, in a somewhat sounder condition than their peers in terms of their records of paying bills in a timely manner, even though a subset were already showing signs of deterioration just before the pandemic hit. From March 2020 to the month of the MSLP loan submission, these firms by and large experienced further deterioration in their payment delinquency status and in turn their risk scores relative to their peers. On the other hand, at the firm level, changes in the risk scores observed in 2020 are at best weakly correlated with the changes observed over the corresponding months in 2019. These statistics together help explain why these firms would have found it attractive to seek credit through an MSLP loan: They were likely deemed too risky to obtain a private bank loan of equal size at the MSLP interest rate. Moreover, it appears that the greater riskiness of these firms was not entirely the result of the pandemic, as some MSLP borrowers had already weakened before the COVID-19 shock hit.

At the same time, some of these firms (which tend to be relatively larger or older) also appear to have exhibited a higher level of operational activity than their peers by spending more on supplies, utilities, and business services or by showing signs of being more active (such as having a larger number of transactions or suppliers, or more reliable data). This may help explain why banks were willing to underwrite MSLP loans for these firms, since survey evidence indicates that many banks were, in fact, reluctant to tap into the MSLP and applied fairly stringent underwriting standards. The spending and activity data may indicate that these firms had greater growth potential, making the lending relationship more valuable to their banks. And the banks turned to the MSLP to accomplish the credit extension to the firms that were deemed relatively risky at the time because the Fed assistance enabled them to offer a lower rate or lend a larger amount, or both, than the banks would have been willing or able to achieve had they used solely their own capital. The lower rate or larger loans should enhance the firms' odds of survival and a more robust recovery, preserving or even boosting the relationship value to the banks.

Another probable reason why making the MSLP loans was in some banks' interest is that these banks already had loans outstanding to some MSLP borrowers at the onset of COVID-19, and thus they could immediately and more explicitly benefit from the injection of additional liquidity into the firms.⁴⁵ Given that some of the MSLP firms showed worsethan-average delinquency records on their obligations in general, it is a distinct possibility that the borrowers started having difficulty meeting the repayment obligations due to the pandemic-induced disruptions. Providing liquidity to help the borrowers continue to meet outlays despite the income shortfall, including making contractual payments on the existing loans, thus would immediately benefit the lenders in several ways. First, the new funding would allow the firms to avoid defaulting on existing loans and thus reduce the odds of a charge-off that would eat into the lenders' capital; it would also reduce the need to increase their loan loss provisions. Second, lending through the MSLP would enable the lenders to minimize the increase in concentration risk due to making more loans to the same borrowers; and it would provide the standard MSLP benefit of conserving banks' risk-based capital.

⁴⁵This is similar to one of a bank's incentives for making loans under the Paycheck Protection Program (PPP) as modeled in Joaquim and Netto (2021).

To the extent our further analysis can confirm the thus far only suggestive evidence that some of the MSLP firms were experiencing more payment difficulties temporarily because they tended to be faster growing, it will strengthen the case for the Fed to roll out a program like the MSLP following major disruptions to the economy. Such a program could confer substantial real economic benefits by providing the "bridge" funding to firms that have good prospects but are suffering from short-term liquidity shortages. On the other hand, there also appears to be indicative evidence that some of MSLP firms were already more "sickly" before the pandemic-induced downturn, such that credit support at a lower-than-market price could mostly serve to prolong their unproductive existence without necessarily leading to productivity improvement that could ensure eventual viability. As Caballero, Hoshi, and Kashyap (2008) demonstrate, having unhealthy firms linger over a longer-than-optimal period could even discourage the entry of new, more promising firms. Our subsequent analysis will try to better distinguish between these two different types of firms, or even between the two possible scenarios. It will help make an MSLP-like program in the future more efficient in terms of funding and more effective in terms of stimulus if we gain a better understanding of the attributes that identify firms with greater growth potential and design the program accordingly to encourage their participation.

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Figure 1: MSLP Firms' 2019 Annual Revenue versus Employment (D&B)

Note: Blue and red dots correspond to firms with actual (N=1,006) versus estimated (N=597) values for firm-level employee counts, respectively. Each dot is based on the average over 1 percent of the firms in each subgroup, mapping to at least five firms. Each of the 100 bins is created by first sorting observations into 10 deciles by employee count based on 03/2020 D&B data. Then, within each decile, they are further sorted into 10 deciles by revenue. Average employment and average annual revenue are then computed for each bin, and depicted in natural log scale. Source: MSLP data and Dun & Bradstreet data for MSLP borrowers matched by name.

Figure 2: MSLP Firms' Employment and Firm Age: Level vs. Percentile Rank within Each Peer Group in 03/2020



(a) Total Number of Employees

Note: N=1,579 in Panel (a), excluding firms with employment greater than 1,000 persons in 03/2020. Panel (b) (N=1,585) excludes firms with ages older than 100 years in 03/2020. Source: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure 3: Distribution of MSLP Firms' Employment Growth

(a) Employment Log Level in 03/2020 vs. Percent Change (03/2020 - MSLP submission month)



(b) Percent Change, 03/2020 – MSLP submission month vs. the corresponding months in 2019



Note: Panel (a) drops firms with employment greater than 1,000 persons in 03/2020 (N=5) or employment growth greater than 100 percent between 03/2020 and the MSLP submission month. Panel (b) excludes firms that began operations after 2018 or had employment growth greater than 100 percent in either period. Source: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure 4: Distribution of MSLP Firms' Percentile Ranks within Peer Groups: Viability Score





□ Level, 03/2020, N=1604 ■ Change, 03/2020 — MSLP submission month, N=1604

(b) Change, 03/2020 – MSLP submission month vs. the corresponding months in 2019



Note: Panel (b) excludes new firms that began operations after 2018. Source: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure 5: Distribution of MSLP Firms' Percentile Ranks within Peer Groups: 24-month Paydex Score





(b) Change, 03/2020 - MSLP submission month vs. the corresponding months in 2019



Note: Panel (b) excludes new firms that began operations after 2018. *Source*: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure 6: Distribution of MSLP Firms' Percentile Ranks within Peer Groups: Portion of 31 Plus Days Past Due in Total Amount Owed over Last 3 Months



(a) Level in 03/2020 vs. Change over 03/2020 – MSLP submission month

(b) Change, 03/2020 – MSLP submission month vs. the corresponding months in 2019



Note: Panel (b) excludes new firms that began operations after 2018. *Source*: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure 7: Distribution of MSLP Firms' Percentile Ranks within Peer Groups: Total Dollar Spending in Last 6 Months





(b) Percent Change, 03/2020 – MSLP submission month vs. the corresponding months in 2019



Note: Panel (b) excludes new firms that began operations after 2018. Source: Dun & Bradstreet data for MSLP borrowers matched by name.



Figure 8: MSLP Firms' Ranks within Peer Groups: 3-Year Viability Score Changes

(a) Change, 03/2020 - 03/2017 vs. Change, 03/2020 - 03/2019





Note: Panel (a) compares 3-year (red hollow bars) vs. 1-year (light blue bars) pre-COVID changes for the subsample with viability score back to 03/2017, vs. 1-year change for the full sample with data back to 03/2019 (navy hollow bars). Panel (b) compares the post-COVID change for the corresponding full sample vs. subsample. Source: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure 9: Comparison of MSLP Firms' Percentile Ranks Based on Different Industry Codes

(a) Percentile Rank of 6-Month Spending Growth from 03/2020 to MSLP Submission Month



(b) Percentile Rank of Viability Score Change from 03/2020 to MSLP Submission Month



Note: Includes only firms with different 2-digit NAICS codes across data sets. Blue dots: MSLP reported industry codes were used to compute percentile ranks on the y-axis. Red dots: a combination of D&B, MSLP, and PPP industry codes were used. *Source*: Dun Bradstreet data for MSLP borrowers matched by name.

Appendix

1 Identifying MSLP Borrowers in the D&B Database

This section briefly discusses the data issues encountered in the process of identifying the DUNS numbers of MSLP borrowers. The borrowing firms were supposed to report their DUNS numbers as part of the data submission required for MSLP loan underwriting, but in practice only about 20 percent of the borrowers provided this information. In fact, about one-quarter of the reported DUNS numbers are erroneous. Hence, we rely mostly on D&B's name-matching algorithm (Integration Manager, IM) for this task. Of the 1,813 accepted MSLP borrowers recorded as of January 8, 2021, we are able to find DUNS matches for 1, 796 directly through IM based on the MSLP firm name and address.¹ Of these, we consider only the 1,516 borrowers matched with a confidence score of 8 or higher (which are deemed sufficiently precise—1, 170 have a perfect score of 10, and 346 have a score 8 or 9). To these, we are able to add 234 borrowers that initially were matched with low confidence scores by improving their scores to 8 or higher with additional information obtained via manual searches. Likewise, we are also able to find matches for 13 of the 17 initially unmatched borrowers. On the other hand, 10 borrowers were incorrectly matched by the algorithm and were removed from our sample after manual inspection. Another 0 borrowers were dropped after we aggregated branches to their headquarters DUNS because several variables are not separately available at the branch level in the D&B database. In sum, our sample of matched borrowers totals 1,749, all of which correspond to headquarters-level DUNS.

Subsequently, several borrowers were removed from our sample either because (1) they are not in the D&B database in the relevant period, (2) they cannot be assigned a peer group due to missing employment data, or (3) their status code changed (that is, a change from branch to headquarters or vice versa) over the sample period.² In March 2020, for instance, 70 of these firms were not included in the D&B database, another 49 had missing values for employment, and 5 changed status over the period used to compute changes in the variables of interest from March 2020 to a firm's MSLP loan submission month. Thus, there are 1,605 firms left for our analysis here.

¹All the counts reported here are based on the number of distinct DUNS unless otherwise noted. Some distinct IDs as reported by the MSLP borrowers are mapped into more than one DUNS numbers.

²When a firm's status changes over a period, changes in many variables' values cannot be correctly computed because the value reported for a headquarters is the sum across all branches. We thus leave these observations out.

2 Relevant Variables in the D&B Database

Employment

D&B offers two types of data on firm employment: 1) the actual employee count for a firm, either directly reported by the firm or gleaned from other sources, and 2) modeled (imputed) employment, which is estimated using D&B's proprietary model along with other data items D&B collects on the firm. About 25 percent of the firms report actual employment. Note, however, that the actual employment data are updated only with a lag and often at different times for different firms, or even any given firm, depending on the arrival of new information. This means that the actual employment may be out of date to varying degrees across firms. To maximize the sample size, we use all the firms with any type of employment data in our baseline analysis, but we discuss separately the pattern of the alternative sample that uses only those firms with actual employment data in cases where they differ sufficiently.

Risk Scores

We consider the three major risk scores compiled by D&B, all of which are meant to be forward-looking. We use the raw scores for all three, where a higher value signifies lower risk (similar to a consumer credit score). Among these, the most comprehensive is the viability score, which ranges from 101 to 800. It assesses a business's overall likelihood of going out of business (which includes becoming inactive or filing for bankruptcy) over the next 12 months. The commercial credit score (CCS, also known as the delinquency score), ranging from 101 to 670, predicts the likelihood of a business having a severely delinquent account (91-plus days past due) over the next 12 months.³ The financial stress score (FSS, also known as the failure score), ranging from 1,001 to 1,875, predicts the likelihood over the next 12 months that a business incurs financial distress (such as ceasing operations, leaving unpaid obligations to creditors, moving into receivership) or files for bankruptcy. As an example, Figure A.8 depicts the range of the viability scores (from the 10th to the 90th percentiles) for the MSLP borrowers after January 2020. They collectively show that the scores generally peaked around March 2020 and then declined visibly among the top percentiles.⁴

 $^{^{3}}$ The marginal odds of being good doubles for each 40-point increase. This also applies to the FSS described next.

⁴The distributional patterns of the time series of these risk scores after January 2020 for all the firms in our internal D&B data are broadly similar. In fact, this holds for basically all of the variables analyzed here. A few minor exceptions are the past due variables, where the highest percentiles of the distribution tend to take the value of 1 throughout the sample months.

Payment Records

The last set of variables record the degree of a business's payment delinquency (if it has been delinquent) over the preceding 3 to 24 months (depending on the variable). We focus on the more timely records over the preceding three months, specifically, the portion of the total amount owed over the most recent three months that is 31-plus, 61-plus, or 91-plus days past due.⁵ Figure A.10 depicts the distribution among MSLP borrowers, after January 2019, of the portion of bills 31-plus days past due. The share of firms with bills past due rose after March-April 2020 and mostly peaked in July, followed by a modest improvement (that is, a decline) in July among the firms with visibly higher-than-average shares (whereas those with the most serious delinquency level saw their portion of 31-plus days past due remain at 1).⁶

As a sufficient statistic of these indicators for how punctually a business has been paying its bills, D&B compiles the Paydex score. The most commonly used version of Paydex is based on payment behavior over the preceding 24 months. Values of 80 and higher mean a firm pays on time; 70 equals 15 days beyond terms; 60 equals 22 days beyond terms; 50 equals 30 days beyond terms; 40 equals 60 days beyond terms; 30 equals 90 days beyond terms; 20 equals 120 days beyond terms. A missing Paydex score (coded as 0 or 999) is due to an insufficient number of qualified transaction experiences and is thus much more prevalent among new firms or firms newly added to the D&B database. This score is available for somewhat fewer firms than the number of firms that have data for recent (over the preceding three months) payment records, because data are not consistently available over time for some firms.⁷ The 24-month Paydex score is available for about 25 percent of the firms after January 2020 among mostly active firms, while payment records over the preceding three months are available for about one-third of the firms. Paydex scores are available for a much higher fraction of the MSLP firms, consistent with those firms being larger than average. Unlike the forward-looking modeled risk scores, the commonly referenced Paydex score is backward-looking, determined entirely by a firm's own payment records.

Total Spending and Activity Indicators

The next group of variables measure how active a business's operations are, which is again positively correlated with its scale. Total business spending measures the dollar amount a

⁵We verify that the patterns found with these delinquency variables based on the *amount* of bills due are similar to those using the portion past due based on the *number* of accounts, or the persistence (the portion of months over the preceding 12 months) of past due.

 $^{^{6}{\}rm The}$ pattern is broadly similar for the portion of bills 61-plus and 91-plus days past due, although the share reporting zero is higher.

⁷The Paydex score is available only for firms with three or more payment experiences from at least two trade providers.

firm spends on materials and services over the preceding six months.⁸ This variable is available for only about 15 percent of the firms. Figure A.11 depicts the range of total spending by the MSLP firms after January 2019. This variable also peaked in March, and the higher percentiles exhibit greater decline since then. Compared with the risk scores, the spending value is much more skewed, with a long right tail.

In addition, D&B tracks the number of data sources for each business (such as government agencies, suppliers, customers, and lending institutions) as well as the number of data points collected from these sources. These are then tallied by the type of data source. As in the case of spending, these activity indicators are by and large available only for large firms, and even among these firms they are often zero over a three-month period. We therefore omit them from our baseline analysis, but we explored their changes after March 2020 in unreported analysis. The pattern is similar to total spending: Both the number of sources and the number of activities reported reached the highest level in March or April 2020 and then retreated, although a modest recovery is observed among the top percentile of the firms after September or October 2020.

⁸We also explored spending by category, such as on office and IT equipment versus gifts and party supplies, but the share of missing data is too high for these individual categories to yield meaningful statistics.

Confidence Code	Field with Mismatch	Accepted	In Review	Draft
10	Total	1170	0	16
8 and 9	Address	104	0	1
8 and 9	Company Name	242	0	8
7 and Below	Address	146	0	4
7 and Below	Company Name	134	0	4
Unmatched	No Candidate Found	17	0	0

Table A.1: Summary of MSLP Firm Name Matching Results

Note: Confidence score is the summary statistic of the match quality produced by D&B's name-matching algorithm. A match with a score of 8 or above is generally considered sufficiently precise. There is a total of 1,813 MSLP borrowers based on unique DUNS numbers that received at least one MSLP loan. Among these, there are 297 that initially had lower confidence scores or were unmatched using the borrower reported information. We were able to improve 247 using additional information obtained via manual searches. In total, we have 1,749 matched borrowers at the headquarters level. Source: Dun & Bradstreet data for MSLP borrowers matched by name.

		March 2019	March 2020
Type of Stats			
Percentiles	1 st	6	8
	5th	25	24
	10th	49	53
	25th	166	176
	50th	701	708
	75th	5004	6192
	90th	24308	32103
	95th	49562	61905
	$99 \mathrm{th}$	147226	180688
Mean No.	of Peers/Group	9344	11544
Cross-Group	p SD, No. of Peers	25673	31041
No. of Uni	ique Peer Groups	854	915

Table A.2: Distribution of Number of Unique DUNS within Each Peer Group

Note: This table reports selected percentiles of the number of firms within each peer group. Peer groups tend to be larger if defined for a smaller employee size bin, a larger state, or a larger industry. The number of distinct peer groups (reported in the last row) is smaller than the number of MSLP firms in each period because many MSLP firms belong to the same state or industry. Source: Dun & Bradstreet data for MSLP borrowers matched by name.

Size	Emp. Data	No. of	Employees		Percent. Share with Start Year			
Bin	Type	Firms	Mean	Median	SD	After 2017	2010-2016	Before 2010
up to 10	Actual	299	4.5	4	2.9	6	41.1	52.8
up to 10	Imputed	483	4.3	4	2.6	49.3	38.7	9.9
11 to 20	Actual	144	15.4	15	3.1	2.8	28.5	68.8
11 to 20	Imputed	40	15.2	15	3.1	17.5	42.5	40
21 to 50	Actual	199	34.8	34	9.6	2.5	17.6	79.9
21 to 50	Imputed	34	34.1	35	9.4	5.9	41.2	52.9
51 to 100	Actual	156	77.1	77	14.9	5.1	19.2	75.6
51 to 100	Imputed	16	71.2	71	14.4	12.5	43.8	43.8
101 to 500	Actual	151	236.1	200	113	3.3	11.9	84.1
101 to 500	Imputed	22	197.7	178.5	89	13.6	22.7	63.6
501 to 1000	Actual	34	731.5	712.5	137.1	2.9	11.8	85.3
501 to 1000	Imputed	3	796	857	144.5	0	33.3	66.7
over 1000	Actual	24	2722.9	1900	1935.1	4.2	4.2	91.7
over 1000	Imputed	0	_	_	_	_	_	_
All	All	1605	99.8	12	419	18.3	30.1	50.9

Table A.3: Distribution of MSLP Firm Employment and Age within Each Size Group

Note: A total of 1,605 matched MSLP borrowers is included in this table. Summary statistics are created separately for two subgroups among MSLP borrower within each employment size bin: 1) only those firms whose employee counts are actual data (rows marked with Actual), versus 2) the rest of the firms, whose employee counts are estimated or modeled by D&B (rows marked with Imputed). Source: Dun & Bradstreet data for MSLP borrowers matched by name.

	Financial Stress Score	Commercia Credit Score	l Overall Viability Score	24-month PAYDEX Score	Portion of 31+ Days Past Due in Total Amount Owed over Last 3 Months	Portion of 61+ Days Past Due in Total Amount Owed over Last 3 Months	Portion of Last 12 Months with An Account 31+ Days Past Due	Total Spending in Last 6 Months (USD)
Financial Stress Score	1.00	0.58	0.61	0.63	-0.34	-0.27	-0.41	0.03
Commercial Credit Score	0.58	1.00	0.53	0.60	-0.65	-0.63	-0.50	0.06
Overall Viability Score	0.61	0.53	1.00	0.51	-0.35	-0.30	-0.42	0.06
24-month PAY- DEX Score	0.63	0.60	0.51	1.00	-0.45	-0.41	-0.41	0.03
Portion of 31+ Days Past Due in Total Amount Owed over Last 3 Months	-0.34	-0.65	-0.35	-0.45	1.00	0.88	0.43	-0.02
Portion of 61+ Days Past Due in Total Amount Owed over Last 3 Months	-0.27	-0.63	-0.30	-0.41	0.88	1.00	0.35	-0.05
Portion of Last 12 Months with An Account 31+ Days Past Due	-0.41	-0.50	-0.42	-0.41	0.43	0.35	1.00	0.09
Total Spending in Last 6 Months (USD)	0.03	0.06	0.06	0.03	-0.02	-0.05	0.09	1.00

Table A.4: Correlations across MSLP Borrowers, Variable Values in March 2020

Note: This table reports correlations across the listed variables' raw values in March 2020 for the 1,605 MSLP borrowers. The pattern of correlations of the firms' percentile ranks for these variables is qualitatively similar. Source: Dun & Bradstreet data for MSLP borrowers matched by name.

	Correlation
Financial Stress Score	-0.05
Commercial Credit Score	-0.11
Overall Viability Score	-0.11
Total Spending in Last 6 Months (USD)	0.44
24-month PAYDEX Score	0.20
Portion of 31+ Days Past Due in Total Amount Owed over Last 3 Months	0.23
Portion of 61+ Days Past Due in Total Amount Owed over Last 3 Months	0.29
Portion of Last 12 Months with An Account 31+ Days Past Due	0.13
Total number of employees for a business	0.13
Number of Strong Business Activity Signals in Last 3 Months	0.20
Number of Unique Data Sources Used within Last 3 Months	0.15

Table A.5: MSLP Firms' Percentile Rank Correlation for Change over 03/2020 - MSLPSubmission Month versus the Corresponding Months in 2019

Note: This table reports for each variable the correlation between the MSLP firms' percentile rank relative to peers in terms of changes from 03/2020 to the MSLP submission month and changes over the corresponding months in 2019, among those MSLP borrowers that appear in both periods. The raw change (or percentage change for total spending in the last 6 months and total number of employees) over each specified period is used to compute the percentile rank for each variable. *Source:* Dun & Bradstreet data for MSLP borrowers matched by name.

Table A.6: MSLP Firms' Percentile Rank Correlation of Post-Pandemic Changes Based on Different Industry Code Data

	Correlation
Financial Stress Score	0.98
Commercial Credit Score	0.99
Overall Viability Score	0.98
Total Spending in Last 6 Months (USD)	0.90
Portion of 31+ Days Past Due in Total Amount Owed over Last 3 Months	0.92
24-month PAYDEX Score	0.92

Note: MSLP firms' percentile ranks relative to peers are computed for changes in each variable from 03/2020 to the MSLP submission month. Peers are defined based on industry codes in D&B data or reported by the MSLP firms. Only firms whose 2-digit NAICS codes differ between these two data sources are included. Source: Dun & Bradstreet data for MSLP borrowers matched by name.



Figure A.1: Growth Rates of Total Number of Employees

Note: Shaded box: inter-quartile range; solid line: median; dotted line: mean. Source: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure A.2: Overall Viability Score



Note: Shaded box: inter-quartile range; solid line: median; dotted line: mean. Source: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure A.3: Distribution of MSLP Firms' Percentile Ranks within Peer Groups: Financial Stress Score



(a) Level in 03/2020 vs. Change over 03/2020 - MSLP submission month

(b) Change, 03/2020 – MSLP submission month vs. the corresponding months in 2019



Note: Panel (b) excludes firms that began operations after 2018. *Source*: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure A.4: Distribution of MSLP Firms' Percentile Ranks within Peer Groups: Commercial Credit Score



(a) Level in 03/2020 vs. Change over 03/2020 - MSLP submission month

(b) Change, 03/2020 – MSLP submission month vs. the corresponding months in 2019



Note: Panel (b) excludes firms that began operations after 2018. *Source*: Dun & Bradstreet data for MSLP borrowers matched by name.



Figure A.5: 24-Month Paydex Score

Note: Shaded box: inter-quartile range; solid line: median; dotted line: mean. Source: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure A.6: Portion of 31 Plus Days Past Due in Total Amount Owed over Last 3 Months



Note: Shaded box: inter-quartile range; solid line: median; dotted line: mean. Source: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure A.7: Total Spending

(a) Level and Raw Change (USD)



Note: Shaded box: inter-quartile range; solid line: median; dotted line: mean. Source: Dun & Bradstreet data for MSLP borrowers matched by name.



Figure A.8: Overall Viability Score, MSLP Borrowers, 01/2019 to 12/2020

Note: Number of MSLP firms in the sample (light gray shading) on the left scale; monthly value at selected percentiles along with the mean value on the right scale. *Source*: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure A.9: 24-Month Paydex Score, MSLP Borrowers, 01/2019 to 12/2020



Note: Number of MSLP firms in the sample (light gray shading) on the left scale; monthly value at selected percentiles along with the mean value on the right scale. *Source*: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure A.10: Portion of 31-Plus Days Past Due in Total Amount Owed over Last 3 Months, MSLP Borrowers, 01/2019 to 12/2020



Note: Number of MSLP firms in the sample (light gray shading) on the left scale; monthly value at selected percentiles along with the mean value on the right scale. *Source*: Dun & Bradstreet data for MSLP borrowers matched by name.

Figure A.11: Total Spending in Last 6 Months, MSLP Borrowers, 01/2019 to 12/2020



Note: Number of MSLP firms in the sample (light gray shading) on the left scale; monthly value at selected percentiles along with the mean value on the right scale. Source: Dun & Bradstreet data for MSLP borrowers matched by name.