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How Did COVID-19 Affect Firms' Access to Public Capital Markets?*

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We find that bond issues have substantially increased since the onset of the COVID-19 crisis in calendar week 12 (March 16–20) for bonds rated A or higher, but surprisingly also for bonds rated BBB or lower. In contrast to existing evidence on bond maturities in economic downturns, we document that maturities exceed those of bonds issued before by the same firms as well as the average maturities during normal times. Determinants of corporate bond spreads substantially differ between COVID-19 and normal times. Most prominently, asset tangibility has a highly significant negative effect on spreads during normal times. During COVID-19, this is reversed, especially in industries heavily affected by lockdown measures, reflecting the inflexibility associated with fixed assets. A different picture emerges for equity issues, which slowed considerably during the first 4 weeks of the pandemic, before accelerating again. Capital raised during COVID-19 via equity issues is approximately 5% of capital raised via bond issues. (*JEL* G01, G32)

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During sharp, unexpected recessions, firms' internally generated sources of funds dry up, generating demand for external capital. The availability of funding liquidity during such periods of economic stress is therefore a major determinant of the severity and persistence of the initial shock. However, if many firms simultaneously face adverse shocks to their

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profitability that are plausibly difficult to quantify, this leads to increased informational frictions, making it more difficult to raise external capital. In fact, many practitioners seem to be concerned that equity and corporate bond issues dry up precisely during crisis times, when demand for capital is high.[1]

The ongoing COVID-19 pandemic creates an opportunity to investigate how firms' debt and equity issue activities are affected by an exogenous demand shock leading to dramatic reductions of internally generated funds. We analyze the extent to which financial markets provide external debt and equity capital to the corporate sector during the COVID-19 pandemic and document the dynamics of debt and equity issuances as well as the cross-sectional differences in firms' access to external capital markets. We show which firm characteristics determine these differences and how the primary corporate bond market changes in the COVID-19 crisis in terms of maturities, spreads, and ratings. We also provide insights on the determinants of coupon yields in the crisis and how they differ from normal times.

Our paper is closely related to an interesting recent contribution by Acharya and Steffen (2020). They find that firms with credit ratings AAA-A increased their bond issuance activities during the recent crisis, whereas firms with the lowest investment-grade rating, that is, BBB, did not do so. Instead these firms seem to extensively draw down their bank credit lines to increase their cash reserves, as a precaution, should they lose their investment-grade status and thus their access to the bond market. Their paper emphasizes the potential risks that this corporate financing behavior has for the capital adequacy of the banking sector. Our focus is on the interplay between corporate characteristics and issuance of external capital during the crisis. We hereby concentrate on the corporate bond primary market and combine the issuance data with data from Compustat. Doing so enables us to provide comprehensive and novel evidence on how firm characteristics are related to issuance decisions and to bond characteristics, such as spreads.

We define calendar week 12, that is, March 16–20, as the beginning of the COVID-19 crisis for the United States and report results all the way through calendar week 20, that is, May 11–15. The first main finding is that corporate bond issuance has substantially increased since the onset of COVID-19, compared to the same time period in the year 2019, but also compared to years 2018 or 2017 and to the precrisis weeks in 2020. This is, in particular, the case for bonds rated A or higher but holds also true for bonds rated BBB or lower. The latter finding is particularly noteworthy if interpreted from the investors' perspective, that is, from the supply side. As Campbell and Taksler (2003) and Ellul, Jotikasthira,

[1] For a recent example of such concerns, see Gross (2020).

and Lundblad (2011) point out, large institutional investors are frequently subject to regulatory constraints, that either prohibit them from holding speculative-grade corporate bonds or impose large capital requirements for such positions. This is especially true for insurance companies, who are by far the largest group of institutional investors in the corporate bond market. Thus, one would expect that insurance companies would be reluctant to purchase BBB-rated bonds during the volatile COVID-19 period. Already a one-notch downgrade is enough to make such a bond noninvestment grade, which would be costly to such investors if their regulatory constraints are binding. Thus, the increased issuance activity for BBB-rated bonds during the COVID-19 crisis implies that such potential concerns of institutional investors must have been offset by slack regulatory constraints, by the extra yield spread of these bonds (see the literature on reaching for yield, e.g., Becker and Ivashina (2015)) or by the increased demand by other investors, such as hedge and mutual funds.[2]

Our finding of a pronounced increase in issuance activity for investment-grade bonds is consistent with Erel et al. (2012), who analyze debt issues over the business cycle and find that capital raising tends to be procyclical (i.e., increases during expansions and decreases in recessions) for non-investment-grade borrowers, whereas it is countercyclical for investment-grade borrowers. We extend their analyses by providing several results about cross-sectional differences among issuers during normal and crisis periods. Specifically, we find that the average issuer during the COVID-19 crisis is larger, has a higher market-to-book ratio, and is less profitable than the average issuer during normal times.

A particularly striking result of our empirical analysis is that, in each of the crisis weeks, issuers have chosen longer maturities for their bonds compared to their previous issues. Even when compared to the average maturity in the first 5 months of 2019, we find that longer maturities were chosen during the first as well as the last 3 weeks of the crisis sample period. Only in the middle weeks, that is, weeks 15–17, the average maturities were slightly below the 2019 value.

This is surprising for several reasons. First, the Fed programs to support the corporate bond market (see the discussion below for further details) target especially bonds with maturities up to 4 years, which is much shorter than the average maturity of the bonds issued in COVID-19 period. Second, the result is also in contrast to the one found in Erel et al. (2012), who suggest that during recessions, issued securities shift toward shorter maturity and more seniority. They interpret this finding as evidence that during downturns the supply of capital (e.g., because of

[2] For an analysis of the effects of investment decisions by mutual funds on corporate bond prices, see, for example, Goldstein, Jiang, and Ng (2017) and Choi et al. (2020).

a flight to quality effect) has a larger impact on corporate financing than the demand for capital, which would reflect adverse selection costs based on information asymmetries. However, as discussed before, supply effects and investor demand for corporate bonds might have been different during the COVID-19 crisis than during earlier economic recessions.

A demand-driven explanation for the longer maturities is that, given the large uncertainties, firms prefer to postpone rollover risk further into the future. Kalemli-Özcan, Laeven, and Moreno (2020) provide a discussion of the interaction between the business cycle and the choice of optimal debt maturity. They highlight that short-term debt is usually cheaper than long-term debt during expansionary periods because it is less affected by debt overhang issues. On the other hand, the rollover risk associated with short-term debt leads to more severe underinvestment problems during recessions, usually associated with increased uncertainties. Thus, if the market expects more frequent recessions due to a higher probability of pandemic shocks, it may be optimal to increase debt maturity.

Our analysis also highlights that the rating composition changes significantly during the duration of the crisis. Whereas initially most of the extra issuance activities are due to issues with ratings A and higher, the rating mix deteriorates as the crisis continues, hits a low in calendar week 17 and settles close to the levels of comparable periods in 2019. These dynamics may be related to the Fed programs, which were announced in calendar week 13 and could therefore have affected issuance activities as of calendar week 14.[3] These programs may have restored trust in the corporate bond market and thus enabled firms with lower ratings to also access the bond market.

Furthermore, we document that average spreads at issuance have increased by roughly 100%, compared to the year before. However, due to the downward shift in the U.S. Treasury yield curve, overall coupons were still below the average coupon rate of all bonds issued in the first 5 months of 2019. Even when we compare coupons to past coupons of the same issuers, they have decreased in 6 of 9 weeks.

Finally, we see that during the very first week of the crisis, experienced bond issuers went to the market. Presumably, these are firms that have strong relations to underwriters and could respond quickly to the disaster by issuing bonds. In the subsequent weeks of the crisis (weeks 14 to 17),

[3] On March 23, 2020, the Fed announced it would establish the Primary Market Corporate Credit Facility (PMCCF) and the Secondary Market Corporate Credit Facility (SMCCF) to support credit to eligible, investment-grade firms, see Federal Reserve (2020a). On April 9, 2020, the Fed expanded the size and scope of these two corporate credit facilities; one notable expansion was that it opened up the possibility for the Fed to purchase ETFs that are exposed to U.S. high-yield corporate bonds (but only after ETFs investing in eligible investment-grade bonds have received support), see Federal Reserve (2020b). While the SMCCF started its operations on May 12, 2020, with Blackrock as investment manager, the PMCCF has not yet started as of May 18, 2020.

this is no longer the case, consistent with potential effects of the Fed programs designed to improve bond market access also for less experienced, smaller bond issuers. However, in weeks 18 to 20, levels of issuer experience increase somewhat toward the average levels during earlier years.

Our final set of results for corporate bond markets pertains to the changing determinants of corporate bond spreads during COVID-19, compared to normal times. Before the crisis, tangibility is one of the most reliably estimated negative determinant of spreads. This is not the case during the crisis weeks, where tangibility does not have a statistically significant effect on spreads. In one of the three regression specifications, the coefficient even switches sign. One possible explanation for these patterns is that tangibility becomes a double-edged sword during a situation like the COVID-19 pandemic. On the one hand, there is the traditional, spread-reducing collateral effect. On the other hand, tangible assets are inflexible, particularly so for firms operating in certain industries whose revenue-generating process relies to a large extent on social mobility and personal interaction (e.g., McDonald's depending on customers eating in their restaurants). Such industries are expected to be less resilient to the pandemic and to be more negatively affected by associated lockdown restrictions.[4] As a consequence, spreads on bonds issued by firms from those industries should increase with tangibility and that is precisely what we find when rerunning our spread regressions for firms operating in retail trade, restaurant, hotel, and transportation industries.

A second pronounced difference between the spread determinants before and during the crisis relates to firms' dividend paying status. Although before the crisis, the regression coefficient of this dummy variable, which is one if the firm has paid dividends at least once in the year before the bond issue, is always negative and even statistically significant in one of the three regression specifications, it reverses sign during the crisis. Being a dividend payer comes with a statistically highly significant positive coefficient during the crisis, implying that dividend-paying firms issued bonds with higher credit spreads. Thus, it seems that typical value firms, which frequently pay regular dividends, are more adversely affected by the pandemic disaster and thus have to pay larger credit spreads when they issue bonds. By contrast growth firms, which frequently do not pay dividends, are less affected. This conforms with the view that these firms have substantial growth options, whose values may be less negatively affected by the disaster, which comes with increases in volatilities.[5]

[4] For an analysis of how various measures of resilience to social distancing affects asset prices, see Pagano, Wagner, and Zechner (2020).

[5] For a more formal foundation of this argument, see, for example, Campbell and Vuolteenaho (2004).

Finally, experience as a bond issuer, as measured by the number of past bond issues, seems to be more important in the crisis. The regression coefficient of this variable is negative and highly significant in all regression specifications for the crisis sample. By contrast the sign of this coefficient is positive in noncrisis periods, in one specification even (marginally) statistically significant. Thus, the trust and experience built by an issuer via past bond issues is particularly valuable in times of market stress.

We complement the above results by providing descriptive statistics of equity issuance activities during the COVID-19 crisis. Here, the picture that emerges is very different from the one for the corporate bond market. Issuance activity in equity markets slowed considerably during early crisis weeks (calendar weeks 12 to 16). While on average we observe around 15 equity issuances during precrisis and normal times, this number drops to less than seven during those early weeks. This slowdown is driven to a large extent by an increase in withdrawn initial public offerings (IPOs), consistent with earlier results in Bernstein (2015) and Borisov et al. (2019). While during normal times, on average, two IPOs are withdrawn per week, this number increases to five during the first 4 weeks of the crisis.

After these first 4 weeks of the crisis, however, equity markets recovered, showed, on average, close to 20 deals and fewer than two withdrawn IPOs per week. The dynamics for capital raised per week are similar to the number of issues in equity markets. Thus, while equity markets never fully froze during the crisis, they showed noticeably reduced liquidity in the first 4 weeks of the crisis to then recover to even somewhat above-average levels. Nevertheless, the role played by equity markets in providing firms with fresh capital is minuscule compared to corporate bond markets. During the crisis weeks, firms raised around US $16 billion in equity markets and US$300 billion in corporate bond markets.

In addition to the above papers, our findings also relate to those of Halling, Yu, and Zechner (2019). In this paper, we find that firm size is the only explanatory variable that predicts increased usage of market-based debt, that is, corporate bonds, during recessions. We also document that profitability is negatively associated with the level of market-based debt during recessions. In accordance with both these results, the average size (average profitability) of issuing firms during the COVID-19 crisis is also significantly larger (significantly smaller) than that of issuers in noncrisis periods.

Finally, our work is related to papers that analyze how the COVID-19 crisis has affected the cross-section of stock returns. Albuquerque et al. (2020) find that firms with high environmental and social ratings have generally fared significantly better than those with low ratings in these

dimensions. The former stocks exhibit higher returns and lower return volatilities during the crisis than other stocks. Ramelli and Wagner (2020) focus on the time series of stock returns. For the United States, they find that at the beginning of the COVID-19 epidemic, firms with China exposure were most adversely affected. This changed when the epidemic moved to Europe and the United States. During this phase of the pandemic almost all firms were negatively affected, but those with high leverage and low cash levels suffered most. Fahlenbrach, Rageth, and Stulz (2020) analyze the effects of financial flexibility on stock prices during the COVID-19 crisis. They find that more financially constrained firms experienced larger stock price drops. None of these papers explores the effects of the crisis on firms' debt and equity issuance, as we do.

1. Data, Sample, and Variables

Our COVID-19 crisis sample spans the period from calendar week 12 (starting with Monday, March 16) through 20 (starting Monday, May 11) in 2020. We start from calendar week 12 because this is when President Trump introduced the travel ban on European countries and when multiple governments in Europe decided to lockdown all social activities for an extended and uncertain period of time. Week 20 was the most recent week with data available on bond and equity issuances at the time the paper was written. We use the first 5 months (January through May) of 2017, 2018, and 2019, that is, "normal"times, as a control sample in our analysis. We focus on the periods January to May to control for any seasonality effects as well as to have enough observations. We also report security issuances in the first 11 weeks of 2020 in order to provide the full picture of security issuance activities in 2020.

We use two primary sources to obtain issuer-/firm-level data: the SDC Platinum database for new bond and equity issues and the Compustat database for balance sheet items. We focus on financial securities issued by nonfinancial, publicly listed firms. Our final sample, obtained by merging the above two data sources, includes 286 bond issues (123 equity issues) during the COVID-19 crisis, 60 bond issues (169 equity issues) in the pre-COVID-19 weeks of 2020, and 444 bond issues (930 equity issues) in the control sample.[6]

For each bond issue, we obtain information on its principal amount (in millions of US$), spread (over Treasury benchmark; bond issues with missing spread information are not considered), coupon rate, maturity,

[6] Our sample concentrates on the issuance activities of U.S. public firms for which we also observe information on the spread. If we relax these requirements and instead look at all bond issuances by nonfinancial firms during the COVID-19 crisis, we find 1,236 issues raising a total of US$773 billion, of which US$640 billion are investment grade.

rating, and industry group. For each bond issuer, we also extract all past issuance activities covered in the SDC Platinum database since 2009. From these data, we calculate the average historical spread, the average historical coupon paid, the total number of past issuances and the total principal amounts raised in the past. Thus, these are issuer-specific variables tracking past issuance activity. For each equity issue, we collect information on issuance proceeds (in millions of US$) and whether it is an IPO or a SEO. Finally, we use Compustat balance sheet variables to construct key firm characteristics including net book leverage (total debt less cash and short term investments to total assets ratio), size (logarithm of net sales), profitability (operating income before depreciation to total assets ratio), tangibility (net PPE to total assets ratio), and dividend payer (a dummy equals one if the issuer has paid a dividend at least once in the four quarters prior to the issue and zero otherwise). Table A1 in the appendix describes each variable used in the empirical analysis in detail.

2. Empirical Findings

In this section, we present our empirical results. We first analyze the issuance activity in bond and equity markets and then present results from regressions to evaluate the determinants of credit spreads during the COVID-19 crisis in comparison to normal times.

2.1 Issuance activity in bond markets

Table 1 contains summary statistics for corporate bond issuance activity during different time periods. Panel A focuses on the precrisis weeks in 2020; panel B highlights the COVID-crisis weeks from March 16 to May 15; and panel C shows the results for the months January to May in the preceding 3 years. We use the precrisis periods to proxy for issuance activities during normal periods. The most important conclusion that can be drawn from the data in Table 1 is that issuance activity has increased considerably during the crisis in comparison to earlier weeks in 2020 as well as to the issuance activity between January and May in the years 2017–2019.[7] We observe a total of 286 bond issuances during the crisis weeks from March 16 to May 15, which is close to or even more than twice the number of issuances during the entire period January to May in each of the three preceding years. These descriptive results already suggest that bond markets have been very important venues to raise capital during the crisis weeks.

[7] We pool the data from past years across the weeks between January and May since issuance activity is frequently very low in individual weeks during these normal times, which makes weekly comparisons noisy.

Table 1
Bond issues

Week	No. of issues	Sum of principal (US$M)	Spread (bps)	Coupon (%)	Hist. avg. coupon	Maturity (year)	Inv. grade	A and higher	Firm size log(sales)
A. Noncrisis weeks in 2020									
2	8	5,900	179	3.69	4.05	13.88	88%	25%	7.63
4	5	3,900	45	2.08	3.62	7.00	100%	100%	7.97
5	4	2,750	86	2.67	3.57	19.25	100%	100%	8.21
6	3	2,000	150	2.46	3.82	20.00	100%	33%	7.99
7	8	4,700	103	2.80	3.51	17.88	100%	38%	8.52
8	14	10,250	125	2.93	4.10	15.43	100%	50%	7.84
10	12	6,550	140	2.49	3.14	13.67	100%	8%	7.67
11	6	3,900	212	2.87	3.35	12.00	100%	0%	7.94
All noncrisis weeks	60	39,950	133	2.81	3.66	14.63	98%	38%	7.92
B. Crisis weeks in 2020									
12	39	44,450	270	3.92	2.84	16.08	100%	82%	9.18
13	59	55,950	258	3.48	3.21	14.20	100%	68%	8.83
14	34	42,850	329	4.03	3.52	14.21	88%	44%	8.69
15	17	10,078	226	2.72	3.06	11.35	100%	47%	8.26
16	16	18,600	217	2.95	3.00	10.44	94%	50%	9.08
17	19	14,100	252	3.12	3.85	11.84	95%	32%	7.70
18	35	49,550	212	2.90	3.21	15.69	100%	63%	8.61
19	38	38,400	228	3.00	3.51	13.53	100%	45%	8.25
20	29	28,400	207	2.82	3.42	13.83	97%	45%	8.22
All crisis weeks	286	302,378	249	3.31	3.28	13.98	98%	56%	8.60
C. January to May 2017, 2018, and 2019									
January to May 2017	173	162,619	116	3.34	3.50	11.66	91%	49%	8.26
January to May 2018	134	125,202	126	3.96	3.86	12.63	89%	22%	7.72
January to May 2019	137	122,479	139	3.92	3.81	13.03	94%	42%	8.19
All	444	410,300	126	3.71	3.70	12.37	91%	39%	8.07

This table reports the summary statistics for bond issue characteristics during the noncrisis weeks in 2020 (panel A), crisis weeks in 2020 (panel B), and January to May 2017, 2018, and 2019 (panel C). The historical average coupon captures the average coupon paid on bonds issued earlier (between 2009 and 2019) by the same firms issuing bonds during the sample periods. Variable definitions and the date of every Monday in the first 20 weeks of 2020 are summarized in the appendix.

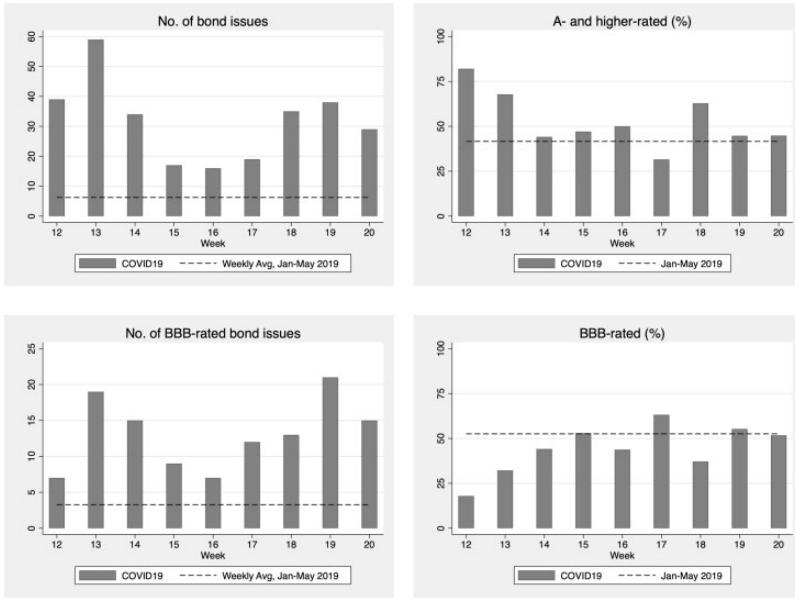

Fig. 1
Issuance activity in bond market: Number of issues The top-left panel shows the weekly average number of issues by nonfinancial and nonutility firms. The top- (bottom)-right panel shows the percentage of bonds issued by A- or higher-rated (BBB-rated) issuers. The bottom-left panel shows the weekly average number of BBB-rated issues. Week 12 (March 16–20) is the first week of President Trump's travel ban on European countries. Week 13 (March 23–27) is the first week upon the Fed's announcements of Primary Market Corporate Credit Facility (PMCCF) and Secondary Market Corporate Credit Facility (SMCCF) programs. Week 20 (May 11–15) is the final week with information available on bond issues when we conducted our analysis. The control sample includes bonds issued from January through May 2019. Variable definitions and the date of every Monday in the first 20 weeks of 2020 are summarized in the appendix.

Interestingly, we also observe that the first 3 weeks as well as the last 3 weeks during the crisis were particularly active. One interpretation of these dynamics could be that issuances in the early weeks of the crisis had already been planned a few weeks before, maybe in response to early signs and rising fears of a COVID-19 pandemic. The subsequent lower levels of issuance activity in the following 3 weeks could then reflect that some firms put issuance activities on hold due to the economic uncertainty around the outbreak in Europe and the US. Finally, the elevated issuance activities in the last 3 weeks could be a consequence of Fed policy interventions that were quickly put in place during the last weeks of March and lead to a, at least partial, stabilization of the economy.[8]

The top-left graph in Figure 1 illustrates these general patterns graphically. The top-right graph highlights the rating mix of bonds issued

[8] Our data on bond issuances also include information on filing dates in addition to issuance dates. Those filing dates, however, are only sparsely filled, and the quality of the data is overall insufficient to

during the crisis. While in the first week of the crisis, a striking fraction of more than 80% of the bonds issued had a rating of A or higher, that value drops to only slightly above 30% in calendar week 17, before it reverts back to roughly 40% during the last couple of weeks of the crisis sample, which corresponds closely to the averages from the previous year. We interpret this issuance quality pattern as evidence that at the beginning of the crisis, when uncertainty was particularly high, only highly rated bonds could be issued. However, once the Fed announced its programs to support credit markets in calendar week 13, market stress was reduced and firms with lower ratings were able to come to the market and issue bonds.

While the results discussed so far imply that investment-grade issuers rated A or higher have been particularly active issuing bonds, the bottom-left graph in Figure 1 shows that the primary market for corporate bonds also worked very well for less highly rated issues, as substantially more BBB-rated bonds were issued in absolute terms during the crisis than during normal times. Even the fraction of BBB-rated issues, expressed as percentage of all bonds issued during the crisis, converges quickly back to average levels after the first few weeks of the crisis period, as can be seen in the bottom-right panel of Figure 1.

The increase in bond issuance activity is also reflected in the total principal amount raised. Table 1 and Figure 2 contain the detailed results. For easier comparison, we fix the vertical axis across graphs. We find that corporate bond markets provided more than US$300 billion to firms during the crisis weeks. This is close to or even more than twice the amount of the total proceeds raised during the entire first 5 months in each of the years 2017–2019. In the first 3 weeks of the crisis alone, US$143 billion was raised. In the following 3 weeks the principal amounts decreased to levels similar to those observed during normal times, albeit still elevated. However, during the last 3 weeks of the crisis, principal amounts spiked back up again, exceeding average weekly levels during normal times by a large margin.

Bonds having at least an A rating raised US$187 billion, accounting for more than 60% of the total raised principal amount. This does not mean that BBB-rated issuers did not raise substantial amounts of capital in the corporate bond market. As the bottom-left graph shows, the weekly amounts of principal raised by BBB-rated bonds exceeded the average level during normal times in every week of the crisis sample period, and in some weeks by a large margin. Thus, investors were willing to supply more capital to BBB-rated issuers during the COVID-19

accurately estimate the average time it takes to issue a bond. Using a shelf registration indicator provided by SDC Platinum, we also investigate whether many of the bonds issued during the crisis were so-called shelf registrations but find that this is not the case.

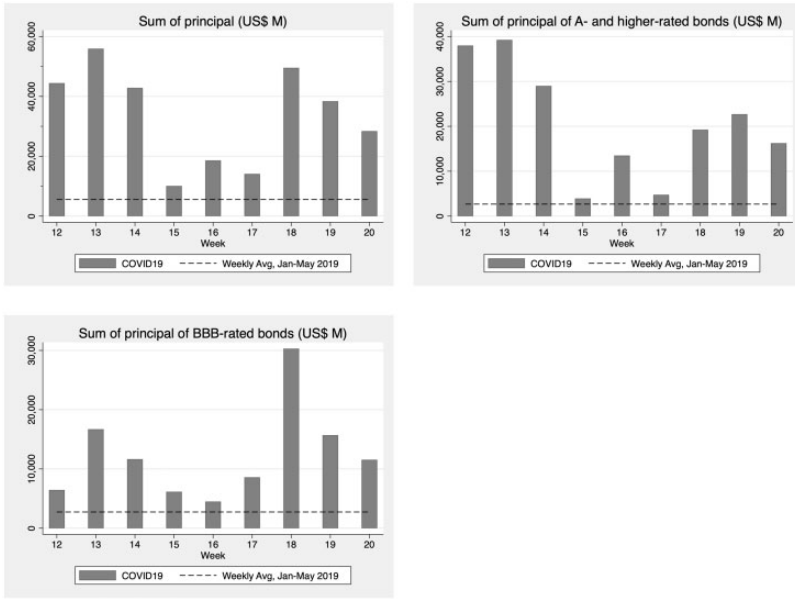

Fig. 2
Issuance activity in bond market: Principal amount The top-left panel shows the weekly (aggregate) principal amount issued by nonfinancial and nonutility firms. The top-right (bottom-left) panel shows the weekly (aggregate) principal amount of A- or higher-rated (BBB-rated) bond issues. Week 12 (March 16–20) is the first week of President Trump's travel ban on European countries. Week 13 (March 23–27) is the first week upon Fed's announcements on Primary Market Corporate Credit Facility (PMCCF) and Secondary Market Corporate Credit Facility (SMCCF) programs. Week 20 (May 11–15) is the final week with information available on bond issues when we conducted our analysis. The control sample includes bonds issued from January through May 2019. Variable definitions and the date of every Monday in the first 20 weeks of 2020 are summarized in the appendix.

sample period than in normal times. This happened even though the large increase in volatilities observed in equity markets is likely to have raised the probability of rating transitions, thereby increasing the probability that BBB-rated bonds being downgraded to noninvestment grade. Potential concerns about regulatory constraints of typical corporate bond investors, such as insurance companies, have apparently not prevented an increase in the supply of capital to BBB-rated issues during the volatile period we study. Alternatively, a potential drop in supply of capital by such institutional investors may have been more than offset by other investors, such as large bond ETFs, which frequently follow passive strategies and simply replicate broad bond indices, which of course includes their BBB-rated constituents. Finally, Fed programs may have also contributed to the documented supply of BBB-rated capital, by purchasing large amounts of Treasury bonds, and creating substitution or reaching for yield effects among other investors (see, e.g., Becker and Ivashina (2015)). Overall, these results reinforce the earlier

observation that the corporate bond market represented a liquid and active venue for lower-rated investment-grade issuers to raise capital.

We next turn to the analysis of bond spreads. Comparing the crisis weeks to the earlier years, we see a pronounced and significant increase in spreads, as one would expect. The average spread during the 9 weeks since May 15 was 249 bps while in earlier years it was between 116 and 139 bps. However, due to the drop in Treasury yields over this period, the difference is much less pronounced in terms of coupon rates (i.e., total borrowing costs). The average coupon rate of issues in the last 9 weeks was 3.31%, while the average in earlier years was 3.71%. Thus, firms were still facing very favorable funding rates in the bond market. The same holds true if we make this comparison for the same set of firms and calculate, for the firms issuing bonds during the crisis, the historical funding costs they paid on bonds issued in the period 2009 to 2019. Historically, those firms paid coupon rates of 3.28%. This is only slightly less than the current average coupon rates of 3.31%.

Figure 3 summarizes these patterns graphically. It is interesting that, except for the first 3 weeks of the crisis, the average coupon rates of issuing firms are smaller than the same firms' historical coupon rates. Thus, the firms issuing corporate bonds during these weeks do so at funding rates that are consistently lower than their historical funding rates since 2009.

Table 1 also provides information regarding the maturities chosen by bond issuers. Overall, firms issue more medium- to long-term bonds during the crisis, as the average maturity of bonds is close to 14 years. Thus, there is no evidence that the maturity of issued bonds has shortened during the crisis. One can, however, observe an interesting time-series pattern. Compared to the first 3 weeks of the crisis, where the average maturity of issues was approximately 15 years, the average maturity dropped to around 11 years in the subsequent 3 weeks (below the average during normal times) to then move back to approximately normal levels in the most recent weeks of the crisis. One might interpret this as evidence that the support programs launched by the FED in calendar Week 13 started to show some impact on corporate bond markets, as these programs provide explicit incentives for firms to issue bonds with a maturity of less than 5 years. This finding is also consistent with the changing rating mix of issuers, as bond issues with lower credit ratings usually have shorter maturities.

Figure 4 illustrates the maturity-related patterns graphically. It also adds another piece of information, namely, the average maturity of earlier bond issues by the same firms, that is, by those firms issuing during the crisis. We find that across all crisis weeks, the average maturity of bonds issued during the crisis is longer than the average maturity of bonds issued by the same companies during normal times. This is quite

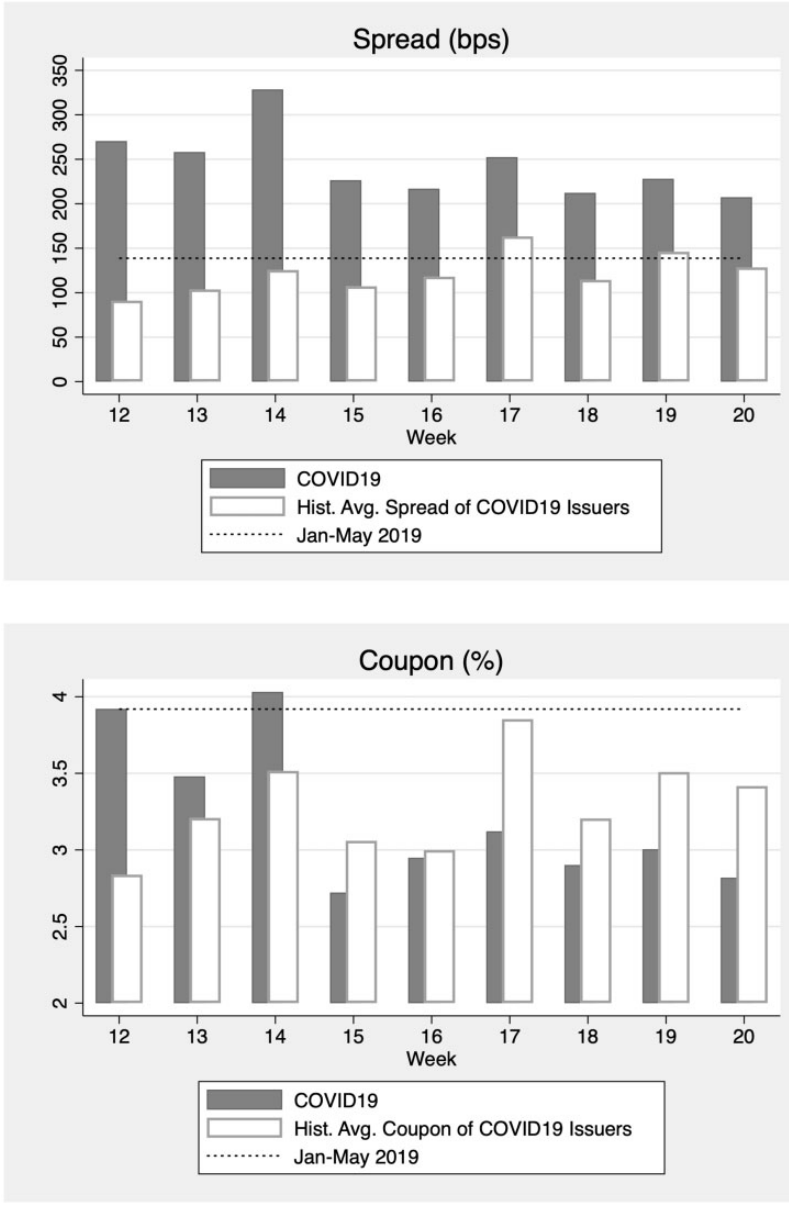

Fig. 3
Issuance activity in bond market: Spread and coupon The graphs show the weekly average offering spread (the top panel) and coupon (the bottom panel) of the bonds issued by nonfinancial and nonutility firms. Week 12 (March 16–20) is the first week of President Trump's travel ban on European countries. Week 13 (March 23–27) is the first week upon Fed's announcements on Primary Market Corporate Credit Facility (PMCCF) and Secondary Market Corporate Credit Facility (SMCCF) programs. Week 20 (May 11–15) is the final week with information available on bond issues when we conducted our analysis. The control sample includes bonds issued from January through May 2019. The graphs also include the historical average spread or coupon of bonds (represented by the unfilled bar charts) issued earlier (between 2009 and 2019) by the same firms issuing bonds during the crisis. Variable definitions and the date of every Monday in the first 20 weeks of 2020 are summarized in the appendix.

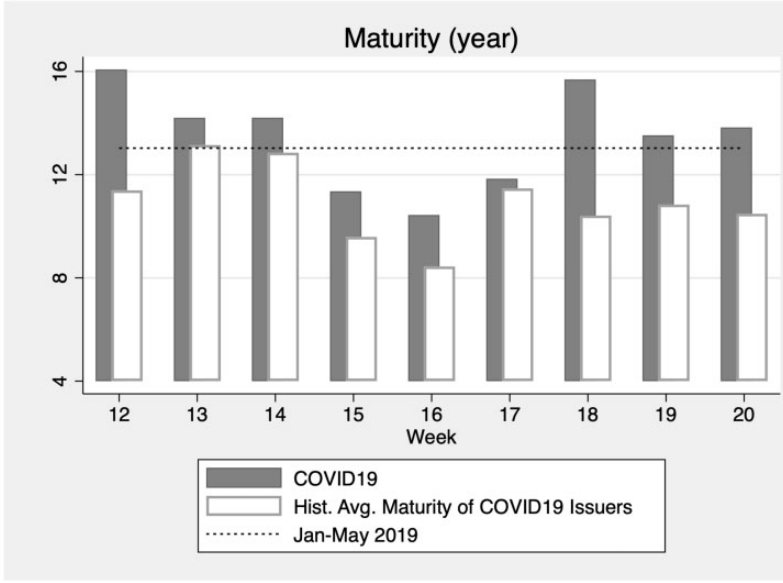

Fig. 4
Issuance activity in bond market: Maturity The graph shows the average maturity for the bonds issued by nonfinancial and nonutility firms. Week 12 (March 16–20) is the first week of President Trump's travel ban on European countries. Week 13 (March 23–27) is the first week upon Fed's announcements on Primary Market Corporate Credit Facility (PMCCF) and Secondary Market Corporate Credit Facility (SMCCF) programs. Week 20 (May 11–15) is the final week with information available on bond issues when we conducted our analysis. The control sample includes bonds issued from January through May 2019. The graph also includes the average maturity of bonds (represented by the unfilled bar charts) issued earlier (between 2009 and 2019) by the same firms issuing bonds during the COVID-19 crisis. Variable definitions and the date of every Monday in the first 20 weeks of 2020 are summarized in the appendix.

striking, since one would expect that firms respond to times of increased uncertainty and downturns by structuring the securities they issue in ways that make them less information sensitive (for supporting evidence, see Erel et al. 2012). This would rather imply that firms should choose shorter debt maturities; this is, in fact, the opposite of what we observe in the data. Increased rollover risk in the wake of COVID-19 could be one reason for the observed longer maturities. Kalemli-Özcan, Laeven, and Moreno (2020) provide convincing evidence that the rollover risk associated with short-term debt leads to substantial underinvestment costs during volatile economic downturns. Thus, if firms and investors expect prolonged periods of high volatility due to elevated probabilities of pandemic crises emerging again in the future, then it may be beneficial to increase the maturity of the bonds issued, even if this makes them more information sensitive.

The above argument for choosing longer maturities would be even more relevant if prolonged pandemic risks are coupled with large rollover

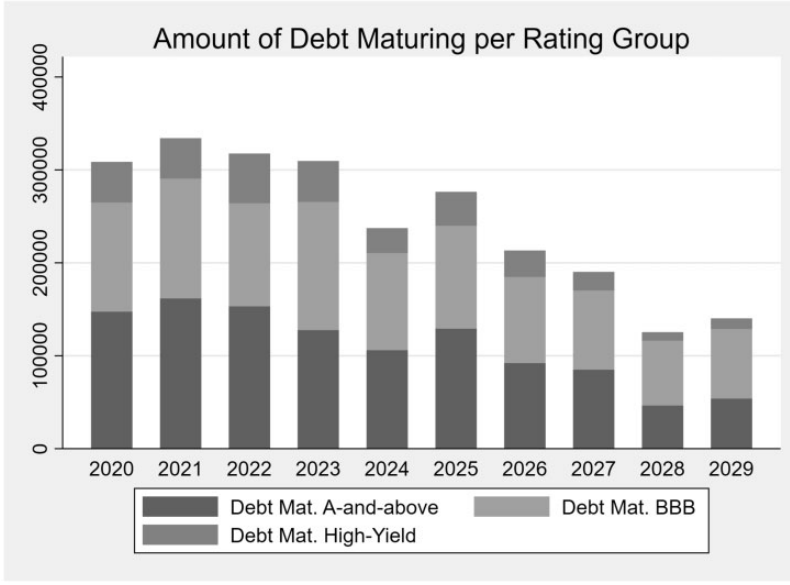

Fig. 5
Rating composition of maturing Debt The graph shows the amount of debt in millions of US$ maturing in 2020 through 2029 across three different rating groups: (1) rated A or higher, (2) BBB rated, or (3) rated below BBB (high yield). Variables, including rating groups, are defined in the appendix. The sample includes all bonds issued by issuers that are not related to the government and do not belong to the utilities or financial industry. Furthermore, all bonds considered have issuance dates in 2009 or later.

needs by firms with low ratings in the coming years.[9] Figure 5 shows some evidence for that. It illustrates the rating composition in dollar terms of maturing debt over the 10 years starting in 2020 for three broad rating groups (A and higher, BBB, and high yield; see the appendix for detailed definitions). We observe that, in 2020, slightly more than US$300 billion of corporate debt is maturing. The majority of the maturing debt is rated A or higher (US$148 billion), followed with only a relatively small margin by debt being rated BBB (US$117 billion). Even though the high-yield part is small in comparison, it is still sizable in economic terms amounting to US$44 billion in 2020. Over the next few years, the composition of maturing debt will experience a notable shift toward BBB-rated bonds and, to a lesser extent, even toward lower-rated bonds. For example, in the year 2023, the majority of maturing debt will actually come from the BBB rating group with US$138 billion (in contrast, maturing debt with an A or higher rating will only amount to US$128 billion in 2023). Together with the fact that high-yield debt maturing in 2023 will stay at similar levels compared to 2020, this implies

[9] This is, for example, discussed in Edgecliffe-Johnson et al. (2020).

that the principal-weighted average rating of maturing debt will substantially decrease in the next 3 years. Together with expectations of increased pandemic risks in the future, this could contribute to the firms' preference for issuing bonds with longer maturities during the crisis, in order to avoid potential rollover risks in the next few years.[10]

Finally, we provide summary statistics of firm characteristics of bond issuers during the crisis. Figure 6 plots two measures that proxy for firms' experience with the bond market, namely, the number of past issues and the amount of principal raised through these past issues. Both measures are extracted from the sample period 2009 to 2019. The figure shows an interesting pattern across time: during the early weeks of the crisis, experience with the bond markets appears to have been very important; in particular, those firms issuing in the very first week of the crisis stand out and seem to be very experienced bond issuers.

We also find that issuers during the crisis period were significantly larger, significantly less-profitable and had significantly higher market-to-book ratios,[11] as shown in Figure 7. The results for firm size and profitability are consistent with Halling, Yu, and Zechner (2019), who show that those variables affect the likelihood of issuers to rely on funding via public debt markets during recessions. The evidence on the market-to-book ratio suggests that growth firms, in contrast to value firms, had better access to corporate bond markets during the crisis. This is a result that we will revisit in our discussion of the determinants of corporate bond spreads. In terms of other firm characteristics, such as tangibility, however, we find no statistically significant differences. Thus, except for its size, profitability, market-to-book ratio, and experience as bond issuers (in the first weeks), the average firm issuing bonds during the crisis appears to be quite comparable to the average firm issuing bonds during normal times. This is particularly the case during the last 3 weeks of the crisis sample period covered in the paper.

As discussed before, one explanation for the increased activity in bond markets could be that the FED has launched a program to support corporate bond markets (recall, however, that the program explicitly targeting primary markets had not started as of May 15, the last day in our sample period). In this program, the FED focuses on short-term bonds with a maturity of less than 5 years. Thus, Table 2 recalculates Table 1 but with a focus on those bond issues with a maturity of more than 4

[10] In unreported results, we find that the fraction of refinancing issuers is around 60% during the COVID-19 crisis. This value is similar to the average frequency of refinancing issuers during normal times. We define a refinancing issuer as an issuer who has an existing bond maturing in the same year in which a new bond is issued.

[11] Note that during the period of the COVID-19 crisis (March 16 onward), the S&P 500 has been approximately in a similar range to where it was from January to May 2019. Thus, the difference in the observed market-to-book ratios is not due to large price movements in the stock market.

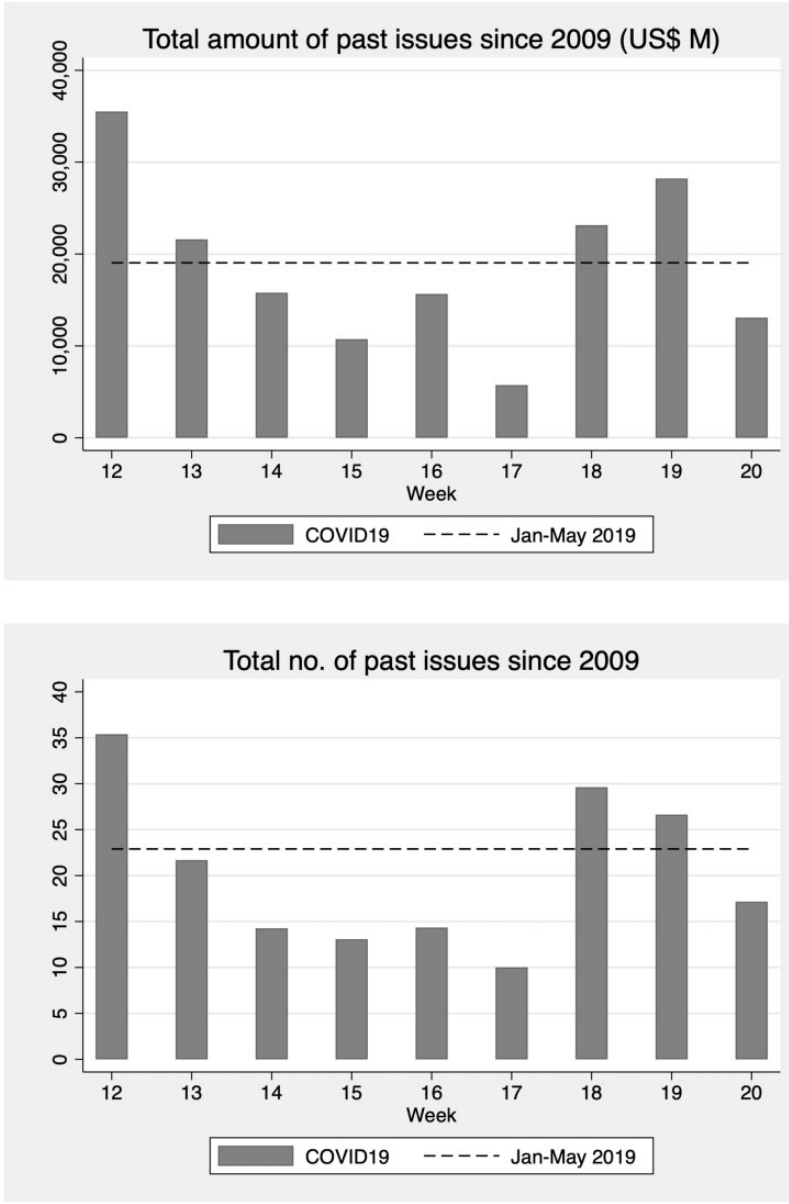

Fig. 6
Past experience of COVID-19 bond issuers The top panel shows the weekly average total principal of past bond issues of COVID-19 bond issuers. The bottom panel shows the weekly average total number of past bond issues of COVID-19 bond issuers. For each bond issuer, we extract all its past issuance activities, as covered in the SDC Platinum database, between 2009 and 2019. Week 12 (March 16–20) is the first week of President Trump's travel ban on European countries. Week 13 (March 23–27) is the first week upon Fed's announcements on Primary Market Corporate Credit Facility (PMCCF) and Secondary Market Corporate Credit Facility (SMCCF) programs. Week 20 (May 11–15) is the final week with information available on bond issues when we conducted our analysis. The control sample includes bonds issued from January through May 2019. Variable definitions and the date of every Monday in the first 20 weeks of 2020 are summarized in the appendix.

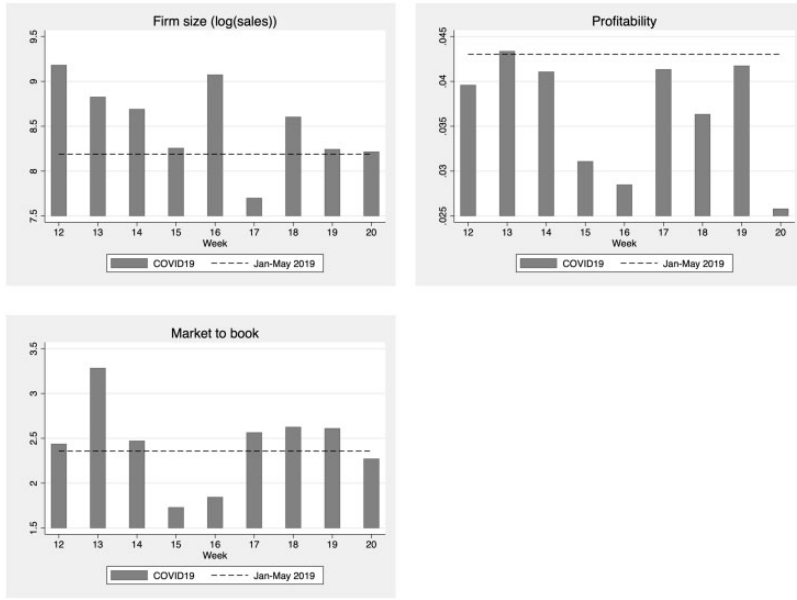

Fig. 7
Firm characteristics of COVID-19 bond issuers The graphs show the weekly average firm characteristics of the issuers that issued bonds during the COVID-19 crisis. Week 12 (March 16–20) is the first week of President Trump's travel ban on European countries. Week 13 (March 23–27) is the first week upon Fed's announcements on Primary Market Corporate Credit Facility (PMCCF) and Secondary Market Corporate Credit Facility (SMCCF) programs. Week 20 (May 11–15) is the final week with information available on bond issues when we conducted our analysis. The control sample includes bonds issued from January through May 2019. Variable definitions and the date of every Monday in the first 20 weeks of 2020 are summarized in the appendix.

years; that is, newly issued bonds that do not qualify for the current FED programs. We first observe that not a single bond with less than 5 years maturity was issued during the first 3 weeks of our sample period. Even if calculated for the entire COVID-19 period, the fraction of bonds with maturities less than 5 years is similar or slightly lower compared to the earlier three benchmark years. These results suggest that, while the Fed programs might have injected confidence into the markets, they have not yet had a noticeable impact on the maturities of the bonds issued.

2.2 Issuance activity in equity markets

After studying the issuance activity in debt markets during the COVID-19 pandemic in detail, we focus on the analysis of equity issue activity next. Compared to the results on bond issuance, a very different picture emerges, as can be seen from the summary of Table 3. The average number of equity issues per week is 13.7 during the COVID-19 sample period, whereas it is 15.4 per week in the earlier weeks of 2020 and between 13 and 15 per week in the corresponding periods of the three

Table 2
Bond issues with a maturity longer than 4 years

Week	No. of issues	Sum of principal (US$M)	Spread (bps)	coupon (%)	Hist. avg. Coupon	Maturity (year)	Inv. grade	A and higher	Firm size log(sales)
A. Noncrisis weeks in 2020									
2	8	5,900	179	3.69	4.05	13.88	88%	25%	7.63
4	4	3,400	50	2.17	3.59	8.00	100%	100%	8.06
5	4	2,750	86	2.67	3.57	19.25	100%	100%	8.21
6	3	2,000	150	2.46	3.82	20.00	100%	33%	7.99
7	8	4,700	103	2.80	3.51	17.88	100%	38%	8.52
8	14	10,250	125	2.93	4.10	15.43	100%	50%	7.84
10	12	6,550	140	2.49	3.14	13.67	100%	8%	7.67
11	6	3,900	212	2.87	3.35	12.00	100%	0%	7.94
All noncrisis weeks	59	39,450	135	2.83	3.66	14.83	98%	37%	7.93
B. Crisis weeks in 2020									
12	39	44,450	270	3.92	2.84	16.08	100%	82%	9.18
13	59	55,950	258	3.48	3.21	14.20	100%	68%	8.83
14	34	42,850	329	4.03	3.52	14.21	88%	44%	8.69
15	12	6,428	186	2.37	2.90	14.75	100%	67%	8.55
16	12	13,250	215	2.99	2.86	12.83	92%	50%	9.05
17	16	10,600	248	3.14	3.80	13.56	94%	31%	7.56
18	31	42,800	215	3.00	3.23	17.32	100%	65%	8.57
19	34	33,700	232	3.10	3.53	14.79	100%	44%	8.13
20	27	26,900	212	2.91	3.41	14.63	96%	48%	8.23
All crisis weeks	264	276,928	250	3.36	3.27	14.89	97%	58%	8.60
C. January to May 2017, 2018, and 2019									
Jan to Apr, 2017	141	137,094	129	3.63	3.61	13.67	90%	45%	8.21
Jan to Apr, 2018	117	109,902	133	4.08	3.92	14.08	89%	22%	7.71
Jan to Apr, 2019	123	111,794	140	3.97	3.79	14.20	95%	41%	8.20
All	381	358,790	134	3.88	3.76	13.97	91%	37%	8.05

This table reports summary statistics of bond issue characteristics during the noncrisis weeks in 2020 (panel A), crisis weeks in 2020 (panel B), and January to May 2017, 2018, and 2019 (panel C). All bond issues included in this table have a maturity longer than 4 years. Variable definitions and the date of every Monday in the first 20 weeks of 2020 are summarized in the appendix.

Table 3
Equity issues

A. Noncrisis weeks in 2020

Week	No. of issues	Sum of proceeds (US$M)	IPO	No. of withdrawn IPOs
2	18	2,076	0%	2
3	6	182	33%	1
4	20	2,585	0%	0
5	24	3,914	29%	3
6	24	3,908	21%	1
7	30	3,766	7%	2
8	12	1,752	8%	0
9	14	552	7%	2
10	12	3,191	8%	3
11	9	341	11%	7
All noncrisis weeks	169	22,268	12%	21
Avg. per week	15.4	2,024		1.9

B. Crisis weeks in 2020

Week	No. of issues	Sum of proceeds (US$M)	IPO	No. of withdrawn IPOs
12	4	66	0%	9
13	6	47	0%	5
14	14	1,026	21%	5
15	3	105	33%	1
16	16	868	0%	2
17	16	2,248	6%	1
18	16	2,991	13%	4
19	24	4,268	13%	1
20	24	4,200	4%	0
All crisis weeks	123	15,818	9%	28
Avg. per week	13.7	1,758		3.1

C. Jan to May of 2017, 2018, and 2019

	No. of issues	No. of issues Avg. per week	Sum of proceeds (US$M)	Sum of proceeds Avg. per week	IPO	No. of withdrawn IPOs	No. of withdrawn IPOs Avg. per week
Jan to May, 2017	315	14.3	55,398	2,518	17%	46	2.1
Jan to May, 2018	331	15.0	62,539	2,843	20%	55	2.5
Jan to May, 2019	284	12.9	53,944	2,452	21%	46	2.1
All	930	14.1	171,881	2,604	19%	147	2.2

This table reports summary statistics of equity issue characteristics during the noncrisis weeks in 2020 (panel A), crisis weeks in 2020 (panel B), and January to May 2017, 2018, and 2019 (panel C). Variable definitions and the date of every Monday in the first 20 weeks of 2020 are summarized in the appendix.

preceding years. Thus, overall, equity markets have been comparable to normal times during the crisis.

These averages, however, hide some interesting time-series dynamics. In the first 4 weeks of the crisis, equity issuance activities slowed considerably, in terms of both the number of issuances and the proceeds raised. This slowdown is driven to a large extent by an increase in the number of withdrawn IPOs. For example, in calendar week 12, the first week of the crisis period, nine IPOs were withdrawn from the markets. On average, across all crisis weeks, around 3 IPOs are withdrawn per week while during normal times only slightly more than 2 IPOs are withdrawn per week. Thus, consistent with earlier work (see Bernstein (2015) and Borisov et al. (2019)), we find that IPOs tend to be withdrawn in times of exogenous negative market shocks. This period of decreased activity in equity markets, however, has not continued throughout the entire COVID-19 sample period. While equity markets have recovered back to normal during calendar weeks 17 and 18, they have become even more active—by more than 50%—than during normal times during the last 2 weeks of the crisis period covered in the paper. This trend is also reflected in the number of withdrawn IPOs that has dropped to one or even zero per week.

Similar time-series dynamics can be observed for the capital raised in equity markets. The total proceeds during the nine crisis weeks sum to around US$16 billion. More than 50% of those have been raised in the last 2 weeks. The average issue volume per week is US$1.8 billion during the crisis, whereas during normal times it is between US$2.2 billion (in the earlier weeks of 2020) and US$2.8 billion (in the period January to May of 2018). Overall, the proceeds raised in equity markets are several magnitudes smaller than the ones raised in bond markets. In this context, it is important to highlight that our sample consists of publicly listed firms. Thus, all the firms issuing bonds in our sample also have the possibility to issue equity.

Even though capital raised via equity issues is much less than that raised via bond issues, it is important to observe that equity markets seem to have functioned well during the crisis. Even in the first 4 weeks of the crisis, where liquidity was low, equity primary markets did not freeze. However, their dynamics have been quite different from those of bond markets, which actually have shown a substantial increase in their supply of capital. These patterns are consistent with a flight-to-quality, in which investor preferences shift from the very risky equity markets to the still risky but safer corporate bond markets.

Finally, we also study the characteristics of firms engaging in SEOs during the crisis. In unreported results, we find no noteworthy differences to those firms with SEOs during normal times. However, their characteristics are significantly different from bond issuers, in general. Equity issuers are much smaller and have very negative average profitability,

Table 4
Bond and issuer characteristics

Variables	mean	SD	p25	p50	p75	N
Spread	174.112	106.382	95.000	150.000	225.000	730
Net book leverage	0.255	0.205	0.127	0.273	0.375	730
Size	8.280	1.100	7.572	8.345	9.404	730
Profitability	0.040	0.017	0.029	0.037	0.049	730
Tangibility	0.291	0.240	0.103	0.198	0.463	730
Dividend payer (dummy)	0.918	0.275	1.000	1.000	1.000	730
Manufacturing (dummy)	0.556	0.497	0.000	1.000	1.000	730
RRHT (dummy)	0.193	0.395	0.000	0.000	0.000	730
Hist. avg. spread	136.648	72.462	87.129	118.500	159.053	720
Total no. of past issues	22.489	17.406	8.000	19.000	30.000	722
A and higher	0.456	0.498	0.000	0.000	1.000	730
BBB	0.482	0.500	0.000	0.000	1.000	730

This table presents the descriptive statistics of the variables used in the regression analysis. Variables are defined in the appendix.

while bond issuers have positive profitability, on average. They also have higher market-to-book ratios, much more cash relative to their size, and lower leverage. These results are consistent with earlier findings in Erel et al. (2012).

2.3 Determinants of bond spreads

We now study the spreads that bond issuers had to pay during the crisis, using regression analysis. The main goal is to shed light on the potentially changing determinants of bond spreads in crisis times compared to normal times. Table 4, first, provides pooled (across crisis and normal periods) descriptive statistics of the variables considered in the analysis (all variables are defined in Table A1 in the appendix). The average spread across all 730 bond observations is 174 basis points. 92% of the sample firms pay dividends, 56% come from the manufacturing industry and the average net book leverage equals 26%. In terms of ratings, 46% of the sample observations have a rating of A or higher, while 48% have a rating of BBB. It is also interesting to emphasize that sample firms had, on average, 22 past bond issues since 2009. During the COVID-19 crisis, we identify five first-time bond issuers (meaning that those issuers have not issued any bonds since 2009), namely, Fox Corporation, Keurig Dr. Pepper Inc., CDW Corporation, DuPont de Nemours Inc., and Corteva Inc.

Table 5 summarizes the different regression results. The first regression specification for each sample—the COVID-19 sample and the normal period sample—includes the following firm characteristics: net book leverage, size, profitability, tangibility, a dummy for being a dividend payer and a dummy for being in the manufacturing industry. The second empirical model for each sample adds information from past bond issuance activities by each issuing firm. Specifically, we add the average spread of

Table 5
Determinants of spread

Variables	(1) COVID-19 spread	(2) COVID-19 spread	(3) COVID-19 spread	(4) Normal period spread	(5) Normal period spread	(6) Normal period spread
Net book leverage	85.906	76.110	16.540	65.880	29.275	17.344
	(.008)	(.012)	(.581)	(.000)	(.007)	(.116)
Size	−4.579	27.011	37.987	−19.273	−4.453	−2.675
	(.499)	(.000)	(.000)	(.000)	(.056)	(.249)
Profitability	−1,497.546	−1,088.492	−350.956	−687.513	−38.790	9.318
	(.000)	(.002)	(.318)	(.000)	(.730)	(.933)
Tangibility	59.212	17.069	14.789	−26.820	−34.718	−29.901
	(.046)	(.531)	(.563)	(.062)	(.000)	(.001)
Dividend payer (dummy)	44.401	63.734	88.727	−38.710	−10.389	−6.529
	(.069)	(.005)	(.000)	(.000)	(.146)	(.355)
Manufacturing (dummy)	−29.712	−27.963	−16.060	−25.930	−15.561	−11.895
	(.026)	(.021)	(.162)	(.000)	(.000)	(.007)
Hist. avg. spread		0.873	0.636		0.705	0.666
		(.000)	(.000)		(.000)	(.000)
Total no. of past issues		−1.076	−0.952		0.157	0.230
		(.009)	(.014)		(.304)	(.127)
A and higher (dummy)			−86.914			−21.862
			(.000)			(.000)
Constant	280.872	−90.997	−151.819	349.523	76.092	68.908
	(.000)	(.192)	(.022)	(.000)	(.000)	(.001)
Year dummies	n/a	n/a	n/a	Yes	Yes	Yes
Observations	286	276	276	444	444	444
Adj. R^2	.110	.321	.401	.260	.700	.711

This table presents regression results using the offering spread of our sample bonds as the dependent variable. Definitions of independent variables are discussed in Section 1 and summarized in the appendix. *p*-values are placed in the parentheses underneath the estimated coefficients.

earlier issues and the number of earlier issues since 2009. Finally, the third regression specification also controls for the rating of a given firm, using a dummy that is one for all issuers with a rating of a single A or higher. For all observations from noncrisis periods, we also control for year fixed effects.

We identify several stark differences between the determinants of bond spreads in the crisis and in normal times. First, during normal times, firm characteristics explain credit spreads quite well. The signs with which characteristics affect spreads are usually consistent across specifications and conform with economic intuition. Net book leverage (+), size (−), tangibility (−), and being a dividend payer (−) show good explanatory power. Finally, being in the manufacturing industry lowers spreads by between 12 and 26 bps during normal times.

During the crisis period, the explanatory power of firm characteristics drops substantially, from 26% to 11%, and several explanatory variables lose their significance. Net book leverage is an exception, as it consistently indicates a positive, albeit not always significant, relation to spreads, as one would expect. However, tangibility, which is very reliably estimated with a negative impact on spreads during normal times, does

not have explanatory power in the crisis. In contrast, being a dividend payer matters during the crisis, but in a rather surprising way: it increases spreads by 44 to 89 bps. These two results are consistent with the interpretation that value firms, which frequently have high amounts of tangible assets and tend to pay dividends, are affected more negatively by the crisis, so that these two variables have very different effects in crisis times compared to normal times.

In a next step, we introduce information about past issuance activity. One of these variables is the average spread paid on past issuances (since 2009) by the same firm. This variable has good explanatory power during normal times. The coefficient is 0.7, and the *t*-statistic is above 20. The R^2 of the regression increases to around 70%. Thus, spreads are highly autocorrelated at the firm level during normal times. However, things look different during the crisis—the average historical spread still has a positive coefficient and is still statistically significant—but less so (the *t*-statistic in this case is 7.9). In this case, the R^2 of the regression increases to 32% but stays far below the level of 70% during normal times. Thus, during the crisis the pricing seems to be much more decoupled from historical spreads. This suggests that there are large cross-sectional differences in how the crisis affects different firms. This is consistent with recent papers by Ramelli and Wagner (2020), Pagano, Wagner, and Zechner et al. (2020) and Albuquerque et al. (2020).

We also consider the number of issues a given firm has done since 2009 as an explanatory variable for spreads. During normal times, this variable does not matter much. It receives a small, positive coefficient which is not significantly different from zero. However, during the crisis, this changes: the coefficient switches to being negative, increases several times in terms of magnitude, and is statistically highly significant. The average firm issuing bonds during the crisis had 22 bond issues before. Multiplying that number with the coefficient yields a noticeable reduction in spreads of around 24 bps. One interpretation of this result is that experience with the bond market (also in terms of building reputation) or maybe an existing network of investors and underwriters (built in the course of earlier issuances) helps during the crisis and allows firms to issue bonds with lower spreads. During normal times that does not seem to matter.

The final model specification includes bond issuer ratings, specifically a dummy that equals one if a given bond has a rating of A or higher. This variable plays an important role, especially during the crisis. The coefficient is quite precisely estimated and equals -86.9, implying that bonds with a rating of A or higher pay, on average, spreads that are 87 bps lower than bonds with a worse credit rating during the crisis. In normal times, the above-A-rating dummy still receives a statistically significant estimate but in economic terms the impact is much smaller (the

Table 6
Determinants of spread: Rating and industry groups

Variables	(1) A and higher COVID-19 spread	(2) Normal period spread	(3) BBB COVID-19 spread	(4) Normal period spread
A. Rating groups				
Net book leverage	51.268	0.891	−52.737	8.001
	(.057)	(.945)	(.430)	(.688)
Size	20.635	−5.767	35.732	−1.930
	(.131)	(.216)	(.001)	(.568)
Profitability	−533.140	−158.226	85.673	−122.067
	(.122)	(.305)	(.905)	(.515)
Tangibility	0.123	−17.537	72.918	−32.878
	(.997)	(.188)	(.136)	(.010)
Dividend payer (dummy)	120.730	16.968	76.070	7.079
	(.000)	(.427)	(.018)	(.440)
Manufacturing (dummy)	−32.078	−10.544	7.221	−10.802
	(.008)	(.088)	(.739)	(.091)
Hist. avg. spread	0.358	0.183	0.095	0.508
	(.088)	(.030)	(.624)	(.000)
Total no. of past issues	−1.247	0.005	0.098	0.519
	(.001)	(.971)	(.915)	(.068)
Constant	−65.078	107.846	−86.523	76.078
	(.641)	(.019)	(.364)	(.011)
Year dummies	n/a	Yes	n/a	Yes
Observations	159	172	113	234
Adj. R^2	.235	.102	.180	.292

Variables	(5) Manufacturing COVID-19 spread	(6) Normal period spread	(7) Nonmanufacturing COVID-19 spread	(8) Normal period spread	(9) RRHT COVID-19 spread	(10) Normal period spread
B. Industry groups						
Net book leverage	−36.758	16.956	79.696	12.391	−95.431	89.910
	(.318)	(.215)	(.253)	(.502)	(.409)	(.009)
Size	64.534	2.991	23.152	−2.930	46.071	−8.010
	(.000)	(.481)	(.024)	(.366)	(.083)	(.180)
Profitability	−640.797	260.595	−101.101	−257.062	1,983.755	−763.865
	(.239)	(.043)	(.874)	(.251)	(.058)	(.015)
Tangibility	−80.283	−32.038	11.871	−23.671	166.930	−41.383
	(.056)	(.081)	(.764)	(.041)	(.068)	(.061)
Dividend payer (dummy)	45.488	4.736	78.007	−11.164	−23.884	14.081
	(.239)	(.645)	(.005)	(.261)	(.718)	(.350)
Hist. avg. spread	0.669	0.496	0.647	0.765	1.228	0.637
	(.000)	(.000)	(.002)	(.000)	(.000)	(.000)
Total no. of past issues	−1.356	−0.256	−1.318	0.661	−0.297	−0.491
	(.007)	(.210)	(.104)	(.010)	(.876)	(.341)
A and higher (dummy)	−90.417	−31.665	−53.491	−22.084	−109.280	−11.660
	(.000)	(.000)	(.012)	(.007)	(.006)	(.322)
Constant	−299.640	24.976	−51.188	61.806	−352.473	132.159
	(.007)	(.477)	(.562)	(.029)	(.172)	(.036)
Year dummies	n/a	Yes	n/a	Yes	n/a	Yes
Observations	162	241	114	203	50	91
Adj. R^2	.446	.654	.340	.754	.365	.758

This table presents regression results using the offering spread of our sample bonds as the dependent variable. Panel A reports the regression coefficients estimated separately for bonds rated A or higher and BBB-rated bonds. Panel B reports the regression coefficients estimated separately for issuers in Manufacturing industry, Nonmanufacturing industry, and RRHT (Retail, Restaurant, Hotel, and Transportation) industry. Definitions of independent variables are discussed in Section 1 and summarized in the appendix. *p*-values are placed in the parentheses underneath the estimated coefficients.

coefficient equals -21.9 during normal times). Adding the rating dummy to the model drives out some of the firm characteristics, in particular net book leverage, as one would expect because the rating will, most likely, condition on these variables. Adding the rating variable increases the R^2 during the crisis period by 8%, while it essentially adds nothing during normal times.

Next, we provide evidence on the determinants of spreads for different subsamples of bonds, using the most comprehensive regression specification introduced above. Table 6 summarizes the corresponding results. In panel A, we focus on the role of ratings and distinguish between bonds rated A or higher and BBB-rated bonds. We find some notable differences. First, we document interesting variation in adjusted R^2. During normal times, the regression framework explains three times as much variation in spreads for the sample of BBB-rated bonds than for the sample of A- or higher-rated bonds. During crisis periods, this pattern reverses and the firm characteristics explain more of the variation in spreads for the A- or higher-rated sample. Second, there is not a single variable that consistently explains spreads across samples and time periods. Being a dividend payer sticks out as it shows a consistently positive coefficient during the crisis period where the effect is much more pronounced for firms rated A or higher. Similarly, being in the manufacturing industry (negatively) and historical average spreads (positively) work robustly during normal times. Traditional variables, such as net book leverage or tangibility, only matter for individual specifications.

Panel B sheds light on the differences in spread determinants across industries. A particularly interesting result arises for tangibility. In the case of manufacturing firms, tangibility shows a negative coefficient not only during normal times but also during crisis periods. Thus, having tangible assets that could serve as collateral seems to lower credit spreads for manufacturing firms during both periods. In fact, the negative coefficient on tangibility doubles in absolute terms during the crisis. In stark contrast to those results, tangibility has basically no effect on spreads during the crisis for nonmanufacturing firms. Finally, when focusing on the group of firms from Retail, Restaurants, Hotel and Transportation (RRHT), which are hit very severely by the lockdown and social distancing measures in response to the pandemic, we find that tangible assets have a large positive (i.e., increasing) effect on credit spreads during the crisis while they have the expected negative effect on spreads during normal times. Thus, during the crisis, credit markets view large amounts of tangible and, as a consequence, inflexible assets that might also incur fixed costs to maintain very negatively in those particular industries. This negative effect by far dominates the spread-reducing collateral effect. A good example to illustrate this mechanism would be McDonald's Corporation that issued several bonds with varying maturities on March 23rd. While having 78% of its assets in tangible

assets (compared to 30% for the average firm in the sample, see Table 4), the spread it paid on the bonds was 285 bps and, thus, substantially more than the average spread of 249 bps reported in Table 1.

The role of tangibility as a determinant of credit spreads may have changed more fundamentally with COVID-19. Firms with more tangible assets are likely to be more seriously affected by the necessary social distancing measures during COVID-19. Thus, these firms may be less resilient to the pandemic and therefore this may counterbalance the positive effects that the availability of tangible assets traditionally had on credit spreads (for an analysis of resilience to social distancing on the cross-section of firms, see Pagano, Wagner, and Zechner 2020).

In addition to the results for tangibility, we find that the increasing effect of being a dividend payer on spreads is predominantly driven by nonmanufacturing firms, and much weaker and statistically not distinguishable from zero for manufacturing firms. The issuer-specific variables historical average spread (positively) and having an A or higher rating (negatively) consistently explain variation in spreads across industries and time periods. The impact of having a good rating is much more pronounced during the crisis period across all subsamples. Interestingly, also our earlier result that the number of past issuances reduces spreads during the crisis seems to be robust and holds for both manufacturing and nonmanufacturing samples.

3. Conclusion

This paper provides evidence on capital provision by financial markets to U.S. firms during the COVID-19 crisis. We find that corporate bond issues have substantially increased since the onset of the pandemic crisis in calendar week 12 (March 16–20). This is the case both for bonds rated A or higher and for bonds rated BBB or lower. The latter result is particularly surprising given that traditional investors in bond markets, such as insurance companies, should be rather hesitant to hold bonds which are rated close to the investment-grade threshold during uncertain times. Potential explanations for this result include a reaching-for-yield behavior by bond investors and a reallocation of capital by mutual and hedge funds toward corporate bond markets. By contrast, issuance frequency and the amounts of capital raised via equity markets decreased significantly in the first 4 weeks of the COVID-19 crisis, but then recovered and in the last 2 weeks of our crisis sample period exceeded levels during normal times quite substantially. Overall, however, the amount of capital raised via equity issues only made up approximately 5% of the capital raised via corporate bond markets.

In the main part of the analysis we therefore explore the dynamics and cross-sectional differences in firms' access to corporate bond markets during the crisis. We show which firm characteristics determine these differences and how the primary corporate bond market changes in the COVID-19 crisis in terms of maturities, spreads, and ratings. We also provide insights on the determinants of credit spreads in the crisis and how they differ from normal times. We find that the firms that were able to respond most quickly to the intensifying crisis by issuing bonds in calendar weeks 12 and 13, have mostly ratings A or better, have substantial experience from previous bond issues, and are larger than issuers during normal times. Over the subsequent crisis weeks, the issuer characteristics change. The average rating deteriorates; issuers are less experienced; and they are smaller. This may be partly due to the Fed programs that were announced in calendar week 13, possibly enabling a broader segment of firms to access the bond market.

Surprisingly, we also find that, compared to their previous issues, firms choose longer maturities during the crisis. This is, in contrast, to earlier results reported in the literature that suggest a tendency to issue shorter-term debt during crises, and to the Fed programs that explicitly target bond issues with maturities less than 5 years. One interpretation of this finding is that firms try to further delay rollover risks, as they might lead to substantial underinvestment incentives during volatile times. This interpretation is also supported by our finding that the rating composition of bonds that need to be rolled over in the coming years will substantially deteriorate. Furthermore, this result sheds light on the supply side of the corporate bond primary market, as it shows that bond investors are willing to provide such longer-term funding even during crisis times.

Finally, we document that determinants of corporate bond spreads substantially change during the COVID-19 crisis. In normal times, asset tangibility has one of the most reliably estimated negative effects on spreads reflecting the collateral effect of tangible assets. This variable loses all statistical significance and even switches signs in some regression specification during the crisis. It shows a pronounced, spread-increasing effect for firms from the Retail, Restaurants, Hotel, and Transportation industries. This may be consistent with a more fundamental change, where a high proportion of tangible assets signals a lower resilience to a pandemic, since it is likely that tangible assets are more adversely affected by social distancing measures. Furthermore, being a dividend payer is associated with lower credit spreads before the crisis, whereas it has a significant spread-increasing effect during the crisis. Finally, experience from past bond issues significantly reduces credit spreads during the crisis, but not in normal periods. Thus, reputation seems to be particularly valuable in times of market stress.

COVID-19 poses huge challenges to society globally, and the response to the pandemic is only starting to affect economies around the world. The present situation creates a unique research opportunity to help us better understand the interplay between financial markets and corporate funding. Going forward, it will be important to analyze not only cross-sectional differences but also international differences in economic resilience to rare disasters, such as a pandemic. We will continue to focus our research efforts on this task.

Appendix

In this appendix, Table A1 defines the variables used in the empirical analysis. Our main data sources are SDC Platinum and Compustat.

Table A1
Variable definitions

Variables	Definition
Bond issue variables	
Principal	Principal amount (US$M)
Spread	Offering spread over benchmark (bps)
Maturity	Maturity (year)
Coupon	Coupon rate (%)
A and higher	A dummy variable equal to one if the issue is rated A- or higher and zero otherwise
BBB	A dummy variable equal to one if the issue is rated BBB-, BBB, or BBB+ and zero otherwise
Inv. grade	A dummy variable equal to one if the issue is rated BBB- or above and zero otherwise
Equity issue variables	
Proceeds	Issuance proceeds (US$M)
IPO	A dummy equal to one if the equity issue is an initial public offering
Issuer characteristics	
Total amount of past issues	Total principal of past bond issues since 2009 (US$M)
Total no. of past issues	Total number of past bond issues since 2009
Hist. avg. spread	Average offering spread of past bond issues since 2009
Hist. avg. coupon	Average coupon of past bond issues since 2009
Hist. avg. maturity	Average maturity of past bond issues since 2009
Size	The natural logarithm of net sales (in US$2002)
Market to book ratio	The market value of total assets to the book value of total assets ratio
Profitability	The operating income before depreciation to total assets (book value) ratio
Tangibility	The net PPE to total assets (book value) ratio
Net book leverage	The total debt less cash and short-term investments to total assets (book value) ratio
Dividend payer	A dummy variable equal to one if the payout is greater than zero and zero otherwise
Manufacturing	An industry dummy for Manufacturing
RRHT	An industry dummy for Retail, Restaurant, Hotel, and Transportation
Sample Periods	
COVID-19	Calendar week 12 through week 20 of 2020
Normal Period	January to May 2017, 2018, and 2019
Pre-COVID-19	Calendar week 1 through week 11 of 2020

Table A2
Calendar weeks and their Mondays

Week	Monday
1	December 30, 2019
2	January 6, 2020
3	January 13, 2020
4	January 20, 2020
5	January 27, 2020
6	February 3, 2020
7	February 10, 2020
8	February 17, 2020
9	February 24, 2020
10	March 2, 2020
11	March 9, 2020
12	March 16, 2020
13	March 23, 2020
14	March 30, 2020
15	April 6, 2020
16	April 13, 2020
17	April 20, 2020
18	April 27, 2020
19	May 4, 2020
20	May 11, 2020

This table lists the date of every Monday in the first 20 weeks of 2020.

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