Bond Market Stimulus: Firm-Level Evidence*

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Abstract

How do asset purchases by central banks transmit to the real economy? Using micro-data on corporate balance sheets, we study firm behavior after the unprecedented policy support to corporate bond markets in 2020. As bond yields fell, firms issued bonds to accumulate large and persistent amounts of liquid assets. The effect on real investment was generally weak: many issuers already had access to bank liquidity and maintained equity payouts, while others used bond funds to pay back bank debt. This evidence sheds light on how corporate liquidity and financial heterogeneity matter for the macro-economy and the transmission of unconventional monetary policy.

Keywords: Corporate bonds, unconventional monetary policy, corporate liquidity
JEL codes: G23, E44, G32, E52

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1 Introduction

Disruptions in credit markets can potentially have large effects on firms and real activity. In crises, central banks often intervene in an attempt to stabilize the financial sector and mitigate spillovers to the real sector. As corporate bond markets become a larger share of the credit supply in the U.S., the Federal Reserve has added new policy tools that target these markets. Notably, in response to the COVID-related market turmoil in spring 2020, the Fed announced its intention to directly purchase corporate bonds for the first time ever. The announcement itself led to a remarkable rebound in bond issuance volume.[1] It is clear that the Federal Reserve revitalized *markets*, however there still remain open questions regarding the net effects on *firms* and the real sector.[2] While the effects of conventional monetary policy on firm financing have been studied in depth [Ottonello and Winberry, 2020], the transmission channel of such unconventional monetary policy is not well understood [Stein, 2012].

To this end, this paper studies firm behavior in the wake of the intervention using micro-data on corporate balance sheets. We ask a central empirical question: what did bond issuers do with the funds? We link bond issuance data with firm-level outcomes for up to two years after the intervention, documenting the dynamics of real investment, cash, bank credit, and equity payouts. We find that firms issued bonds to accumulate large, persistent amounts of cash while investment remained weak. Many firms already had access to bank liquidity and even maintained equity payouts, while others used bond funds to pay back bank debt, suggesting that they did not highly value the additional bond liquidity. Unlike normal times, out of $1 of new bond issued, as much as 90 cents was used on average to increase cash or repay existing debt, with zero increase in real investment. Our micro-evidence can help inform macroeconomic models of firm financing with heterogeneity [Greenwald et al., 2023].

[1] For detailed micro-evidence, including high-frequency analysis of the announcements effects of the bond purchasing program, see Haddad et al. [2021a], Gilchrist et al. [2020], Kargar et al. [2020], Boyarchenko et al. [2020], Halling et al. [2020a], O'Hara and Zhou [2020], Falato et al. [2020], Flanagan and Purnanandam [2020].

[2] The bond market intervention had the dual objective of not only supporting market functioning, but also of ultimately having real effects. For instance, Chairman Powell cited stimulating the "employment and spending of businesses". Semiannual Monetary Policy Report to the Congress, June 16th, 2020.

We first provide evidence that, unlike normal times, 2020 bond issuers used bond proceeds to accumulate liquid assets, essentially "borrowing to save" [Xiao, 2020]. Importantly, cash levels remain elevated up to two years after issuance. Acharya and Steffen [2020b] first identified that the safest firms issued bonds to raise cash at the start of the COVID crisis. The Fed intervention allowed riskier firms to do the same. On the other hand, there was negligible increase in real assets and investment. For example, Chevron issued $650 million in bonds on March 24th, but cut its 2020 capital spending plan by $4 billion.

Since this evidence does not necessarily isolate the effects of the intervention from the general macroeconomic environment, we conduct two empirical analyses to infer the causal effects of the intervention on firm behavior. First, we exploit a plausibly exogenous rule for bond purchases by the Federal Reserve where each issuer was given a weight that mirrored its weight in the market portfolio. Controlling for firm characteristics, we confirm that firms more exposed to the intervention were significantly more likely to increase cash but not more likely to increase investment (or cut it less) relative to others. We also provide suggestive evidence of minimal employment effects. Second, we conduct a high-frequency identification strategy that exploits the heterogeneity in response of credit spreads for firms of varying eligibility around the policy announcement days, finding similar effects on cash and investment.

State-of-the-art macroeconomic models of monetary transmission emphasize the role of heterogeneity in financial positions across firms [Ottonello and Winberry, 2020]. Nevertheless, they often assume that firms borrow to finance investment, abstracting away from cash and liquid assets for tractability. Our finding that firms borrowed to accumulate cash supports recent efforts to explicitly incorporate corporate liquidity in macroeconomic models.[3] Dynamic corporate finance models have also argued that firms have incentives to preemptively lock-in long-term financing when it is temporarily plentiful.[4]

A potential explanation for the weak investment response is that targeted firms might not be among the most financially constrained at the time, and thus had a low (shadow) value of additional

[3]E.g., Jeenas [2019], Greenwald et al. [2023], Kiyotaki and Moore [2019], Kim [2021], Ebsim et al. [2020].
[4]E.g., Bolton et al. [2013], Eisfeldt and Muir [2016], Acharya et al. [2020].

liquidity. Conceptually, the marginal value of additional liquidity declines with the total financial slack available to the firm. For instance, the intervention might have limited effects on investment if it targeted firms with ample access to alternative sources of liquidity. For this reason, it is important not to consider bond financing in isolation. The next two parts of the paper thus investigate available bank credit and equity payouts, respectively. Our micro-data is well-suited to capture the rich array of financing structures in the cross-section of firms.

Using data on bank credit lines, we document two new facts that suggest that many bond issuers were apparently far from a binding credit limit. First, many riskier high yield (HY) and safer investment grade (IG) firms left their existing credit lines with their banks untouched in the midst of the crisis while instead issuing bonds. For example, CVS had over $6 billion in credit line available, yet it still issued $4 billion in BBB-rated bonds. Almost 30% of HY firms that issued bonds received no new net bank funding between January and March. The pattern is even stronger for BBB-rated IG firms, which were responsible for the bulk of bond issuance in this period, with nearly 50% not drawing on their existing credit lines. Importantly, establishing this fact requires data on off-balance sheet bank credit, a crucial source of corporate liquidity.

Second, issuers that did borrow from their banks early in the crisis aggressively repaid these loans by issuing bonds after the intervention. Among the HY issuers that received bank funds in March, nearly three quarters repaid some amount after their bond issuance, while 42% actually repaid their credit line in full by the end of June 2020. For example, Kraft Heinz, which was downgraded from IG to HY in February 2020, drew $4 billion from its credit line between February and March. In May, it issued $3.5 billion in bonds and used these funds to fully repay its credit line. Kraft was far from an isolated example: among HY issuers repaying bank loans, the median firm paid back 100% of its Q1 borrowing, representing 43% of its bond issuance. The pattern is similar for safer IG firms, although a smaller share drew on their credit lines in the first place. We estimate that at least $125 billion was repaid by bond issuers to banks between April and September.

We then study the propensity of firms to engage in equity payouts. Almost 50% of issuers still repurchased shares in the Spring of 2020, in a period of high uncertainty. This is striking since

discretionary equity payouts are a direct sign of the value of internal funds being low. There is some heterogeneity: the average probability of repurchasing shares following bond issuance fell by about 20 percentage points, consistent with some firms aiming to preserve cash.[5]

Our evidence points to some degree of heterogeneity but nevertheless questions how highly many issuers valued the additional liquidity at the margin. Post-intervention, there was a large disconnect between credit and investment, as bond funds were primarily used to adjust capital structure, via the active management of cash and financial debt. On average, out of $1 of new bond issued, as much as 45 cents was used to increase cash, 15 cents to pay back bank debt, and 30 cents to refinance existing bonds, with zero increase in real investment. In contrast, before the stimulus, out of $1 raised in bond markets, 8 cents went towards real investment, while only 6 cents went towards cash and 3 cents went towards paying back bank debt.

While conceptually, capital structure changes can affect real investment, in this setting two forces seem to have limited this channel. First, the nature of the firms targeted by the intervention: as a group, bond issuers tend to be the least constrained firms in the economy. Second, the banking sector was much healthier than in 2008-09. Banks entered the crisis with strong balance sheets, received deposit inflows and were able to lend extensively to large firms by honoring their credit line commitments [Greenwald et al., 2023, Chodorow-Reich et al., 2022].[6] Our findings highlight the practical challenge for central banks of how to best target these unconventional policy actions in order to help firms that need liquidity the most.

Our findings also suggest that the 2020 Federal Reserve program had a different transmission mechanism relative to the 2016 Corporate Sector Purchase Program in Europe (CSPP). While both programs had similar effects on markets by reducing yields and stimulating issuance, the effect on firms' balance sheets was strikingly different: Grosse-Rueschkamp et al. [2019] find no effect on cash holdings, credit line balances, or share repurchases.

[5]Ford Motor Co. and Freeport-McMoRan Inc. suspended dividend payments while AT&T halted share repurchases. "Companies Race for Cash in Coronavirus Crisis", *Wall Street Journal*, 03/23/2020. Interestingly, Hotchkiss et al. [2020] shows that equity issuance was important for smaller and riskier firms that typically do not issue bonds.

[6]This is not to say that there were no disruptions in loan markets, in particular for small firms [Greenwald et al., 2023, Chodorow-Reich et al., 2022, Kapan and Minoiu, 2021, Acharya et al., 2020].

Our firm-level evidence can thus help to draw a more complete picture of how asset purchases by central banks transmit to the real economy. It highlights that the value of corporate liquidity is a central object to assess policy intervention, as an important driver of conventional investment multipliers. It also shows the value of not just looking at market data, such as yields and issuance volumes, but also at firms' balance sheets and operations throughout the years following the intervention. The events of 2020 show that a closer integration of corporate finance and macroeconomics is an important agenda for further research.[7]

Related literature: This paper contributes to our understanding of unconventional monetary policy, and specifically measures aimed at the corporate bond market. While there is extensive evidence that the Federal Reserve actions lowered bond yields and stimulated issuance in 2020,[8] we provide a first step towards understanding real effects by documenting the dynamics of firms' real investment, cash, bank credit, and equity payouts, up to two years after the intervention. Our evidence relates to the debate on whether asset purchase programs stimulate firm investment or only lead to capital structure changes [Stein, 2012]. We also show that the effect of the 2020 intervention on firms' balance sheets was different from the CSPP.[9]

The goal of this paper is to provide evidence on the transmission channel in order to inform the micro-foundations of macroeconomic models of monetary transmission. State-of-the-art models like Ottonello and Winberry [2020] have shown the crucial role of heterogeneity in financial positions to explain different responses to monetary policy across firms. Nevertheless, these models tend to abstract from firms' cash and liquid assets for tractability.[10] Like Ottonello and Winberry [2020], we view the interplay among default risk, leverage, and investment as key for monetary

[7] A prominent recent example is Greenwald et al. [2023], that shows how some of our micro-evidence can be used to build and calibrate a structural model of firm financing and investment that can match the 2020 episode.

[8] See for instance Boyarchenko et al. [2020], Haddad et al. [2021a], Kargar et al. [2020], O'Hara and Zhou [2020], Gilchrist et al. [2020], Liang [2020], Flanagan and Purnanandam [2020], Vissing-Jorgensen [2020].

[9] See Grosse-Rueschkamp et al. [2019], Ertan et al. [2019], Arce et al. [2021] for evidence on the CSPP. Other work examining the effect of conventional and unconventional monetary policy on the bond market include Kashyap et al. [1996], Crouzet [2021], Lhuissier and Szczerbowicz [2018], Todorov [2020], Pegoraro and Montagna [2021], De Santis and Zaghini [2019], Ippolito et al. [2018], Holm-Hadulla and Thürwächter [2020], Bolton and Freixas [2006], Elliott et al. [2019], Giambona et al. [2020], Siani [2019].

[10] HANK models also tend to assume firms only borrow to invest, as they tend to focus on the crucial role of liquidity in the household sector [Kaplan et al., 2018, Auclert et al., 2020].

transmission. Our analysis complements theirs as we study the surprise announcement of an unconventional monetary policy intervention and highlight the role played by cash and liquid assets. Generally, we relate to works studying the effects of firm financing on the macro-economy using micro-data [Chodorow-Reich, 2014, Lian and Ma, 2018, Greenwald, 2019, Drechsel, 2022].

Just as the Global Financial Crisis showed that financial intermediation needed a proper place in macro-finance models, evidence from 2020-22 highlights the importance of bond markets and corporate finance for the macro-economy. Our evidence supports recent efforts to incorporate corporate liquidity as a key transmission channel in macroeconomic models [Xiao, 2020, Jeenas, 2019, Kiyotaki and Moore, 2019, Kim, 2021, Ebsim et al., 2020].[11] We show the relevance of these mechanisms in the transmission of an unprecedented unconventional policy intervention. While our reduced-form evidence is not the proper counterfactual to assess what would have happened absent the intervention, Greenwald et al. [2023] build a structural model of firm financing and investment to estimate the macroeconomic effects of the bond market intervention, building on some of our micro-evidence. Their results provide evidence that our findings have aggregate implications and matter for the design of macroeconomic models.

This paper is also part of the literature on corporate financing during the COVID crisis. In particular, we show that considering multiple forms of external financing, such as bonds, bank loans, and equity, is crucial to understand this episode. We build on Acharya and Steffen [2020b] who link bond ratings with credit line drawdowns and bond issuance in the early part of the COVID crisis by studying the later period after the intervention and following firms into 2021-22.

2 Background and Data

The onset of the COVID pandemic in early 2020 marked a large negative shock to both the real economy and financial markets. First, many firms faced large reductions in operating income and rising uncertainty [De Vito and Gomez, 2020, OECD, 2020], leading to a "dash for cash"

[11] The sovereign debt literature has also highlighted the role of liquidity management by governments: emerging markets should build a large stock of reserves as a buffer against disruptions in international financial markets. See for instance Bianchi et al. [2018].

[Acharya and Steffen, 2020b] as firms attempted a variety of measures to alleviate severe cash shortfalls. Second, the onset of the crisis saw significant disruptions in secondary markets for corporate bonds, including sudden spikes in spreads and outflows from bond funds.[12] Corporate bond issuance plummeted to a near stop, especially for riskier firms.

These disruptions triggered a spectacular response by the Federal Reserve: it announced the purchases of corporate bonds for the first time ever, among many other interventions.[13] These announcements on March 23 and April 9 had a significant positive effect on bond markets ([Haddad et al., 2021a]), and bond issuance quickly reached historical heights.[14] Risky HY (safer IG) firms issued over $120 billion ($500 billion) in USD bonds in January-May 2020, compared to over $90 billion ($200 billion) in the same period in 2019, despite a three-week hiatus in March 2020.[15]

There remain open questions regarding the net effects of the post-policy issuance bonanza on firms and the real sector. The goal of this paper is to exploit rich micro-data on firm behavior in the wake of the intervention to draw implications for monetary policy and macroeconomic models. We take the market rebound as given and ask a central empirical question: What did bond issuers do with the funds? This firm-level evidence is a key first step to tracing the transmission mechanism.

We construct a panel data set covering all U.S. non-financial bond issuers in the past two decades. Our main empirical analysis compares the behavior of bond issuers in the post-intervention period of March 23 to June 30, 2020 with those of the "normal" period of 2010-2019.[16] We follow 2020 issuers' balance sheets into mid-2022, up to two years after their first 2020 issuance, to understand the medium-term impact beyond the immediate market rebound.

Bond issuance data comes from Mergent FISD, which includes detailed security-level data on corporate bond offerings. We restrict the sample to U.S. dollar bonds of at least $100 million face

[12] See, e.g., [Haddad et al., 2021a, Kargar et al., 2020, O'Hara and Zhou, 2020, Falato et al., 2020, Ma et al., 2020].

[13] For example, the Federal Reserve also lowered the policy rate back to zero, provided liquidity to dealers and purchased large quantities of Treasuries bonds.

[14] It is understood that the intervention worked mainly through an announcement effect: actual purchases ended up being small given the strong market recovery. For more analysis on corporate bond markets in this period, see Halling et al. [2020a], Boyarchenko et al. [2020], Gilchrist et al. [2020], Liang [2020], Flanagan and Purnanandam [2020].

[15] Becker and Benmelech [2021] and Hotchkiss et al. [2020] find that the number of HY issuers was below trend initially. Figure IA.1 illustrates these dynamics for both the IG and HY markets.

[16] Figure IA.2 in the Internet Appendix shows the time series of yield and issuance over a longer sample.

value issued by firms that report in U.S. dollars.[17] In line with much of the empirical literature on corporate bonds, we exclude financial, sovereign, and utility issuers.[18] We merge the issuance data with quarterly balance sheet data from Compustat and quarterly debt composition from Capital IQ. The filters and merges yield a sample of 317 firms issuing 598 bonds during the post-Fed intervention spring 2020 period, and 1,297 firms issuing 6,645 bonds in the "normal period".[19] We use Enhanced TRACE data (cleaned via methods described in Dick-Nielsen [2014]) to compute daily spread changes for the second IV analysis. Tables IA.1 and IA.2 in the Internet Appendix display summary statistics of our baseline sample.[20] During the peak COVID episode of March-May 2020 (March-May 2017-2019), the median bond was $650 million ($500 million) with an eight-year (eight-year) tenor and a yield of 4.03% (4.88%).[21]

The 2020 crisis was an unusual episode, but it helps us to better understand how firms use the bond market, particularly in the context of policy intervention and in the absence of a concurrent banking crisis.[22] Indeed, banks entered 2020 with strong balance sheets, received large deposit inflows, and were ultimately able to lend extensively to large firms via credit lines draw-downs.[23] However, since there were still some disruptions in loans markets for small firms[24] and term loans for large firms,[25] we focus on credit line draw-down activity of bond issuers in studying firms' choices between loans and bonds, as this segment faced relatively less turmoil.

[17] We restrict the sample in this way to ensure that the issuance event study analyses would not be too influenced by very small issuances. Our baseline results are qualitatively the same when we use a $50 million cutoff.

[18] We also exclude convertible bonds, capital impact bonds, community bonds, PIK securities, and exchanged bonds. Bonds associated with the T-Mobile / Sprint acquisition in April 2020 are also excluded.

[19] We match 84% of bonds in our sample to firms in Compustat. 49% of unmatched bonds are foreign issuers. For balance sheet analyses, we include only the 86% of matched issuing firms that either report financial statements in U.S. dollars or are domiciled in the U.S.

[20] Firms that issue in bond markets are on the larger end of the distribution of all firms. In 2019, the median bond issuer had $10.7 billion in total assets and $1.2 billion in quarterly revenues at year end, compared to the median Compustat firm with $1.5 billion in assets and $195 million in quarterly revenues.

[21] Table IA.4 in the Internet Appendix also shows that secured bonds were more common during COVID, consistent with the long-term evidence of Benmelech et al. [2020], although they still constituted a small share of issuance.

[22] This is useful because liquidity shocks for firms are often correlated with bank liquidity shocks. For instance, during the 2008-09 financial crisis, weak bank balance sheets forced many firms to turn to the bond markets [Becker and Ivashina, 2014, Crouzet, 2017, De Fiore and Uhlig, 2015, Adrian et al., 2013].

[23] E.g., [Acharya and Steffen, 2020b, Li et al., 2020, Greenwald et al., 2023, Chodorow-Reich et al., 2022].

[24] [Greenwald et al., 2023, Chodorow-Reich et al., 2022, Kapan and Minoiu, 2021, Acharya et al., 2020]

[25] [Becker and Benmelech, 2021, Fleckenstein et al., 2020]

3 Liquid Assets and Real Investment

This section revisits a classical macroeconomic paradigm in light of the Federal Reserve announcement to intervene in corporate bond markets. State-of-the-art models like Ottonello and Winberry [2020] have shown the crucial role of firm heterogeneity in the differential transmission of monetary policy. However, in this model, firms borrow to finance investment, thus an intervention that stimulates credit should directly increase investment. Moreover, they abstract from firms' cash and liquid assets for tractability. This section uses panel data in a similar spirit to Ottonello and Winberry [2020], with two key differences: (1) we study the surprise announcement of an unconventional monetary policy intervention; and (2) we explicitly study the response of liquid assets. We further document the role of firm heterogeneity.

We examine changes in firms' balance sheets around bond issuance by running an *event study analysis* where we regress firm balance sheet quantities on dummy variables for each of the five quarters leading up to issuance and the eight quarters following issuance.[26]

$$Y_{fq} = \sum_{m=-4}^{8} \beta_m Issue_{f,q-m} + \alpha_f + \alpha_{ind \times year} + \varepsilon_{fq} \tag{1}$$

We run the regression separately for issuance during normal times vs. issuance in the wake of the announcement of Fed intervention, using issuance between March 23 and June 30, 2020 for the latter subsample. Then we plot the time dummy coefficients, β_m, to visualize the pre- and post-trends of balance sheet quantities in both periods. The analysis exploits within-firm variation by including firm fixed effects, and includes industry-year fixed effects to account for industry shocks.

Cash accumulation: We first find striking evidence of cash accumulation following issuance. The top panel of Figure 1 shows the dynamic coefficient plots for cash as a ratio of assets. Issuance following the Fed's announcement is followed by a large increase in cash levels that is highly persistent. Importantly, the cash accumulated was still largely unspent four quarters after issuance

[26] Because we study a single shock, this dynamic event study specification is the closest to Jorda projections that are typically used in the context of monetary policy shocks.

in early 2021, and cash levels remain elevated even two years after issuance. In contrast, in normal times, cash holdings rise modestly and revert within two quarters following issuance.[27]

We find surprisingly little heterogeneity between risky and safe firms. While Acharya and Steffen [2020b] first identified that the safest firms issued bonds to raise cash at the start of the COVID crisis, we find that HY issuers exhibit this behavior as well.[28] Note also in the spring 2020 period, cash had started to increase in the quarter prior to bond issuance, reflecting firms seeking out alternative sources of cash (e.g., drawing down on a bank credit line) before the intervention. We discuss the link between credit lines and bond issuance in Section 4.

Real investment: Real investment did not follow a similar pattern. The bottom panel of Figure 1 shows the dynamics of investment in operating activity, as proxied by property, plant and equipment.[29] Bond issuance does not coincide with a significant increase in real investment, even at a horizon of two years.[30] This is true for both IG and HY firms.[31] Investment opportunities may have been limited in the immediate wake of the pandemic. However, if firms issued to maintain the option to invest in the future, we would expect to see some eventual uptick in investment. We do not see a significant recovery for bond issuers even as investment opportunities likely normalized.

Note that these event studies track each firm's own use of funds, but without any direct comparison to firms that did not issue bonds. Figure IA.3 in the Internet Appendix estimates cash and investment dynamics for firms that issue bonds March 23 - June 30 period *relative* to firms that did not, with similar results. However, these regressions are unable to control for endogenous selection into issuance that may correlate with balance sheet outcomes. In the next section, we try to overcome this endogeneity issue by exploiting cross-sectional exposure to policy intervention.

[27] For a comparison with the Global Financial Crisis, see the discussion in Xiao [2020]. Figure IA.7 in the Appendix shows cash dynamics around bond issuance in that period.

[28] The top panel of Figure IA.6 in the Internet Appendix shows similar dynamics for HY firms for cash accumulation.

[29] Results are similar if we use non-cash assets as a proxy for investment to include changes to working capital.

[30] To see this, compare for example the coefficients at $t+4$ to the coefficients at $t-1$ in Figure 1; they are statistically indistinguishable.

[31] The bottom panel of Figure IA.6 in the Internet Appendix shows similar dynamics for HY firms for investment.

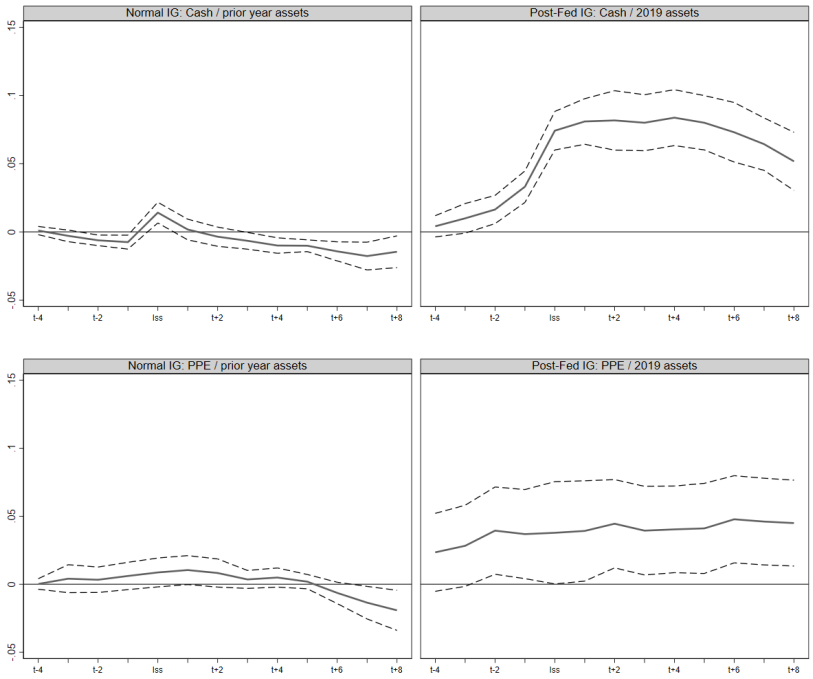

Figure 1 – Liquid Assets and Real Investment: Coefficient plots for IG firms

Notes: Each point is an estimate of β_m from the regression $Y_{fq} = \sum_{m=-4}^{8} \beta_m Issue_{f,q-m} + \alpha_f + \alpha_{ind \times year} + \varepsilon_{fq}$, with 95% confidence intervals. "Cash / 2019 assets" is cash and short term investments, normalized by the firm's 2019 year end total assets. "Cash / prior year assets" is normalized by the firm's total assets from one year prior. "PPE / 2019 assets" is normalized by the firm's 2019 year end total assets. "PPE / prior year assets" is total property plant and equipment, normalized by the firm's total assets from one year prior. Observations are firm-quarters up to five quarters prior to a bond issuance and eight quarters following a bond issuance, including all issuers rated BBB- or above. "Iss" denotes the quarter ending immediately after issuance. We include firm and industry-year fixed effects. Standard errors are clustered by 2-digit industry level. All ratios are winsorized at the 1% level in the entire sample. "Normal" times includes bonds issued between 2010-2019, "Post-Fed" times includes bonds issued March 23 - June 30, 2020.

3.1 Isolating the effect of the intervention

A limitation of event study regressions is that they do not isolate the effect of the intervention from the general macroeconomic environment. Given the pandemic was a concurrent shock, we would like to separate out the effect of the policy intervention from the pandemic itself. Anecdotally, some firms reported lower investment demand through 2020 due to heightened uncertainty. An illuminating example is Chevron, which raised $650 million in bond capital on March 24th, and explicitly said that it would not use these funds for investment.[32] In principle, avoiding a large re-

[32]Instead, it planned to reduce its 2020 capital spending plan by $4 billion (or 20%) in response to the crisis. Chevron CEO said: "We are taking actions expected to preserve cash, support our balance sheet strength, lower short-

duction in investment might be evidence of real effects. To identify the effect of the intervention on firm behavior, in this subsection we conduct two additional variable analyses. The first exploits an exogenous rule for the magnitude of potential bond purchases by the Federal Reserve. The second exploits high-frequency changes in credit spreads for eligible bonds around policy announcements.

3.1.1 Index weight IV analysis

The first instrument relies on an exogenous rule for the bond purchase program. Specifically, each investment-grade bond issuer was assigned a weight that is intended to match the composition of the market portfolio for corporate bonds. The instrument is relevant if firms with a higher weight in the index (thus are more affected by the policy intervention) issue more bonds than comparable firms. The exclusion restriction is satisfied if a firm's weight in the portfolio is orthogonal to its exposure and response to the COVID shock, conditional on controls.[33] We thus capture balance sheet adjustments that result from policy-driven bond issuance. Because the Fed only targeted individual firms that were IG, we can only construct this instrument for IG issuers.[34]

To test the relevance of the instrument, we run a cross-sectional regression of abnormal firm issuance on their weight in the index for IG issuers. Abnormal issuance is the amount issued by the firm in March 23–June 30, 2020 minus the average quarterly issuance for that firm from 2000–2019 to account for different cross-firm propensities to rely on bond financing.

$$AbnormalAmtIssued_{f,2020H1} = \gamma WeightIndex_f + \beta X_f + \alpha_{ind} + \varepsilon_f \tag{2}$$

We include industry fixed effects to absorb persistent cross-industry variation in balance sheet and issuance levels, and we control for issuer credit rating and 2019 year end firm size (total assets), cash, leverage, sector and Tobin's Q, as these characteristics could mechanically correlate with

term production, and preserve long-term value."

[33] By definition of the Fed's broad market portfolio, the index is meant to track the "composition of the broad, diversified universe of secondary market bonds" (New York Fed). As such, greater exposure to the index arises from more bonds outstanding, which is unlikely to be correlated with exposure to the pandemic. Indeed, we find zero correlation between firm-level index weight and exposure to COVID measured with industry abnormal employment decline in 2020Q1 as in Chodorow-Reich et al. [2022].

[34] Note that, as discussed above, IG firms represent the bulk of issuance post-intervention.

market weights but may be related to investment opportunities.[35]

The first stage, reported in Table IA.3, is statistically and economically significant: a larger weight in the index increases firm propensity to issue relative to its typical issuance amount. Thus, conditional on observable characteristics, greater exposure to the Federal Reserve's intervention increased firm issuance. This suggests that despite small actual Fed purchases, the magnitude of promised intervention affected firm issuance decisions even between similar firms.

In the second stage, we regress cash and real investment on the predicted values of amount issued in the first half of 2020 interacted with quarter dummies up to one year before and two years after the Fed's intervention. We run the following regression:

$$\ln(Y)_{fq} = \sum_{m=-4}^{8} \left(\beta_m \mathbf{1}\{q = 2020Q1 + m\} \times \widehat{AbnormalAmtIssued}_f \right) + \alpha_f + \varepsilon_{fq}, \tag{3}$$

where we control for firm fixed effects.[36]

Figure 2 reports the point estimates with 95% confidence intervals for BBB-rated issuers. We report the same plots for A-rated issuers in Figure IA.8 in the Internet Appendix, which is qualitatively the same. We find that firms more exposed to the intervention were significantly more likely to increase cash and maintain higher cash balances for many quarters following the intervention. Only around two years following the intervention do firms begin decreasing their cash balances, but levels remain elevated relative to 2019. Consistent with the event study results, investment by treated firms remains stagnant relative to the control group in the year following the shock. This is inconsistent with the intervention helping to prevent a significant reduction in investment during

[35]For the credit rating control, we create a numerical analog to credit rating as described in Table IA.17 in the Internet Appendix. Higher numbers are safer credit ratings, and we log the numerical rating to account for nonlinearities. We use market value to book value to proxy for Tobin's Q. We exclude values of market to book that are zero or negative and winsorize at the 1% level.

[36]The controls for sector, 2019Q4 size (total assets), cash, leverage, and Tobin's Q are absorbed by the firm fixed effects. An alternative second stage specification with the firm-level controls and industry fixed effects instead of firm fixed effects to match the first stage yields qualitatively similar results. We report the plots with firm fixed effects to be more comparable to Figure 1.

these uncertain times.[37]

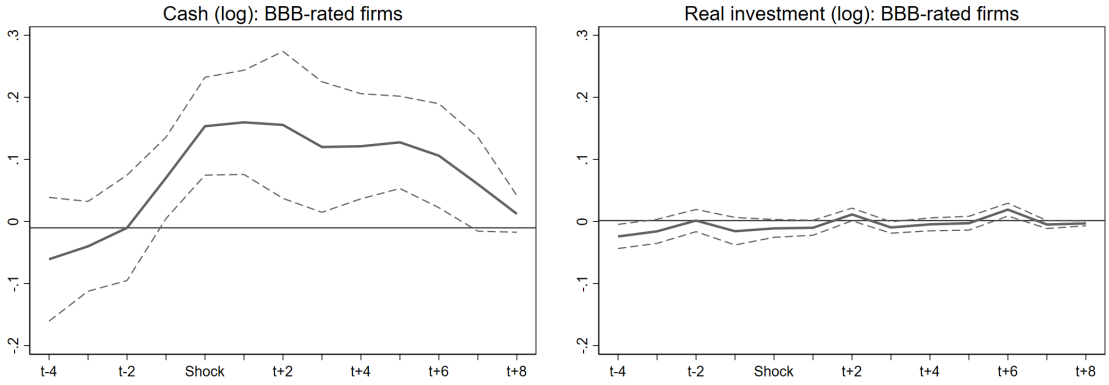

Figure 2 – Second stage estimates: BBB-rated firms

Notes: Each point is an estimate of β_m from the regression equation (3), with 95% confidence intervals, where $\widehat{AbnormalAmtIssued}_f$ is recovered from the first stage equation (2). Cash is cash and short term investments, and Real investment is total plant, property and equipment. Both left-hand-side variables are logged. Includes issuers of credit rating BBB- to BBB+. Observations are firm-quarters up to five quarters before and eight quarters following the Federal Reserve's announcement to intervene in corporate bond markets in March 2020, which is denoted by "Shock". We include firm fixed effects and cluster standard errors by 2-digit industry. Solid horizontal lines are drawn at the value for the coefficient at 2019Q4 ('t-2').

One of the primary objectives of the policy was to support employment. The lack of high-frequency data prevents us from carrying an equally detailed analysis of employment, but we provide suggestive evidence of minimal employment effects. We adapt our IV methodology and run cross-sectional regressions of the log employment on the instrumented COVID-time issuance for three different time periods. The results in Table IA.5 suggest that policy-driven increases in bond issuance did not significantly increase employment for 2020–2022.

We also consider heterogeneity of liquidity accumulation across firms based on COVID exposure.[38] Table IA.6 in the Internet Appendix shows that exposure to COVID, measured with industry abnormal employment decline in 2020Q1 as in Chodorow-Reich et al. [2022], does not lead firms to accumulate significantly higher cash balances among bond issuers.

[37] As an OLS benchmark, we plot in IA.4 in the differences in cash and real investment for all issuers versus all non-issuers, which yields similar results. The OLS estimates for cash changes around the shock are positive and slightly lower than the IV estimates, suggesting an attenuative bias.

[38] Hotchkiss et al. [2020] document a U-shaped relationship between cash flow shocks and external financing raised.

3.1.2 High-frequency credit spreads analysis

To further assess if the Federal Reserve's policy announcement was the driver of bond issuance and the resulting accumulation of cash in lieu of investment, we adapt a high-frequency identification method used in Haddad et al. [2021b] that identifies variation in daily bond prices in response to cross-sectional variation in policy eligibility. The corporate bond purchase programs explicitly targeted IG bonds that were lower than 5 years in remaining maturity and bond ETFs.[39] Haddad et al. [2021b] show that upon the announcement dates March 23 and April 9, eligible bonds had a significant decline in credit spreads. We show that firm-level credit spreads had similar dynamics.

Specifically, we regress the cumulative log spread change (amount outstanding weighted average) at the firm level on indicator variables for dates on and after each announcement date (March 23 and April 9) and an IG rating, plus firm-level shares of short-term and ETF-eligible bonds outstanding, and corresponding interactions. We use bond-day level data from March 20 to April 13 to isolate the impact of the policy itself rather than the pre-policy run-up in credit spreads.[40] We control for credit rating, total assets, leverage, Tobin's Q and cash at the firm level as of 2019Q4, plus industry fixed effects and the firm-level eligibility criteria (IG dummy, share of short-term bonds, and share of ETF-eligible bonds).[41] The first three columns of Table IA.8 show the credit spread results. Upon both policy announcement dates, spreads decline overall, with a greater effect for IG firms with a greater share in short-term and ETF-eligible bonds outstanding.[42]

Next, we recover the firm-specific predicted cumulative spread change from March 20 through

[39]The first announcement of the corporate bond purchase program was March 23, 2020, where IG bonds under 5 years in remaining maturity and IG ETFs were eligible for purchase. On April 9, the Federal Reserve expanded the size of the program and eligibility to HY ETFs and certain HY bonds if they were IG as of March 22. For more detail on the program, see Haddad et al. [2021b].

[40]As per HMM, the change in spreads at the bond level is constructed using the average traded price of the last five transaction on day t, and we include only bonds that have a median of at least five daily transactions in January 1 - May 20, 2020. Our left hand side variable accumulates the bond-level spread changes to the firm level by computing the weighted average traded price on day t for all bonds that firm f has outstanding to the weighted average price on March 20 (prior to the intervention announcement).

[41]In Table IA.7 in the Internet Appendix, we verify that the bond-level regressions corresponding to Table 4 in Haddad et al. [2021b] show similar credit spread responses to policy eligibility for our sample of firms.

[42]These directional effects are similar to what Haddad et al. [2021b] finds in their Table 4 using one-day spread changes (rather than cumulative spread changes) and dummy variables for each announcement date (rather than dummy variables for the days after each announcement date), with some small discrepancies in the interaction terms in the third regression.

April 9 using the interaction terms from the regression in the third column of Table IA.8.[43] We then regress an indicator variable for bond issuance from March 23–June 30, 2020 on this predicted spread change to test if the policy intervention-induced spread changes affect firm issuance decisions. Table IA.8 column (4) shows that greater predicted spread declines increase the probability of issuance, while the last two columns show that those firms with the 25% biggest policy-driven predicted drop in credit spreads (across all firms or among their ratings category IG vs. HY) are significantly more likely to issue during this period.

We then test how much balance sheet characteristics respond to the policy-driven change in credit spreads by running the following specification:

$$\ln(Y)_{fq} = \sum_{m=2019Q2}^{2022Q2} \left(\beta_m \mathbf{1}\{q = m\} \times \mathbf{1}\{HighExposure\}_f \right) + \alpha_f (+\alpha_q) + \varepsilon_{fq} \tag{4}$$

where $HighExposure_f = 1$ if $\Delta\hat{s}_f$ is in the top 25th percentile of the cross-section of firms. The first panel of Figure 3 shows that there is a significant increase in cash and no significant increase in investment for IG firms with the largest policy-driven predicted credit spread declines. The second panel of Figure 3 shows the difference-in-differences equivalent using quarter fixed effects. While this specification absorbs a significant amount of the post-policy intervention, including a "tide that lifts all boats", it nevertheless shows that firms that were more exposed to the policy intervention held more in cash relative to the control group in each period, and did not increase investment. Figure IA.5 shows that treated HY firms also did not increase investment, though they do not accumulate cash as much as IG firms do.

3.2 Connection to existing theories

Next, we connect to existing models of firm financing to rationalize our findings of increased cash and no increase in investment. First, our liquidity accumulation finding is at odds with many state-of-the-art macroeconomic models of monetary transmission [Kaplan et al., 2018, Ottonello and Winberry, 2020, Auclert et al., 2020] that assume firms borrow to finance investment and would

[43] For those bonds that do not trade on April 9, we use the April 10 price.

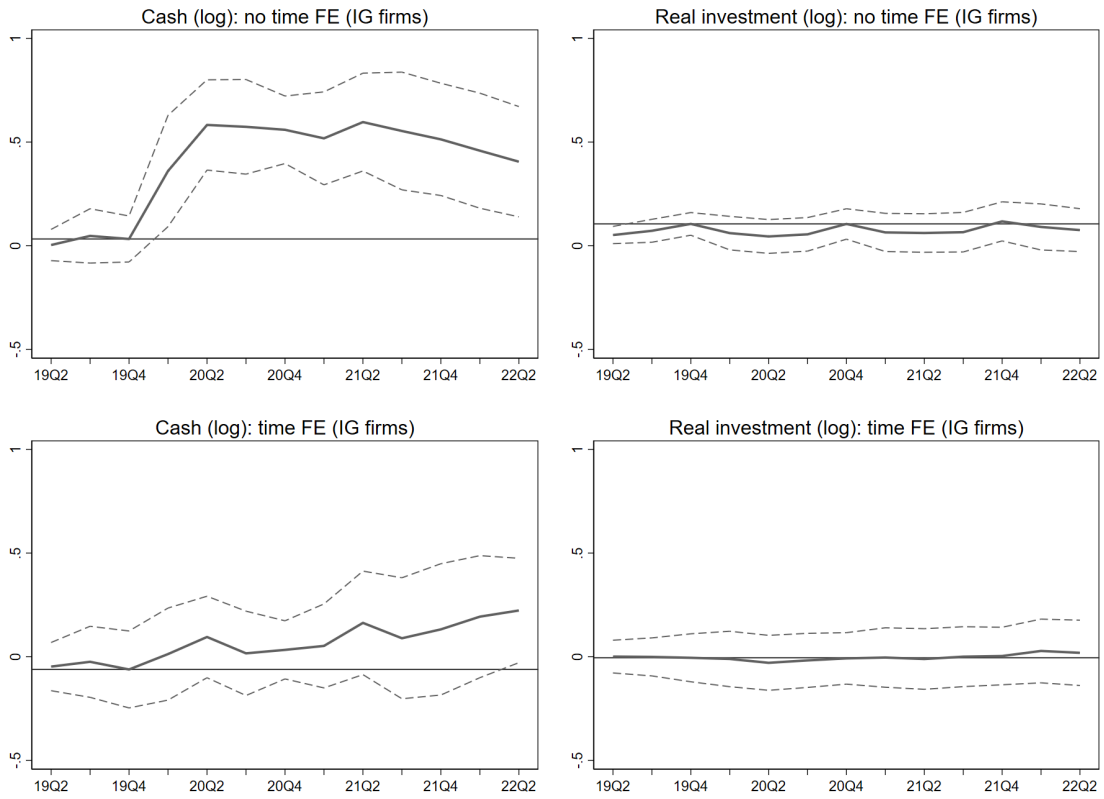

Figure 3 – Policy-driven credit spread change treatment effect and Diff-in-Diff: IG firms

Notes: Each point is an estimate of β_m from the regression $\ln(Y)_{fq} = \sum_{m=2019Q2}^{2022Q2} \left(\beta_m \mathbf{1}\{q=m\} \times \mathbf{1}\{HighExposure\}_f\right) + \alpha_f + (\alpha_q +)\varepsilon_{fq}$, with 95% confidence intervals, where $\mathbf{1}\{HighExposure\}_f$ is a dummy variable that equals 1 if firm f has a predicted policy-driven credit spread reduction recovered from column (3) of Table IA.8 (using only the interaction terms) that is in the top 25% of IG firms. Cash is cash and short term investments, and Real investment is total plant, property and equipment. Both left-hand-side variables are logged. Observations are firm-quarters for IG firms from Q1 2019–Q2 2022. The upper panel includes firm fixed effects, the lower panel includes firm and quarter fixed effects, and we cluster standard errors by 2-digit industry. Solid horizontal lines are drawn at the value for the coefficient at 2019Q4.

thus fail to match the striking pattern of debt issuance followed by accumulating liquid assets. Because cash is equivalent to negative debt, borrowing to hoard cash should have value.

However, our evidence supports efforts to incorporate corporate liquidity as a key transmission channel in macroeconomic models [Xiao, 2020, Jeenas, 2019, Kiyotaki and Moore, 2019, Kim, 2021, Greenwald et al., 2023]. Xiao [2020] introduced a "borrowing to save" mechanism in a quantitative macroeconomic framework applied to the Great Recession. Our evidence supports the idea that this is a general phenomenon that can arise beyond a financial crisis.[44] In addition,

[44]The baseline model of Xiao [2020] assumes a negative credit shock, but borrowing to save can also occur after

Jeenas [2019] emphasizes the role of corporate liquidity in monetary policy transmission due to fixed issuance costs on long-term debt financing. Dynamic corporate finance models have similarly stressed the value of raising external financing to accumulate liquidity. In the models of Bolton et al. [2013], Eisfeldt and Muir [2016] or Acharya et al. [2020], in the presence of time-varying financial conditions, firms have incentives to preemptively lock-in financing when it is temporarily plentiful in order to accumulate liquid assets instead of investing, as we observe in the data.[45]

A potential explanation for the lack of investment is that targeted firms were not particularly financially constrained. The theories cited above would thus suggest they might have had a low (shadow) value of additional liquidity.[46] While in the presence of financial frictions a dollar inside the firm can be worth more than a dollar outside, the marginal value of additional liquidity is theoretically declining in total financial slack available to the firm [Bolton et al., 2011]. The intervention might have limited effects on investment if it targeted firms with ample access to alternative sources of liquidity. Thus, it is important not to consider bond financing in isolation.

4 Bonds vs. Other Financing Sources

Large firms have access to multiple sources of financing, including bank loans and bonds.[47] Bank credit lines provide substantial liquidity insurance to firms in the case of future shocks. To understand the benefits of the liquidity accumulation documented in Section 3, we next examine bank credit and equity payouts. The marginal value of additional liquidity is higher for firms that have less financial slack. By studying bank credit lines and equity payouts, we can better understand the marginal value of additional liquidity for bond issuers.

shocks to aggregate demand or uncertainty about credit conditions.

[45]These models often focus on equity for tractability, but the insights extend to all forms of external financing.

[46]Note that we are using the term financially constrained at a general level. In a specific model, there can often be different constraints at play. For instance, in the model of Jeenas [2019] firms can be at a “liquidity constraint” or at "borrowing constraint". His liquidity constraint would be the relevant one for this discussion.

[47]Indeed, even the largest bond issuers have large credit lines with banks [Sufi, 2009, Acharya et al., 2018, Greenwald et al., 2023] and in recent years, while term loans did not keep up with bond issuance, undrawn credit lines have grown significantly [Berg et al., 2020].

Table 1 – Debt Composition: Aggregate Flows over 2020Q1

	HY Billions of USD	IG, BBB Billions of USD	IG, A or above Billions of USD
Bond issuance	111.1	258.4	231.7
Credit line	50.1	73.5	4.04
All bank debt	56.4	102.8	20.0
Undrawn credit EOY 2019	121.2	350.4	152.3

Notes: This table classifies aggregate debt flows based on FISD bond issuance data (Row 1) as well as changes in outstanding debt for other credit instruments during 2020Q1 based on Capital IQ Capital Structure Summary table (Rows 2 and 3). Undrawn credit EOY 2019 is the outstanding available Undrawn Revolving Credit at the end of 2019. Issuers include all U.S. firms that issued a bond March 23 - June 30 2020 that we could merge with Capital IQ information.

4.1 Issuing Bonds when Bank Credit was Already Committed

First, we focus on the revealed preference of firms choosing between bonds and bank credit using micro-data on bank loans. We match our issuance data with information on each issuer's debt composition from Capital IQ.[48] These data include drawn amounts on revolving credit lines, total bank debt, and importantly, undrawn (off-balance sheet) credit lines that were available as the COVID crisis unfolded. As debt composition data is reported only at quarter end, we approximate flows by computing differences between quarters.

We first show that many firms left their existing credit lines untouched in the first quarter of 2020 and issued bonds instead. We lay out aggregate credit flows for all firms that issued bonds March 23 - June 30, 2020 in Table 1. IG issuers with BBB (A) credit ratings had $350 (152) billion in available credit committed by their banks as of end of 2019, yet only drew down $73 (4) billion. These firms instead opted to borrow $258 (232) billion from bond markets. Surprisingly, high yield firms are similar: they issued over $111 billion in bonds in Q1 2020 despite having in aggregate $121 billion in available credit lines as of Q4 2019.[49]

As an example, CVS had $6 billion of its credit line available at the beginning of 2020, yet

[48] For the spring 2020 analysis, we can match 283 issuers to Capital IQ bank credit line data. Table IA.9 shows that in general bond issuers matched to Capital IQ seem to have identical characteristics relative to all issuers, in 2020 as well as in earlier periods.

[49] Figure IA.9 in the Internet Appendix illustrates this unused aggregate dry powder visually.

Table 2 – Bank borrowing in 2020Q1 for bond issuers

	HY Share	IG, BBB Share	IG, A or above Share
Maxed out CL (>90%)	0.21	0.09	0.06
High utilization of CL (50-90%)	0.16	0.09	0.00
Drew some CL (1-50%)	0.31	0.33	0.26
Did not draw CL (0%)	0.32	0.48	0.69
No net bank funds	0.26	0.39	0.66
Av. drawdown rate	0.41	0.22	0.09

Notes: This table classifies bond issuers based on changes in outstanding debt for different credit instruments during 2020Q1, based on the Capital IQ Capital Structure Summary tables. Row 1 includes issuers that maxed out their credit lines, i.e. the increase in Revolving Credit is at least 90% of Undrawn Revolving Credit at the end of 2019. Row 2 includes issuers that drew some of their credit lines, i.e. the increase in Revolving Credit as a ratio of Undrawn Revolving Credit at the end of 2019 is between 0% and 90%. Row 3 includes issuers that did not draw, i.e. the increase in Revolving Credit is 0 or less. Row 4 includes issuers with no net bank funding, defined as the sum of Revolving Credit, Term Loans and Federal Home Loan Bank borrowings. Row 5 reports the average increase in the drawdown rate, defined as the ratio of Revolving Credit to the Undrawn Revolving Credit at the end of 2019. Includes U.S. firms that issued a bond March 23 - June 30, 2020 that we could merge with Capital IQ.

it issued $4 billion in BBB-rated bonds. We show that CVS was not alone, and strikingly, this behavior includes many riskier HY firms. Table 2 tracks the change in debt composition during the first quarter of 2020. The first five rows show the share of firms that, respectively, (i) maxed out their credit lines (i.e., drew down on at least 90% of their available credit as of end of 2019), (ii) utilized highly their credit line (i.e., drew down on between 50-90% of their available credit as of end of 2019), (iii) drew a little available credit (1-50%), (iv) did not draw on their credit line, and (v) did not receive any bank funding.[50] The last row reports average draw-down rates.

We find that firms that issued bonds generally left available bank credit underutilized, and the drawdown rate increases with issuer risk. For the riskiest firms that issued between March 23rd and June 30th, only 21% had maxed out their credit line by end of March, and the average draw-down rate was 41%. Across all potential sources of bank debt, 26% did not receive new net bank funding in Q1 2020. This implies that many of these riskier firms had available "dry powder"

[50]Note that because the data consists of stocks of debt outstanding reported quarterly, these numbers are not completely free of measurement error. First, our definition of "maxing out" can occasionally incorrectly include firms that signed new credit lines during the COVID crisis. In our exploration, this measurement problem seems to be more pronounced for IG firms. For instance, McDonald's signed a new credit line of $10B, of which it drew $1B. Second, we can only observe quarter-end balance. If a firm drew on its credit line on March 1st and repaid it by March 31st, our data would not capture this behavior.

from banks that they decided not to use early on in the crisis. The pattern is even more striking when looking at IG firms, although there is still a risk gradient within this group. Among the BBB (A) issuers, 48% (69%) left their credit line untouched in Q1 2020; those that did use their credit lines drew down 22% (9%) of available credit capacity on average.[51] This difference across rating categories is consistent with differences in draw-downs described in Acharya and Steffen [2020b] and predicted in Acharya and Steffen [2020a].

In addition to ratings, part of the heterogeneity across firms can also be explained by different exposure to the COVID shock. Table IA.10 in the Internet Appendix shows that exposure to the COVID shock predicts credit line draw-downs in our cross-section of bond issuers. Moreover, firms with larger undrawn credit line balances from 2019 were more likely to draw but less likely to max out. Other balance sheet characteristics, such as lower initial cash balances or higher current debt ratios, do not have much predictive power once accounting for other factors.

One possibility is that undrawn credit was in fact restricted by banks, for instance because of actual or potential covenant violations. Three pieces of evidence tend to speak against this interpretation: the extensive borrowing by large firms [Li et al., 2020, Greenwald et al., 2023, Chodorow-Reich et al., 2022], the apparent lack of enforcement around covenant violations in 2020 [Acharya et al., 2021], and the observation that riskier issuers drew more. Overall, while not drawing down on credit lines preserves liquidity, this is a sign that many bond issuers had a significant amount of financial slack in Spring 2020.

4.2 Repaying Bank Loans After Issuing Bonds

Next, we examine whether firms use proceeds from bond issuance to repay bank loans. The previous section documents significant heterogeneity among bond issuers at the outset of the crisis: a minority of bond issuers did rely heavily on bank lending at first. In this section, we investigate changes in these firms' debt compositions during the second quarter of 2020.

[51] In practice, covenants limits can reduce the effective maximum that firms can draw [Greenwald, 2019]. Although it is challenging to precisely estimate covenant-adjusted credit limits, the fact that we see many firms not draw at all or draw small amounts suggests covenants were not the only reason for low drawdown rates.

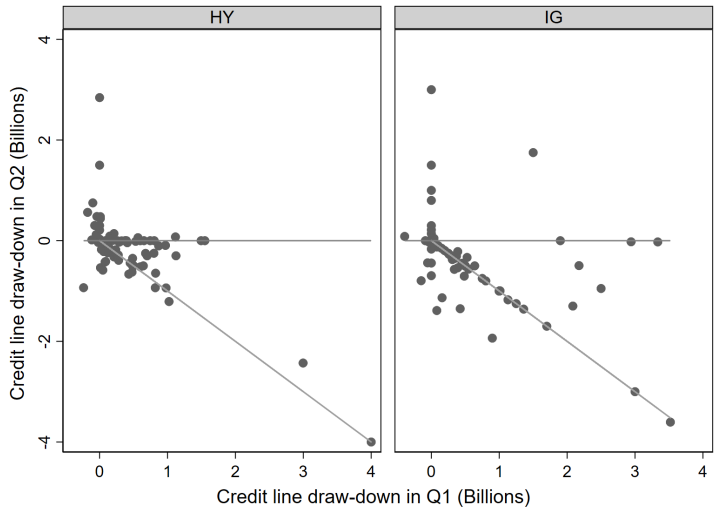

Figure 4 – Loan-bond substitution: Credit line draw-downs in 2020Q2 vs. 2020Q1

Note: This figures plots credit line repayment in 2020Q2 against 2020Q1 credit line draw-downs, based on Capital IQ Capital Structure Summary tables, separately for high-yield and investment grade issuers. For ease of interpretation, the figure also displays the negative 45 degree line (exact repayment in Q2) and horizontal line (no change in credit line in Q2). Issuers include all U.S. firms that issued a bond March 23 - June 30 2020 that we could merge with Capital IQ information. For clarity, the plots excludes large outliers Volkswagen, Ford, and GM.

We find that a large share of firms that did borrow from their banks early in the crisis issued bonds in Q2 2020 to aggressively repay their bank loans. The Kraft Heinz example above is not unique. Figure 4 illustrates the cross-section of repayment behavior by plotting credit line draw-downs in Q1 against draw-downs in Q2 for each firm in our sample. A negative value indicates that the firm paid down a portion of the outstanding credit line. Strikingly, many firms are exactly on the negative forty-five degree line, denoting full repayment within three months, like Kraft Heinz. These firms borrowed from available bank credit lines only to pay back 100% of bank borrowings following a bond issuance. A noticeable number of firms repaid even more, using bonds to pay down bank debt that preceded the COVID crisis. Many firms repaid partially, with only a few firms borrowing more in the second quarter.

Table IA.11 in the Internet Appendix provides more detail on the distribution of credit line repayments. Among all HY issuers, 74% of these repaid some amount of credit line after their bond issuance with 42% repaying their credit lines *in full*. The median HY firm that paid back some of its bank loan paid back 100% of its Q1 borrowing, representing 43% of their bond issuance. These

patterns are similar for IG firms, although a smaller share drew on their credit lines in the first place. 91% of BBB firms that drew down on their bank credit line in Q1 repaid their bank in Q2 following bond issuance, with the median also repaying 100%. The safest, A-rated firms exhibit a similar pattern. Table IA.12 in the Internet Appendix provides some aggregate magnitudes. At least $125 billion was repaid by bond issuers to banks between April and September 2020.[52]

Repaying credit lines does preserve future liquidity: it is plausible that issuers expected other shocks to materialize in the future and to maintained credit capacity as insurance. Nevertheless, our two main points stand: (1) bond issuers had significant financial slack in Spring 2020 in the form of bank credit; (2) an important share of bond proceeds were channeled to the banking sector.

4.3 Preference for Bonds over Loans

The traditional explanation for firms borrowing from the bond market over banks revolves around weak balance sheets of banks given compelling evidence from the GFC [Becker and Ivashina, 2014, Crouzet, 2017]. In 2020, banks' balance sheets were strong and access to credit lines was largely unimpeded for large firms.[53] The simplest alternative explanation would be that bonds became cheaper relative to loans during this time. However, while bond yields fell following the intervention, this is insufficient, since loan interest rates also fell. Internet Appendix B shows evidence that the bond-loan spread did not necessarily shrink significantly, consistent with emergency measures affecting both loan and bond markets. Differences in other contract terms, such as maturity, interest rate fixation, or covenants could explain the substitution. If the core logic is to lock-in funds for as long as possible due to uncertain external financing costs [Bolton et al., 2013] or fixed

[52]Debt substitution occurs following bond issuance in normal times as well, but to a much smaller extent. Of course, in normal times, liquidity needs are significantly smaller and far fewer firms draw on or repay their credit lines. Figure IA.10 in the Internet Appendix shows the estimates of a dynamic within-firm regression similar to Figure 1 but for credit line draw-downs up to 1 year before and 2 years after issuance. Table IA.13 and Figure IA.11 in the Internet Appendix summarize the magnitudes of draw-downs and repayments for the first half of 2019 rather than 2020. No IG bond issuers maxed out on their credit lines, and only 2% of HY firms maxed out on their credit lines; 53% of the riskiest bond issuers did not draw down on their credit lines.

[53]Of course, our results should not be interpreted as bank lending being unimportant for firms' access to liquidity. In fact, many firms do not have access to bond markets and crucially rely on bank funding. For example, Halling et al. [2020b] argue that while there has been an emphasis on loan-bond substitution in recessions, bank financing still increases for the average US public firm during these times.

issuance costs [Jeenas, 2019], then firms' preferences for bonds could be explained by their longer maturities and higher likelihood of being fixed-rate relative to loans.[54]

As a concrete example, consider again Kraft Heinz that so eagerly repaid their credit lines by issuing bonds. Their May 2020 bond issuance was not cheaper than their last bond issued in 2019 or their existing bank credit lines. However, these bonds had much longer duration. Kraft Heinz had a revealed preference for the longer-maturity source of funds (bonds), even though it did not necessarily become cheaper. Finally, it is also possible that bonds having less restrictive covenants than loans might have played a role. See Internet Appendix B for a more detailed discussion.[55] This suggests that changes in firms' debt composition after the intervention can be beneficial. We discuss debt refinancing in more details in Section 5 below.

4.4 Equity Repurchases

Finally, we explore whether firms use bond proceeds to pay out shareholders. There is a potential concern that loose monetary policy can lead to leveraged payouts, instead of stimulating corporate investment [Acharya and Plantin, 2021]. To shed light on this issue, we conduct an event study analysis similar to Section 3 where the outcome variable of interest is a dummy for whether the firm conducted share repurchases in a given quarter. We exclude normal dividends given firms' well-known reluctance to cut them and instead look at share repurchases, which are more discretionary in nature [Farre-Mensa et al., 2018]. Figure 5 shows dynamic coefficients plots around issuance for IG firms.[56] It confirms that bond issuance is often associated with share repurchases in normal times [Farre-Mensa et al., 2018, Ma, 2019].

[54]These differences are well documented for both bonds issued in 2020 and prior years. While the typical loan maturity for a bond issuer is four years [Schwert, 2018], the median IG bond issued in 2020 is 10 years, and 7 years for the median HY bond. Halling et al. [2020a] argue that bond maturities did not significantly shorten during COVID, in spite of the Federal Reserve intervention incentivizing short maturity, contrary to prior evidence [Erel et al., 2012].

[55]While the implication of these differences in contract terms is intuitive, they are nevertheless absent from the classical models that rationalize banks' comparative advantage in providing liquidity relative to the market [Holmström and Tirole, 1998, Kashyap et al., 2002, Gatev and Strahan, 2006, Acharya et al., 2018]. Interestingly, the economics behind bond issuance thus seem quite different from commercial paper, which is typically seen as the main source of market-based liquidity for firms. The very short-term nature of commercial paper makes it a poor option to lock-in funds and build liquidity buffers.

[56]Coefficient plots for high yield firms in Figure IA.14, in the Internet Appendix, show a very similar story.

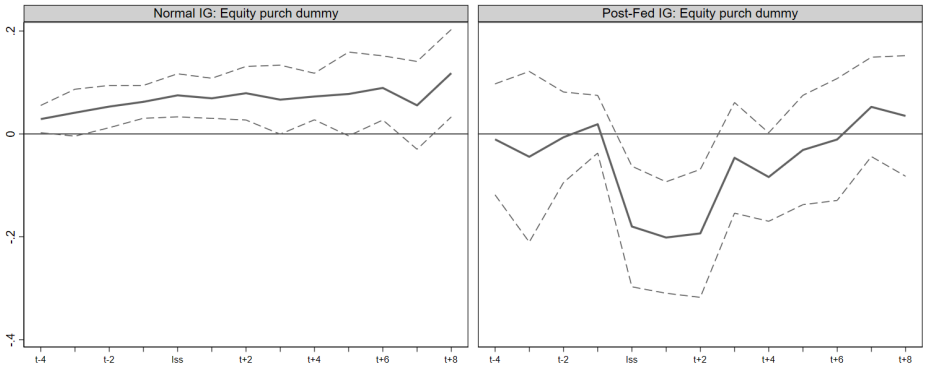

Figure 5 – Equity repurchases: Coefficient plots

Notes: Each point is an estimate of β_m from the regression $Y_{fq} = \sum_{m=-4}^{8} \beta_m Issue_{f,q-m} + \alpha_f + \alpha_{ind \times year} + \varepsilon_{fq}$, with 95% confidence intervals. "Equity purchase dummy" is an indicator for positive purchases of common or preferred shares in that quarter. Includes investment grade firms (rated BBB- and above). Observations are firm-quarters up to five quarters prior to a bond issuance and eight quarters following a bond issuance. "Iss" denotes the quarter ending immediately after issuance. We include firm and industry-year fixed effects. Standard errors are clustered by 2-digit industry level. All ratios are winsorized at the 1% level. "Normal" times includes bonds issued between 2010-2019, "Post-Fed" times includes bonds issued between March 23 - June 30, 2020.

However, the dynamics in 2020 are more nuanced. On the one hand, issuers were significantly less likely to purchase equity following bond issuance. The probability of repurchase after issuance falls by about 20 percentage points, consistent with the hypothesis that many firms aim to preserve cash on their balance sheets.[57] Share repurchase activity resumed within a few quarters following issuance. Despite the overall reduction, 47% of issuers still repurchased shares between March and June 2020. This is evidence that many issuers did not highly value inside liquidity at the margin, since discretionary equity payouts are a direct sign of the value of internal funds being low. Table IA.14 estimates that over $160B was spent on share repurchases between March and December 2020 in our sample of spring 2020 issuers.[58]

[57] High-profile examples of reductions in shareholder payouts were widely covered in the news. For example, Ford Motor Co. and Freeport-McMoRan Inc. suspended dividend payments while AT&T halted share repurchases. "Companies Race for Cash in Coronavirus Crisis", *Wall Street Journal*, 03/23/2020.

[58] This is in line with Hotchkiss et al. [2020], which finds that in aggregate, large companies paid out more to their equity holders than they raised. Table IA.15 shows that in the cross-section of Spring 2020 bond issuers, a high cash balance in 2019Q4 is the only strong predictor of repurchases after March 2020, while credit ratings and exposure to COVID have no significant explanatory power, confirming that payouts were pervasive.

5 Decomposing Use of Funds from Bond Issuance

In this section, we decompose the use of each dollar of bond proceeds after the intervention. These magnitudes are potentially helpful to calibrate models of firm behavior by informing the marginal propensities of firms to invest or save out of bond issuance. We run the following generalized version of our event study regressions, where we normalize the amount issued per quarter and the firm balance sheet characteristics with each firm's total assets at 2019 year end. By normalizing both the dependent and independent variables, we can use the coefficient estimates to attribute each dollar of bond issuance to cash holdings, real investment, bank debt reduction, equity payouts, or other uses, for the average issuer in each time period. We include industry-year fixed effects to absorb any cross-industry variation in exposure to the COVID shock, and firm fixed effects to absorb persistent cross-sectional variation in balance sheet characteristics. Finally, we control for current period cash flow from operations, again normalized by total assets in 2019, in order to absorb any changes in cash resulting from operations (CFO).

$$\frac{Y_{fq}}{Assets2019_f} = \sum_{m=-4}^{4} \beta_m \frac{AmtIssued_{f,q-m}}{Assets2019_f} + \alpha_f + \alpha_{ind,y} + \frac{CFO_{fq}}{Assets2019_f} + \varepsilon_{fq} \tag{5}$$

Table 3 summarizes point estimates of $\beta_{t+2} - \beta_{t-2}$ for the key balance sheet characteristics. Note that computing the difference between these two periods nets out important dynamics of many balance sheet characteristics, described in detail in previous sections.[59] Nevertheless, the simple difference estimate is valuable as it allows us to quantify the use of proceeds on average. The first column presents estimates for bond issuers in normal times, while the last three columns present estimates for firms issuing in the months following the Federal Reserve's announcement of bond market intervention in March 2020.

The table highlights that the vast majority of funds raised in the wake of the policy intervention announcement were used to adjust firms' capital structure. The second column reports that out

[59] For example, it understates the amount repaid to banks as it misses some high-frequency movement in credit lines draw-downs highlighted above.

Table 3 – Decomposition of $1 bond issue ($\beta_{t+2} - \beta_{t-2}$)

	Normal: All	Post-Fed: All	Post-Fed: IG	Post-Fed: HY
Rollover bonds	0.48	0.30	0.20	0.43
Pay down bank debt	0.03	0.15	0.09	0.23
Real investment	0.08	-0.00	0.04	-0.06
Payout to equity	0.01	-0.06	-0.09	-0.02
Cash	0.06	0.45	0.61	0.25

Notes: Reports point estimates of $\beta_{t+2} - \beta_{t-2}$ from the regression equation (5). First column includes estimates on the full subset of bonds issued between 2010-2019, second column includes bonds issued between March 23 - June 30, 2020, third and fourth columns report estimates on subsamples of bonds issued between March 23 - June 30, 2020 by investment grade and high yield issuers, respectively. Total debt is total long term debt plus debt in current liabilities. Senior bonds and notes are from Capital IQ. Investment grade firms are rated BBB- and above, and high yield firms are rated below BBB-. Observations are firm-quarters up to five quarters prior to a bond issuance and eight quarters following a bond issuance. "t+2" denotes the quarter end that falls at least one full quarter after bond issuance, and "t-2" denotes quarter end that falls at least one full quarter preceding issuance. We include firm and industry-year fixed effects. Standard errors are clustered by 2-digit industry level. All ratios are winsorized at the 1% level in the entire sample.

of $1 of new bonds issued post intervention, as much as 45 cents was used to increase cash and 15 cents to pay back bank debt. This is significantly more than in normal times. On the other hand, the average firm experienced zero corresponding increase in real investment, compared to an increase in investment of 8 cents in normal times. On average, payouts to equity also declined slightly, suggestive that there were no massive leverage payouts during that window.[60]

Debt refinancing: After the Fed intervention, 30 cents were spent on average on rolling over existing bonds.[61] There is substantial heterogeneity across firms in this dimension: HY firms spend 43 cents towards rolling over existing bonds, 23 cents more than IG firms. (Cash is the opposite: IG firms increased cash by 36 cents more). This heterogeneity is reflected in total debt as well: Figure IA.12 in the Internet Appendix shows that total leverage dropped after an initial spike post-intervention in spite of the issuance boom, with HY firms decreasing their leverage even faster than IG firms. This is consistent with the evidence in Xu [2018] that HY firms are quicker to refinance their bonds when credit conditions ease, primarily to extend maturity and reduce rollover risk, in

[60]The decomposition does not add exactly to one, and any residual sources or uses of cash could arise from a combination of equity issuance, net working capital, or depreciation and amortization.

[61]This number is based on the change in total bonds outstanding, and as such it cannot distinguish directly between replacing a maturing bond with retiring a bond early (through a call option or another mechanism).

line with the mechanisms in Xiao [2020] or Jeenas [2019]. [62]

6 Discussion and Implications

The events of 2020 show that a closer integration of corporate finance and macroeconomic models is important to understand the transmission of unconventional monetary policy. Evaluating the aggregate equilibrium effect of the Fed announcement and comparing it to a counterfactual economy absent intervention would require estimating a quantitative macroeconomic model, which is outside the scope of this paper. However, in this section we discuss how our results can inform the micro-foundations of such a model.

In terms of modeling, rationalizing the pattern of debt issuance for the purpose of accumulating liquid assets requires an explicit role for liquid assets and long-term financing, as in Xiao [2020] and Jeenas [2019]. Moreover, the active choice of bonds over bank loans implies modeling explicitly this margin, going beyond existing models that tend to focus on shocks to banks' balance sheets. Finally, given that we observe many firms issuing bonds to repurchase equity, incorporating joint debt issuance and payouts in models of unconventional monetary policy is an important avenue for future research [Acharya and Plantin, 2021].[63] Our evidence emphasizes the

[62] Immediate roll-over risk was nevertheless limited in Spring of 2020. Table IA.16 in the Appendix shows that HY issuers with a bond maturing in 2020 made up only 8% of all issuers and 29% of HY issuance volume in Spring 2020. Additional cross-sectional tests in Tables IA.6, IA.10, and IA.15 confirm that current-debt-to-assets ratios have little to no significant explanatory power in our sample. While extending maturity was clearly valuable to HY firms, the data does not support the idea that the intervention prevented a massive default wave in 2020. See "Will the coronavirus trigger a corporate debt crisis?", *Financial Times*, 03/12/2020. In addition, Becker and Benmelech [2021] argue that call activity did not exceed prior years, in line with Table 3. In line with this evidence, we were only able to find 21 COVID issuers that engaged in early bond refinancing using Mergent FISD data up to October 2020. This refinancing activity was likely concentrated towards the end of the year, as aggregate net debt financing turned negative at the end of 2020 [Hotchkiss et al., 2020].

[63] Note that this pattern represents a challenge to many corporate finance theories based on liquidity management: firms typically raise funds when cash is low but pay out when cash is high, but do not do both at once. Acharya and Plantin [2021] present a model of corporate finance with agency frictions that predicts that loose monetary policy can lead to leveraged payouts. However, corporate finance models which introduces a tax advantage of debt financing generate incentives to behave this way (e.g.Begenau and Salomao [2019]). More generally, models of market timing such as Ma [2019] can also explain this pattern with shifts in relative valuation between debt and equity markets; see also Baker and Wurgler [2002], Baker et al. [2003], Pegoraro and Montagna [2021]. For other theories of debt-financed payouts, see Farre-Mensa et al. [2018]. Macroeconomic models that predict debt-financed payouts in good times include Jermann and Quadrini [2012], Begenau and Salomao [2019], Covas and Den Haan [2011].

role of the value of corporate liquidity in policy transmission, as it drives investment multipliers. Estimating how large this value of liquidity was for targeted firms is thus key for future policy analysis. The macroeconomic model of Greenwald et al. [2023] incorporates all these key margins in a general equilibrium of firm investment with financial frictions. They find that a policy of supporting corporate bond markets has effects that mirror our empirical findings. We take their results as evidence that our empirical findings have aggregate implications and matter for the design of macroeconomic models.

Overall, our evidence suggests that this specific intervention had limited real effects, as bond proceeds were primarily used to adjust capital structure. We qualify this statement in three ways. First, there were benefits to firms: increased cash, lower draw-downs on credit lines, and extended debt maturity all contributed to strengthening firms' financial positions and potentially reducing default risk in medium-run.[64] The repayment of bank debt might have also potentially allowed banks to lend more to other firms [Greenwald et al., 2023, Acharya et al., 2021, Kapan and Minoiu, 2021].[65] Second, capital structure changes can have strong effects on real investment. However, in this setting two forces seemed to have limited this channel: (i) the nature of the firms targeted by the intervention: as a group, bond issuers tend to be the least constrained firms in the economy; and (ii) banks were healthier than in 2008-09 and were able to lend to large firms by honoring their credit line commitments [Acharya and Steffen, 2020b, Li et al., 2020, Chodorow-Reich et al., 2022]. Third, the intervention might have prevented a full-blown financial meltdown with dramatic real effects, although this is hard to test directly.

Our findings thus highlight the practical challenge for central banks to target unconventional policy towards firms that need liquidity the most. We also find that the 2020 Federal Reserve program had a different transmission mechanism relative to what prior work has identified for the CSPP Grosse-Rueschkamp et al. [2019]. While both programs had similar effects on markets by

[64] Recall that Figure IA.12 shows that corporate leverage quickly returned to its pre-crisis level due to debt substitution.

[65] The ECB 2016 corporate bond program helped banks relax their lending constraints, allowing them to lend to smaller firms [Grosse-Rueschkamp et al., 2019, Arce et al., 2021, Ertan et al., 2019].

reducing yields and stimulating issuance, the transmission to real effects differs significantly.[66]

One might ask which lessons can generalize beyond this specific recent episode, as each crisis is different and many factors determine the effects of public intervention. Nevertheless, our findings are rooted in trends in corporate financing for large firms that are likely here to stay: (i) the growing importance of bond financing over bank loans [Crouzet, 2021], (ii) large bond issuers have access to significant quantities of off-balance sheet credit from banks [Chodorow-Reich et al., 2022, Greenwald et al., 2023], (iii) concurrent debt issuance and share repurchases are pervasive among large firms [Ma, 2019, Farre-Mensa et al., 2018].

7 Conclusion

This paper studies firm behavior in the wake of the unprecedented policy support to the corporate bond market in 2020. While bond issuance surged, real investment did not, as funds were mainly used to accumulate liquid assets and repay other debt. Moreover, most bond issuing firms had access to credit lines from banks that they chose not to use, even though the crisis did not originate in the banking sector. Our evidence highlights the value of studying firms' balance sheets, beyond the market rebound, to better understand potential real effects of bond purchases and inform the micro-foundations of macroeconomic models. Just as the GFC showed that financial intermediation was more complex than previously thought and needed a proper place in macro-finance models, the market turmoil in 2020 highlights the complexity and central place of bond markets and corporate finance for the macro-economy [Brunnermeier and Krishnamurthy, 2020].

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[66] Grosse-Rueschkamp et al. [2019] find no effect on credit lines balances, cash holdings, or share repurchases. Instead, BBB-rated firms repaid term loans while highly-rated firms increased acquisitions. On the other hand, the Fed program seemed to have been more about a direct effect on issuers through increasing their available liquidity.

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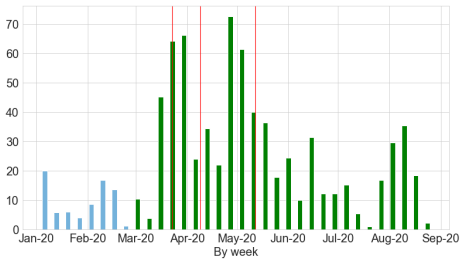
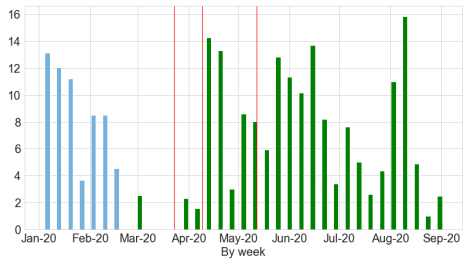
Internet Appendix to

Bond Market Stimulus: Firm-Level Evidence

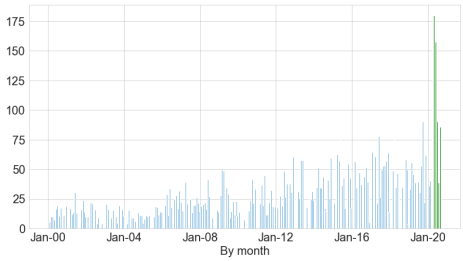
A - Additional Figures and Tables



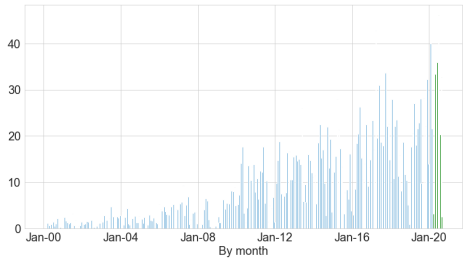
(a) IG: 2020



(b) HY: 2020



(c) IG: 2000-2020



(d) HY: 2000-2020

Figure IA.1 – Comparing IG vs. HY bond issuance volumes

Source: Mergent FISD, retrieved via WRDS October 2022. Denotes weekly issuance volumes for USD corporate bond issuance of over $100 million in size issued by U.S. domiciled companies or companies that report in U.S. dollars. Note red lines correspond to March 23, 2020 (first Fed announcement to buy corporate bonds); April 9, 2020 (first Fed announcement to buy high yield corporate bonds); and May 12, 2020 (start of Fed bond buying program).

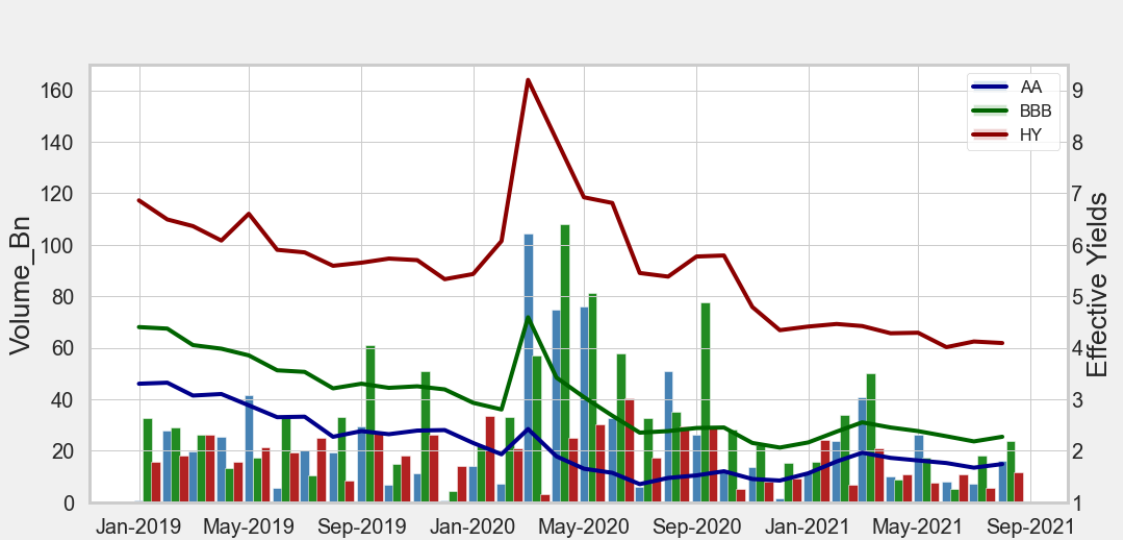


Figure IA.2 – Bond Issuance volume and yields through 2020

Notes: Bars represent monthly issuance volumes, in billions of dollars, for rating categories AA and above, BBB- to BBB+, and high yield (BB+ and below). Lines represent yields for the ICE Bank of America U.S. Indices for U.S. dollar denominated corporate debt publicly issued in the U.S. domestic market in the same three ratings categories, as pulled from the Federal Reserve Economic Data.

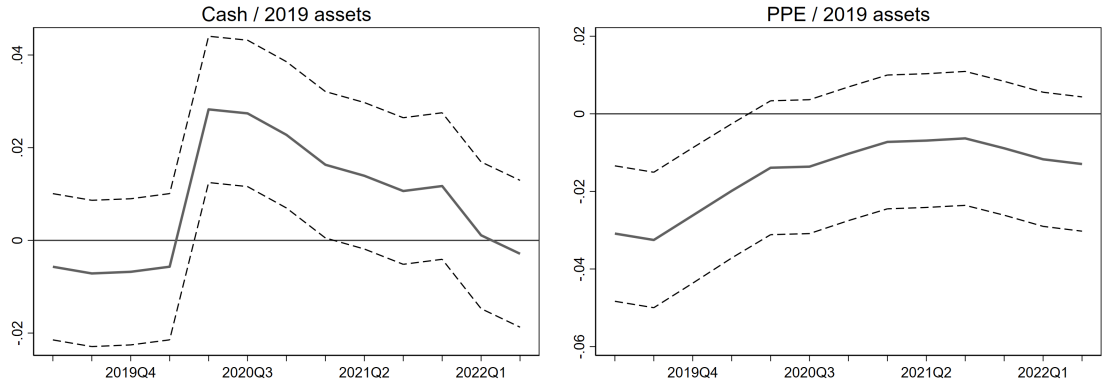


Figure IA.3 – Issuer vs. non-issuer balance sheet dynamics: Coefficient plots

Notes: Each point is an estimate of β_q from the regression
$Y_{fq} = \sum_{m \in 2019Q1:2022Q2} \left(\beta_m \mathbf{1}\{q = m\} \times \mathbf{1}\{\text{Spring20 issuer}_f\} + \gamma_m \mathbf{1}\{q = m\} \times \mathbf{1}\{\text{IG}_f\} \right) + \alpha_f + \alpha_{ind,q} + \varepsilon_{fq}$, with 95% confidence intervals. "Cash / 2019 assets" is cash and short term investments, normalized by the firm's 2019 year end total assets. "PPE / 2019 assets" is total property plant and equipment, normalized by the firm's 2019 year end total assets. Observations are firm-quarters from 2019Q1-2022Q2. "Spring20 Issuer" denotes the firm issued in March 23-June 30, 2020. We include firm and industry-year fixed effects. Standard errors are clustered by 2-digit industry level. All ratios are winsorized at the 1% level in the entire sample.

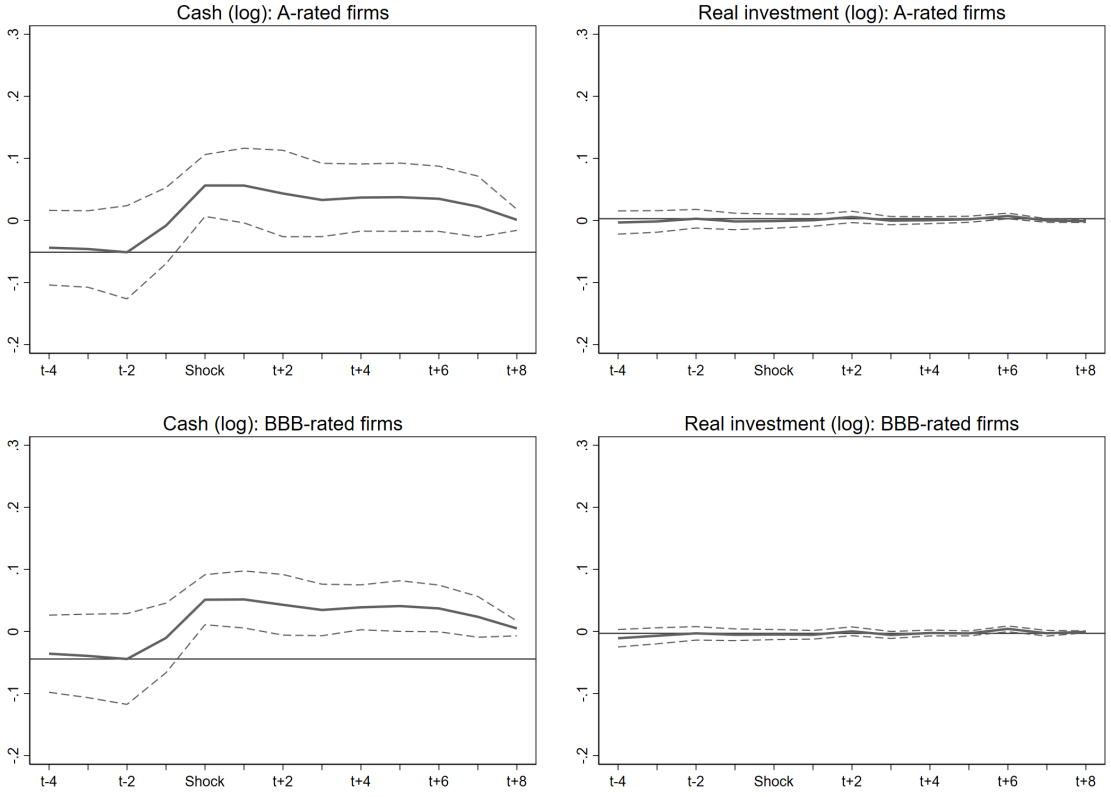


Figure IA.4 – OLS estimates: A- and BBB-rated firms

Notes: Each point is an estimate of β_{t+m} from the regression $\ln(Y)_{fq} = \sum_{m \in 2019Q1:2022Q2} \left(\beta_m \mathbf{1}\{q = m\} \times AbnormalAmtIssued_f\right) + \alpha_f + \varepsilon_{fq}$, with 95% confidence intervals, where $AbnormalAmtIssued_f$ is the amount issued by the firm as reported in Mergent FISD in 2020Q1 and 2020Q2 minus the average quarterly issuance for that firm 2000-2019. Cash is cash and short term investments, and Real investment is total plant, property and equipment. Both left-hand-side variables are logged. Top panel includes issuers of credit rating A- and above; bottom panel includes issuers of credit rating BBB- to BBB+. Observations are firm-quarters up to five quarters before and eight quarters following the Federal Reserve's announcement to intervene in corporate bond markets in March 2020, which is denoted by "Shock". We include firm fixed effects and cluster standard errors by 2-digit industry. Solid horizontal lines are drawn at the value for the coefficient at 2019Q4 ('t-2').

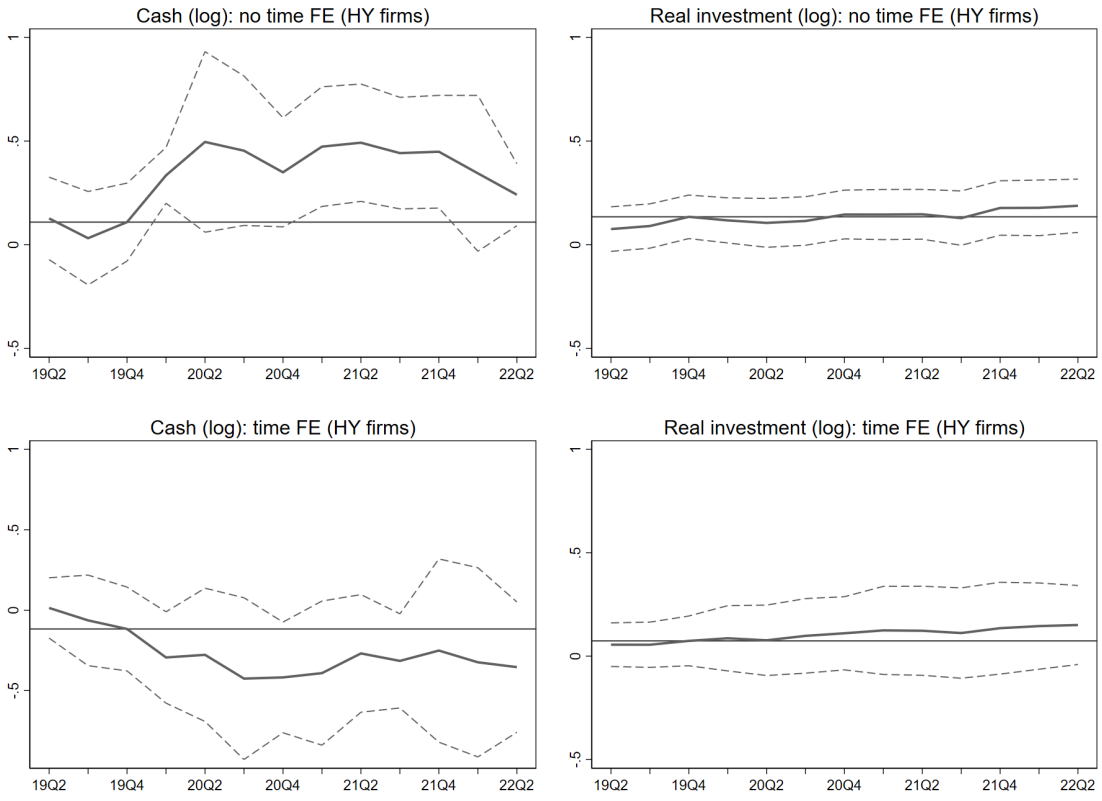


Figure IA.5 – Policy-driven credit spread change treatment effect and Diff-in-Diff: IG firms: HY firms

Notes: Each point is an estimate of β_m from the regression $\ln(Y)_{fq} = \sum_{m=2019Q2}^{2022Q2} \left(\beta_m \mathbf{1}\{q=m\} \times \mathbf{1}\{HighExposure\}_f\right) + \alpha_f + (\alpha_q +)\varepsilon_{fq}$, with 95% confidence intervals, where $\mathbf{1}\{HighExposure\}_f$ is a dummy variable that equals 1 if firm f has a predicted policy-driven credit spread reduction recovered from column (3) of Table IA.8 (using only the interaction terms) that is in the top 25% of HY firms. Cash is cash and short term investments, and Real investment is total plant, property and equipment. Both left-hand-side variables are logged. Observations are firm-quarters for HY firms from Q1 2019–Q2 2022. The upper panel includes firm fixed effects, the lower panel includes firm and quarter fixed effects, and we cluster standard errors by 2-digit industry. Solid horizontal lines are drawn at the value for the coefficient at 2019Q4.

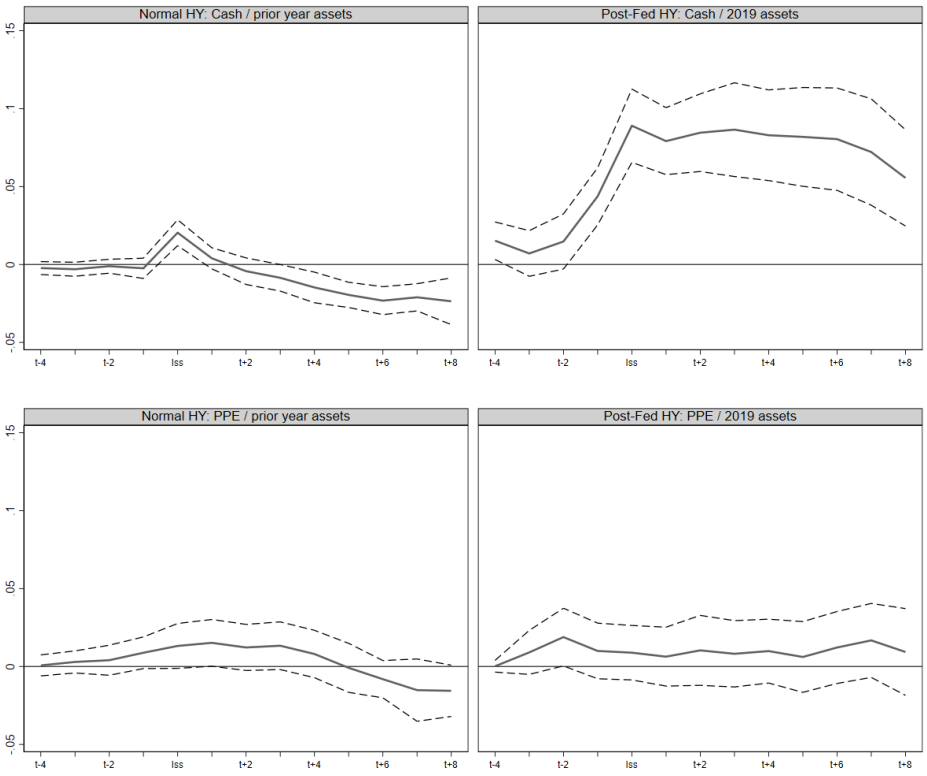


Figure IA.6 – Liquid Assets and Real Investment: Coefficient plots for HY firms

Notes: Each point is an estimate of β_m from the regression $Y_{fq} = \sum_{m=-4}^{8} \beta_m Issue_{f,q-m} + \alpha_f + \alpha_{ind \times year} + \varepsilon_{fq}$, with 95% confidence intervals. "Cash / 2019 assets" is cash and short term investments, normalized by the firm's 2019 year end total assets. "Cash / prior year assets" is cash and short term investments, normalized by the firm's total assets from one year prior. Observations are firm-quarters up to five quarters prior to a bond issuance and eight quarters following a bond issuance, including all issuers rated below BBB-. "Iss" denotes the quarter ending immediately after issuance. We include firm and industry-year fixed effects. Standard errors are clustered by 2-digit industry level. All ratios are winsorized at the 1% level in the entire sample. "Normal" times includes bonds issued between 2010-2019, "Post-Fed" times includes bonds issued March 23 - June 30, 2020.

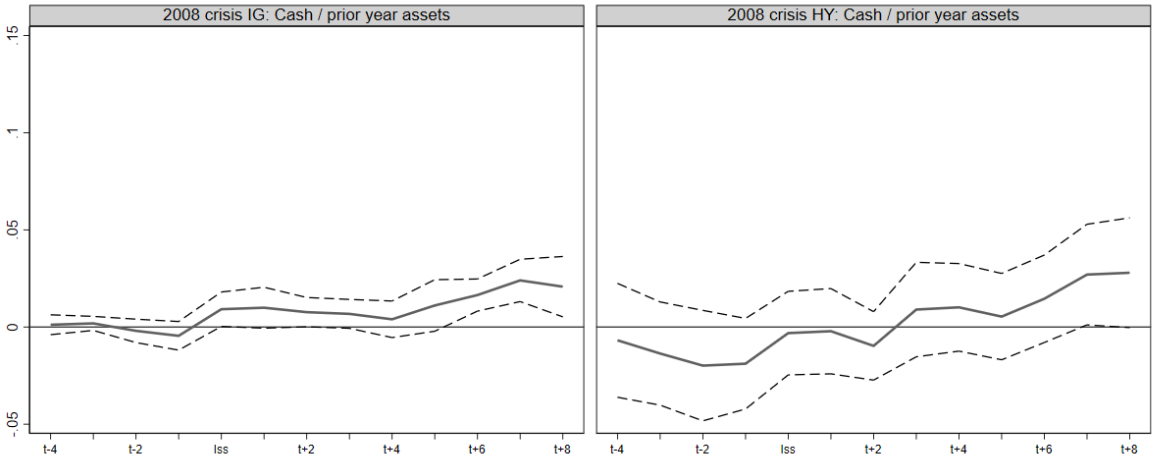


Figure IA.7 – Liquid Assets: Coefficient plots – Global Financial Crisis

Notes: Each point is an estimate of β_m from the regression $Y_{fq} = \sum_{m=-5}^{4} \beta_m Issue_{f,q-m} + \alpha_f + \alpha_{ind \times year} + \varepsilon_{fq}$, with 95% confidence intervals. Cash is cash and short term investments. The left hand side panel includes investment grade firms (rated BBB- and above), while the right hand side panel includes high yield firms (rated below BBB-). Observations are firm-quarters up to five quarters prior to a bond issuance and eight quarters following a bond issuance. "Iss" denotes the quarter ending immediately after issuance We include firm and industry-year fixed effects. Standard errors are clustered by 2-digit industry level. All ratios are winsorized at the 1% level. GFC times includes bonds issued October 1, 2007 - June 30, 2009.

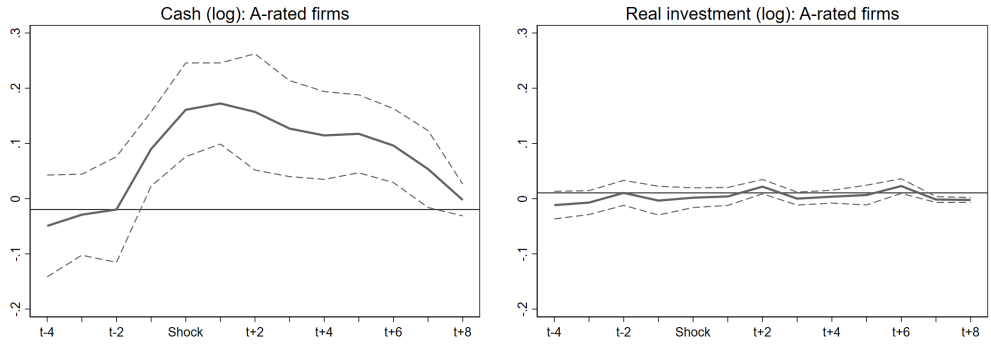


Figure IA.8 – Second stage estimates: A-rated firms

Notes: Each point is an estimate of β_m from the regression $\ln(Y)_{fq} = \sum_{m=2019Q2}^{2022Q2} \left(\beta_m \mathbf{1}\{q = m\} \times \widehat{AbnormalAmtIssued}_f \right) + \alpha_f + \varepsilon_{fq}$, with 95% confidence intervals, where $\widehat{AbnormalAmtIssued}_f$ is recovered from the first stage 2. Cash is cash and short term investments, and Real investment is total plant, property and equipment. Both left-hand-side variables are logged. Includes issuers of credit rating A- and above. Observations are firm-quarters up to five quarters before and eight quarters following the Federal Reserve's announcement to intervene in corporate bond markets in March 2020, which is denoted by "Shock". We include firm fixed effects and cluster standard errors by 2-digit industry. Solid horizontal lines are drawn at the value for the coefficient at 2019Q4 ('t-2').

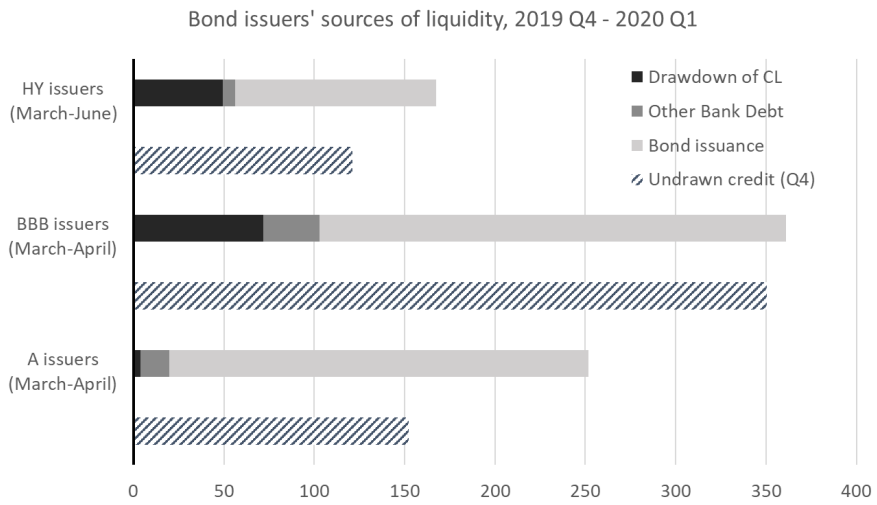


Figure IA.9 – Visualizing dry powder: Debt Composition Aggregate Flow

Notes: This figure classifies aggregate debt flows based on FISD bond issuance data as well as changes in outstanding debt for other credit instruments during 2020Q1 based on Capital IQ Capital Structure Summary table. Undrawn credit EOY 2019 is the outstanding available Undrawn Revolving Credit at the end of 2019. See Table 1 for underlying numbers. Issuers include all U.S. firms that issued a bond between issued March 23 - June 30, 2020 that we could merge with Capital IQ information.

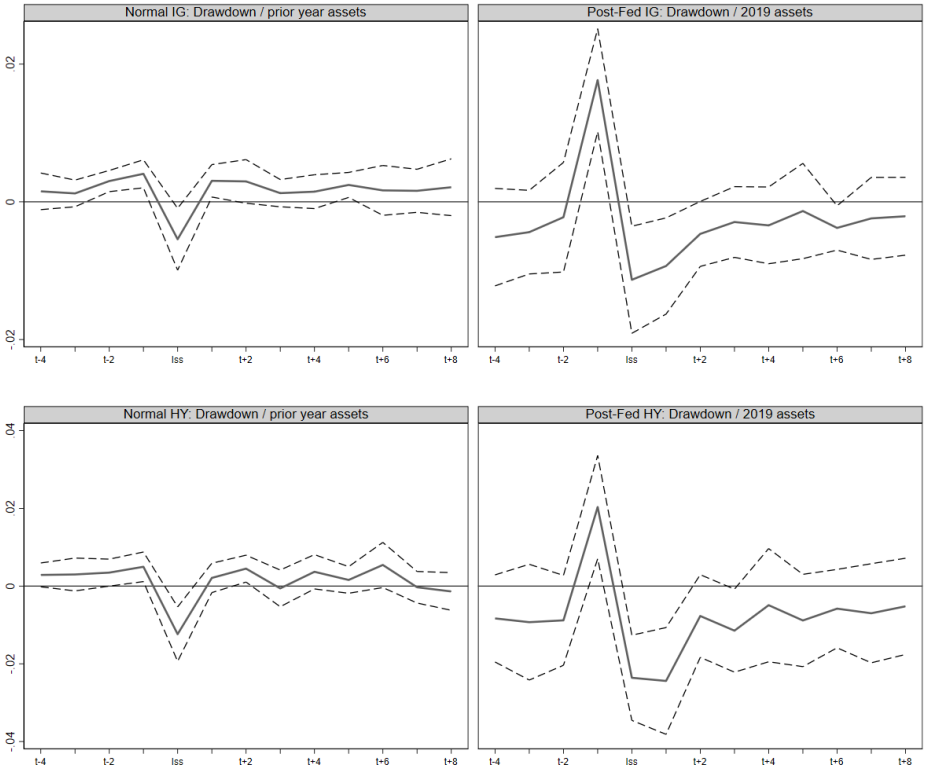


Figure IA.10 – Drawn amount on credit lines: Coefficient plots

Notes: Each point is an estimate of β_m from the regression $Y_{fq} = \sum_{m=-5}^{4} \beta_m Issue_{f,q-m} + \alpha_f + \alpha_{ind \times year} + \varepsilon_{fq}$, with 95% confidence intervals. Credit Line Drawn Down is the amount drawn down on bank credit line at quarter end (negative values are repayments). Observations are firm-quarters up to five quarters prior to a bond issuance and eight quarters following a bond issuance. "Iss" denotes the quarter ending immediately after issuance. We include firm and industry-year fixed effects. Standard errors are clustered by 2-digit industry level. "Normal" times includes bonds issued between 2010-2019, "Covid" times includes bonds issued March 23 - June 30, 2020.

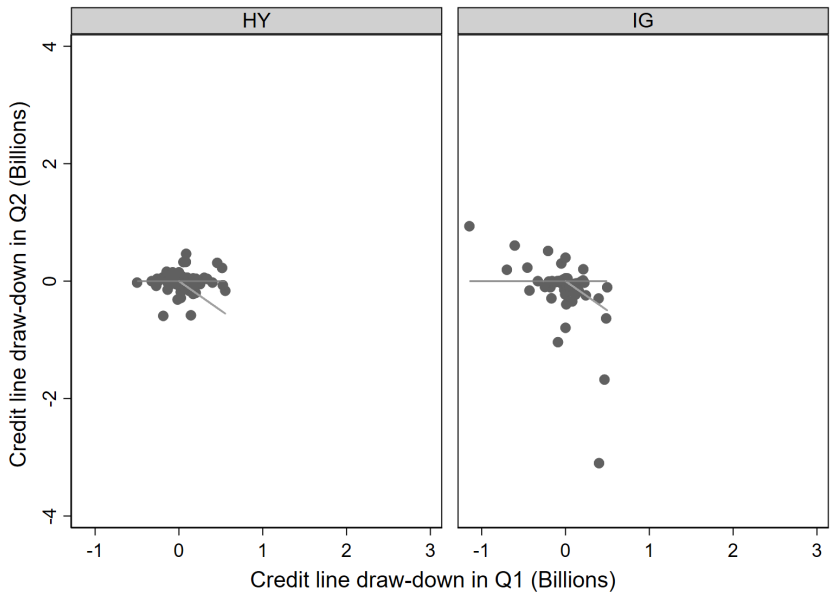


Figure IA.11 – Visualizing crowding out: Credit line draw-downs in 2019Q2 vs. 2019Q1

Note: This figures plots credit line repayment in 2019Q2 against 2019Q1 credit line draw-downs, based on Capital IQ Capital Structure Summary table, separately by high-yield and investment grade issuers. For ease of interpretation, the figure also displays the negative 45 degree line (exact repayment in Q2) and horizontal line (no change in credit line in Q2). Excludes firms that did not draw down in 2019Q1, and excludes the outlier HCA Inc.

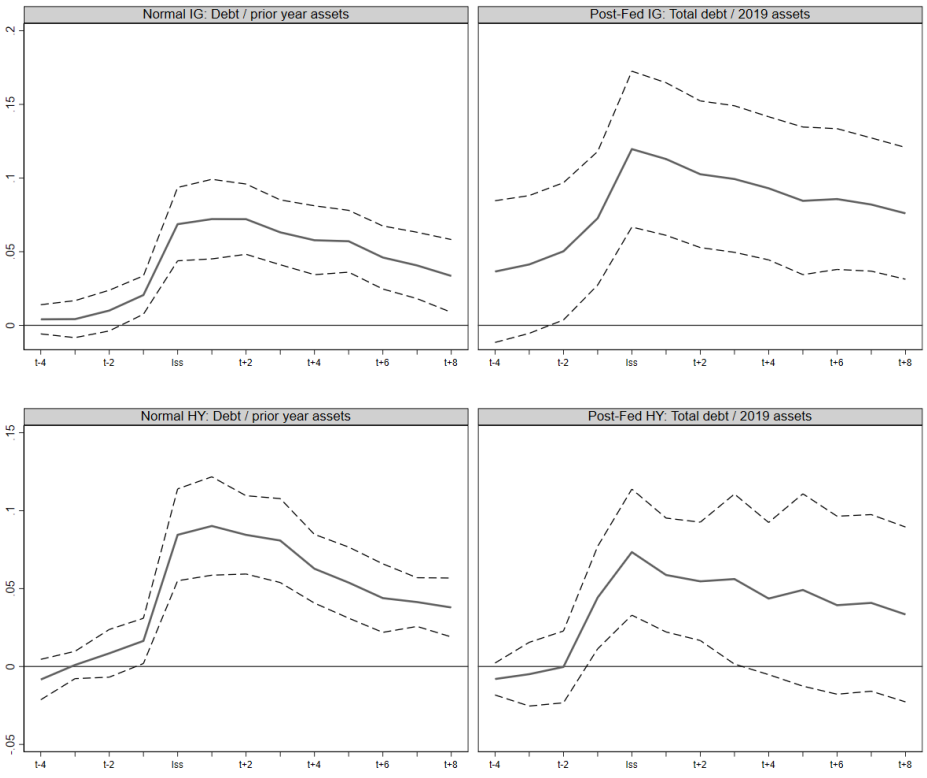


Figure IA.12 – Total debt: Coefficient plots

Notes: Each point is an estimate of β_m from the regression $Y_{fq} = \sum_{m=-4}^{8} \beta_m Issue_{f,q-m} + \alpha_f + \alpha_{ind \times year} + \varepsilon_{fq}$, with 95% confidence intervals. "Total debt / 2019 assets" is short term plus long term debt, normalized by the firm's 2019 year end total assets. "Total debt / prior year assets" is short term plus long term debt, normalized by the firm's prior year total assets. The top panel graphs are investment grade firms (rated BBB- and above), while the bottom panel are high yield firms (rated below BBB-). Observations are firm-quarters up to five quarters prior to a bond issuance and eight quarters following a bond issuance. "Iss" denotes the quarter ending immediately after issuance. We include firm and industry-year fixed effects. Standard errors are clustered by 2-digit industry level. All ratios are winsorized at the 1% level. "Normal" times includes bonds issued between 2010-2019, "Post-Fed" times includes bonds issued between March 23 - June 30, 2020.

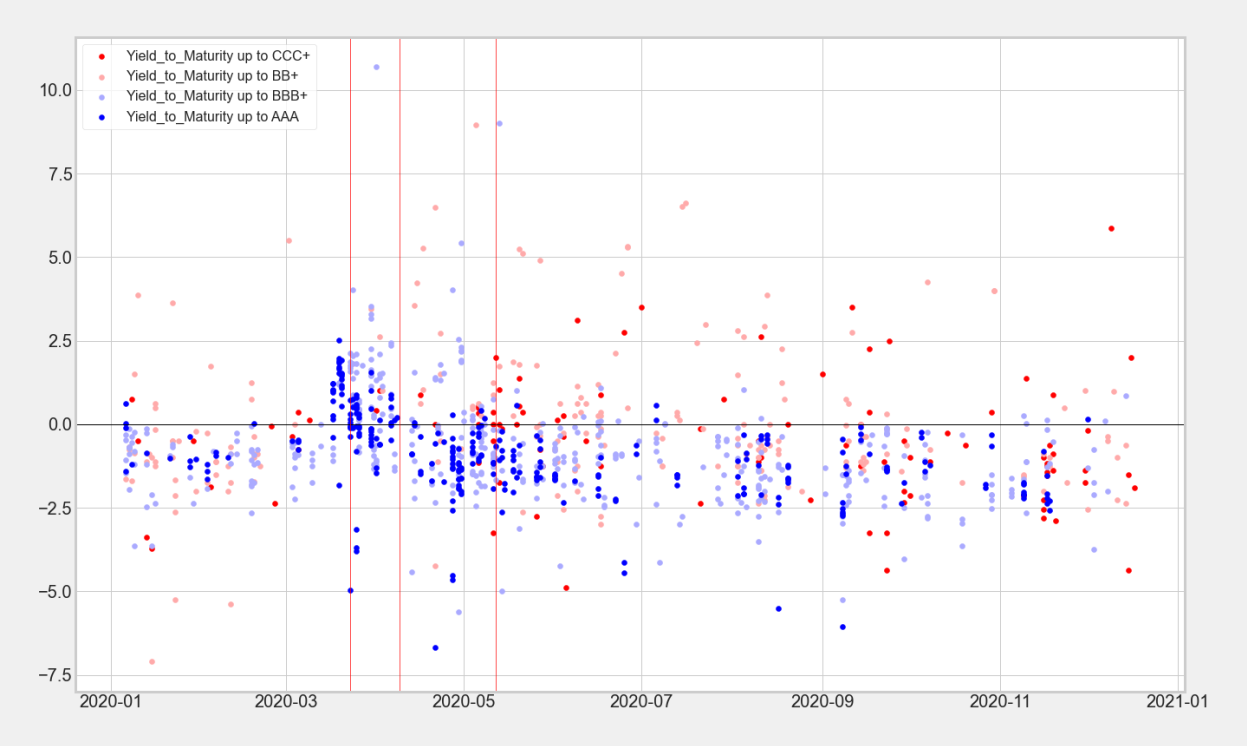


Figure IA.13 – Yield to maturity vs. most recent issuance by same issuer

Source: Mergent FISD, retrieved via WRDS October 2022.

Note: Each point is the yield to maturity on a new issuance, net of the yield to maturity on the most recent issuance by the same issuer of the same tenor (within 1 year). A value greater than zero means the new bond has a higher cost of capital (credit spread) than the most recent bond issued by the same firm. Note red lines correspond to March 23, 2020 (first Fed announcement to buy corporate bonds); April 9, 2020 (first Fed announcement to buy high yield corporate bonds); and May 12, 2020 (start of Fed bond buying program).

Table IA.1 – Summary statistics: bond issuance, 2019-2020

	Num Offerings	Amount (Bn)	Tenor	Rating	Credit Spread	Yield
IG Issuance: 2019						
10%	1	1.4	9.2	13.6	92	2.89%
50%	5	5.0	13.3	14.7	140	3.80%
90%	10	21.2	19.1	16.7	193	4.46%
IG Issuance: Weeks since March 2020						
2020-03-02	10	7.6	13.4	14.6	141	2.46%
2020-03-09	3	3.9	12.2	14.2	211	2.91%
2020-03-16	11	45.2	15.6	17.2	270	3.93%
2020-03-23	27	62.9	13.4	16.1	272	3.68%
2020-03-30	18	59.6	13.6	15.4	348	4.26%
2020-04-06	11	18.7	11.6	15.1	308	3.80%
2020-04-13	11	28.4	12.1	15.3	237	3.22%
2020-04-20	14	18.0	10.9	14.4	273	3.51%
2020-04-27	22	65.5	14.3	15.5	218	3.17%
2020-05-04	26	55.3	12.7	15.2	252	3.26%
2020-05-11	20	37.5	15.2	14.8	251	3.54%
2020-05-18	9	34.2	17.4	16.4	166	2.71%
2020-05-25	9	11.2	14.5	15.6	169	2.51%
2020-06-01	12	24.4	12.0	14.9	156	2.35%
2020-06-08	8	9.1	10.4	13.8	180	2.62%
2020-06-15	14	26.6	11.8	14.6	202	2.68%
2020-06-22	6	10.1	11.7	15.8	156	2.25%
2020-06-29	3	8.8	18.7	14.0	170	2.62%
HY Issuance: 2019						
10%	2	1.7	6.7	7.9	305	4.91%
50%	5	3.7	8.0	9.2	374	6.17%
90%	9	8.3	9.1	10.3	495	7.12%
HY Issuance: Weeks since March 2020						
2020-03-02	3	2.5	8.7	10.0	447	5.46%
2020-03-30	4	2.3	5.0	9.5	662	6.56%
2020-04-06	3	1.6	5.0	7.0	814	8.62%
2020-04-13	10	13.9	5.5	10.3	709	7.85%
2020-04-20	17	12.8	5.2	9.5	689	7.24%
2020-04-27	5	2.7	5.0	8.8	554	7.14%
2020-05-04	9	8.1	8.4	10.8	495	6.30%
2020-05-11	10	7.1	6.3	8.6	662	7.05%
2020-05-18	10	5.6	6.4	9.2	617	7.90%
2020-05-25	6	9.1	6.4	9.3	617	6.77%
2020-06-01	11	8.3	6.6	9.9	581	6.52%
2020-06-08	12	8.9	7.4	9.4	438	5.40%
2020-06-15	13	7.9	7.5	9.1	547	6.51%
2020-06-22	8	7.5	7.6	9.4	575	7.48%
2020-06-29	3	2.3	7.7	7.7	584	6.38%

Source: Mergent FISD, retrieved via WRDS October 2022.

Note: Summary table includes all U.S. dollars (USD) corporate bond issuance of over $100 million in size issued by U.S. domiciled companies or companies that report in USD. Excludes sovereign, supra-sovereign, financial, and utility offerings, convertible notes, impact bonds, bonds issued directly in exchange of existing bonds, PIK notes, and reopening issuance of existing bonds. Variables are averaged across week, except number of offerings and amount issued, which are summed across weeks.

Table IA.2 – Summary statistics: bond issuers, 2017-2020

	Normal times			Covid times		
	10%	50%	90%	10%	50%	90%
Balance sheet metrics						
Cash/Assets (prior Q4)	0.6%	4.9%	21.8%	0.8%	4.8%	20.0%
Cash/Assets (Q1)	0.5%	4.4%	21.3%	1.3%	7.8%	22.1%
Debt/Assets (prior Q4)	16.7%	38.7%	65.5%	22.0%	39.8%	67.8%
Debt/Assets (Q1)	18.2%	40.0%	64.6%	24.6%	43.1%	72.4%
Current debt/Debt (prior Q4)	0.0%	2.4%	15.8%	1.0%	5.5%	16.0%
Log assets (prior Q4)	7.3	9.0	10.8	8.2	9.7	11.3
Cash flow metrics						
Sales growth	-18%	-1%	16%	-27%	-5%	10%
Profit growth	-175%	-30%	112%	-335%	-31%	99%
Cash flow growh	-142%	-45%	64%	-150%	-61%	43%
Cash growth	-48%	-2%	89%	-24%	20%	369%
Bond metrics						
Amount per bond (MM)	300.0	500.0	1100.0	400.0	650.0	1450.0
Credit spread (bps)	97.0	229.5	519.0	145.0	300.0	720.8
Yield	3.382%	4.876%	7.874%	2.172%	4.025%	8.600%
Tenor (years)	5.0	8.0	11.0	5.0	8.0	20.0
Coupon	3.000%	4.875%	7.750%	2.138%	4.000%	8.625%
Rating	7.0	12.0	16.0	8.0	13.0	17.0

Source: Mergent FISD, retrieved via WRDS October 2022 and Compustat.

Note: Summary table includes all USD corporate bond issuance of over $100 million in size issued by U.S. domiciled companies or companies that report in USD. “Post-Fed" refers to bond issuers from March 1 - June 30, 2020. “Normal" refers to bond issuers from March 1 - June 30, 2017-2019. Growth variables are measured from Q4 of prior year to Q1 in year of issuance. Excludes sovereign, supra-sovereign, financial, and utility offerings, convertible notes, impact bonds, bonds issued directly in exchange of existing bonds, PIK notes, and reopening issuance of existing bonds. See Table IA.17 for mapping of credit ratings to the numerical aggregation shown here.

Table IA.3 – First stage

	(1) Abnormal amt issued (Bn)	(2) Abnormal amt issued (Bn)
Weight in Fed Index	4.324***	3.080**
	(1.135)	(1.266)
Credit rating		1.142
		(2.119)
Assets (log) - 2019		0.0982
		(0.113)
Cash (log) - 2019		0.188
		(0.115)
Leverage - 2019		-0.393
		(0.936)
Tobin's Q		-0.0000953
		(0.000383)
Constant	0.417***	-4.567
	(0.114)	(4.972)
Industry FE	✓	✓
Observations	380	380

Source: Reports point estimates of γ from the regression equation $AbnormalAmtIssued_{f,2020H1} = \gamma WeightIndex_f + \beta X_f + \alpha_{ind} + \varepsilon_f$, where abnormal issuance is the amount issued by the firm as reported in Mergent FISD in March 23–June 30, 2020 minus the average quarterly issuance for that firm 2000-2019. Includes IG issuers only (credit rating BBB- and above). Weight in Fed Index is pulled from the Federal Reserve Board of New York Broad Market Index as of December 1, 2020. Total assets, leverage, cash, and Tobin's Q are at the firm level as of 2019Q4. We also control for credit rating and industry fixed effects. Standard errors, in parentheses, are clustered by 2-digit industry level.

Table IA.4 – Non-Price Terms and Covenants

	Bonds:				Loans:	
	IG-normal	HY-normal	IG-2020	HY-2020	IG	HY
Maintenance covenants:						
Maintenance net worth	2.3%	6.4%	0.0%	0.0%	5.9%	3.4%
Net earnings test	0.0%	0.0%	0.0%	0.0%	37.7%	29.8%
Leverage test	0.0%	0.0%	0.0%	0.0%	56.8%	37.0%
Incurrence covenants:						
Sale of assets	80.0%	79.7%	89.3%	96.4%	1.8%	16.4%
Dividend related payments	0.1%	34.0%	0.9%	29.1%	10.6%	24.0%
Stock issuance issuer	0.0%	10.1%	0.0%	0.0%	0.4%	3.8%
Senior debt issuance	0.0%	0.0%	0.0%	0.0%	1.1%	13.4%
Secured	0.5%	9.6%	1.9%	23.6%	7.0%	61.5%

Notes: This table computes (1) the percentage of bonds that report covenants that have each covenant and (2) the percentage of loans with each covenant. Bond statistics include all bonds issued 2010-2019 and March 23 - June 30, 2020 that also have loans available or outstanding as of end of 2019. Loan statistics computed over all bond issuers 2010-2019 and March-June 2020 that have bank loans available or outstanding as of end of 2019. The following loan types are included: Revolver/Line, Standby Letter of Credit, Revolver/Term Loan, 364-Day Facility. "Normal" times includes bonds issued 2010-2019, while "Spr 2020" includes bonds issued between March 23 - June 30, 2020. Source: Mergent FISD, retrieved via WRDS October 21, 2020 and Dealscan, retrieved October 2022.

Table IA.5 – Effect of bond market stimulus on log employment

	(1) First stage - Iss COVID	(2) Second stage - Emp 2020	(3) Second stage - Emp 2021	(4) Second stage - Emp 2022
Weight in Fed Index	3.018**			
	(1.295)			
Abn amt issued during 2020 H1(log)		-0.178	-0.174	-0.135
		(0.151)	(0.142)	(0.119)
Credit rating	1.001	1.384	1.080	1.119
	(2.336)	(1.061)	(0.959)	(0.839)
Assets (log) - 2019	0.160	0.682***	0.686***	0.621***
	(0.116)	(0.0721)	(0.0646)	(0.0614)
Cash (log) - 2019	0.162	0.176**	0.188**	0.186**
	(0.125)	(0.0802)	(0.0884)	(0.0661)
Leverage - 2019	-0.216	-0.216	-0.572	-0.219
	(0.986)	(0.479)	(0.523)	(0.443)
Tobin's Q	-0.0000983	-0.000764*	-0.000601***	-0.000704*
	(0.000398)	(0.000426)	(0.000186)	(0.000375)
Constant	-4.651			
	(5.425)			
Industry FE	✓	✓	✓	✓
Observations	346	346	327	339
F-statistic		5.430	5.493	5.027

Source: First column reports point estimates of γ from the regression equation $AbnormalAmtIssued_{f,2020H1} = \gamma Eligibility_f + \beta X_f + \alpha_{ind} + \varepsilon_f$, where abnormal issuance is the amount issued by the firm as reported in Mergent FISD in 2020Q1 and 2020Q2 minus the average quarterly issuance for that firm 2000-2019. Columns (2) through (4) report the cross-sectional second stage regression results of log employment on instrumented amount issued for the years 2020, 2021, and 2022, respectively. Specifically, the second stage is $\ln(Employment)_f = \beta_{IV}\widehat{AbnormalAmtIssue}_f + \zeta X_f + \alpha_{ind} + \nu_f$. Includes IG issuers only (credit rating BBB- and above). Weight in Fed Index is pulled from the Federal Reserve Board of New York Broad Market Index as of December 1, 2020. Total assets, leverage, cash, and Tobin's Q are at the firm level as of 2019Q4. Employment data is reported at fiscal year end. We control for credit rating and industry fixed effects. Standard errors, in parentheses, are clustered by 2-digit industry level. There are fewer firms represented in these regressions than in Table IA.3 because we condition on the availability of employment data in Compustat.

Table IA.6 – Cash, Real Assets, and Total Debt: Cross-sectional regressions

	(1) Delta cash / assets 2019 Q4	(2) Delta real assets/ assets 2019 Q4
Exposure to COVID shock	0.00536	-0.000278
	(0.00472)	(0.00194)
HY	0.00249	-0.00625
	(0.0153)	(0.00499)
IG, BBB	-0.00990	0.000484
	(0.0129)	(0.00452)
Cash/Assets (2019Q4)	0.239***	0.0310*
	(0.0887)	(0.0162)
Current Debt/Assets (2019Q4)	0.0363	-0.0100
	(0.103)	(0.0232)
Undrawn credit EOY 2019 / Assets (2019Q4)	0.184	0.0790**
	(0.115)	(0.0365)
Observations	239	235
R-squared	0.121	0.0526

Notes: This table reports cross-sectional regressions of our sample of bond issuers on different balance sheet variables. Delta Cash / Assets is the firm-level change in cash and short term investments between 2019Q4-2020Q2 divided by the total assets in 2019Q4. Delta PPE / Assets (2019Q4) is the firm-level change in PPE between 2019Q4-2020Q2 divided by total assets in 2019Q4. Exposure to COVID is constructed as per Chodorow-Reich et al. [2022] using abnormal employment decline in 2020Q1 at the industry level according to BLS data. The omitted category for ratings dummies is IG, A-rated or above. Issuers include all U.S. non-financial firms that issued a bond March 23 - June 30, 2020 that we could merge with Compustat data.

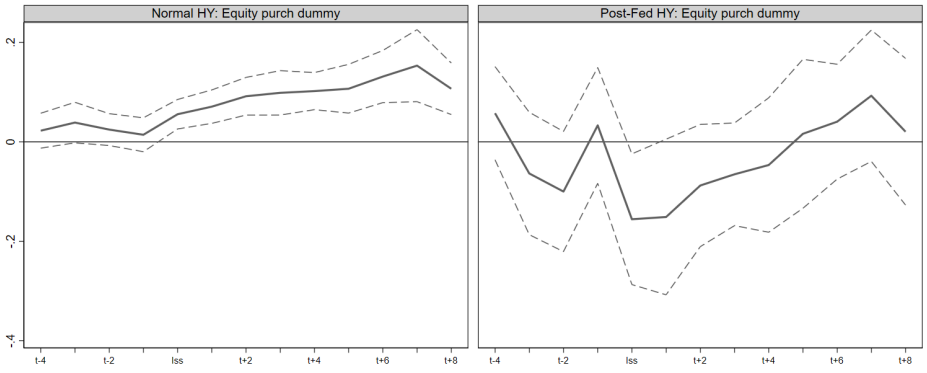


Figure IA.14 – Equity repurchases: Coefficient plots

Notes: Each point is an estimate of β_m from the regression $Y_{fq} = \sum_{m=-4}^{8} \beta_m Issue_{f,q-m} + \alpha_f + \alpha_{ind \times year} + \varepsilon_{fq}$, with 95% confidence intervals. "Equity purchase dummy" is an indicator for positive purchases of common or preferred shares in that quarter. Includes high yield firms (rated below BBB-). Observations are firm-quarters up to five quarters prior to a bond issuance and eight quarters following a bond issuance. "Iss" denotes the quarter ending immediately after issuance. We include firm and industry-year fixed effects. Standard errors are clustered by 2-digit industry level. All ratios are winsorized at the 1% level. "Normal" times includes bonds issued between 2010-2019, "Post-Fed" times includes bonds issued between March 23 - June 30, 2020.

Table IA.7 – Replicating HMM Table 4 for our subsample

	(1) $\Delta ln(s_{f,t})$	(2) $\Delta ln(s_{f,t})$	(3) $\Delta ln(s_{f,t})$
Mar 23	0.104***	0.0863***	0.0933***
	(0.00768)	(0.00566)	(0.00715)
April 9	-0.110***	-0.0907***	-0.0815***
	(0.00766)	(0.00795)	(0.00953)
IG×Mar 23	-0.144***	-0.118***	-0.106***
	(0.00995)	(0.00775)	(0.0120)
IG×April 9	-0.00106	0.00444	-0.00547
	(0.00934)	(0.00897)	(0.0119)
Mar 23×Short		0.0339**	0.0269*
		(0.0148)	(0.0154)
April 9×Short		-0.0382**	-0.0474***
		(0.0152)	(0.0161)
Mar 23×IG×Short		-0.0505***	-0.0624***
		(0.0193)	(0.0214)
April 9×IG×Short		-0.0116	-0.00164
		(0.0186)	(0.0201)
Mar 23×ETF			-0.0235**
			(0.0109)
April 9×ETF			-0.0339**
			(0.0165)
Mar 23×IG×ETF			-0.0111
			(0.0155)
April 9×IG×ETF			0.0353*
			(0.0185)
Bond FE	✓	✓	✓
Observations	20398	20398	20398

Source: Reports point estimates from regressing change in daily log credit spreads ($\Delta ln(s_{f,t}) = ln(s_{f,t}) - ln(s_{f,t-1})$). *IG* is a dummy variable that equals one if the bond is rated BBB- or above. ETF equals 1 if the bond belongs to the baskets of either the LQD ETF or the HYG ETF. *Short* equals 1 if the bond has under 5 years in time to maturity. We include bond fixed effects. Includes bonds that have a median of at least five daily transactions in the period January 1 - March 20, 2020 with positive amounts outstanding that we could merge with Compustat and observe rating, leverage, cash, Tobin's Q, and total assets for the issuing firm. Standard errors, clustered by bond, are in parentheses. Includes bond-day observations from March 20–April 13, 2020.

Table IA.8 – High frequency policy-related spread changes from March 20, 2020

	(1) $\ln(s_{ft}) - \ln(s_{f,3/20})$	(2) $\ln(s_{ft}) - \ln(s_{f,3/20})$	(3) $\ln(s_{ft}) - \ln(s_{f,3/20})$	(4) SS: Issue	(5) SS: Issue	(6) SS: Issue
Post Mar 23	-0.104***	-0.0537	-0.00836			
	(0.0223)	(0.0423)	(0.0510)			
Post April 9	-0.237***	-0.236***	-0.198***			
	(0.0180)	(0.0293)	(0.0336)			
IG×Post Mar 23	-0.277***	-0.225***	-0.263***			
	(0.0226)	(0.0340)	(0.0323)			
IG×Post April 9	-0.128***	-0.0978**	-0.0933**			
	(0.0214)	(0.0340)	(0.0344)			
Post Mar 23×Short		-0.0893	-0.134**			
		(0.0565)	(0.0595)			
Post April 9×Short		-0.00297	-0.0378			
		(0.0642)	(0.0648)			
Post Mar 23×IG×Short		-0.119*	-0.0804			
		(0.0582)	(0.0540)			
Post April 9×IG×Short		-0.0627	-0.0676			
		(0.0693)	(0.0648)			
Post Mar 23×ETF			-0.143***			
			(0.0456)			
Post April 9×ETF			-0.138***			
			(0.0415)			
Post Mar 23×IG×ETF			0.125**			
			(0.0533)			
Post April 9×IG×ETF			0.0398			
			(0.0431)			
ETF					-0.00543	-0.0573
					(0.111)	(0.114)
$E[\Delta \ln(s_f)]$				-1.192**		
				(0.545)		
Highest 25% $E[\Delta \ln(s_f)]_{ETF}$					0.177**	
					(0.0668)	
Highest 25% $E[\Delta \ln(s_f)]_{ETF\ for\ IG/HY}$						0.115**
						(0.0529)
Constant	0.911***	0.819***	0.802***	-0.207	-0.246	-0.314
	(0.190)	(0.185)	(0.181)	(0.304)	(0.301)	(0.303)
Firm controls	✓	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓	✓
Observations	4777	4777	4777	302	302	302

Notes: First three columns report the regression of changes in daily log credit spreads relative to March 20, 2020 ($\Delta ln(s_{f,t}) = ln(s_{f,t}) - ln(s_{f,March20})$) on firm-level characteristics, time dummy variables, and interactions of the two. The regression is on bond-day data from March 20–April 13, 2020. The outcome variable for the last three columns is a dummy variable that equals one if the firm issued bonds in March 23– June 30, 2020. Column (4) reports the effect on issuance of the predicted spread change using the interaction variables estimated from column (3). The last two columns report how much more likely "HighExposure" firms are to issue relative to the control group, where firms are "HighExposure" if their predicted spread change (using the interaction variables estimated from column (3)) is in the top 25% in magnitude across all firms (in Column 5) or in their rating category (IG vs. HY, in Column 6). Firm-level credit spreads are computed as the log of the amount-outstanding weighted average credit spreads. A bond's price on day t is constructed using the average traded price of the last five transaction on that day. To avoid significant outliers due to illiquid bonds, we include only bonds that have a median of at least five daily transactions in January 1 - May 20, 2020. IG is a dummy variable that equals one if the firm has bonds outstanding rated BBB- or above. ETF is the firm-level share of bonds outstanding that belongs to the baskets of either the LQD ETF or the HYG ETF. *Short* is the share of a firm's bonds outstanding that are under 5 years in time to maturity. We include controls for the short share, credit rating, IG dummy, leverage, size, Tobin's Q, and cash at the firm level as of 2019Q4, plus industry fixed effects and cluster standard errors by 2-digit industry.

Table IA.9 – Sample Summary Statistics: All bond issuers versus. Capital IQ

	Bond issuers: 2000-2020	CIQ Sample: 2000-2020	Bond issuers: COVID	CIQ Sample: COVID
Total Assets (log)	9.30	9.30	9.93	9.93
Leverage	0.46	0.46	0.46	0.46
Cash / Assets	0.06	0.06	0.06	0.06
Total bonds issued	8.99	9.23	2.01	2.02
Average bond size ($MM)	505.07	510.77	785.01	782.18
Credit Rating	11.30	11.23	12.58	12.56
Average tenor (years)	9.48	9.43	10.46	10.45
Bonds issued 2019 (#)	0.49	0.52	1.09	1.10
Bonds issued 2019 ($MM)	419.38	441.98	979.09	984.09
Bonds issued COVID (#)	0.36	0.39	1.48	1.49
Bonds issued COVID: ($MM)	355.20	375.21	1448.66	1449.00
Number of firms	1664.00	1537.00	408.00	398.00

Source: Mergent FISD, Compustat, and Capital IQ retrieved via WRDS October 2022.

Note: Capital IQ sample includes all bond issuers matched to the Capital IQ database where there is a reported value for Drawn Credit Line or Undrawn Credit Line. All bond issuers include USD corporate bond issuance of over $100 million in size issued by U.S. domiciled companies or companies that report in USD. “Post-Fed" refers to bond issuers from March 23 - June 30, 2020. Excludes sovereign, supra-sovereign, financial, and utility offerings, convertible notes, impact bonds, bonds issued directly in exchange of existing bonds, PIK notes, and reopening issuance of existing bonds. See Table IA.17 for mapping of credit ratings to the numerical aggregation shown here.

Table IA.10 – Credit line draw-downs in 2020Q1: Cross-sectional regressions

	(1) Maxed out CL	(2) Did not draw CL	(3) Av. drawdown rate
Exposure to COVID shock	0.0754**	-0.0764**	0.123***
	(0.0306)	(0.0323)	(0.0434)
HY	0.134**	-0.134	0.233***
	(0.0547)	(0.0994)	(0.0774)
IG, BBB	0.0379	-0.0457	0.0960
	(0.0422)	(0.0973)	(0.0605)
Cash/Assets (2019Q4)	0.156	0.625	-0.331
	(0.228)	(0.422)	(0.338)
Current Debt/Assets (2019Q4)	0.135	0.562	-0.0169
	(0.369)	(0.648)	(0.638)
Undrawn credit EOY 2019 / Assets (2019Q4)	-0.290	-1.617***	0.0359
	(0.411)	(0.577)	(0.625)
Observations	240	240	226
R-squared	0.0776	0.0923	0.121

Notes: This table reports cross-sectional regressions of our sample of U.S. firms that issued a bond March 23 - June 30, 2020 that we could merge with Capital IQ information. Outcome variables include various credit line drawdown activities in 2020Q1, based on the Capital IQ Capital Structure Summary tables. "Maxed out CL" is a dummy variable that equals 1 if the bond issuers drew down at least 90% of its Undrawn Revolving Credit at the end of 2019, and equals 0 otherwise. "Did not draw CL" is a dummy variable that equals 1 if the bond issuer drew down 0% or less of Undrawn Revolving Credit at the end of 2019, and equals 0 otherwise. "Av. drawdown rate " is the amount drawn as a ratio of Undrawn Revolving Credit at the end of 2019. Exposure to COVID is constructed as per Chodorow-Reich et al. [2022], using abnormal employment decline in 2020Q1 at the industry level according to BLS data. The omitted category for ratings dummies is IG, A-rated or above. Cash, Current debt, and Assets are from Compustat.

Table IA.11 – Bond-loan substitution: Distribution of firms

Panel A: Share of bond issuers repaying credit lines in Q2

	Mean
HY	
Share Repaid some credit line in Q2, conditional on Q1 draw-down	0.74
Share Repaid all credit line in Q2, conditional on Q1 draw-down	0.42
IG, BBB	
Share Repaid some credit line in Q2, conditional on Q1 draw-down	0.91
Share Repaid all credit line in Q2, conditional on Q1 draw-down	0.66
IG, A or above	
Share Repaid some credit line in Q2, conditional on Q1 draw-down	0.73
Share Repaid all credit line in Q2, conditional on Q1 draw-down	0.64

Panel B: Fraction of credit line repayment conditional on repaying

	25%	50%	75%
HY			
Q2 CL repayment/Q1 CL drawdown (%)	31.3	100.0	118.2
Q2 CL repayment/Bond issuance (%)	10.0	43.2	97.5
IG, BBB			
Q2 CL repayment/Q1 CL drawdown (%)	70.8	100.0	103.9
Q2 CL repayment/Bond issuance (%)	22.9	64.9	113.0
IG, A or above			
Q2 CL repayment/Q1 CL drawdown (%)	100.0	100.1	315.7
Q2 CL repayment/Bond issuance (%)	6.5	33.4	78.6

Notes: Panel A displays the share of HY, BBB-rated, and A-rated firms that issued bonds March 23 - June 30, 2020 and drew down on their credit lines in 2020Q1 that repaid some or all of their credit line balance 2020Q2, based on Capital IQ. Panel B displays the distribution of credit line repayment in 2020Q2 as a share of 2020Q1 credit line draw-downs (Row 1) or as a share of bond issuance in 2020 between March and June (Row 2), conditional on repaying some positive amount in 2020Q2.

Table IA.12 – Bond-loan substitution: aggregate flows in spring 2020

	HY USD Bn	IG, BBB USD Bn	IG, A or above USD Bn
Bond issuance March 23-June 30th	111.1	258.4	231.7
Credit line Q1	50.1	73.5	4.0
Credit line Q2	-14.9	-32.6	-3.9
Total bank debt Q1	56.4	102.8	20.0
Total bank debt Q2	-20.9	-34.7	7.1
Total bank debt Q3	-31.0	-30.3	-16.5

Notes: This table classifies aggregate debt flows based on FISD bond issuance data (Row 1) as well as changes in outstanding debt for credit lines and total bank debt based on Capital IQ Capital Structure Summary tables. Rows 2 and 4 displays the change between 2019Q4 quarter end and 2020Q1 quarter end. Rows 3 and 5 displays the change between 2020Q1 quarter end and 2020Q2 quarter end. Row 6 displays the change between 2020Q2 quarter end and 2020Q3 quarter end. Issuers include all U.S. firms that issued a bond March 23 - June 30, 2020 that we could merge with Capital IQ.

Table IA.13 – Bank borrowing in 2019Q1 for bond issuers

	HY Share	IG, BBB Share	IG, A or above Share
Maxed out CL	0.02	0.00	0.00
Drew some CL	0.32	0.21	0.08
Did not draw CL	0.48	0.63	0.65
No net bank funds	0.53	0.62	0.84

Notes: This table classifies bond issuers based on changes in outstanding debt for different credit instruments during 2019Q1, based on the Capital IQ Capital Structure Summary tables. Row 1 includes issuers that maxed out their credit lines, i.e. the increase in Revolving Credit is at least 90% of Undrawn Revolving Credit at the end of 2018. Row 2 includes issuers that drew some of their credit lines, i.e. the increase in Revolving Credit as a ratio of Undrawn Revolving Credit at the end of 2018 is between 0% and 90%. Row 3 includes issuers that did not draw, i.e. the increase in Revolving Credit is 0 or less. Row 4 includes issuers with no net bank funding, defined as the sum of Revolving Credit, Term Loans and Federal Home Loan Bank borrowings. Bond issuers are all U.S. firms that issued a bond in 2019Q1 that we could merge with Capital IQ information.

Table IA.14 – Aggregate Flows for Spring 2020 issuers

	Aggregate flow
Amt issued (March 23-June 30th 2020)	575.93
Cash increase (2019Q4 to 2020Q2)	478.44
Real investment increase (2019Q4 to 2020Q2)	-96.25
Bank debt increase (2019Q4 to 2020Q2)	90.97
Total debt increase (2019Q4 to 2020Q2)	508.44
Share repurchase (2020Q2-2020Q4)	162.61

Notes: This table reports aggregate numbers for firms that issued a bond during the March 23rd- June 30th, in billions of USD. The first row, amount issued denotes FISD bond issuance volumes. Rows 2 through 5 rows report the change between 2019Q4 quarter end and 2020Q2 quarter end. "Cash" (cheq) is cash and short term investments. "Real investment" is total plant, property and equipment. "Total debt" (dltt + dlc) is total long term debt plus debt in current liabilities. Cash, non-cash and total debt are all reported from Compustat. "Bank Debt" if based on Capital IQ Capital Structure Summary tables. Finally the last row reports share repurchases (prstkcy), from Compustat, as the aggregate repurchases from 2020 Q2 through 2020 Q4.

Table IA.15 – Share repurchases in 2019-2020: Cross-sectional regressions

	(1) 2019 Q4 Repurchase	(2) 2020 Q2 Repurchase	(3) 2020 Q3 Repurchase	(4) 2020 Q4 Repurchase
Exposure to COVID shock	0.0639**	0.0399	0.0214	-0.0405
	(0.0311)	(0.0348)	(0.0350)	(0.0347)
HY	-0.176*	-0.187*	-0.0759	-0.0185
	(0.0989)	(0.0997)	(0.0980)	(0.0973)
IG, BBB	0.0136	-0.126	-0.0262	0.0715
	(0.0931)	(0.0966)	(0.0975)	(0.0964)
Cash/Assets (2019Q4)	0.975***	1.102***	1.202***	1.022***
	(0.226)	(0.262)	(0.252)	(0.248)
Current Debt/Assets (2019Q4)	-0.670	0.568	-0.701	-0.538
	(0.602)	(0.701)	(0.728)	(0.692)
Undrawn credit EOY 2019 / Assets (2019Q4)	0.153	-1.314**	-0.674	-0.474
	(0.593)	(0.611)	(0.645)	(0.630)
Observations	240	240	240	240
R-squared	0.0859	0.0979	0.0692	0.0555

Notes: This table reports cross-sectional regressions on the probability to repurchase shares of our sample of U.S. firms that issued a bond March 23 - June 30, 2020 that we could merge with Capital IQ. Dependent variables in Columns 1-4 are dummy variables that equal 1 if the firm repurchased shares in 2019Q4, 2020Q2, 2020Q3, and 2020Q4, respectively, and equal 0 otherwise. Exposure to COVID is constructed as per Chodorow-Reich et al. [2022], using abnormal employment decline in 2020Q1 at the industry level according to BLS data. The omitted category for ratings dummies is IG, A rated or above. Equity repurchases, Cash, Current debt, and Assets are from Compustat.

Table IA.16 – Spring 2020 bond issuers with a bond due later in the year

	All	IG	HY
Number of issuers (Spring 2020)	311	190	121
Issued amount (Spring 2020)	581	470	112
Number issuers with upcoming maturity	90	74	16
Amount issued by firms with upcoming maturity	253	228	25
Total amount maturing in 2020 for Spring 2020 issuers	140	107	33

Notes: Includes all USD corporate bond issuance March 23 - June 30, 2020 of over $100 million in size issued by U.S. domiciled companies or companies that report in U.S. dollars and have a credit rating.

Table IA.17 – Credit Rating Legend

Moody's	**S&P**	**Fitch**	**Numerical**
Aaa	AAA	AAA	22
Aa1	AA+	AA+	21
Aa2	AA	AA	20
Aa3	AA-	AA-	19
A1	A+	A+	18
A2	A	A	17
A3	A-	A-	16
Baa1	BBB+	BBB+	15
Baa2	BBB	BBB	14
Baa3	BBB-	BBB-	13
Ba1	BB+	BB+	12
Ba2	BB	BB	11
Ba3	BB-	BB-	10
B1	B+	B+	9
B2	B	B	8
B3	B-	B-	7
Caa1	CCC+	CCC+	6
Caa2	CCC	CCC	5
Caa3	CCC-	CCC-	4
Ca	CC	CC	3
C	C	C	2
D	D	D	1

B - Preference for Bonds over Loans

Did the bond-loan spread shrank significantly during this episode? In fact, in aggregate data it is not obvious that the bond-loan spread shrank significantly, consistent with emergency measures affecting both loans and bond markets.

Bond spreads: Looking at changes between February 14 (before the crisis) to June 30, 2020 (end of our spring 2020 issuance sample, after the market panic and Fed intervention), bond yields were not much lower. For AA rated bonds, yields on ICE BofA US Corporate Index went from 2.18% to 1.57%, an 61bps decrease. For BBB bonds, the fall was even smaller, at 24bps (2.92% to 2.68%), while for BB HY bonds yields actually increased by 159bps (3.52% to 5.11%). Figure IA.13 confirms this pattern using micro-data on bond yields within issuer.

Loan spreads: Estimating changes in loan rates is more challenging. One approach followed by Acharya et al. [2021] is to calculate loans spreads using loans traded in the secondary market as part of the U.S. Leveraged Loan Index. Strikingly, they find that if anything, loan spreads *fell more* than bond spreads for firms with rating BB or above in the months following the intervention. A potential limitation though is that credit lines rarely trade in secondary markets.

An alternative approach is to directly look at credit line contracts and pricing. On that front, one thing to note is that the vast majority of credit lines have a floating rate that move one to one with a benchmark rate (often LIBOR or the prime rate). In Spring 2020, these benchmark rates fell by 100 to 150bps as the Federal Reserve returned to the zero lower bound. This is about two times greater than the drop in bond yields for highly rated firms.

Moreover, micro-data on loan pricing at the firm-level also suggests that it is unlikely that bonds became cheaper than loans: in the sample of spring 2020 issuers for which we were able to find loan pricing in Dealscan, the yield on their 2020 bond was on average 172bps higher than the LIBOR spread of their credit line (176bps for the median). While these different approaches all point against bonds having become obviously cheaper than loans during this time, this is however not definitive evidence and a more thorough analysis of loan vs bond spreads is warranted.

Indeed, it is well understood that credit line pricing is complex and that the micro-data quality is imperfect. We are able to find all-in-drawn spread information for only 116 out of the 313 firms that composed our main sample of March 23-June 30 issuers. Nevertheless, the all-in-drawn spread, although widely used, is only a proxy of the marginal cost of drawing in bad times. Interest rates floors can limit the pass-through, although Roberts and Schwert [2020] estimate that LIBOR floors on loans originated after 2018 are smaller than 50bps. Performance pricing provisions or covenant violations can lead to an increase in loan spreads as borrower creditworthiness deteriorates. On the other hand, the all-in-drawn spread often includes fees that are paid irrespective of drawn amounts, and must thus be deducted to estimate the marginal cost of drawing. There is unfortunately too little data on floors, performance pricing, and fees in our matched sample to conduct a high-frequency analysis of loan pricing in spring 2020. For more details on loan pricing in the United States and data limitations, see Berg et al. [2016].

Kraft example: The May 2020 Kraft Heinz bond issuance included three tranches with maturity ranging from seven to thirty years, priced at 3.9% to 5.50%. This is a 15-60 basis point higher yield relative to their previous issuance in September 2019 (priced between 3.75% and 4.9%). While the pricing of their credit line is more complex, its maximum spread (accounting for its rating downgrade) was 1.75% over the benchmark rate, which was 1.5% in March and then fell dramatically in spring 2020. The interest expense associated with drawing down on their bank credit line was thus likely lower than issuing bonds, and declined even further in spring 2020. However, their bank loan had a time to maturity between three and four years.[67] Kraft Heinz seemed to prefer the longer-maturity source of funds (bonds) even though it did not appear to have become relatively cheaper.

Bond covenants: While loans have covenants that give lenders discretion to reduce credit before maturity, bond covenants are less intrusive and much more rarely triggered passively (they

[67] More details are available in their annual report `https://www.sec.gov/ix?doc=/Archives/edgar/data/1637459/000163745921000009/khc-20201226.htm`. The credit line pricing is complicated by the fact that there was a floating rate multi-currency loan (and thus has multiple base rates) and that the spread depended on their rating without the formula being disclosed. A conservative estimate is 3.25%, coming from taking both the highest benchmark rate value in March 2020 and the highest spread. In reality, this is likely to be an upper bound.

more rarely include "maintenance" covenants, relying instead on "incurrence" covenants).[68] This implies a more nuanced perspective on the value of bank "flexibility" relative to market financing. A well understood benefit of bank debt is that it is easier to renegotiate because it tends to be held by more concentrated creditors relative to bonds [Bolton and Scharfstein, 1996]. However, the flip side is that renegotiation can be detrimental to the borrower: loan contracts include non-price loan terms that grant lenders discretion after bad news. This is well understood in practice.[69] Nevertheless, how much weaker bond covenants really are is the subject of active research: incurrence covenants impose restrictions on firm behavior [Bräuning et al., 2021], and banks did not seem to strictly enforce covenants violations in 2020 [Acharya et al., 2021].

[68]For more on covenants violations on bank loans, see Sufi [2009], Murfin [2012], Chodorow-Reich and Falato [2017], Lian and Ma [2018], Greenwald [2019], Acharya et al. [2014], Berlin et al. [2020]. For bond covenants, see Green [2018], Becker and Ivashina [2016], Rauh and Sufi [2010]. Table IA.4 in the Internet Appendix confirms this difference in covenants, in line with Bradley and Roberts [2015] that use an earlier sample.

[69]" 'Companies don't want to be subject to the testing of maintenance covenants,' said Evan Friedman, head of covenant research at Moody's. 'Going to the bond market can give companies more freedom, as they don't have to demonstrate their financial fitness again until the debt matures.' " Source: "Companies Issue New Bonds to Pay Down Short-Term Debt Amid Pandemic", *Wall Street Journal*, September 2nd 2020. Note also that this could potentially explain part of the surge in convertible bond issuance witnessed in 2020, as Kahan and Yermack [1998] and Rauh and Sufi [2010] show the almost complete absence of covenants in convertible issues. Note however that this argument essentially assumes that covenants on a firm's existing loans do not apply if the loan is not drawn i.e. springing covenants [Berlin et al., 2020]. More generally, this relates to the role of different types of creditors in insolvency outcomes [Djankov et al., 2008]. Note finally that there can be ex-ante efficiency gains achieved by using debt covenants [Green, 2018].