

Corporate Bond Issuance Over Financial Stress Episodes: A Global Perspective

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Abstract

We use a merged global data set of security-level corporate bond issuance and firm-level financial statement data to show that, in contrast to earlier periods of financial stress, during the COVID pandemic nonfinancial firms around the world were more likely to issue bonds than over preceding years. We explore the characteristics of firms that issued bonds, as well as examine the post-pandemic evolution of firm financial ratios, and find that in advanced economies resilience in bond issuance during COVID was driven by less risky firms, as predicted by existing theories. In contrast, during COVID we do not observe a shift to larger or less risky issuers in emerging economies. We explore potential channels that explain corporate bond issuance patterns, including central bank intervention and supply of capital.

JEL Codes: F30, G15, G30.

Keywords: corporate bonds, issuance, COVID, crises

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1 Introduction

During periods of financial market stress, investors hoard liquidity, disengage from risk and flock to high-quality assets, making it more difficult for firms to raise capital and secure funding. For example, during the depths of the global financial crisis, only the highest quality firms were able to access external capital markets, and even those firms had to issue bonds that investors deemed as less risky, such as those with shorter maturities and more security (Erel et al., 2012). Such flight-to-quality behavior by bond investors can result in an inefficient allocation of capital to firms, leading to foregone investment opportunities and other social costs (Caballero and Krishnamurthy (2008), Vayanos (2004)).

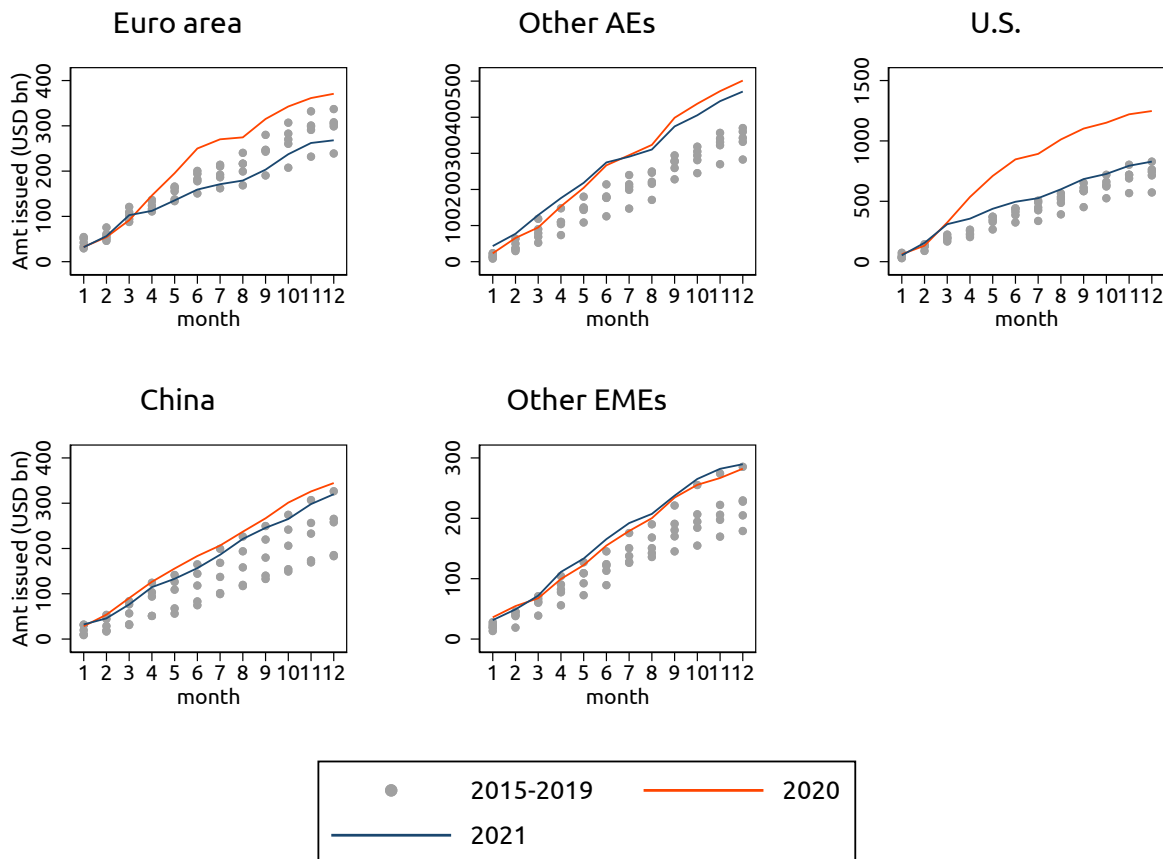
In contrast, this pattern was not observed during the COVID pandemic, even as the global economy entered into uncharted waters amid unprecedented uncertainty. As documented in Halling et al. (2020) and Becker and Benmelech (2021), issuance of corporate bonds by U.S. firms boomed in spring of 2020, partly reflecting extraordinary monetary and fiscal support. Such resilience of primary corporate bond markets helps alleviate firms' financial constraints, allows them to pursue attractive investment opportunities and better withstand future shocks (Han and Qiu, 2007). However, elevated debt issuance, especially among riskier firms, may precede future credit crunches, significant widening of credit spreads and deterioration of firms' financial health and credit quality (Greenwood and Hanson, 2013). Therefore, it is important to understand how firms' financial ratios have evolved through the pandemic.

Furthermore, financial media and market participants point to a similar bond issuance boom outside of the U.S. (for example, Toole (2021), Lonski (2021), and Wheatley (2020)). Indeed, as shown in Figure 1, comparing cumulative nonfinancial corporate bond issuance by year in different regions from 2015 to 2021, bond issuance boomed everywhere around the world in 2020 despite the pandemic (red lines); almost all regions experienced a record level of annual

issuance, with the only exception being non-China emerging market economies (EMEs), which also saw record issuance but in 2021 (blue lines).

Figure 1: Total value of corporate bond issuance by year for 2015-2021

Annual U.S. dollar value of nonfinancial corporate bond issuance for 2015 to 2021. Includes issuance from firms in our matched sample. Source: Refinitiv Workspace.



However, academic literature has devoted much less attention to issuance patterns outside of the U.S. and ensuing implications for issuing firms, despite rapidly increasing importance of corporate bond markets abroad over recent decades.¹ In this paper, we attempt to close this gap by using a merged global data set on security-level corporate bond issuance and

¹Debt securities of non-financial corporations as a percentage of GDP almost doubled between 2009 and 2020, reaching 6.8% in advanced economies and 2.2% in emerging economies (Aldasoro et al., 2021). Within our sample, the new issue corporate bond market outside the U.S. reached \$1.35 trillion in 2021, compared to \$830 billion in the U.S.

firm-level financial statements to examine how nonfinancial corporate bond issuance patterns during COVID pandemic compared to those observed in previous periods of financial stress (the global financial crisis and the taper tantrum) across firms and countries. Furthermore, we examine financial health ratios for firms from various regions around the world that issued bonds during COVID and identify how they used the proceeds from such issuance.

In particular, we ask the following questions: How did corporate bond issuance evolve over the COVID pandemic in different regions, and how does such evolution compare to previous periods of financial stress? We then examine the characteristics of firms that issued bonds during COVID, as well as what these firms used the raised cash for and how healthy they look in a post-pandemic world. Comparing the evolution of corporate debt issuance and firm financials across stress periods and countries should help us understand both firms' responses to stress and how government policies helped them cope, as well as how the ongoing removal of policy accommodation may affect the corporate sector around the world.

In order to formally quantify how the different periods of stress impacted the bond market, we examine a global panel of more than 60,000 firms from 45 countries over a 16 year period that includes the three periods of acute economic distress (COVID, taper tantrum and the global financial crisis). We then delve deeper into the subsample of firms that issued bonds during COVID, and compare their characteristics to issuers in the non-stress years leading up to 2020.² Finally, we examine the post-COVID outcomes for the sample of firms that contributed to the issuance boom during COVID compared to those that didn't.

We first use this panel data to estimate firms' propensity to issue bonds during normal and stress periods. We find that in contrast to the global financial crisis and the taper tantrum, firms in all regions were *more* likely to access the corporate bond market during COVID relative to non-stress periods. Furthermore, the amount issued and number of issued

²The definition of the COVID period used throughout this paper aims to capture only an initial, especially uncertain, period of the pandemic (March to June 2020, inclusive) rather than the entire duration of the pandemic.

corporate bonds was also higher during COVID relative to preceding years, in contrast to previous periods of stress.

Second, consistent with the theory that capital providers become more cautious in bad times, we find that increased issuance during COVID was driven by less risky firms in advanced economies, as proxied by firm size, leverage and profitability. In contrast, bonds and issuing firms from emerging economies were *not* safer during COVID (unlike during the global financial crisis or taper tantrum). This result is especially pronounced for issuers of local currency bonds (compared to USD bonds).

Third, we explore potential channels that may explain these corporate bond issuance patterns, with a focus on the unprecedented central bank policy support that occurred globally. Bond-buying programs in many economies expanded central bank balance sheets dramatically, and we show that the addition of proxies for this activity and other macroeconomic conditions dampens the importance of the onset of the COVID pandemic in our regression analysis; in other words, monetary policy support partly explains the boom in COVID issuance.

In our final set of analysis, we examine the evolution of firm financial ratios around the COVID pandemic to identify use of bond issuance proceeds and assess if firms appear over-levered. We show that Chinese firms, in particular, who issued during COVID, have higher leverage than their non-issuing peers.

Related Literature. There is a fast-growing literature that examines how firms reacted to the onset of COVID during 2020, including their access to capital and funding markets. After initially relying on credit lines in a “dash for cash” (Acharya and Steffen, 2020), companies were able to successfully tap capital markets, although less financially constrained and higher-credit-quality companies were, at least initially, more successful in raising capital than others (e.g. Halling et al. (2020)). In addition, bond issuance was more resilient than syndicated

loan issuance (Becker and Benmelech, 2021), and debt financing was more prevalent than equity issuance early in the pandemic (Hotchkiss et al., 2020). A smaller number of papers examine what firms did with the proceeds from bonds issued during COVID; Darmouni and Siani (2022) show they used funds to repay loans and hoard cash rather than real investment, likely driven by precautionary motives (Pagano and Zechner, 2022). These cash holdings helped firms keep their net leverage stable even amid a borrowing binge; gross leverage ratios exhibited an increasing trend even prior to the pandemic (Benmelech, 2021). Pagano and Zechner (2022) argue that for listed companies even gross leverage ratios declined as equity capital increases dominated their borrowing-induced balance-sheet expansion.

Our paper examines whether some of these patterns hold around the globe and how they compare to prior periods of financial stress. To our knowledge, non-U.S. evidence on issues related to firms' capital raising and financial decisions during the COVID pandemic is quite scant, with the exception of some analysis of European firms. In particular, Darmouni and Papoutsi (2021) investigate whether in Europe it was corporate bonds of larger safer issuers or those of new market entrants that were subject of sell-off by bond investors and downgrades by rating companies while Pagano and Zechner (2022) examine capital raising activities and financial decisions of firms in both U.S. and Europe and document broadly similar patterns across the two regions.

Our study contributes to the literature along three dimensions. First, to our knowledge, our paper is the first comprehensive examination of COVID-period corporate bond issuance across all regions, including EMEs. While the issuance surge in the U.S. and Europe has been documented and is perhaps not surprising, less is known about EMEs, the governments of which provided less monetary and fiscal support. EMEs are of growing importance in their own right. Moreover, issuance patterns in EMEs may help understand cross-border spillovers of advanced economy monetary and fiscal policies.

Second, we compare bond issuance patterns to those observed over earlier periods of financial

stress, including the global financial crisis and the taper tantrum, helping shed light on the role unprecedented worldwide policy support distinguishing the COVID pandemic might have played in supporting corporate credit markets. In this respect, the closest study is Becker and Benmelech (2021); it compares capital raising during COVID pandemic to those during the global financial crisis in the context of the U.S.

Third, we examine not only bond issuance but also link firm-level issuance to firm-level financial and real outcomes, again using our comprehensive cross-country firm-level data set.³ Stabilizing corporate borrowing rates and facilitating firms' access to bond markets is one of the initial steps through which credit market support policies affect the economy. These effects have been studied both in context of COVID policies in the papers cited above and in the context of earlier credit market support programs by ECB and BOE (D'Amico and Kaminska, 2019; Todorov, 2020). However, longer-term macroeconomic and financial-stability implications of such policies will depend on what companies do with the raised funds. Tracking firms' financial and real outcomes over time is the first step to understanding such longer-term effects.

2 Empirical Specification

2.1 Data and Variables of Interest

We use data on corporate bond issuance transactions from Refinitiv Workspace for Investment Banking for a sample period of January 1, 2005 to December 31, 2021. The database covers transaction-level details for bond offerings from companies around the world. We exclude convertible debentures and preferred shares, as well as \$0 issuance and securities

³Other papers that employ issuance-firm matched datasets for firms outside of the U.S. include Gozzi et al. (2010), Gozzi et al. (2015), Cortina et al. (2018), and Didier et al. (2021).

with less than 1 year to maturity at issuance.

We then match bond issuance data with firm-level annual financial statements from Refinitiv Worldscope for the years 2004-2020 (financial data is lagged to the fiscal year before bond issuance). We match first based on the ultimate parent's Refinitiv Instrument Code (RIC), which can be found in both Refinitiv Workspace and Refinitiv Worldscope. We then supplement additional matches based on firm name (Issuer/Borrower Name Full in Refinitiv Workspace and Name in Refinitiv). Some of the matches in this second step include subsidiary firms that have financial statements in Worldscope while the ultimate parent does not (e.g. PetroChina).

We focus on bond issuance activity by non-financial corporations by excluding from Worldscope all firms with an SIC code between 6000 and 6999. We also exclude public administration firms with an SIC code above 9000. Finally, we exclude firms in countries with fewer than 10 unique issuers over the sample period.

Our final matched dataset includes 60,421 firms from 45 countries, of which 6,058 issued at least one bond during our sample period (see Appendix A for a breakdown by country). Our matched dataset of 80,375 bonds totals US\$25.8 trillion in face value, which represents 75.5% of the number of and 97.3% of the face value of non-financial corporate bonds in Refinitiv Workspace.

Our main variables of interest concern monthly bond issuance at the firm level, comparing issuance decisions and firm characteristics during months with financial stress compared to months with no stress ("normal times"). We define our independent variables of interest as three dummies for the periods of financial stress, which take on a value of 1 in the following months:

- COVID pandemic: March to June 2020, inclusive;

- Taper tantrum: May 2013 to April 2014 inclusive; and
- Global financial crisis: December 2007 to June 2009, inclusive.

These months were chosen based on the likely impact on the bond markets. The GFC months were chosen based on the NBER-defined recession; the taper tantrum includes the May 2013 testimony by Ben Bernanke signaling the unexpected start to the end of quantitative easing, and includes the subsequent slow-down in China and other EMEs; and the COVID months include the four months where the VIX index was at an average monthly level above 30.

We first examine bond issuance decisions, such as the propensity to issue a bond (*issuermummy*, which takes on a value of 1 if the firm issues at least one bond in a month and 0 otherwise), and the dollar amount and number of bonds issued by a firm in a month. We then look at the characteristics of the bonds issued, such as the weighted average time to maturity of new bonds issued by a firm in a month, and the proportion of bonds issued by a firm that are rated and investment grade rated.

We then turn to characteristics of bond issuers as of the firm's previous fiscal year end, such as log assets (log of USD total asset value), book leverage (total debt divided by total assets), and profitability (net income divided by total assets). The latter two variables are winsorized at the 5% and 95% level.

We then investigate the time series of macroeconomic variables around our periods of financial stress. At the country-month level, we examine a country's average 10-year government yield, the size of the central bank's balance sheet relative to GDP, and flows into a country's bond mutual funds as a percentage of such funds' assets under management. At the monthly level but with no country variation, we examine the level of the Wu-Xia Shadow Federal Funds Rate (Wu and Xia, 2016), the level of the USD broad dollar index, and the monthly VIX level.

In a final set of analysis, we look at the evolution of firm financial ratios after the onset of the COVID pandemic. In addition to the previously defined book leverage, we also look at the percentage of short-term debt relative to total debt; the proportion of firms with interest coverage ratios (defined as earnings before interest, taxes, depreciation and amortization divided by interest expense) less than 2; and cash, capital expenditures and dividends, all divided by total assets.

We perform our analysis for five separate geographical areas: the euro area, other advanced economies (AEs), the United States, China, and other emerging market economies (EMEs). In China and other EMEs, in addition to looking at all bond issuance, we examine in some tests local currency issuance and USD issuance.

Table 1 shows summary statistics for the full sample period, broken down by region.

In Panel A, we describe the characteristics of bond issuance, including the regional breakdown of the 6,058 unique issuing firms. Our sample includes 17,542 bonds from nonfinancial corporations in the U.S.⁴ For firm-months that include issuance, the average amount of bonds issued is largest in the U.S. at approximately \$992 million, followed closely by the euro area at \$984 million. Other AEs, China and other EMEs are smaller at \$579 million, \$370 million and \$242 million, respectively. In terms of number of bonds issued, for months with positive issuance the average number of bonds issued is 2.01 in other AEs, 1.96 in the euro area, 1.91 in other EMEs, 1.73 in the U.S. and 1.46 in China. Average initial time to maturity is longer in advanced economies (U.S. at 11.5 years, other AEs at 9.0 years and euro area at 8.5 years) than in emerging economies (6.1 and 5.8 years in China and other EMEs, respectively). The majority of bonds in the U.S. and euro area are rated, while only 40% of bonds in other AEs are rated. Only 12% and 16% of bonds in China and other EMEs are rated.

⁴This number can be calculated as the number of firm-months with issuance (10,142) multiplied by the average number of bonds when issuing (1.73). Our sample is similar to the 17,379 bonds issued between 2002 and 2020 as described in Becker and Benmelech (2021).

Table 1: Summary statistics

Sample:	Euro area	Other AEs	U.S.	China	Other EMEs
<i>Panel A: Bond issuance details</i>					
Number of unique issuing firms	468	1,286	1,499	975	1,830
Number of firm-months with issuance	4,713	8,964	10,142	6,821	13,420
Average number of bonds	0.02	0.01	0.02	0.01	0.01
Average number of bonds (>0)	1.96	2.01	1.73	1.46	1.91
Average bond size (\$m)	\$9.2	\$2.3	\$8.7	\$3.3	\$1.2
Average bond size (>\$0m)	\$983.0	\$578.8	\$991.7	\$369.8	\$241.8
Weighted average maturity	8.54	8.95	11.45	6.10	5.80
Rated share	67.2%	39.9%	89.1%	12.2%	15.8%
IG rated share	54.6%	32.3%	53.6%	4.1%	10.1%
<i>Panel B: Bond issuer characteristics</i>					
Log assets	10.24	9.47	9.36	8.96	8.34
Book leverage	35.6%	36.8%	38.3%	36.6%	37.1%
Profitability	3.2%	3.3%	3.7%	3.0%	2.9%
<i>Panel C: All firm characteristics</i>					
Number of unique firms	4,043	18,360	12,073	6,407	19,538
Number of unique firm-months	503,946	2,257,255	1,155,809	773,922	2,719,365
Log assets	5.35	4.05	4.10	5.73	4.50
Book leverage	24.8%	18.7%	27.3%	21.1%	23.9%
Tangibility	23.4%	30.1%	24.7%	26.5%	31.1%
<i>Panel D: Macroeconomic conditions</i>					
Level of 10-year yield	2.88%	2.12%	2.92%	3.45%	4.76%
Change in USD broad index	0.05%	0.05%	0.05%	0.05%	0.05%
Wu Xia shadow Fed Funds rate	0.69%	0.69%	0.69%	0.69%	0.69%
Monthly change in VIX	2.10%	2.10%	2.10%	2.10%	2.10%
Flow into bond funds as % of AUM	0.39%	0.41%	0.32%	5.06%	0.74%

Panel B shows characteristics of bond issuing firms whereas Panel C shows characteristics of all firms. Not surprisingly, bond issuers are, on average, larger and more levered than the firms in the full sample. In terms of bond issuers, euro area firms are the largest and least levered, while firms in other EMEs are smallest and have the second highest leverage (U.S. issuers have the highest leverage). In the full sample, Chinese firms are the largest and have the second lowest leverage, while U.S. firms are the second smallest and have the highest leverage.

Finally, Panel D shows that the average 10-year government yields over the sample period are lowest in other AEs, followed by the euro area and the U.S. Non-China EMEs have the highest average sovereign yields. China has experienced the largest average flows into bond mutual funds, although the average is positive across all regions. Over the sample period, the average monthly change in the USD broad dollar index is 0.05%, the average shadow Federal Funds rates is 0.69%, the average monthly change in VIX is 2.10% and the average change in the 1-month euro area overnight index swap around European Central Bank announcements is 0.19%.

2.2 Regression specifications

In order to test the relationship between issuance decisions and periods of financial stress, our main regression specification takes on the following form:

$$y_{i,t} = \alpha + \beta * COVID + \delta * TT + \gamma * GFC + \eta_i + \epsilon, \quad (1)$$

where $y_{i,t}$ is one of issuer dummy, dollar amount issued, or number of bonds issued. These variables are defined for the full sample of firm-months. We run the analysis on an unbalanced panel, based on the fact that some firms enter and exit the sample, but for robustness we

also re-run the analysis using only the firms with data for all years; the results remain qualitatively the same. β , δ and γ measure whether issuance decisions change during stress months relative to the rest of the sample period. We control for firm fixed effects in all specifications with η_i . In order to properly account for the cross-sectional dependence in our panel data, we use Driscoll-Kraay standard errors (Driscoll and Kraay, 1998).

We then run Equation 1 on the sample of firm-months with positive issuance. The dependent variables $y_{i,t}$ that we explore are dollar-amount weighted average maturity of bonds issued in a firm-month, share of bonds issued in a firm-month with a rating, and share of bonds issued in a firm-month with an investment grade rating.⁵

We next examine whether the characteristics of firms that issue during stress periods are different than firms that issue in non-stress periods, using the following regression specification:

$$y_{i,t} = \alpha + \beta * COVID + \delta * TT + \gamma * GFC + \eta_j + \rho_t + \epsilon, \quad (2)$$

where $y_{i,t}$ is the firm characteristic of interest for firm i that issues a bond in month t . The firm characteristics we examine are log assets, book leverage, and profitability. The coefficients β , δ and γ measure the difference in average firm characteristics in stress periods relative to non-stress periods. We control for industry fixed effects (using 1-digit SIC code) with η_j and include a linear time trend with ρ_t . We cluster our standard errors at the industry level.

⁵The rated share and investment grade rated share are essentially bi-modal (either 0 or 1), with very few firm-months with issuance of both rated and unrated bonds, or investment grade and non-investment grade rated bonds.

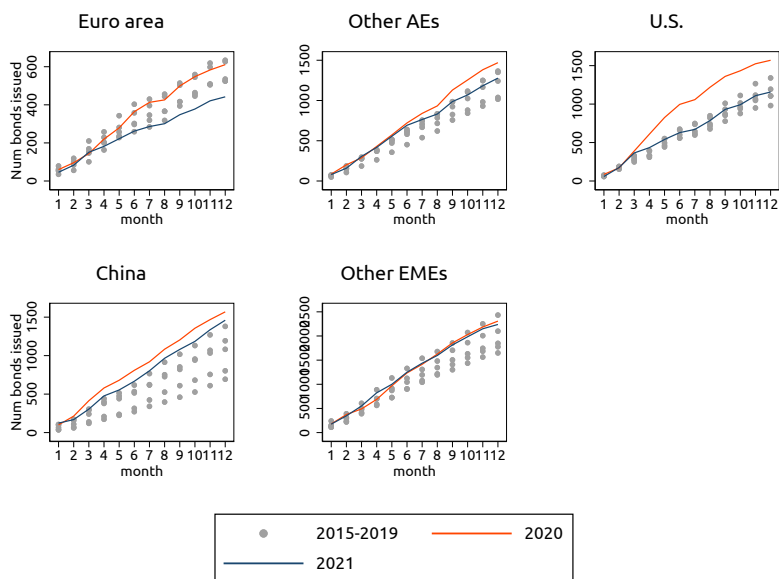
3 Empirical Results

3.1 What does corporate bond issuance look like during periods of financial stress?

As shown in Figure 1 in the introduction, total dollar issuance of nonfinancial corporate bonds surged to record or near-record levels in 2020 across all regions, despite the COVID pandemic. After a brief stall in the corporate bond market at the onset of the pandemic early in the year, cumulative dollar issuance in 2020 (red line) exceeded issuance levels from the previous five years (gray dots) in almost all regions, especially in advanced economies. For the U.S., this pattern is particularly pronounced and is in line with findings from previous literature (e.g. Halling et al. (2020) and Hotchkiss et al. (2020)). Issuance in 2021 (blue line) generally remained high in all regions except for the euro area, and actually exceeded 2020 issuance levels in non-China EMEs.

Figure 2: Number of corporate bonds issued by year for 2015-2021

Annual number of nonfinancial corporate bonds issued for 2015 to 2021. Includes issuance from firms in our matched sample. Source: Refinitiv Workspace.



These patterns largely remain if we examine the number of issued bonds rather than the overall issued amounts. In particular, Figure 2 shows that the number of bonds issued peaked in 2020 in other AEs, U.S. and China. The number of bonds is lower than in previous years in the euro area, indicating that the high dollar issuance was partly driven by larger bonds being issued.

To contrast the issuance of corporate bonds during the COVID pandemic to that in other periods of stress, Figure 3 shows the pattern of total dollar issuance around the global financial crisis (top panel) and the taper tantrum (bottom panel). As shown in panel (a), total dollar issuance levels in 2008 were generally in line in previous years, but surged in 2009 in all areas except the U.S. We conjecture that issuance behavior during the taper tantrum to be most affected in China and other EMEs. Indeed, panel (b) shows that while issuance levels for these regions in early 2013 is above previous years (especially in China, which was experiencing significant growth in its bond market), there is a distinct ‘flattening’ of the issuance curve beginning in May 2013 and continuing into early 2014.

We next formally test whether issuance patterns during COVID are different than non-stress times and other stress episodes using the regression in Equation (1). Table 2 uses the full panel of firm-months and examines as dependent variables bond issuance propensity (issuer dummy), number of bonds issued, and dollar amount issued. In the first line, we show the mean of each dependent variable over the entire sample period (including stress periods) for the applicable region.

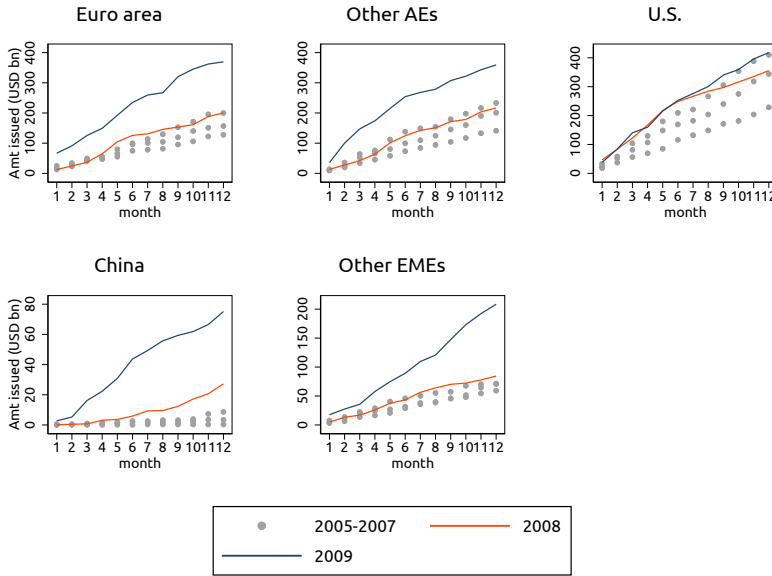
The first panel of Table 2 looks at issuance propensity, which is a dummy that takes on a value of 1 in months when a firm issues at least one bond and 0 otherwise. The first line shows that the average propensity varies between 0.40% to 0.94% depending on the region, with U.S. firms at 0.88%. In other words, out of a time period of 1000 months, an average firm accesses the bond market between 4 times (every 20.8 years) and 9 times (every 9.3

Figure 3: Total value of corporate bond issuance by year

Annual U.S. dollar value of nonfinancial corporate bond issuance for 2005 to 2009 in panel (a) and for 2010 to 2014 in panel (b). Includes issuance from firms in our matched sample.

Source: Refinitiv Workspace.

((a)) 2005-2009



((b)) 2010-2014

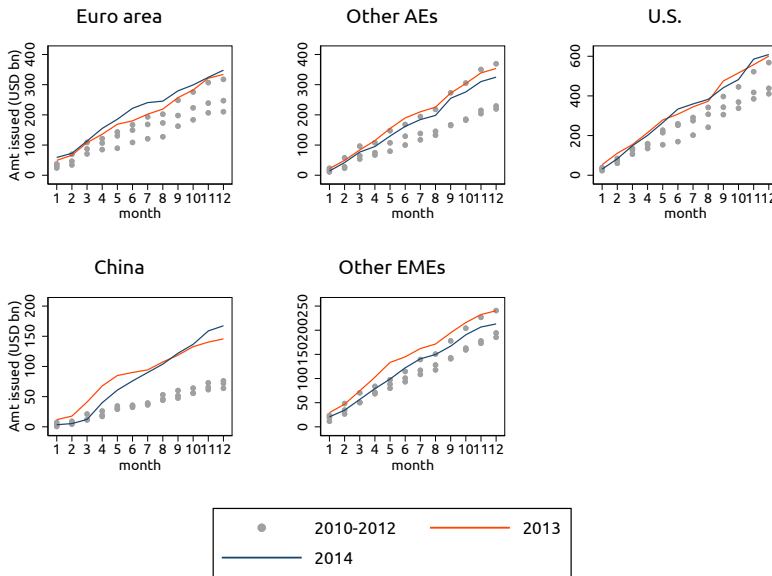


Table 2: COVID is different than previous periods of stress in terms of issuance behavior

This regression examines bond issuance outcomes for 2005 to 2021 for a global sample of public firms in Refinitiv Worldscope. The dependent variables are *issuer_dummy* (a dummy that takes on a value of 1 if a firm issues at least one bond in a month and 0 otherwise), *dollar_amount_issued* (total face value of bonds issued in a month by a firm, including \$0), and *number_bonds_issued* (total bonds issued in a month by a firm, including no bonds). The independent variables of interest are the stress period dummies, defined in Section 2.1. The regressions include firm fixed effects and Driscoll-Kraay standard errors are shown below the coefficients; *, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

Sample:	Euro area	Other AEs	U.S.	China	Other EMEs
<i>Dependent variable</i>	<i>Issuer dummy</i>	<i>Issuer dummy</i>	<i>Issuer dummy</i>	<i>Issuer dummy</i>	<i>Issuer dummy</i>
Mean	0.94%	0.40%	0.88%	0.88%	0.49%
COVID pandemic	0.00640*** (0.00156)	0.00121** (0.000480)	0.0129*** (0.000863)	0.00807*** (0.00137)	0.00278*** (0.000798)
Taper tantrum	0.00204*** (0.000512)	0.000628* (0.000319)	0.000253 (0.000521)	-0.00495*** (0.00152)	-0.00133*** (0.000321)
Global financial crisis	-0.000608 (0.00126)	-0.000721** (0.000337)	-0.00167** (0.000799)	-0.00982*** (0.00173)	-0.00168*** (0.000438)
<i>Dependent variable</i>	<i>Dollar amount issued</i>	<i>Dollar amount issued</i>	<i>Dollar amount issued</i>	<i>Dollar amount issued</i>	<i>Dollar amount issued</i>
Mean	9.19	2.30	8.70	3.26	1.19
COVID pandemic	12.43*** (1.126)	2.300*** (0.411)	29.11*** (2.463)	3.125*** (0.407)	0.585*** (0.174)
Taper tantrum	3.019** (1.443)	0.231 (0.221)	-0.183 (0.749)	-1.156** (0.557)	0.0769 (0.104)
Global financial crisis	0.797 (1.797)	0.136 (0.469)	-2.482*** (0.914)	-2.855*** (0.765)	-0.605*** (0.157)
<i>Dependent variable</i>	<i>Number of bonds issued</i>	<i>Number of bonds issued</i>	<i>Number of bonds issued</i>	<i>Number of bonds issued</i>	<i>Number of bonds issued</i>
Mean	0.02	0.01	0.02	0.01	0.01
COVID pandemic	0.0107*** (0.00211)	0.00376*** (0.000864)	0.0279*** (0.00191)	0.0155*** (0.00283)	0.00513*** (0.00178)
Taper tantrum	0.00446*** (0.00171)	0.000743 (0.000563)	-1.87e-07 (0.000742)	-0.00835*** (0.00228)	-0.00250*** (0.000742)
Global financial crisis	0.00302 (0.00196)	-0.00129** (0.000614)	-0.00337** (0.00142)	-0.0138*** (0.00246)	-0.00364*** (0.000860)
Controls (applies to all dependent variables)					
Constant	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
# of observations	503,946	2,257,255	1,155,809	773,922	2,719,365
# of firms	4,043	18,360	12,073	6,407	19,538

years).⁶ The coefficients represent the *change* in issuance propensity during the relevant time periods relative to non-stress periods (the omitted time variable); Table 2 shows that a given firm’s likelihood of issuing a bond was significantly increased during the COVID pandemic months. We can estimate economic significance by comparing the level of the coefficient with the sample mean: issuance likelihood in the U.S. was 1.29% higher during the COVID period, which is about 1.5 times higher (an increase of 147%) relative to the sample mean issuance propensity of 0.88%. Calculated similarly, issuance likelihood increased by 92%, 68%, 57%, and 30% in China, euro area, other EMEs and other AEs, respectively. In contrast to the increased issuance likelihood during COVID, issuance propensity decreased significantly in almost all regions during the global financial crisis: issuance propensity was 6%, 18%, 19%, 34% and 111% lower in the euro area, other AEs, U.S., other EMEs and China, respectively.⁷ During the taper tantrum, issuance propensity declined 56% and 27% in China and other EMEs, respectively.

The second and third panels of Table 2 show similar results for the dollar amount and number of bonds issued. Both dependent variables include firms that do not issue bonds, which is why the sample means are lower than expected (for example, the average firm-month includes issuance of 0.02 bonds, or \$8.7 million in the U.S. over the entire sample period). During the COVID pandemic period, firms issued significantly more, both in terms of dollar amounts and number of bonds.⁸ U.S. firms increased the most (the coefficients imply increases of 335% for dollar amount and 184% for number of bonds)⁹, followed by Chinese firms (increases of 96% and 121%, respectively), euro area firms (135% and 58%),

⁶This percentage includes all firm-months, even for those firms that never issue a bond. If we restrict the sample to firms that issue at least one bond over our sample period, the average issuance propensity per firm-month is between 4.3% and 6.6%, which corresponds to issuance every 1.9 and 1.3 years, respectively.

⁷Note that we are using a linear probability model, which allows for declines in excess of 100% in contrast to logit or probit models.

⁸Amounts issued are converted into USD no matter the underlying issuance currency, which may lead to concern that results for the second panel are driven by exchange rates. Issuance propensity and number of bonds issued do not suffer from this concern, however, and we find consistent results across all three variables.

⁹Calculated as \$29.11 million divided by \$8.7 million, and 0.0279 bonds divided by 0.02 bonds.

other advanced economy firms (100% and 47%), and other emerging economy firms (49% and 54%). In contrast, most regions saw significantly fewer bonds and lower dollar amounts issued during the global financial crisis, and EME firms issued significantly fewer bonds during the taper tantrum.¹⁰

Next, we examine whether the surge in issuance is driven by bonds denominated in a firm's local currency or in USD. In Table 3, we replace issuance propensity from the first panel of Table 2 with a propensity to issue in either USD or local currency. The dependent variable in the top panel, USD issuer dummy, takes on a value of 1 if the firm issues at least one bond denominated in USD in a month and 0 otherwise. Likewise, in the bottom panel, the local currency issuer dummy takes on a value of 1 if the firm issues at least one bond in their nation's home currency. Comparing the USD bond issuance propensity with that for overall bond issuance, we observe that the coefficient on the GFC dummy remains negative and significant in most regions, while the coefficient on COVID dummy is only positive and statistically significant in other AEs and the U.S. That said, even though for other regions loadings of USD issuance propensity on the COVID dummy are not statistically significant, they are still positive, suggesting that, in contrast to GFC and normal times, propensity to issue USD bonds did not decline, and in some regions even increased, during COVID. The pattern for local currency issuance propensity, however, mirrors the results for overall bond issuance shown in the first panel of Table 2 more closely: firms were significantly more likely to issue bonds during COVID in their home currency. In other words, the higher propensity to issue bonds during our COVID period relative to other stress and non-stress periods is to a large extent driven by local-currency bond issuance, particular in euro area and in EMEs.

Overall, these results provide evidence that nonfinancial corporate bond issuance patterns

¹⁰While not shown, we also run the regressions for the amount issued for only the subsample of firm-months with bond issuance. Conditional on non-zero issuance, the amount issued is significantly larger during COVID in all regions but China (where it is insignificantly larger). In contrast to Cortina et al. (2021), we find that the amount issued during the GFC is not significantly larger in any region, and is in fact significantly smaller in the U.S. and non-China EMEs.

Table 3: COVID issuance increases driven by local-currency bonds in euro area and EMEs

This regression examines bond issuance outcomes for 2005 to 2021 for a global sample of public firms in Refinitiv Worldscope. The dependent variables are *issuer_dummy_USD* (a dummy that takes on a value of 1 if a firm issues at least one USD-denominated bond in a month and 0 otherwise), and *issuer_dummy_local_currency* (a dummy that takes on a value of 1 if a firm issues at least one bond denominated in their home currency in a month, and 0 otherwise). The independent variables of interest are the stress period dummies, defined in Section 2.1. The regressions include firm fixed effects and Driscoll-Kraay standard errors are shown below the coefficients; *, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

Sample:	Euro area	Other AEs	U.S.	China	Other EMEs
<i>Dependent variable</i>	<i>Issuer dummy USD</i>	<i>Issuer dummy USD</i>	<i>Issuer dummy USD</i>	<i>Issuer dummy USD</i>	<i>Issuer dummy USD</i>
Mean	0.17%	0.10%	0.81%	0.14%	0.07%
COVID pandemic	0.000996 (0.000614)	0.000384** (0.000153)	0.0128*** (0.000804)	0.000677 (0.000542)	0.000139 (0.000193)
Taper tantrum	0.000476 (0.000376)	0.000255*** (7.50e-05)	0.000221 (0.000491)	-0.000577* (0.000309)	-7.48e-05 (7.32e-05)
Global financial crisis	-0.000413 (0.000252)	-0.000252*** (8.52e-05)	-0.00145* (0.000790)	-0.00178*** (0.000278)	-0.000521*** (0.000101)
<i>Dependent variable</i>	<i>Issuer dummy local currency</i>	<i>Issuer dummy local currency</i>	<i>Issuer dummy local currency</i>	<i>Issuer dummy local currency</i>	<i>Issuer dummy local currency</i>
Mean	0.76%	0.30%	0.83%	0.76%	0.42%
COVID pandemic	0.00648*** (0.00102)	0.000807** (0.000321)	0.0126*** (0.000825)	0.00746*** (0.00172)	0.00270*** (0.000670)
Taper tantrum	0.00197*** (0.000515)	0.000335 (0.000261)	0.000186 (0.000526)	-0.00471*** (0.00149)	-0.00129*** (0.000285)
Global financial crisis	-0.000990 (0.00125)	-0.000580** (0.000232)	-0.00148* (0.000780)	-0.00824*** (0.00156)	-0.00112** (0.000435)
Controls (applies to all dependent variables)					
Constant	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
# of observations	503,946	2,257,255	1,155,809	773,922	2,719,365
# of firms	4,043	18,360	12,073	6,407	19,538

over the onset of the COVID pandemic were different from the global financial crisis and the taper tantrum: despite market turmoil, bond markets did not experience the sustained decline in issuance observed in other episodes of severe stress. In addition, the surge in issuance was driven not by USD issuance, but rather by issuance in firm's home currency.¹¹

3.2 Are corporate bonds issued during periods of financial stress different?

The last section shows that in contrast to previous stress episodes, during the COVID pandemic firms were more likely to access the bond market, resulting in higher number and dollar amounts of corporate bonds issued. In this section, we examine the quality of bonds issued, as well as the characteristics of issuing firms, during stress and non-stress periods.

Prior literature has shown that it is higher quality firms that issue during crises. Erel et al. (2012) show that capital raising is different for investment and non-investment grade firms: while for non-investment-grade firms external capital raising is procyclical, for investment-grade firms it is countercyclical. This can be partly attributed to investors willingness to supply capital, which becomes more limited or selective during times of stress (as in Caballero and Krishnamurthy (2008)). For this reason, we hypothesize that bonds issued during periods of acute stress would be less risky and come from higher quality firms relative to normal times.

We first look at two indicators of duration and credit risk, respectively, associated with newly issued bonds: time to maturity at issuance and bond rating. Longer term bonds expose investors to higher duration risk as well as longer exposure to a given firm's credit risk. As investors seek to lower risk exposures during periods of stress, we conjecture that

¹¹The conclusions in this section remain robust when we consider only the subsample of firms that exist in Refinitiv Worldscope for the entire sample of 2004-2021. In other words, the results are not driven by survivorship bias.

bonds issued during periods of financial stress would have shorter time to maturity (for example, Cortina et al. (2021) show that bonds issued during the GFC have significantly shorter time to maturity in both advanced and emerging economies). Similarly, investors should be more willing to buy investment grade rated bonds during stress periods relative to normal times. The results of using these dependent variables in the regression in Equation 1 are shown in Table 4, which includes only firm-months with at least one bond issuance. For emerging economies, we show results for issuance in local currency as well as issuance in USD.

Similar to Table 2, the first line in each panel includes the sample mean, and the coefficients can be interpreted as the change during the relevant time periods relative to non-stress periods. The first panel looks at time to maturity, which is on average shorter in China and other EMEs (approximately 6 years) compared to euro area and other AEs (approximately 9 years) and the U.S. (approximately 11 years).

During the global financial crisis, bonds in all regions had shorter time to maturity, though only significantly so in the euro area (equivalent to 23% shorter relative to the sample mean). Bonds issued during COVID had shorter maturities in euro area and other AEs, with the latter significantly shorter by 1.5 years or 17% compared to the sample mean. In contrast, the maturity of bonds issued by firms in the U.S. were insignificantly longer, also seen in USD bonds issued by firms in emerging markets. In China, bonds issued in renminbi had insignificantly longer maturities, while bonds issued in USD had insignificantly shorter maturities.

The next panel looks at the share of issuance with an investment grade bond rating. It is important to note that the share of bonds with an external rating is much lower in EMEs relative to the advanced economies, and there is variation within advanced economies, with lower rated shares in other AEs relative to the U.S. and euro area; as a result, other AEs and EMEs have lower levels of investment grade rated bonds. During the COVID period, the

Table 4: Bonds issued during COVID by EME firms are different than previous periods of stress

This regression examines bond characteristics for corporate bonds issued between 2005 and 2021 by a global sample of public firms in Refinitiv Worldscope. The dependent variables are *weighted_average_maturity* (the average time to maturity of bonds issued by a firm in a month, weighted by face value), and *ig_rated_share* (proportion of bonds issued in a firm-month that have an investment grade rating). The independent variables of interest are the stress period dummies, defined in Section 2.1. The regressions include industry (one-digit SIC code), year and nation fixed effects and standard errors clustered at the industry level are shown below the coefficients; *, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

Sample:	Euro area	Other AFE	U.S.	China	China	Other EMEs	Other EMEs
				RMB Issuance	USD Issuance		
<i>Dependent variable</i>	<i>Weighted average maturity</i>	<i>Weighted average maturity</i>	<i>Weighted average maturity</i>	<i>Weighted average maturity</i>	<i>Weighted average maturity</i>	<i>Weighted average maturity</i>	<i>Weighted average maturity</i>
Mean	8.54	8.95	11.45	6.20	5.94	5.14	9.87
COVID pandemic	-1.398 (1.024)	-1.531*** (0.241)	0.604 (0.327)	0.251 (0.723)	-0.275 (0.779)	-0.0334 (0.378)	0.421 (0.865)
Taper tantrum	-0.309 (0.363)	0.107 (0.250)	-0.749* (0.373)	-0.343 (0.204)	0.552 (2.034)	0.270 (0.365)	-0.211 (0.529)
Global financial crisis	-1.984*** (0.366)	-1.228 (0.946)	-1.367 (0.743)	-0.803 (0.476)		-0.0871 (0.255)	-0.467 (0.993)
# of observations	4,691	8,933	10,125	5,742	1,083	11,332	1,937
R-squared	0.085	0.139	0.169	0.038	0.103	0.133	0.174
<i>Dependent variable</i>	<i>IG rated share</i>	<i>IG rated share</i>	<i>IG rated share</i>	<i>IG rated share</i>	<i>IG rated share</i>	<i>IG rated share</i>	<i>IG rated share</i>
Mean	0.55	0.32	0.54	0.01	0.23	0.05	0.36
COVID pandemic	0.182*** (0.0172)	0.0710* (0.0335)	0.222*** (0.0254)	-0.00137 (0.00357)	0.0136 (0.0632)	-0.00192 (0.00679)	0.0915 (0.0978)
Taper tantrum	0.0128 (0.0268)	0.0381*** (0.00828)	0.00622 (0.0313)	0.00185 (0.0109)	0.0344 (0.0613)	0.0299 (0.0178)	0.106** (0.0417)
Global financial crisis	0.191*** (0.0539)	0.0817* (0.0373)	0.124*** (0.0173)	-0.0117 (0.0141)		-0.0133 (0.0268)	0.0935 (0.0560)
# of observations	4,713	8,964	10,142	5,850	1,084	11,462	1,947
R-squared	0.164	0.153	0.112	0.005	0.198	0.135	0.165
Controls (applies to all dependent variables)							
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SIC 1 digit FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nation FE	Yes	Yes	n/a	n/a	n/a	Yes	Yes

share of investment grade rated bonds increased significantly in advanced economies, similar to the pattern observed during the GFC. In contrast, the share of investment grade rated bonds issued in local currency declined in both China and other EMEs, while the IG share increased for USD issuance. Notably, the coefficient for the taper tantrum shows that the share of highly rated bonds increased in EMEs, again consistent with the conjecture that it is less difficult for higher-quality issuers, compared to their lower-quality peers, to access the market during stress.

Overall, the results from Table 4 show that while bonds issued during COVID in advanced economies are generally less risky relative to normal market conditions, COVID bonds in emerging economies are not safer than those issued in non-stress periods.

We now turn to characteristics of firms that issue bonds. We first examine graphically the distribution of firm characteristics of bond issuers in Figure 4, comparing issuers during three periods: the relatively calm period of 2015-2019 (gray line); the peak market stress period of COVID from March to June 2020 (red line); and the rest of the COVID pandemic in our sample period ending in December 2021 (black line).¹² We show log assets (panel (a)), book leverage (panel (b)), and profitability (panel (c)) of bond issuers by sub-region (euro area and other AEs are combined into AEs in these graphs), and for emerging markets we look at issuers of local currency bonds compared to issuers of USD denominated bonds. Each characteristic is measured using the firm financial statements for the year before bond issuance.

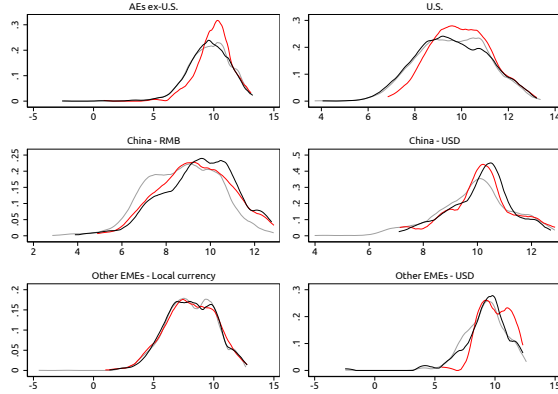
Less risky issuers should generally be larger, less leveraged and more profitable. Panel (a) of Figure 4 shows that issuers during COVID were generally larger than issuers in previous years in AEs, the U.S. and China; this is visualized as the red line (COVID) shifting to the right compared with the gray line (2015-2019); this shift is temporary as the black line

¹²We label the peak stress period as “COVID” and the post-peak stress period as “post-COVID”, acknowledging that the pandemic was ongoing but the financial market stress subsided.

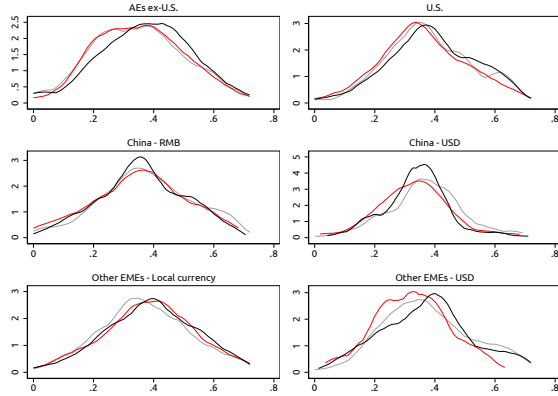
Figure 4: Distribution of firm characteristics of corporate bond issuers

Distributions of firm characteristics for firms that issued bonds between 2015-2019 (gray line), in March-June 2020 inclusive (red line), and between July 2020 and December 2021 (black line). Panel (a) shows the natural logarithm of total assets, panel (b) shows book value of debt divided by total assets, and panel (c) shows net income divided by total assets.

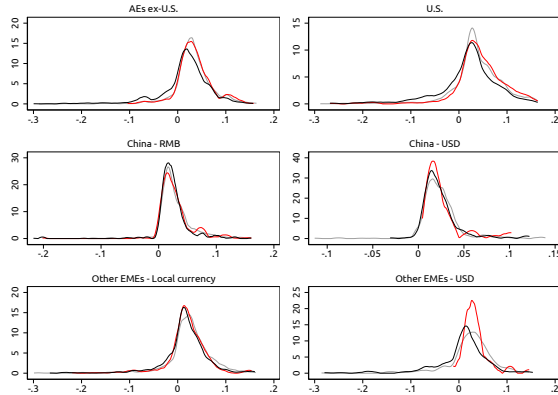
((a)) Log assets of issuers



((b)) Book leverage of issuers



((c)) Profitability of issuers



(post-COVID) is more in line with the gray line. A similar pattern is observed in USD issuance by non-China EME issuers, while the three distributions of firm size for issuers of local currency bonds in non-China EMEs almost entirely overlapping.¹³ Panel (b) shows that the distribution of book leverage for issuers is lower (i.e., shifted to the left) during COVID (red line) compared to the pre-COVID period (gray line) for the U.S. and for USD issuers in EMEs; in contrast, in AEs and local currency EME issuance, COVID firms are the same or even higher levered than the pre-COVID period. Interestingly, the distribution of firm leverage in the post-COVID period (black line) has shifted higher in several regions, including AEs and USD issuance in the non-China EMEs. Finally, panel (c) shows that the distribution of profitability of COVID issuers looks higher (i.e. shift to the right) in advanced economies and USD issuance in emerging economies compared to the pre-COVID period, while it looks the same for local currency issuers in EMs. Taken together, Figure 4 presents visual evidence that bond issuance during COVID followed different patterns in advanced versus emerging economies. In particular, issuance in AEs and USD issuance in EMEs came from less risky firms, while local currency issuance in EMEs did not come from less risky firms (as prior literature would lead us to expect).

We test the relationship formally in regression form using equation 2. In particular, for the sample of firms who issue bonds, we put as dependent variables their characteristics (size, leverage and profitability) as of the year end before issuance. We then compare the characteristics of firms that issue during periods of financial stress (as measured by the stress period dummies) relative to normal times. For the advanced economies, we look at issuance in all currencies. For China and other EMEs, we also break down the analysis into issuance in local currency bonds and USD bonds. In all specifications, we include year and 1-digit SIC code fixed effects. The results are shown in Table 5.

¹³Issuers from China, either of renminbi or USD bonds, follow a different pattern for firm size: the distributions are shifting to the right (i.e., issuing firms are getting larger) in the time series. In other words, issuers in post-COVID are larger than issuers in COVID, who are larger than issuers in pre-COVID. This is more consistent with a trend of growing firms.

Table 5: EME local currency bond issuers in COVID are not safer

These regressions examine firm characteristics of bond issuers during periods of financial stress, relative to bond issuers during normal market conditions. The regressions include a global sample of public firms in Refinitiv Worldscope who issued bonds between 2005 and 2021. The dependent variables (firm characteristics) are calculated as of the fiscal year end in the year before issuance, and include log assets (natural logarithm of the book value of assets), book leverage (book value of debt divided by book value of assets) and profitability (net income divided book value of assets). The first three panels look at advanced economies, including the euro area, other AEs and the U.S.; issuance in all currencies is included in these panels. The second three panels include issuance by Chinese firms in three sets of currencies: all currencies, Chinese renminbi only, and USD only. The final three panels include issuance by firms in other EMEs in three sets of currencies: all currencies, local currency only and USD only. The regressions include industry (one-digit SIC code), year and nation fixed effects and standard errors clustered at the industry level are shown below the coefficients; *, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

Advanced economies:			Euro area			Other AEs			U.S.		
<i>Dependent variable</i>	<i>Log assets</i>	<i>Book leverage</i>	<i>Profitability</i>	<i>Log assets</i>	<i>Book leverage</i>	<i>Profitability</i>	<i>Log assets</i>	<i>Book leverage</i>	<i>Profitability</i>		
Mean	10.24	0.36	0.03	9.47	0.37	0.03	9.36	0.38	0.04		
COVID pandemic	0.373** (0.143)	-0.0287*** (0.00697)	0.00745* (0.00369)	0.343** (0.120)	0.00669 (0.00793)	0.00851 (0.00474)	0.213* (0.0905)	-0.0299** (0.00872)	0.0132*** (0.00283)		
Taper tantrum	0.0515 (0.0306)	-0.00334 (0.00629)	0.00295 (0.00323)	0.0722 (0.0530)	0.00178 (0.00320)	0.00407** (0.00171)	-0.0604 (0.0412)	0.00326 (0.00830)	-0.00625 (0.00633)		
Global financial crisis	0.264 (0.161)	0.00657 (0.0135)	0.00768** (0.00296)	0.274* (0.137)	-0.0197*** (0.00448)	0.00692 (0.00384)	0.517*** (0.0815)	-0.0437** (0.0138)	0.0155 (0.0139)		
# of observations	4,713	4,707	4,713	8,964	8,963	8,964	10,142	10,140	10,138		
R-squared	0.356	0.178	0.150	0.181	0.295	0.109	0.139	0.054	0.086		

China:			All issuers			CNY issuers			USD issuers		
<i>Dependent variable</i>	<i>Log assets</i>	<i>Book leverage</i>	<i>Profitability</i>	<i>Log assets</i>	<i>Book leverage</i>	<i>Profitability</i>	<i>Log assets</i>	<i>Book leverage</i>	<i>Profitability</i>		
Mean	8.96	0.37	0.03	8.83	0.37	0.03	9.86	0.35	0.03		
COVID pandemic	0.133 (0.122)	-0.00678 (0.00828)	0.00349 (0.00309)	0.186 (0.136)	-0.00661 (0.00964)	0.00454 (0.00421)	0.0197 (0.171)	0.000676 (0.0139)	-0.00126 (0.00357)		
Taper tantrum	0.125 (0.107)	-0.00647 (0.0127)	0.000787 (0.00278)	0.0431 (0.150)	-0.00338 (0.0143)	-0.00265 (0.00276)	0.0867 (0.171)	-0.0202 (0.0181)	0.00948 (0.00570)		
Global financial crisis	0.965** (0.363)	0.0230 (0.0486)	0.00243 (0.0248)	0.977** (0.368)	0.0267 (0.0486)	0.00369 (0.0253)					
# of observations	6,821	6,821	6,821	5,850	5,850	5,850	1,084	1,084	1,084		
R-squared	0.214	0.130	0.068	0.209	0.128	0.056	0.199	0.198	0.251		

Other EMEs:			All issuers			Local currency issuers			USD issuers		
<i>Dependent variable</i>	<i>Log assets</i>	<i>Book leverage</i>	<i>Profitability</i>	<i>Log assets</i>	<i>Book leverage</i>	<i>Profitability</i>	<i>Log assets</i>	<i>Book leverage</i>	<i>Profitability</i>		
Mean	8.34	0.37	0.03	8.20	0.37	0.03	9.17	0.36	0.03		
COVID pandemic	-0.147 (0.0851)	-0.00295 (0.0105)	0.00307 (0.00261)	-0.123 (0.0889)	0.00249 (0.0106)	0.00158 (0.00306)	0.525*** (0.126)	-0.0671*** (0.0187)	0.0157*** (0.00306)		
Taper tantrum	0.315** (0.0993)	-0.00704 (0.00775)	0.00118 (0.00163)	0.344** (0.129)	-0.00763 (0.00897)	0.00150 (0.00194)	0.178 (0.117)	0.00374 (0.0191)	-0.00469 (0.00316)		
Global financial crisis	0.0406 (0.0941)	-0.0163 (0.0125)	0.00755 (0.00525)	0.0857 (0.0707)	-0.0199 (0.0124)	0.00831 (0.00590)	0.0777 (0.362)	-0.0284 (0.0252)	0.0352 (0.0191)		
# of observations	13,420	13,418	13,419	11,462	11,460	11,461	1,947	1,947	1,947		
R-squared	0.141	0.127	0.095	0.139	0.125	0.096	0.340	0.214	0.166		

Controls (applies to all dependent variables)									
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SIC 1 digit FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nation FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

As in the previous tables, the first line in each panel shows the sample average for the dependent variable (including only the firm-months with positive issuance). The first panel shows the results for the advanced economies. During the COVID pandemic and the global financial crisis, firms that issued bonds were generally less risky relative to bond issuers in non-stress periods: they are larger (positive coefficients on the dummies), have lower leverage (negative coefficients) and higher profitability (positive coefficients). In terms of magnitudes, during COVID for example, log assets of issuing firms were 3.6%, 3.6% and 2.3% larger in the euro area, other AEs and U.S., respectively, relative to the sample mean. Similarly, profitability of issuing firms was 23%, 25% and 36% higher. Leverage of issuing firms was 8.1% and 7.8% lower in the euro area and U.S., and insignificantly higher in other AEs.

The second panel shows the results for issuance in China, where bond issuers during COVID were larger, less levered and more profitable, although not significantly. The break down by currency shows that it is yuan issuers that follow this same pattern, while USD issuers have insignificantly higher leverage and lower profitability.

Finally, in the third panel we look at characteristics of bond issuers in other EMEs. Issuers of USD bonds are larger than issuers of local currency bonds, and they are also less levered and more profitable. During COVID, issuers of USD bonds in non-China EMEs were 5.7% larger, 19% less levered and 48% more profitable than the sample average, indicating significantly less risky bond issuers during this time period. In contrast, firms that issued local currency bonds had smaller log assets, higher book leverage, and slightly higher profitability, albeit not significant. In other words, local currency bond issuers in these markets were *not* less risky, as one would conjecture them to be during a period of market turmoil, and as we saw in other regions.

Overall, our results from this section confirm that in most regions, bond issuance during COVID was done by firms that are safer and higher quality, as would be expected during times of stress where investors become more cautious in supplying capital. The notable

exception is issuers of bonds in China and other emerging economies, especially firms in non-China EMEs that issue local currency bonds. In other words, investors did not discriminate bond issuance on firm quality in these regions.

3.3 Policy support and resilience of corporate bond market during COVID

So far we have shown that, in contrast to previous episodes of financial stress, during COVID non-financial corporate bond issuance boomed globally, and for some regions this activity continued even for riskier firms. What might have driven such resilience of primary corporate bond market? One feature that distinguishes COVID and is likely responsible for bond-market resiliency is unprecedented policy stimulus, including policy support measures specifically targeting corporate bond markets and corporate sector more generally, that central banks and governments from around the world introduced following the onset of the COVID pandemic.

Indeed, we show in figure 5 the evolution of the size of central banks' balance sheets (as a portion of GDP) from 2005 through 2021. Although the amounts of central bank assets in all regions increased during GFC and COVID, the speed and size of the increases during COVID is striking, particularly in the U.S., euro area and other EMEs. Such expansion of balance sheets likely drove long-term yields down (figure 6), leading to normalization of bond market functioning and higher demand for riskier bonds. In contrast, during the taper tantrum, central bank balance sheets around the globe, and in particular in emerging economies (bottom row), did not expand rapidly. Overall, figure 5 shows high-level evidence that monetary policy support likely helped bolster corporate bond markets globally.

Unprecedented size and scale of policy support during COVID pandemic likely contributed to a quick improvement of investor sentiment toward bonds, as well as their willingness to

Figure 5: Central bank assets as percentage of GDP

Monthly time series from 2005 to 2021 showing the size of central bank assets divided by GDP, with the ratio normalized to 1 as of January 2005. Shaded areas represent the months of the GFC, taper tantrum and COVID as per Section 2.1. Lines for euro area, other AEs and other EMs are calculated as the sum of central bank assets divided by the sum of GDP for the member countries. Source: Haver.

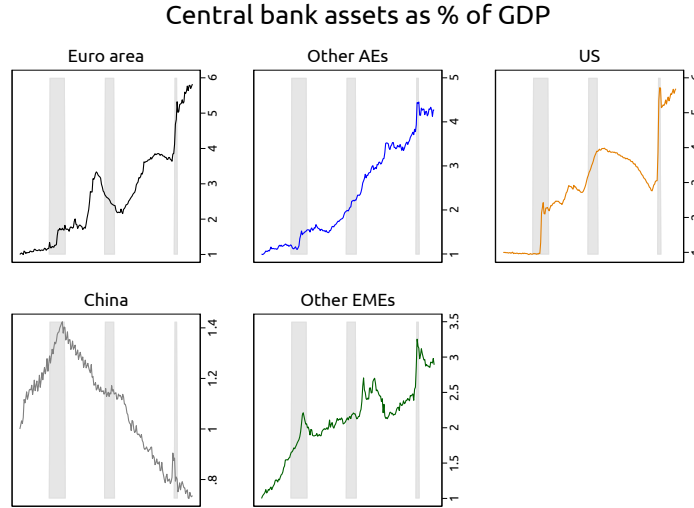


Figure 6: Yields on 10-year government bonds

Monthly time series from 2005 to 2021 showing the yields on 10-year government bonds. Shaded areas represent the months of the GFC, taper tantrum and COVID as per Section 2.1. Each time series is demeaned, and lines for euro area, other AEs and other EMs are calculated as the mean of the member countries. The euro area calculation excludes the Greece, Ireland, Italy, Portugal and Spain. Source: Haver.

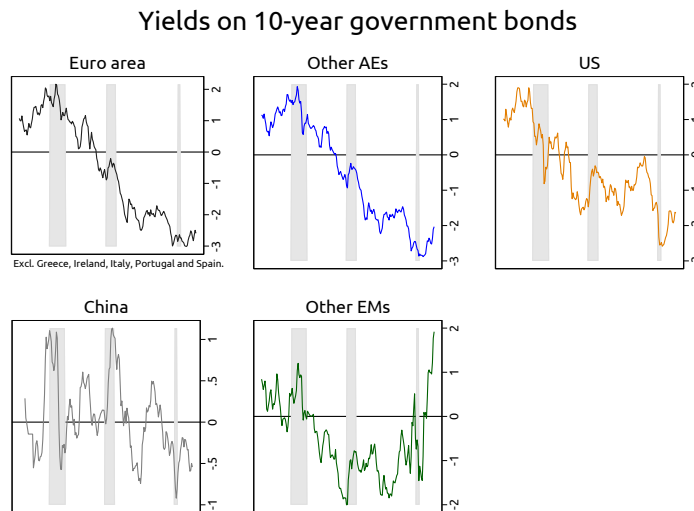
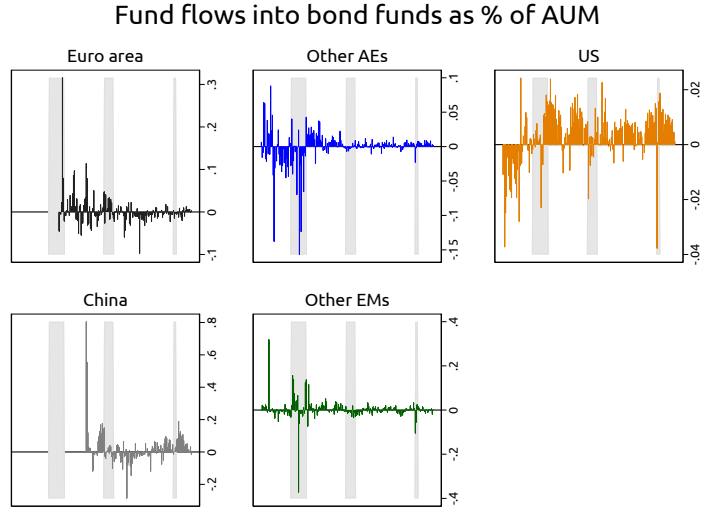


Figure 7: Fund flows into bond funds as percentage of assets under management

Monthly time series from 2005 to 2021 showing the flows into bond mutual funds, divided by the previous month’s assets under management. Shaded areas represent the months of the GFC, taper tantrum and COVID as per Section 2.1. Bars for euro area, other AEs and other EMs are calculated as the sum of fund flows divided by the sum of the assets under



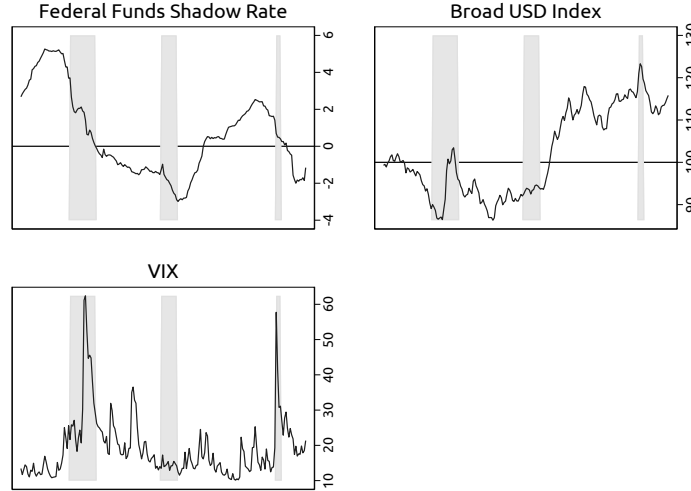
management. Source: EPFR.

supply capital more generally. In Figure 7, we examine fund flows into bond mutual funds as a percentage of assets under management (AUM). In advanced economies (top row), bond flows experienced outflows for many months during the GFC; the outflows from other AEs during the GFC is especially striking. In contrast, during COVID, although all regions experienced one or two months of large outflows (the outflows in March 2020 in the U.S. were very outsized), the sentiment quickly turned with market participants returning to investing in bonds, a pattern which held up for the post-COVID months of 2020 and 2021. The same pattern exists in emerging economies for the GFC and COVID; the taper tantrum also saw a number of consecutive months of modest outflows from bond funds. Overall, there is some evidence that investors’ capital flows were different in COVID compared to previous financial stress episodes.

In order to formally examine the relationship between policy support, as well as changes in macroeconomic environment and firm-level accounting characteristics, and corporate bond issuance patterns in stress periods and normal times, we re-run the regressions from Table

Figure 8: Other time series macroeconomic conditions

Monthly time series from 2005 to 2021 showing the Federal Funds shadow rate (as per Wu and Xia (2016)), the level of the broad dollar USD index, and the level of the VIX. Shaded areas represent the months of the GFC, taper tantrum and COVID as per Section 2.1. The lines for the USD index and VIX are calculated as monthly average of daily values. Source: Federal Reserve Bank of Atlanta and Bloomberg.



2 with firm characteristics and macroeconomic conditions as controls (some of which are shown in figure 8); the results are shown in Appendix C. Overall, the addition of controls partly explains corporate bond issuance patterns across the world, with the coefficients on the controls mostly moving in the expected direction in terms of their impact on issuance levels. Importantly, the effect of adding controls is a general dampening of the coefficient on the COVID pandemic period dummy in all regions, with the coefficient for other AEs even becoming insignificant. This is evidence that some of the patterns in the global corporate bond market that we have documented can be partially explained by firm characteristics and macroeconomic conditions in 2020.

3.4 Post-COVID outcomes

In a final analysis, we attempt to answer two questions: (1) did firms who issued during COVID take on excessive leverage? and (2) what did COVID issuers do with the funds

raised? In order to answer these questions, we examine the evolution of financial ratios between fiscal years 2015 to 2021 of firms that issued during 2020 compared to firms that did not issue in 2020 (though have issued bonds at least once during our sample period).

We address the first question about firm riskiness in Figure 9. The first set of graphs shows average book leverage for 2020 issuers (green lines) and 2020 non-issuers (orange lines). All regions show a peak of leverage in 2020 with a subsequent decline in 2021, but COVID issuers have relatively higher leverage and saw relatively slower post-peak declines in the U.S., and China and other EMEs. The second panel shows the relatively proportion of short-term debt compared to total debt, which decreased relatively more for 2020 issuers by the end of the sample for all regions, suggesting that bond issuers were able to use the bond market to lock in financing over longer horizons. The third panel shows a measure of debt-at-risk, calculated as the percentage of firms that have interest coverage ratios less than 2, where interest coverage is calculated as earnings before interest, taxes, depreciation and amortization (EBITDA) divided by interest expenses. In most regions, we do not observe strong relative differences in evolution of debt-at-risk measures between 2020 issuers and 2020 non-issuers, except for China, where 2020 non-issuers experienced a sharp decline in riskiness where as 2020 issuers did not. Overall, we provide initial evidence of potential excess risk taken on by COVID issuers in China, based on book leverage ratios and debt-at-risk measures.

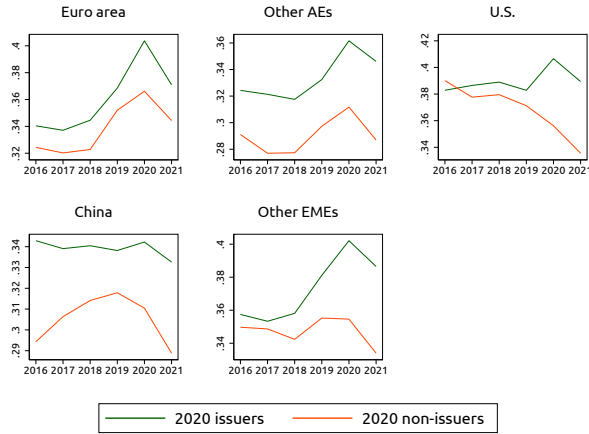
We address the second question about what firms did with funds raised in Figure 10. We consider three possibilities: building cash levels, investing in capital assets via capital expenditures, or paying out dividends to equity holders. All variables are scaled by total assets.

The first panel shows that while cash levels have increased in all regions across the sample period, issuers during 2020 did not increase more than non-issuers; in fact, in the euro area and China, these issuers appear to have accumulated less cash on their balance sheets. The

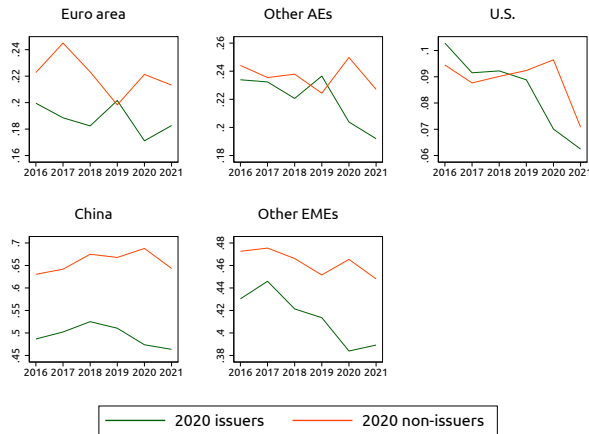
Figure 9: Measures of firm riskiness around COVID

Each graph compares the average annual ratio for firms that issued bonds in 2020 (green line) compared to the sample of firms that have ever issued bonds but did not issue in 2020 (orange line). Source: Refinitiv Worldscope.

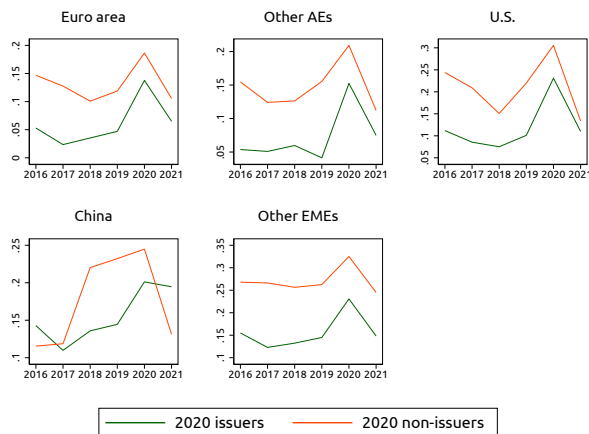
((a)) Book leverage



((b)) Short-term debt to total debt



((c)) Percent of firms with interest coverage ratio less than 2



second panel looks at capital expenditures and shows little difference between 2020 issuers and non-issuers, with perhaps the exception of U.S. (where issuers invested more in 2021 than non-issuers) and China (where issuers invested less in 2021 than non-issuers). The third panel shows similar patterns in dividend payments between issuers and non-issuers in all regions. Overall, the evolution of potential uses of proceeds do not appear visually different for firms that issued bonds during COVID compared to non-issuing peers. One possible explanation could be that firms that did not issue bonds during COVID used other sources of financing.

4 Conclusion

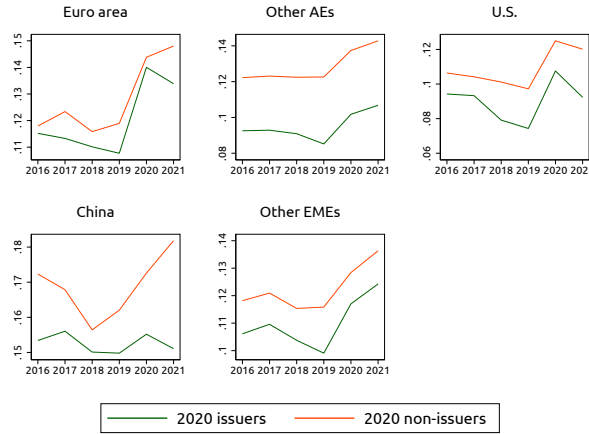
It has been widely documented in the media and in academic research that while there was a brief hiatus in primary corporate bond market activity in the first few weeks of COVID, corporate bond issuance in the U.S. subsequently surged as financing conditions improved markedly amid unprecedented monetary and fiscal support measures. Such resiliency of corporate bond markets is at odds with what one might expect based on past financial stress experience and the corresponding research. It is important to understand its causes and implications, including those that benefit the health of the economy and those that could lead to longer-term vulnerabilities. Easy access to bond markets in bad times may help firms sustain their activity, capital investment and employment, but may also facilitate weaker, riskier firms taking on additional financing pushing their solvency problems down the road and, thus, hinder creative destruction. Related economic research has mostly focused on the U.S. and, to a lesser extent, Europe. In this paper, we find that corporate bond issuance surged globally during COVID, not just in the U.S., and that this surge contrasted with issuance behavior observed during other periods of acute financial stress.

In particular, we find that during COVID firms had higher issuance propensity and issued

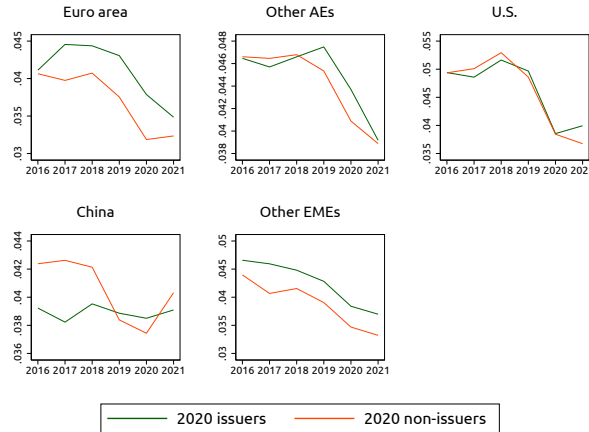
Figure 10: What did firms do with cash raised?

Each graph compares the average annual ratio for firms that issued bonds in 2020 (green line) compared to the sample of firms that have ever issued bonds but did not issue in 2020 (orange line). Source: Refinitiv Worldscope.

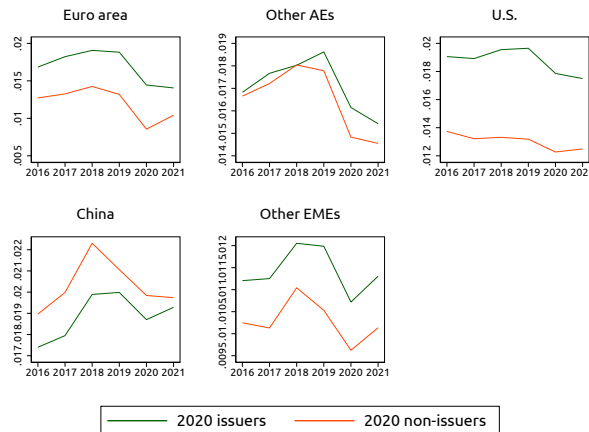
((a)) Cash as a percentage of total assets



((b)) Capital expenditures as a percentage of total assets



((c)) Dividends as a percentage of total assets



more bonds (both in terms larger number of issues and amounts issued) across the globe. Importantly from a financial stability perspective, issuers in EMEs behaved differently during the COVID compared to previous stress periods, and we do not observe a shift to larger or less risky borrowers. One possible explanation is that depressed bond yields led investors to “reach” for higher-yielding emerging-market assets making them less discerning regarding the riskiness of these assets. Another possibility is that support programs by EME central banks themselves improved financing conditions in emerging markets and corporate bond issuance more attractive.

As a result, leverage and interest coverage ratios of EME firms reached potentially concerning levels by the end of 2021. While outside of the scope of this paper, these vulnerabilities are particularly important in light of increasing inflation and monetary policy tightening experienced beginning in 2022. Any resulting economic slowdown could lower firms’ cash flows and undermine their ability to service debt, and less favorable corporate bond markets may make rolling over debt more difficult. On the other hand, firms’ hearty cash positions may allow them to weather any turbulence in the bond markets.

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Appendix A Issuance by Country

Table A1: Number of issuers and non-issuers by country

Country	Number of listed firms			Country	Number of listed firms		
	Issuers	Non-issuers	Total		Issuers	Non-issuers	Total
Argentina	23	92	115	Luxembourg	19	71	90
Australia	90	2,696	2,786	Malaysia	61	1,261	1,322
Austria	16	81	97	Mexico	64	136	200
Belgium	26	140	166	Netherlands	45	215	260
Bermuda	19	86	105	New Zealand	25	186	211
Brazil	159	400	559	Norway	54	366	420
Canada	226	4,376	4,602	Peru	14	151	165
Chile	28	222	250	Philippines	30	206	236
China	975	5,432	6,407	Poland	22	684	706
Colombia	10	76	86	Portugal	11	56	67
Denmark	15	211	226	Russian Federation	58	1,041	1,099
Finland	36	177	213	Singapore	98	796	894
France	121	946	1,067	South Africa	21	400	421
Germany	90	946	1,036	Spain	38	199	237
Greece	21	333	354	Sweden	96	928	1,024
Hong Kong	129	1,504	1,633	Switzerland	85	246	331
India	198	3,338	3,536	Taiwan	113	2,350	2,463
Indonesia	79	624	703	Thailand	154	652	806
Ireland	29	135	164	Turkey	12	389	401
Israel	10	682	692	United Kingdom	209	2,529	2,738
Italy	52	453	505	United States	1,499	10,574	12,073
Japan	409	4,589	4,998	Vietnam	17	1,180	1,197
Korea (South)	552	2,208	2,760				

Appendix B Description of Variables

Table B2: Periods of financial stress

Name	Description
COVID pandemic	A dummy that takes on a value of 1 in the months of March to June 2020, inclusive.
Taper tantrum	A dummy that takes on a value of 1 in the months of May 2013 to April 2014, inclusive.
Global financial crisis	A dummy that takes on a value of 1 in the months of December 2007 to June 2009, inclusive.

Table B3: Firm characteristics (source: Refinitiv Worldscope)

Name	Description
Log assets	Log of book value of total assets (converted to USD) at the end of the fiscal year ending in the previous calendar year.
Book leverage	Book value of total debt divided by book value of total assets, both at the end of the fiscal year ending in the previous calendar year. Winsorized at the 5% and 95% level.
Tangibility	Net property, plant and equipment divided by book value of total assets, both at the end of the fiscal year ending in the previous calendar year. Winsorized at the 5% and 95% level.
Profitability	Annual net income for the fiscal year ending in the previous calendar year, divided by the book value of total assets at the end of the fiscal year ending in the previous calendar year. Winsorized at the 5% and 95% level.

Table B4: Issuance outcomes (source: Refinitiv Workspace)

Name	Description
<i>Calculated for all firm-months (including those with zero issuance)</i>	
Issuer dummy	A dummy equal to 1 in the months that a firm issues at least one bond, and 0 otherwise.
Dollar amount issued	The total amount of issuance (converted to USD) in a given firm-month.
Number of bonds issued	The number of bonds issued in a given firm-month.
Issuer dummy USD	A dummy equal to 1 in the months that a firm issues at least one USD-denominated bond, and 0 otherwise.
Issuer dummy local currency	A dummy equal to 1 in the months that a firm issues at least one bond denominated in their home currency, and 0 otherwise.
<i>Calculated for firm-months with non-zero issuance only</i>	
Weighted average maturity	The average maturity of bonds issued by a firm in a month, weighted by the USD size of each bond.
Rated share	Proportion of bonds issued by a firm in a month that have a rating.
IG rated share	Proportion of bonds issued by a firm in a month that have an investment grade rating.

Table B5: Macroeconomic variables

Name	Description	Source
Level of 10-year yield	The monthly average 10-year yield in a firm's country of domicile.	Bloomberg
Change in USD broad dollar index	The month-over-month difference in the log of the monthly average level of the trade-weighted U.S. dollar index, multiplied by 100.	Bloomberg
Wu Xia shadow Federal Funds rate	Shadow interest rate calculated when the Federal Funds rate is at the zero lower bound Wu and Xia (2016).	Federal Reserve Bank of Atlanta
Change in VIX	The month-over-month difference in the log of the VIX index.	Bloomberg
Flow into bond funds as % of AUM	Net fund monthly flows into a country's bond mutual funds, divided by the previous month end's assets under management.	EPFR
Change in central bank assets as % of GDP	The monthly level of the level of a central bank's balance sheet, divided by monthly GDP; where monthly GDP not available, quarterly GDP is used for the three months in that quarter.	Haver

Appendix C Impact of additional controls

Table C6: Effect of firm and macroeconomic controls

This regression re-examines bond issuance outcomes for 2005 to 2021 for a global sample of public firms in Refinitiv Worldscope, adding firm characteristics and macroeconomic variables as controls. The dependent variables are *issuer_dummy* (a dummy that takes on a value of 1 if a firm issues at least one bond in a month and 0 otherwise), *dollar_amount_issued* (total face value of bonds issued in a month by a firm, including \$0), and *number_bonds_issued* (total bonds issued in a month by a firm, including no bonds). The controls include firm characteristics (log assets, book leverage, and tangibility) and macroeconomic characteristics (level of 10-year yield by country, change in central bank balance sheet as a percentage of GDP, change in USD broad index, Wu Xia shadow Federal Funds rate, the monthly change in VIX, and flows into a country's bond funds as a percentage of those funds assets under management). The regressions include firm fixed effects and Driscoll-Kraay standard errors are shown below the coefficients; *, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

<i>Dependent variable</i>	<i>Issuer dummy</i>				
COVID pandemic	0.00632*** (0.00149)	0.000541 (0.000367)	0.0121*** (0.00123)	0.00179** (0.000786)	0.00186*** (0.000526)
Taper tantrum	0.000967 (0.000706)	0.000520*** (0.000191)	0.000511 (0.000377)	-0.00367*** (0.000558)	-0.00242*** (0.000262)
Global financial crisis		-0.000436** (0.000209)	-0.00104*** (0.000270)		-0.00183*** (0.000404)
Log assets	0.000494 (0.000325)	0.000337*** (4.60e-05)	0.000437*** (7.62e-05)	0.00575*** (0.000600)	0.00208*** (0.000224)
Book leverage	-0.00146 (0.00161)	-0.000650* (0.000354)	0.000783 (0.000637)	0.00238 (0.00247)	0.00261*** (0.000831)
Tangibility	0.00168 (0.00314)	5.77e-05 (0.000325)	0.00113 (0.000699)	0.000150 (0.00321)	0.000582 (0.00108)
Level of 10-year yield	0.0428 (0.0293)	-0.0450*** (0.00956)	-0.174*** (0.0222)	-0.168*** (0.0470)	-0.0607*** (0.00864)
Chg in central bank assets as % of GDP	0.000814 (0.00285)	0.00108 (0.00153)	-0.00360 (0.00407)	-0.00278 (0.00305)	0.00237*** (0.000773)
Flow into bond funds as % of AUM	-0.00269** (0.00115)	0.000528** (0.000235)	0.0559*** (0.0104)	-0.00207*** (0.000271)	0.00585*** (0.000914)
Change in USD broad index	-0.0404** (0.0174)	-0.00623* (0.00374)	-0.0240*** (0.00715)	0.00992 (0.0124)	-0.0415*** (0.00641)
Wu Xia shadow Fed Funds rate	-0.00216 (0.0177)	0.00867** (0.00422)	0.00956 (0.00781)	0.0902*** (0.0130)	0.000282 (0.00615)
Change in VIX	0.00517 (0.00452)	-0.000751 (0.000941)	0.00115 (0.00235)	0.00714*** (0.00266)	-0.000113 (0.00152)
Controls					
Constant	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
# observations	267,075	1,600,372	1,097,000	576,258	1,209,006
R-squared	0.264	0.178	0.121	0.188	0.186

Table C6 (continued): Effect of firm and macroeconomic controls

Sample	Euro area	Other AEs	U.S.	China	Other EMEs
<i>Dependent variable</i>					
<i>Dollar amount issued</i>					
COVID pandemic	12.26*** (2.635)	1.702*** (0.600)	28.26*** (4.216)	0.845 (0.568)	-0.0661 (0.266)
Taper tantrum	3.270** (1.438)	-0.0421 (0.185)	1.358 (1.000)	-0.723 (0.712)	-0.0363 (0.223)
Global financial crisis		0.813*** (0.282)	-1.524*** (0.502)		-0.717*** (0.247)
Log assets	-0.203 (0.742)	0.244*** (0.0543)	1.036*** (0.284)	1.909*** (0.291)	0.517*** (0.0905)
Book leverage	-2.214 (2.826)	-0.352 (0.426)	4.894** (2.040)	-0.647 (0.887)	0.581 (0.379)
Tangibility	-0.238 (3.963)	-0.204 (0.323)	-2.994* (1.543)	0.517 (1.775)	0.00733 (0.414)
Level of 10-year yield	-31.73 (35.75)	-52.03*** (11.15)	-374.4*** (64.06)	-80.71*** (27.21)	-23.89*** (6.021)
Chg in central bank assets as % of GDP	-1.039 (5.675)	2.958 (2.401)	-19.22* (10.84)	-3.034 (1.896)	1.611*** (0.573)
Flow into bond funds as % of AUM	1.240 (1.919)	0.227* (0.123)	64.99*** (18.66)	-0.584*** (0.155)	0.665* (0.401)
Change in USD broad index	-0.324 (32.98)	-8.447* (4.656)	-1.858 (15.38)	-11.39 (6.940)	-13.69*** (4.275)
Wu Xia shadow Fed Funds rate	26.57 (32.40)	-7.778* (4.140)	72.25*** (12.82)	22.90*** (6.941)	-6.801** (3.400)
Change in VIX	6.582 (11.50)	0.371 (1.135)	14.06** (7.077)	3.773** (1.791)	1.644* (0.939)
Controls					
Constant	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
# observations	267,075	1,600,372	1,097,000	576,258	1,209,006
R-squared	0.139	0.249	0.085	0.189	0.135

Table C6 (continued): Effect of firm and macroeconomic controls

<i>Dependent variable</i>	<i>Number of bonds issued</i>				
COVID pandemic	0.0101*** (0.00322)	0.00188** (0.000918)	0.0287*** (0.00337)	0.00444*** (0.00152)	0.00100 (0.00124)
Taper tantrum	0.00353* (0.00186)	0.000952** (0.000385)	0.00182** (0.000721)	-0.00448*** (0.000788)	-0.00474*** (0.00104)
Global financial crisis		-7.67e-06 (0.000801)	-0.00235*** (0.000811)		-0.00270*** (0.000810)
Log assets	-0.000274 (0.00114)	0.000496*** (9.32e-05)	0.00135** (0.000569)	0.00921*** (0.00137)	0.00411*** (0.000640)
Book leverage	-0.00449 (0.00440)	-0.00253*** (0.000908)	0.00623 (0.00423)	0.000935 (0.00376)	0.00509*** (0.00195)
Tangibility	-0.00422 (0.00780)	0.000264 (0.000813)	-0.000961 (0.00254)	-0.00392 (0.00865)	0.00416 (0.00447)
Level of 10-year yield	0.0204 (0.0603)	-0.123*** (0.0262)	-0.310** (0.136)	-0.472*** (0.139)	-0.0864*** (0.0235)
Chg in central bank assets as % of GDP	0.000158 (0.00741)	0.00755* (0.00419)	-0.0222** (0.00933)	-0.00298 (0.00468)	0.00567*** (0.00143)
Flow into bond funds as % of AUM	-0.00357* (0.00209)	0.00161*** (0.000582)	0.0952*** (0.0229)	-0.00225*** (0.000426)	0.0143*** (0.00366)
Change in USD broad index	-0.0159 (0.0595)	-0.0124 (0.00963)	-0.00588 (0.0198)	0.0108 (0.0179)	-0.0737*** (0.0173)
Wu Xia shadow Fed Funds rate	0.00441 (0.0503)	0.0305** (0.0128)	0.0693*** (0.0165)	0.133*** (0.0246)	0.0279 (0.0306)
Change in VIX	0.0147 (0.0111)	-0.000211 (0.00208)	0.00710 (0.00574)	0.0167*** (0.00481)	0.00106 (0.00302)
Controls					
Constant	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
# observations	267,075	1,600,372	1,097,000	576,258	1,209,006
R-squared	0.363	0.571	0.164	0.339	0.389