Dash for Dollars☆

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Abstract

Within-firm variation of corporate bond spreads around the Covid-19 outbreak shows that US dollar-denominated bonds experienced larger increases in spreads relative to non-dollar bonds, especially at short maturities. Differently, in the non-dollar sample it was the spreads of longer maturity bonds that widened more markedly. Price pressures arising from a liquidity-driven dash for cash alone cannot rationalize these findings. Instead, the patterns we uncover suggest a 'dash for dollars', in which investors sold their dollar-denominated assets first, with a consequent impact on prices. We link these dynamics to the dominant role of the US dollar in the international financial system.

Keywords: Heterogeneity, Credit spreads, Liquidity, Dash-for-cash, US dollar, Covid-19, Event-study, Identification.

JEL Codes: E44, E58, G01, G12, G15, G18.

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1 Introduction

Corporate bond markets around the world were under severe distress during the outbreak of the Covid-19 pandemic. Corporate bond spreads widened sharply between late February, when the rate of expansion of Covid-19 accelerated worldwide, and mid-March, when the Fed announced a series of measures to ease conditions in financial markets. While the dramatic widening of credit spreads caught the attention of most commentators, another defining feature of the stress period was how highly heterogeneous the increase in spreads across bonds was.

In this paper, we exploit such heterogeneity to learn about the nature of the underlying shock hitting financial markets and its transmission mechanisms. To do that, we construct a new global data set comprising information on more than $9,000$ corporate bonds issued by almost $2,000$ non-financial corporations, covering more than 50 countries and five major international currencies. To inform our empirical estimates we exploit a unique feature of our data, namely that firms have multiple outstanding bonds with heterogeneous characteristics. By exploiting within-firm variation across bonds, we are effectively controlling for firm-level heterogeneity in analyzing spread dynamics, hence circumventing problems associated with unobserved correlations that are hard to control for—for example, if certain types of firms systematically issued bonds of particular characteristics.

We first document that short-term bonds, which are typically perceived as more liquid, experienced larger increases in spreads than long-term bonds. This feature of the data has been highlighted in recent studies that focus on the Covid-induced corporate bond market distress in the US. Haddad et al. (2020), among others, interpret this pattern as the result of selling pressures from bond investors trying to obtain cash, a so-called 'dash for cash'. In response to such shock, investors sold their assets following a pecking order of liquidity, selling their most liquid assets first in order to minimize the adverse price impact of fire-sales—a phenomenon that has been dubbed a 'reverse flight to liquidity' (Ma et al., 2020). If intermediaries do not have capacity or willingness to absorb the resulting increase in supply, such selling pressure can lead to the price dynamics observed in the data, in which more liquid securities end up displaying larger falls in prices (and, hence, increases in spreads) than less liquid ones.[1]

Our data allow us to uncover an additional empirical pattern that existing studies, which focus exclusively on the US, have overlooked. In particular, we document that bonds denominated in US dollars experienced significantly larger increases in spreads relative to bonds denominated in other currencies. As for bond maturity, the pecking order of liquidity mechanism described above offers a lens for the interpretation of this finding. A larger widening of the spread on US dollar bonds relative to non-dollar bonds could simply reflect the fact that US dollar bonds are more liquid—and hence subject to larger selling pressures. Indeed, superior liquidity of US dollar securities is tightly linked to the special role of the US dollar as an international currency, as discussed by Gourinchas et al. (2019), among others.

In this paper we argue that this interpretation, according to which investors sold relatively more liquid US dollar bonds so as to minimize the price impact of fire sales, is not the only one consistent with our results. In particular, we draw a distinction between the liquidity of dollar securities (i.e. a characteristic of the asset being sold) and investors' need to secure and hold cash dollars (i.e. a need of the agent selling the asset). Our hypothesis is that investors did not sell dollar assets because of their superior liquidity, but because of an increase in the likelihood of having to meet immediate dollar-denominated liabilities—another facet of the dollar hegemony (Gopinath and Stein, 2020).

To shed some light on the separate existence of these two channels, we investigate how the maturity and currency dimensions interact. We show that US dollar spreads widened more than non-dollar spreads, independently of the underlying maturity of the bonds considered. In addition, within the group of dollar bonds, shorter maturity spreads widened more than

[1] Kargar et al. (2020) find that at the height of the Covid-19 stress dealers were not willing to absorb inventory using their balance sheets, and indeed did not absorb any inventory at all on net as a sector.

longer maturity spreads. These findings can still be interpreted as evidence of superior liquidity of short-term bonds denominated in US dollars. However, we also uncover that in the non-dollar sample it is long maturity bonds that experience a larger increase in spreads. The reversal in the relation between maturity and bond spreads in the non-dollar sample suggests that the pecking order of liquidity mechanism is not the only one at work, as one would expect more liquid short-term bonds to be subject to a larger selling pressure (i.e. a larger increase in spreads) for each currency in isolation. This insight, together with the strongly asymmetric reaction of US dollar bonds with respect to bonds denominated in other currencies, lends support to dollar-centric hypotheses that are independent of liquidity features. In sum, our findings are consistent with the fact that investors sold their liquid assets to obtain cash. But not just any cash. The world economy witnessed a 'dash for dollars'.

Our conjecture is that the asymmetric dynamics between dollar and non-dollar bonds uncovered in this paper are ultimately related to the role of the US dollar as a 'dominant currency' in the international monetary and financial system. The hegemony of the US dollar, as documented by a growing literature, has a range of implications for both goods and assets markets.[2] There are, in particular, two dimensions of this special status that could be behind our findings. The first one is related to the use of the US dollar as a unit of account. One aspect of this property is the widespread denomination of financial and real liabilities in US dollars, which means that agents need to secure US dollars when these liabilities become due, including in stress periods (for example to meet margin calls, investor redemptions, etc). If, at the same time, the cost of hedging FX exposures is high—as it is typically the case during periods of stress, including the one induced by Covid-19, as shown

[2] Goldberg and Tille (2008) and Gopinath (2016) provide evidence on the extensive use of the dollar for trade invoicing. Ilzetzki et al. (2019) document the dominant role of the dollar as an anchor currency. It is also well known that banks and non-banks outside the US tend to borrow in US dollars (see, among many others, Shin, 2012, Brauning and Ivashina, 2020) and that international investors tend to hold US dollar assets (Maggiori et al., 2020). Gopinath and Stein (2020) show how dominance in trade invoicing and global banking can arise from complementarities between a currency's role for invoicing decisions and its role as a safe store of value.

by a sharp widening of CIP deviations—then investors would find it optimal to sell US dollar denominated assets first. The second relevant dimension is related to the use of the US dollar as a store of value. In particular, because of the tendency of the dollar to appreciate during periods of heightened risk aversion (a key feature of an international currency, as discussed in Gourinchas et al. (2017, 2019) and Maggiori (2017)), agents building precautionary cash buffers might prefer to do so in US dollars rather than in any other currency. These two forces would lead agents to sell US dollar denominated securities in order to obtain cash dollars, independently of the liquidity of the securities in question, and hence constituting an independent channel to the liquidity-based mechanism put forward by Haddad et al. (2020).

While less pervasive than today, the US dollar still played a dominant role in the international financial system during the 2008 global financial crisis (Maggiori et al., 2019). It is therefore natural to investigate whether the dash for dollars is a unique feature of the Covid-19 outbreak, or is instead common to other periods of stress in international financial markets. To do that, we re-estimate our baseline specification using data from the second half of 2008. Within-firm variation in bond spreads around the most acute phase of the global financial crisis delivers results that are consistent with our baseline findings, therefore lending support to the dash for dollars interpretation, as well as to its generality beyond the Covid-19 episode.

Finally, after dissecting corporate spread dynamics during the period of stress, in an additional exercise we also consider the sample period in which markets turned, and spreads started compressing. The generalized widening of corporate bond spreads ended on March 20th, which marks the end of our baseline sample period. On March 23rd the Federal Reserve announced that it would explicitly take on credit risk (with a Treasury backstop) by directly buying investment-grade corporate debt in primary (PMCCF programme) and secondary markets (SMCCF) for the first time since quantitative easing was introduced in 2008. In the last part of the paper we show that in the week following the PMCCF/SMCCF announcements, the market for corporate bonds turned in a way that mirrors the dash for dollars episode during the widening period. Specifically, it was spreads of US dollar denominated bonds, particularly at the short-end, that compressed the most.

Our findings speak most directly to studies analyzing the behavior of corporate bond spreads during the Covid-19 pandemic (Haddad et al., 2020, Kargar et al., 2020, Gilchrist et al., 2020, Ebsim et al., 2020).[3] In particular, Haddad et al. (2020) highlight the role of a dash for cash in explaining the dynamics of corporate bond spreads during the outbreak, in turn linking it to a reverse flight to liquidity (see also Ma et al., 2020). According to this interpretation, investors in need of cash sold their most liquid securities first to minimize the price impact in a fire-sale context, nevertheless exerting selling pressure on their prices.[4] We complement those explanations by providing evidence that investors' behavior did not constitute a dash for cash in general but a dash for US dollars in particular.

Our results, hence, constitute complementary evidence to studies analyzing US dollar shortages around the Covid-19 outbreak (see, among others, Avdjiev et al., 2020, Eren et al., 2020, Bahaj and Reis, 2020), but shifting the focus from exchange rate markets into corporate bond markets. In related work, Liao (2020) studies the link between within-firm corporate bond spread differentials across currencies and deviations from the CIP condition in FX markets. While he focuses on relative currency dynamics at the business cycle frequency, we instead point to absolute directional differences between the US dollar and other currencies during a period of stress. Additionally, Liao (2020) puts emphasis on the consequences for corporate bond issuance, while being agnostic about the origin of pricing anomalies in corporate spread and FX derivative markets. We instead analyze a period during which the market for issuance was effectively shut, and therefore naturally focus on investors' rather than issuers' behavior.

[3]A broader literature has exploited the variation in asset prices induced by the Covid-19 outbreak to learn about a variety of transmission mechanisms. See, for example, Gormsen and Koijen (2020), Ebsim et al. (2020), Jiang et al. (2021), O'Hara and Zhou (2021), and Croce et al. (2020), among others.

[4]This hypothesis has also been put forward in the case of US Treasury bonds (He et al., 2020).

2 Data & Stylized facts

In this section we first describe the details of the global corporate bond data set that we compiled for our analysis. We then report a set of stylized facts that center on the dynamics of corporate bond spreads at the time of the acceleration of the Covid-19 pandemic.

2.1 A Global Corporate Bond Data Set

We build a large global data set of individual corporate bonds at daily frequency for the January-April 2020 period. The bonds we consider are the constituents of a comprehensive global index of investment grade corporate bonds, the ICE Bank of America Merrill Lynch's Global Corporate Index. Our initial data set includes daily data for more than $14,500$ investment grade bonds of residual maturity above one year, issued by about $2,900$ companies in 60 countries. The main variable of interest for our study is a bond's Option Adjusted Spread (OAS). The OAS is defined as the number of basis points that the government spot curve is shifted in order to match the present value of discounted cash flows to the corporate bond's price.[5] The data set also contains information on other bond characteristics, such as the maturity of the bond, its currency of denomination, coupon, seniority and rating.

For the empirical analysis, we exclude bonds issued by firms in the banking and financial services industries to focus on 'real economy' firms, and focus on senior unsecured bonds. This leads to a final data set comprising $9,063$ bonds, issued by $1,845$ firms in 56 countries. Table 1 reports a breakdown of the number of available observations for bonds, firms, and countries of residency of the issuers.

The bonds considered are denominated in a range of currencies. US dollar denominated bonds dominate, comprising 67% of the sample, followed by euro (24%), sterling (5%), Canadian dollar (4%), and yen (0.2%). A unique feature of our data set is the fact that

[5] For details on the calculation of the OAS, see https://www.theice.com/market-data/indices.

Table 1 GLOBAL CORPORATE BOND DATA SET:
DESCRIPTIVE STATISTICS

	Observations	Share
Observations	9,063	
of which USD	6,036	0.67
EUR	2,152	0.24
GBP	456	0.05
CAD	401	0.04
JPY	18	0.00
Firms	1845	
of which >=2 bonds	1342	0.73
>= 2 currencies	274	0.15
Countries	56	
US	4896	0.65
EA	1763	0.24
EM	840	0.11

NOTE. USD stands for US dollar, EUR for euro, GBP for pound sterling, CAD for Canadian dollar and JPY for yen. US stands for United States, EA stands for Euro Area and EM for Emerging Markets. Sample based on the cross-section of senior unsecured bonds issued by non-financial corporates that are available from February to April 2020.

many firms have multiple outstanding bonds at any given point in time. Specifically, 72% of the firms considered have two or more outstanding bonds, and 15% have bonds in two or more currencies. The average number of outstanding bonds per firm in our sample is 5, and varies from a minimum of 1 to a maximum of 98. Finally, approximately 90% of the bonds considered are issued by advanced economy firms. Specifically, about 65% of the bonds correspond to US firms, and about 25% to EU firms.

The dominance of US dollar bonds documented above is not fully explained by the prevalence of bonds issued by US firms, and it also applies to the non-US portion of our sample. While 88.5% of bonds issued by US firms are denominated in US dollars, the dollar still dominates issuance by non-US firms, with 41% of the sample. Euro denominated bonds also make up for 41% of the non-US sample, but that is largely due to the presence of European firms. For the non-US, non-EA sample, the US dollar makes up for 58% of bonds while the euro is the currency of denomination of 16% of the sample. This US dollar 'dominance' is nothing but a reflection of its role as the leading international currency, as documented by Maggiori et al. (2020) and Gopinath and Stein (2020), among others, and it plays a central role in the interpretation of our main empirical findings. Despite the dominance of US dollar bonds, there is still enough within-firm currency variation (i.e. firms that issue bonds in a range of currencies) to allow us to estimate currency effects using within-firm information (see Section 3).

Table 2 reports the summary statistics of corporate bond characteristics. The average bond in our sample has a face value of 790 million US dollars, a time-to-maturity of slightly below 10 years, and a coupon of 3.5%. Crucially, there is heterogeneity in the maturity dimension, with the 25th percentile being 3.5 years and the 75th percentile 13.4 years.

Table 2 SUMMARY STATISTICS OF CORPORATE BOND CHARACTERISTICS

	Mean	Median	25th pctile	75th pctile
Face value (USD m.)	789	520	400	800
Time to maturity (yrs)				
Full sample	9.9	6.5	3.5	13.4
USD	11.1	7	3.5	18.4
Non-USD	7.6	5.7	3.4	9.0
Coupon (%)	3.5	3.5	2.5	4.5

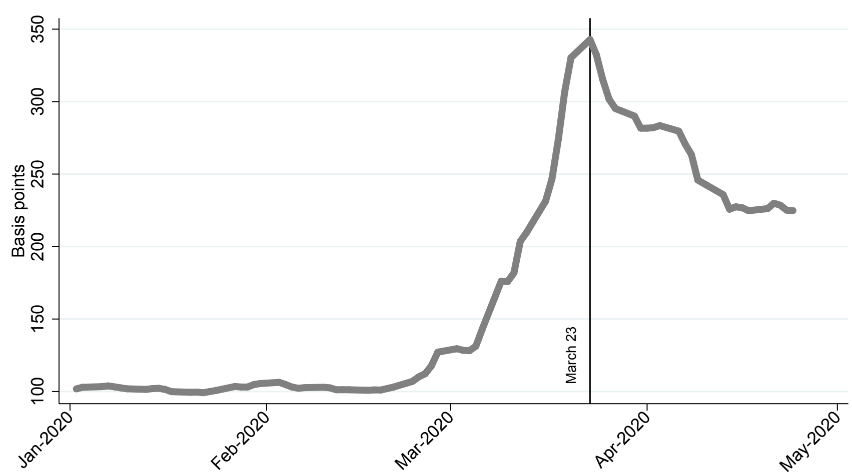
NOTE. Summary statistics for the corporate bonds in our sample. The sample consists of 9,063 bonds issued by 1,845 firms in 56 countries. Sample based on the cross-section of senior unsecured bonds issued by non-financial corporates that are available from February to April 2020.

In order to shed light on the role played by firm characteristics in explaining the heterogeneity in the reaction of corporate bond spreads to the Covid-19 shock, we also merge the bond database described above with data on issuers' balance sheets coming from Eikon. We use the latest reported data for these companies (as of March 20th) and drop firms with the latest information reported before December 2018. We obtain data for about 1,250 firms out of the $1,845$ non-financial companies identified as the issuers of the bonds in our data set.

2.2 The Heterogeneous Widening of Corporate Bond Spreads During Covid-19

In this section, we provide some stylized facts on the behavior of corporate bonds spreads during the acceleration of the Covid-19 pandemic. Corporate bond spreads widened sharply between late February, when the rate of expansion of Covid-19 accelerated worldwide, and mid-March, when the Fed announced a series of measures to ease conditions in financial markets. The corporate bond spread of the ICE Bank of America Merrill Lynch's Global Corporate Index increased threefold, from roughly 100 basis points at the end of February to a peak of more than 300 basis on March 23rd, as shown in Figure 1.

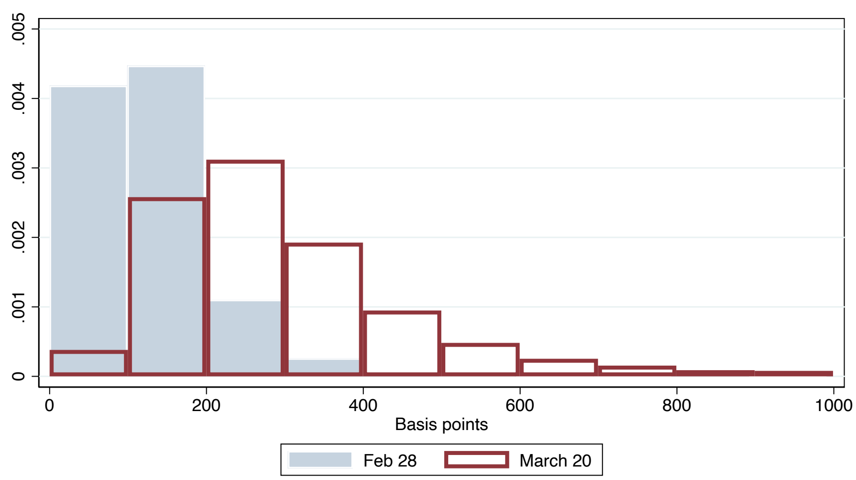
Figure 1 Corporate bond spreads widening during Covid-19



Note. Time series evolution of the ICE Bank of America Merrill Lynch's Global Corporate Index. The index is constructed as an average of individual bonds' option-adjusted spreads weighted by market capitalization. March 23rd corresponds to the Fed announcement of its corporate bond purchase program. Sample period: January to April 2020. Source: ICE Bank of America Merrill Lynch.

While the dramatic widening of credit spreads caught the attention of most commentators, another defining feature of the stress period was that the increase in spreads was highly heterogeneous across bonds. Using the bond-level data for the constituents of the ICE Global Corporate Index described in the previous section, Figure 2 reports the distribution of bond spreads on February 28th and on March 20th, i.e. before the Covid-19 acceleration and on the last trading day before targeted Fed action on the market. Not only the average of the distribution rose sharply, but also its dispersion increased markedly, as shown by the additional mass on the right tail of the distribution.[6]

Figure 2 Corporate bond spreads during Covid-19: Heterogeneity



Note. Empirical distribution of individual bonds option-adjusted spreads on February 28 (light blue bars) and on March 20 (transparent red bars) based on the constituents of the ICE Global Corporate Index. The chart truncates the distributions at 1,000 basis points, as there are only marginal differences between the alternative chart using all data. Source: ICE Bank of America Merrill Lynch.

What bond characteristics are associated with such heterogeneity? A first look at the data shows that the increase in spreads between February 28th and March 20th was more marked for short-maturity bonds. Panel (A) of Figure 3 shows that the spread of bonds with residual maturity below two years increased, on average, by about 70 basis more than the spread of bonds with residual maturity of more than two years. This feature of the data is

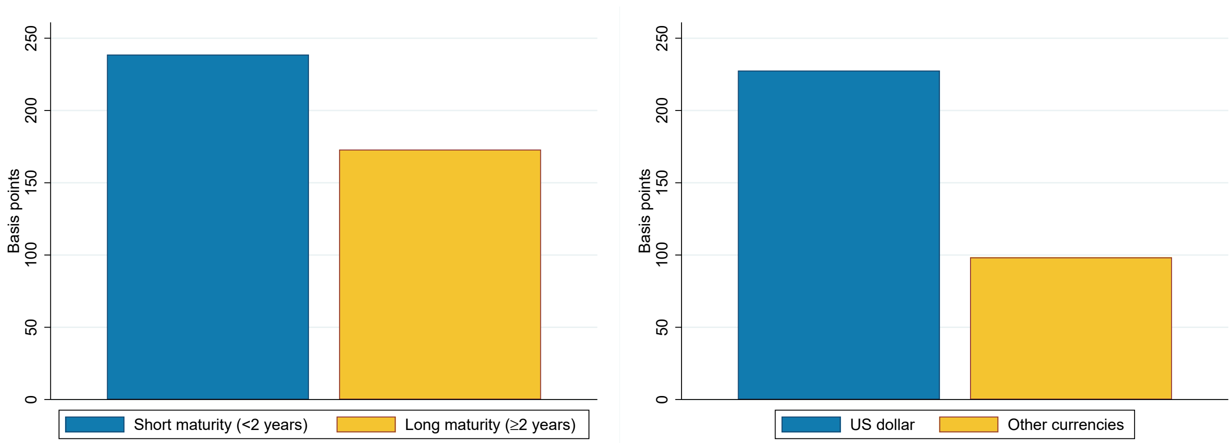
[6]The countercyclicality of the dispersion of bonds spreads is not unique to the Covid-19 episode, but rather a regular feature of the data. For example, Figure A.1 in the Appendix shows that both the mean and the variance of credit spreads increased around the peak of the global financial crisis.

in line with the findings from recent studies, which focus on the US corporate bond market during the distress period of March 2020 (see, among others, Haddad et al., 2020).

But there is a second dimension that previous studies, which exclusively focus on the US, have overlooked. Specifically, Panel B of Figure 3 shows that the average spread increase for bonds denominated US dollars is significantly higher than the spread increase of bonds denominated in other currencies.[7] The spread on dollar bonds widened, on average, by almost 250 basis points, an increase that is more than twice as large as the increase of the spread on non-dollar bonds.

Figure 3 HETEROGENEITY IN SPREAD WIDENING: THE ROLE OF MATURITY AND CURRENCY OF DENOMINATION

(A) Heterogeneity by maturity (B) Heterogeneity by currency



NOTE. Panel (A) displays the average increase of corporate bond spreads between February 28th and March 20th for bonds with remaining maturity below and above two years. Panel (B) report the average change in corporate bond spreads over the same period but split by currency. 'Other' (non-US dollar) currencies include euro, pound sterling, Canadian dollar, and yen. Source: ICE Bank of America Merrill Lynch.

Of course, the simple unconditional sample averages in Figure 3 are only illustrative. They could be driven by a variety of mechanisms and fully consistent with alternative hypotheses. To sharpen the identification of the role of bond characteristics in explaining the heterogeneity in spread dynamics, in the next section we exploit a unique feature of our data.

[7] The pattern is common across currencies when considered in isolation. See Figure A.2 in the Appendix.

The fact that firms have multiple outstanding bonds with heterogeneous characteristics at any given point in time allows us to exploit within-firm variation to inform our empirical estimates. The design of our exercise means that we are effectively controlling for firm-level heterogeneity in analyzing spread dynamics, hence circumventing problems associated with unobserved correlations that are hard to control for—for example, if certain types of firms systematically issued bonds of particular characteristics.

3 The Dash for Dollars

In this Section we analyze the role of bond maturity and currency of denomination in explaining the heterogeneous response of corporate bond spreads to the initial phases of the Covid-19 pandemic outbreak. We then use the insights from this analysis to shed light on the nature of the underlying shock hitting markets and its transmission mechanisms.

3.1 Baseline Results

The presence of multiple bonds per firm allows us to estimate the following bond-level regression:

$$\Delta s_{b,i} = \alpha + \delta_i + \beta_1 Matu_{b,i} + \beta_2 USD_{b,i} + \Gamma X_{b,i} + \varepsilon_{b,i} \tag{1}$$

In equation (1), $\Delta s_{b,i}$ is the change between February 28th and March 20th in the (option-adjusted) spread of bond b issued by firm i. $Matu_{b,i}$ is the remaining time to maturity of the bond, and $USD_{b,i}$ is a dummy variable that identifies US dollar-denominated bonds.[8] $X_{b,i}$ stands for a set of additional control variables, including bonds' face value and a dummy

[8] A more detailed specification which considers the full set of currency dummies (excluding the US dollar to avoid multi-collinearity) leads to homogeneous coefficients across non-dollar currencies, suggesting that a parsimonious specification with a single US dollar dummy is able to capture the basic dynamics of interest. See the robustness exercises at the end of this Section for more details.

variable that controls for bonds' coupon type. Crucially, δ_i is a firm fixed effect, i.e. a dummy variable that controls for unobserved time-invariant heterogeneity at the firm level. The static nature of these fixed effects is not a problem in our setting given our focus on differences between two points in time only (i.e. a difference-in-difference strategy). The end-February starting date is an admittedly arbitrary starting point which aims to capture the end of relatively tranquil market conditions, and the end-point of March 20th corresponds to the last trading day before Fed's announcement of its corporate bond purchase programs.[9]

It follows that, in equation (1), the β coefficients are largely estimated using data *within* firms, i.e. exploiting variation across bonds issued by the same firm. This constitutes one of the main advantages of our approach and data, and plays an important role in the interpretation of our results. Exploiting variation within firms, the β coefficients in our bond level regression are estimated keeping the fundamentals of the firm fixed.[10] This means that the different response of spreads by, say, maturity cannot be attributed to a systematic relation between maturity and firms' characteristics (which would arise, for example, if low-risk firms would systematically issue longer maturity bonds than high-risk firms). The same logic applies to the currency of denomination of the bonds.

The results from the within-firm specification described above are reported in Table 3. Columns (1) and (2) report the effect of maturity and currency of denomination, respectively, on bond spreads. Results in column (3) consider these two dimensions jointly. The coefficient estimates show that short-term bonds and US dollar denominated bonds are both associated with a larger increase in corporate bond spreads, in line with the unconditional evidence reported in Figure 3.

What does the empirical evidence around these two dimensions of heterogeneity tell us

[9]Results are robust to alternative ending dates for our exercise. See the robustness exercises at the end of this Section for more details.

[10]For example, Gilchrist and Zakrajsek (2012) regress credit spreads on a measure of distance to default computed using Merton's model. Our approach would absorb the change in the default probability of a firm without taking a particular stance on the right measure of default probability to use. We discuss these issues in more detail in Section 4.

Table 3 CORPORATE BOND SPREADS WIDENING:
THE ROLE OF MATURITY AND CURRENCY OF DENOMINATION

	(1)	(2)	(3)	(4)
Maturity (β_1)	-3.07***		-3.55***	0.28*
	(0.23)		(0.24)	(0.15)
USD (β_2)		111.58***	124.54***	163.11***
		(6.86)	(6.85)	(8.07)
USD x Maturity (β_3)				-4.64***
				(0.27)
Constant	174.95***	100.61***	113.95***	102.10***
	(6.27)	(4.82)	(4.97)	(4.96)
Observations	8,809	8,809	8,809	8,809
R-squared	0.09	0.12	0.23	0.26
Number of firms	1,814	1,814	1,814	1,814

NOTE. Columns (1) to (3) report results from specification (1), namely $\Delta s_{b,i} = \alpha + \delta_i + \beta_1 Matu_{b,i} + \beta_2 USD_{b,i} + \Gamma X_{b,i} + \varepsilon_{b,i}$. Column (4) reports results from specification (2), namely $\Delta s_{b,i} = \alpha + \delta_i + \beta_1 Matu_{b,i} + \beta_2 USD_{b,i} + \beta_3 Matu_{b,i} \times USD_{b,i} + \Gamma X_{b,i} + \varepsilon_{b,i}$. Robust standard errors are reported in parentheses. Credit spread changes between 20th March and 28th February 2020 (dependent variable) are trimmed at the 1st and 99th percentiles. Coefficients corresponding to coupon type dummies and bond face value not reported.

about the nature of the shock and its transmission mechanism? In a tail event such as the one induced by the Covid-19 shock, investors require cash to meet margin calls, redemptions, and other immediate obligations (either as a realization or in expectation), thus generating a dash for cash. One interpretation that is consistent with our empirical findings (put forward, among others, by Haddad et al., 2020) is that bond holders in need of cash started by selling their most liquid assets in order to minimize the adverse price impact of fire-sales, generating a pecking order of liquidity. In these circumstances, the sell-off can be so extreme as to lead the price of liquid assets to fall by more than that of illiquid assets.[11] This is the interpretation espoused by most of the recent literature in regard to the Covid-19 episode to rationalize the finding that short-term bonds experienced larger increases in spreads than

[11] The selling pressure itself is not enough to generate the observed price dynamics. The second necessary condition is arbitrageurs such as dealers not stepping in to close price distortions with respect to fundamentals and across markets, be it for regulatory or cost reasons. See Haddad et al. (2020) for a more detailed discussion.

long-term bonds, even within the investment grade class, as seen in column (1) of Table 3.

The same interpretation can be applied to our results on the currency dimension of corporate bonds (in columns (2) and (3) of Table 3), as long as investors perceive US dollar bonds as more liquid than non-dollar bonds—a reasonable assumption given the dollar's special standing in the international financial system.[12] As discussed, among others, by Gourinchas et al. (2019), the widespread use of the US dollar is in part a consequence of its liquidity, i.e. the fact that large transactions can be conducted without an outsize impact on prices.

A liquidity-based interpretation, however, is not the only possible reading of our results. A complementary hypothesis is that investors did not sell dollar assets because of their superior liquidity, but because of an increase in the likelihood of having to meet dollar-denominated liabilities. In other words, we highlight a distinction between the liquidity of dollar securities (i.e. a characteristic of the asset being sold) and investors' need to secure and hold cash dollars (i.e. a need of the agent selling the asset). As we discuss below, there are reasons for why agents might want to secure cash dollars specifically which are ultimately linked to the dollar's role as an international unit of account and store of value—another facet of the dollar hegemony (Gopinath and Stein, 2020).

An additional exercise can help us shed some light on the separate existence of these two channels, namely a general dash for cash leading to a pecking order of liquidity versus a more specific dash for dollars. In particular, we ask whether the maturity and currency dimensions uncovered in columns (1) to (3) in Table 3 are related or independent. We tackle this question by incorporating an interaction term between the maturity of the bond and the US dollar dummy variable in our baseline specification:

$$\Delta s_{b,i} = \alpha + \delta_i + \beta_1 Matu_{b,i} + \beta_2 USD_{b,i} + \beta_3 Matu_{b,i} \times USD_{b,i} + \Gamma X_{b,i} + \varepsilon_{b,i}. \quad (2)$$

[12] Eichengreen and Xia (2019) document that the dollar serves as the undisputed vehicle currency for international debt issuance, cross border loans, FX turnover or reserve accumulation.

The coefficient estimates from this specification, reported in column (4) of Table 3, show that there is indeed an interaction between these two dimensions of heterogeneity. We highlight three results. First, US dollar spreads increase by more than the spreads of bonds denominated in other currencies, independently of their maturity, as shown by the positive sign of the coefficient on the dollar dummy (β_2). Second, within the group of dollar bonds, shorter maturity bonds are associated with a larger increase in spreads, as indicated by the strongly negative coefficient on the interaction term (β_3). These findings are consistent with the pecking order of liquidity interpretation of previous studies, as argued above. However, third and finally, it is longer maturity bonds that experience larger increases in spreads in the non-dollar sample, as shown by the positive sign of the coefficient on maturity (β_1).[13] The reversal in the relation between maturity and bond spread increases in the non-dollar sample suggests that the pecking order of liquidity mechanism is not the only one at work, as one would expect more liquid short-term bonds to be subject to a larger selling pressure (i.e. a larger increase in spreads) for each currency in isolation. This feature, together with the strongly asymmetric behavior of US dollar bonds vis-à-vis bonds denominated in other currencies, lends support to the dash for dollars hypothesis.

What could be the driving force behind the dash for dollars? Our conjecture is that the different dynamics between dollar and non-dollar bonds uncovered in Table 3 are ultimately related to the role of the US dollar as a dominant currency in the international monetary and financial system.[14] There are two prominent features of the dollar hegemony that could be related to our findings. First, the US dollar is the most widespread currency for international security issuance and cross-border banking, as well as portfolio holdings of international investors. Dollar dominance therefore implies that, globally, a larger share of balance sheets

[13]Note than the sharper increase in longer maturity non-dollar bond spreads is statistically significant to even higher confidence levels in the currency-by-currency specification reported in Table B.1 in Appendix B.

[14]A growing literature has documented the hegemony of the US dollar for both goods and assets markets. Goldberg and Tille (2008) and Gopinath (2016) provide evidence on the extensive use of the dollar for trade invoicing. Ilzetzki et al. (2019) document the dominant role of the dollar as an anchor currency. It is also well known that banks and non-banks outside the US tend to borrow in US dollars (see, among many others, Shin, 2012, Brauning and Ivashina, 2020) and to invest in US dollar assets (Maggiori et al., 2020).

is denominated in US dollars than in any other (non-domestic) currency. This, in turn, means that agents may face more obligations to be met in US dollars than in other foreign currencies. If these obligations have to be suddenly met (or, equally, if the probability of having to meet these obligations in the near future increases), a demand for cash dollars would arise. Of course, investors could also obtain US dollar 'synthetically' by selling non-dollar assets and hedging the resulting exchange rate risk in FX markets. Historical evidence shows, however, that the cost of this operation—as captured by deviations in the Covered Interest Parity (CIP) condition—tends to increase during periods of stress, and the Covid-19 episode was not an exception.[15] Our hypothesis is therefore that investors did not only require cash in general but US dollar cash in particular, and that they were forced to sell US dollar assets to secure it.

Another defining feature of a dominant currency is its perceived safety, which is derived from the fact that it offers a natural hedge in times of crisis. If agents in need of precautionary cash have the choice of securing cash in dollars or in other currencies, they could choose to do so in dollars for two reasons. First, the US dollar tends to appreciate in crisis times (i.e. it is a so-called safe haven currency). Second, agents in need of non-dollar cash can exploit CIP deviations in their favor, as it is relatively cheap to obtain non-dollar cash by converting dollars in FX derivative markets. These two reasons reinforce the precautionary motive for holding US dollar cash.[16]

In sum, the Covid-19 episode was characterized by a dash for cash. But not any sort of cash. Our results suggest that investors sold their US dollar assets for reasons that go beyond their superior liquidity in their drive to obtain cash, and are instead related to the

[15] Avdjiev et al. (2020), Eren et al. (2020), Bahaj et al. (2020) among others provide extensive evidence on the widening of CIP deviations during the Covid-19 episode. See Figure C.1 in Appendix C.

[16] Selling pressure affecting US dollar bonds could also have originated in investors revising down their expectations for the future path of the US dollar after its sharp appreciation in March 2020. However, it is hard to think that in a context of heightened market tensions and high levels of risk aversion investors would have chosen an asset class with such high transaction costs and low liquidity as corporate bonds to execute trades reflecting this view. Additionally, paths implied by FX forwards, despite being an imperfect measure of expectations, point to *improved* prospects for the US dollar during our window (see Figure C.2 in Appendix C).

need of obtaining cash dollars. We conjecture that the choice to sell US dollar assets is explained by the need to sell assets that match the currency of denomination of obligations to be met, particularly when the cost of hedging FX risk is high, and/or to build cash buffers in a currency that provides a good hedge against tail risk.

3.2 Robustness

We consider here a set of additional empirical exercises showing the robustness of our main results. Specifically, we consider alternative versions of our baseline specifications (1) and (2) where we (i) include currency-specific dummies (instead of a single dollar dummy) and (ii) consider different ending dates for our sample period.

When we consider the full set of currency dummies (excluding the US dollar to avoid multicollinearity) instead of a single US dollar dummy we find relatively homogeneous coefficients across non-dollar currencies, in terms of both the currency dummies in isolation (i.e. the coefficient β_2) and the interaction with the maturity of the bonds in consideration (i.e. the coefficient β_3). Table B.1 in Appendix B reports these additional results, which support the more parsimonious specification with a single dollar dummy chosen for our baseline results.

Our baseline specification is estimated on an admittedly arbitrary sample, starting on February 28 and ending on March 20th. The last day of our sample denotes the peak value of the ICE Global Corporate Index and also corresponds to the last trading day before the Fed's announcement of its corporate bond purchase programs, therefore constituting a natural end point for our analysis. Although not directly targeted to the corporate bond market, the Fed did take some actions before March 20th by changing the terms of its existing swap lines agreements. We therefore consider alternative specifications where we vary the end dates of our window of study. If we consider changes in spreads up to the trading days before the Fed's first swap line announcement (March 13th) and second swap line announcement

(March 18th), we find that results are unchanged in terms of sign and statistical significance (even though slightly smaller in magnitude). See Table B.2 in Appendix B.

4 Identification Challenges

The main advantage of our data set is the fact that companies have a large number of bonds outstanding across the maturity spectrum, and issued in a range of currencies. As discussed above, this means we can identify the effect of bond characteristics (including maturity and currency of issuance) in explaining the heterogeneity in spread dynamics using within-firm information—that is, keeping firms' characteristics fixed.

The way to implement this within-firm identification in our panel data set is by using firm fixed effects—i.e. dummy variables that absorb all observed and unobserved time-invariant heterogeneity at the firm level. The static nature of these fixed effects is not a problem in our setting given our focus on differences between two points in time only (a difference-in-difference strategy). While simple and powerful, this approach is not without its limitations.

First, firm fixed effects do not ensure that identification comes exclusively from within-firm information. The fixed effects absorb the average spread variation for each firm, but the remaining across-firms heterogeneity is still used to obtain the coefficient estimates. Second, the fixed effects control for the *average* effect at the firm level. If there is an omitted variable that has heterogeneous effects across some relevant bond characteristic, then the fixed effects cannot effectively (and fully) control for it. In our setup, this would be the case if there were a term-structure to default risk. For example, if Covid-19 increased the probability of short-term default more than long-term default, we should observe a relatively larger spread increase for short-maturity bonds—and, thus, a flattening of the corporate bond yield curve as the one uncovered in Section 3. Despite the effect of default probability being firm-specific, its term dimension renders the firm fixed effect a fallible tool to account for it. Third, our sample includes bonds issued by firms headquartered in many countries around the world. As regulation and balance sheet practices of these firms may be heterogeneous, there is a risk that we are uncovering dynamics that are not truly global in nature but specific to a particular geography.

In this section, we conduct a number of exercises that allow us to unpack the role of firm-fixed effects, as well as to rule out the possibility that any of the issues laid above affect our results.

4.1 Within-firm Identification

In order to increase the relative importance of within-firm information in the identification of the effect of bond maturity and currency of denomination on spread dynamics we proceed in two ways. First, we repeat the estimation of equation (1) but limit the sample to the firms that have bonds outstanding in at least two currencies ('multi-currency' firms). Second, we take the within-firm argument to the limit and estimate our preferred specification on a firm-by-firm basis, in a purely cross-sectional fashion across its outstanding bonds. This second exercise is made possible by the fact that some firms in our sample have a large number of outstanding bonds (e.g. our sample contains data on 92 different bonds issued by AT&T).

Table 4 reports the coefficient estimates based on our multi-currency firms sample (column 1) and on a selected set of individual firms ranked by the number of their bonds outstanding, while still meeting the multi-currency requirement (columns 2-6). The results are in line with our baseline specification. Specifically, we find that, first, US dollar bonds with short maturities experience the sharpest increase in spreads, as shown by the negative estimate of β_3. Second, the negative relation between spreads and maturity does not hold for bonds denominated in other currencies: the coefficients on maturity, β_1, are positive across all specifications, although some of them are not statistically significant. Note that insignificance of the β_1 coefficients (relative to a positive and significant β_1 in our baseline) is

Table 4 MULTI-CURRENCY FIRMS AND FIRM-LEVEL REGRESSIONS

	(1) Multi-curr.	(2) AT&T	(3) VZ	(4) AAPL	(5) VOD	(6) EDF
Maturity (β_1)	0.15	1.87***	2.52***	2.12***	1.06***	0.06
	(0.17)	(0.29)	(0.68)	(0.70)	(0.35)	(0.07)
USD (β_2)	150.49***	339.11***	263.82***	115.66***	280.47***	90.57***
	(8.88)	(19.12)	(37.81)	(12.78)	(39.59)	(11.55)
USD x Maturity (β_3)	-3.74***	-10.84***	-9.74***	-3.65***	-6.17**	-1.48***
	(0.36)	(1.07)	(1.65)	(0.73)	(2.28)	(0.22)
Constant	103.11***	84.56***	81.53***	59.87***	79.44***	117.73***
	(5.04)	(9.15)	(12.37)	(10.62)	(20.74)	(9.04)
Observations	3,337	92	55	48	36	32
R-squared	0.38	0.79	0.68	0.62	0.75	0.79
Firm FE	Yes	No	No	No	No	No

NOTE. Results from specification (2), without firm fixed effects for firm-level regressions in columns (2)-(6). *Multi-curr* denotes a sample of multi-currency firms; *AT&T* is AT&T, *VZ* is Verizon, *AAPL* is Apple, *VOD* is Vodafone, and *EDF* is Électricité de France. Robust standard errors are reported in parentheses. Credit spread changes between 20th March and 28th February 2020 (dependent variable) are trimmed at the 1st and 99th percentiles. Coefficients corresponding to coupon type dummies and bond face value not reported.

not a problem for our interpretation. According to the pecking order of liquidity mechanism, one would expect more liquid short-term bonds to be subject to a larger increase in spreads for each currency in isolation—that is, one would expect both β_1 and β_3 to be significantly negative. Third, and finally, the coefficient on the dollar dummy in isolation, β_2, is positive and strongly statistically significant across all specifications.

4.2 Term-structure of Default Risk

Because of its transitory nature, the Covid-19 shock may have increased the probability of short-term default by more than long-term default. As firm fixed effects can only control for average firm characteristics, they would fail to account for this term-structure dimension of default risk. For our purposes, this is particularly concerning because a flattening of the default risk curve would lead to a flattening of the credit spreads curve as the one we document above, therefore leading to a competing explanation for our empirical findings.

In order to rule out the possibility that a change in the term structure of default probability (which is not common across bonds of a given firm) drives our results, we proceed in a number of ways. First, we note that the relative increase in short-term bond spreads only happens for US dollar bonds (as already pointed out in the previous Section, and highlighted by the results in column (4) of Table 3). This asymmetric behavior is hard to reconcile with the logic laid above: if Covid-19 increased firms' short-term default probability more than long-term default probability, it should have done so for both the US dollar and non-US dollar bonds of a given firm.

Table 5 High rating sample & Term-structure of debt

	(1)	(2)	(3)
Sample:	Top IG	Full	Full
Maturity (β_1)	0.29*	-3.71***	-3.56***
	(0.16)	(0.28)	(0.28)
USD (β_2)	145.32***	125.37***	125.47***
	(9.01)	(7.76)	(7.76)
USD x Maturity (β_3)	-3.67***		
	(0.32)		
ShortLong x Maturity (β_4)			-1.04
			(0.88)
Constant	71.42***	121.39***	120.65***
	(5.68))	(5.52)	(5.61)
Observations	3,494	6,289	6,289
R-squared	0.28	0.24	0.24
Number of firms	632	1,039	1,039

Note. Robust standard errors are reported in parentheses. Credit spread changes between 20th March and 28th February 2020 (dependent variable) are trimmed at the 1st and 99th percentiles. Coefficients corresponding to coupon type dummies, bond face value, and firm debt ratio in isolation (*ShortLong*) not reported.

Second, we repeat the estimation of equation (1) in a sample of bonds limited to those rated A3 or above, i.e. at the top of the investment grade spectrum.[17] Although short-term default probability could still increase at the margin, one would expect it to play a small role in the case of these bonds. Column (1) of Table 5 reports the results from this exercise, which are in line with our baseline findings. Dollar bonds at the safest end of the credit spectrum still display a larger increase in spreads, the more so the shorter their maturity. For non-dollar bonds, however, it is long-maturity bonds that experience the largest increases in spreads, as shown by the positive and significant coefficient on maturity (β_1).

Finally, and addressing the issue most directly, we feed in firms' balance sheet information to our baseline sample to try and directly control for the term-structure of default risk. Specifically, we consider an interaction term between bond maturity and the ratio of a firm's short-to-long term debt ($ShortLong_i$) in a new specification:

$$\Delta s_{b,i} = \alpha + \delta_i + \beta_1 Matu_{b,i} + \beta_2 USD_{b,i} + \beta_4 Matu_{b,i} \times ShortLong_i + \Gamma X_{b,i} + \varepsilon_{b,i}, \qquad (3)$$

where $X_{b,i}$ includes the previous set of control variables (including bonds' face value and a dummy variable that controls for bonds' coupon type).[18] If short-term default probabilities were to be behind the increase in short-term spreads, we would expect this effect to be stronger for firms with a larger share of short-term debt, i.e. we would expect a positive and significant β_4 coefficient. The results from specification (3) are reported in column (3) of Table 5. As the balance sheet data needed is not available for all firms in our baseline sample, in column (2) we also report the results from a simple specification where we consider only maturity and currency of denomination in isolation (as in column (3) of Table 3), but restricted to this subset of firms. The results in Table 5 show that the increase in spreads is

[17] A similar approach is used in Kozlowski (2021), who exploits variation across highly rated firms to abstract from default considerations.

[18] Short-term debt is defined as the sum of short-term bank borrowings, notes bearable and other interest bearing liabilities with maturities below one year, and the current portion of long-term debt or capitalized lease obligations that is due to expire within one year. Long-term debt is defined as the sum of interest-bearing debt with maturities beyond one year and the portion of capitalized lease obligations that are due beyond one year. The source for these data is Eikon.

not more marked for firms with larger ratios of short-term to long-term debt—thus suggesting that an increase in short-term default probability is unlikely to be the driving force behind our baseline results.

4.3 Geographical Heterogeneity

One potential concern about our baseline results in Table 3 is that they might not be truly global in nature, but instead a reflection of particular dynamics prevalent in a given geography. This could arise, for example, due to heterogeneity in norms and regulation or balance sheet practices across different jurisdictions. To address this concern, and in order to assess the robustness of our baseline results, we repeat the estimation of specification (2) splitting the sample into country groups.

Table 6 GEOGRAPHICAL SPLITS

Sample:	(1) US	(2) Non-US	(3) AEs	(4) AEs ex-US	(5) EU
Maturity (β_1)	0.33	0.30*	0.37***	0.41***	0.66**
	(0.43)	(0.16)	(0.13)	(0.14)	(0.29)
USD (β_2)	178.93***	139.82***	168.17***	147.56***	132.65***
	(10.47)	(11.60)	(8.12)	(13.15)	(16.11)
USD x Maturity (β_3)	-4.91***	-3.94***	-4.80***	-4.13***	-3.95***
	(0.48)	(0.48)	(0.29)	(0.58)	(0.89)
Constant	122.37***	87.87***	104.08***	89.35***	88.41***
	(12.32)	(5.28)	(4.73)	(4.88)	(4.47)
Observations	4,725	4,073	7,995	3,270	1,733
R-squared	0.27	0.26	0.27	0.28	0.30
Number of firms	720	1,090	1,460	744	341

NOTE. Results from specification (2). Robust standard errors are reported in parentheses. Credit spread changes between 20th March and 28th February 2020 (dependent variable) are trimmed at the 1st and 99th percentiles. Coefficients corresponding to coupon type dummies and bond face value not reported.

Table 6 reports the results from this exercise. It shows that our benchmark results hold for samples of (i) advanced economies, (ii) US, (iii) non-US, (iv) advanced economies ex-US and (v) European Union headquartered firms. That is, the US dollar as a currency of denomination is a central variable for understanding the dynamics of corporate bonds issued by companies both inside and outside the United States.

5 Dynamics During the Global Financial Crisis

The fact that corporate bond spreads displayed dynamics consistent with a dash for dollars during the acceleration of the Covid-19 pandemic leads to the natural question of whether this phenomenon is common to other crisis episodes. In this section, we explore the behavior of corporate bond spreads in the second half of 2008, at the height of the Global Financial Crisis (GFC), to assess whether the patterns uncovered in Section 3 also hold in that period.

In particular, we estimate specification (2) on a sample of corporate bonds comprising the same index used in our baseline results (i.e. investment grade bonds comprising the ICE Bank of America Merril Lynch's Global Corporate Index).[19] We consider the change in spreads between June 16 (a local minimum for the Global Corporate Index, which precedes the sharpest acceleration on record) and December 8th (the all-time peak of the index). This period therefore covers the filing for bankruptcy of Lehman Brothers in September 2008, a usual reference point for analyzing GFC-related dynamics.

Results, reported in Table 7, show that it was indeed US dollar denominated bonds, particularly those of shorter maturities, that displayed the largest widening in spreads during the height of the GFC, as it was the case during the Covid-19 market turmoil. Differently from the Covid-19 episode, results do not point to a stronger widening in spreads at longer maturities for non-US dollar bonds, at least in a statistically significant way. Importantly, however, they do not point to a sharper widening for shorter maturities either, as it is instead the case for US dollar bonds. In terms of magnitudes, the coefficients are similar in size to

[19]Naturally, the overlap between the GFC and the Covid-19 samples is only partial due to the issuance of new bonds and the maturing of existing bonds. Despite the difference in the constituents, we note that the characteristics of the bonds considered for the exercise in this Section are very similar to our baseline as reported in Section 2. See Tables A.1 and A.2 in Appendix A.

those reported in Table 3, but are smaller in relative terms given the sharper increase in overall spreads in 2008: the intercept for the GFC exercise is more than twice as large as the Covid-19 one. Also, the combination of currency of denomination and maturity explains a smaller share of the overall variation in spreads in the GFC period compared to the Covid-19 one: the R^2 of our preferred specification, reported in column (4) in both tables, is 19% for GFC and 26% for Covid-19.

Table 7 Corporate bond spreads widening during the GFC

	(1)	(2)	(3)	(4)
Maturity (β_1)	-2.89***		-3.17***	0.39
	(0.38)		(0.39)	(0.58)
USD (β_2)		141.60***	149.28***	190.40***
		(19.81)	(19.82)	(23.57)
USD x Maturity (β_3)				-4.37***
				(0.80)
Constant	358.51***	239.38***	268.85***	236.53***
	(4.31)	(12.32)	(11.97)	(14.30)
Observations	3,658	3,658	3,658	3,658
R-squared	0.06	0.11	0.17	0.19
Number of firms	847	847	847	847

Note. Columns (1) to (3) report results from specification (1), namely $\Delta s_{b,i} = \alpha + \delta_i + \beta_1 Matu_{b,i} + \beta_2 USD_{b,i} + \Gamma X_{b,i} + \varepsilon_{b,i}$. Column (4) reports results from specification (2), namely $\Delta s_{b,i} = \alpha + \delta_i + \beta_1 Matu_{b,i} + \beta_2 USD_{b,i} + \beta_3 Matu_{b,i} \times USD_{b,i} + \Gamma X_{b,i} + \varepsilon_{b,i}$. Robust standard errors are reported in parentheses. Credit spread changes between 8th December and 16th June 2008 (dependent variable) are trimmed at the 1st and 99th percentiles. Coefficients corresponding to coupon type dummies and bond face value not reported.

These results reinforce our interpretation that, during periods of stress, investors try to secure US dollars in particular, rather than cash in general. As discussed in Section 3, we link this interpretation to the role of the US dollar as a dominant global currency—and, in particular, to its role as an international medium of exchange and unit of account. Moreover, the stronger effects seen during the Covid-19 pandemic compared to the GFC in 2008 (in terms of relative magnitude and share of variance explained) could be taken as reflecting the increasing dominance of the US dollar, as documented by (see Maggiori et al., 2020).

6 The Way Down

On March 23rd the Federal Reserve announced that it would explicitly take on credit risk (with a Treasury backstop) by directly buying investment-grade corporate debt in primary (PMCCF programme) and secondary markets (SMCCF) for the first time since QE was introduced in 2008.[20] This measure, the first one directly targeting the asset class analyzed in our study, can be associated with the end of the aggregate corporate spreads widening documented in panel A of Figure 1. In this section, we analyze the dynamics of spreads in the subsequent compression phase.

We follow an approach that mirrors the one employed in previous sections. Specifically, we estimate bond-level regressions matching those in Section 3 for the period following the PMCCF/SMCCF policy announcement date. While it is tempting to interpret this analysis as an event study around the policy announcement, a word of caution is needed. In particular, the combination of the relative illiquidity in corporate bond markets (which requires using wide time windows to let prices incorporate new information) and the proximity in time of a large number of actions by the Federal Reserve warns against such interpretation.[21] Nevertheless, the regression analysis conducted here is still useful for understanding which bond characteristics were associated with a particularly sharp compression in spreads in the period following Federal Reserve actions in response to Covid-19 related market disruptions.

Table 8 reports the results, following the same structure as in Table 3. We run our baseline specification by focusing on the change in spreads in the first five trading days after the PMCCF/SMCCF announcement.[22] The length of the window for our exercise is similar to past studies analyzing corporate spread dynamics. For example, Gertler and

[20]The March 23rd Fed announcement is available at this link `https://www.federalreserve.gov/newsevents/pressreleases/monetary20200323b.htm`. On April 9th, the scale of this program was increased, and eligibility was widened so as to include high-yield bonds, provided they were investment-grade as of March 22nd (the so-called 'fallen angels'), see `https://www.federalreserve.gov/newsevents/pressreleases/monetary20200409a.htm`.

[21]The Federal Reserve announced new measures in every trading day (but one) in the period from March 15th to March 23rd. See Table 2 in Haddad et al. (2020) for a comprehensive list.

[22]Results are robust to using a 10-day window instead. See Table B.3 in Appendix B.

Table 8 The Way Down:
The role of maturity and currency of denomination

	(1)	(2)	(3)	(4)
Maturity	0.18		0.42**	-0.37***
	(0.17)		(0.18)	(0.13)
USD		-59.58***	-61.10***	-69.00***
		(6.98)	(7.24)	(8.16)
USD x Maturity				0.95***
				(0.23)
Constant	-5.70*	25.79***	24.22***	26.65***
	(3.11)	(4.99)	(4.91)	(5.00)
Observations	8,809	8,809	8,809	8,809
R-squared	0.00	0.05	0.05	0.05
Number of firms	1,814	1,814	1,814	1,814

Note. Columns (1) to (3) report results from specification (1), namely $\Delta s_{b,i} = \alpha + \delta_i + \beta_1 Matu_{b,i} + \beta_2 USD_{b,i} + \Gamma X_{b,i} + \varepsilon_{b,i}$. Column (4) reports results from specification (2), namely $\Delta s_{b,i} = \alpha + \delta_i + \beta_1 Matu_{b,i} + \beta_2 USD_{b,i} + \beta_3 Matu_{b,i} \times USD_{b,i} + \Gamma X_{b,i} + \varepsilon_{b,i}$. Robust standard errors are reported in parentheses. Credit spread changes between 30th March and 23rd March 2020 (dependent variable) are trimmed at the 1st and 99th percentiles. Coefficients corresponding to coupon type dummies and bond face value not reported.

Karadi (2015) consider a 10-day window in an event study similar in spirit to ours. Gilchrist et al. (2020), who present results based on 1-day, 5-day and 10-day windows, find that longer windows tend to deliver more stable and statistically significant results.[23]

Columns (1) to (3) consider the role of maturity and currency of denomination when introduced one at the time and then jointly, in line with the specification in equation (1). The results show that US dollar-denominated bonds experienced a larger fall in spreads than bonds denominated in other currencies, as shown by the (strongly significant) negative coefficient on $USD_{b,i}$; and that short-maturity bond spreads compressed the most in the period under consideration, as shown by the positive coefficient on $Matu_{b,i}$. Column (4) displays the results of our preferred specification (displayed in equation 2). In a way that mirrors our results in the widening period, we find that it is US dollar dollar bonds that displayed

[23]The wider window used in high-frequency analysis of corporate bonds (relative to Treasuries and/or equities) is motivated by the lower liquidity of the underlying assets, which might mean it takes longer for prices to incorporate news.

the sharpest compression in spreads, particularly at the short-end of the curve. In contrast, it is longer maturity spreads that compressed more markedly for non-US dollar bonds, once more mirroring the dynamics observed in the widening phase. Overall, there was a reversion of the uncovered dash for dollars dynamics in the days following the PMCCF/SMCCF announcement.

Can the timing and characteristics of spreads compression be informative about the mechanisms at play? In principle, Fed actions might have eased the dash for dollars through two complementary channels. First, the direct provision of US dollars to foreign central banks via swap lines might have eased access to US dollars for non-US financial institutions.[24] Second, any type of Fed action resulting in looser monetary and financial conditions might have also led to the easing of intermediaries' balance sheet constraints via a reduction in risk perceptions and an increase in prices across asset classes. With increased balance sheet capacity, financial intermediaries might have exploited the arbitrage opportunity provided by CIP deviations, putting pressure towards closing them.[25] This, in turn, could have led to a reduction in the cost of accessing US dollars synthetically, therefore reducing the need to fire-sell US dollar securities.

The unconditional properties of the data data suggest that the spread dynamics uncovered in the widening period did not revert following the first Fed announcements—i.e. those covering 'standard' easing policies by the way of Fed Funds rate cuts and traditional Quantitative Easing (i.e. the purchase of Treasuries and MBS), as well as cheaper and more extensive swap lines. Indeed, credit spreads kept on increasing until March 23 (see Figure 1), with US dollar bonds displaying the largest increases. A conditional analysis based on our preferred specification (2) shows that dash for dollars dynamics intensified rather than abate in the days following those announcements (see Table B.3 in Appendix B). This, together

[24]The Federal Reserve announced an improvement in the terms of its swap lines with the central banks on its standing network on March 15th, an expansion of the network on March 19th, and an increase in the frequency of operations for the original set of counterparties on March 20th.

[25]This mechanism has been highlighted, among others, by Du et al. (2018)

with results in Table 8, lends some weight to the hypothesis that it was the direct purchase of corporate bonds by the Fed that led to a reversion of the dash for dollars dynamics documented in the widening period.

A series of studies, complementary to ours, focus more narrowly on the effect of Fed action (PMCCF/SMCCF announcements in particular) but do not explore the role of underlying bond characteristics beyond those warranting inclusion in the purchase programs. Specifically, Haddad et al. (2020) find that investment grade bonds of maturities of five years and less (i.e. those targeted by the Fed) experienced particularly large gains on the day of the PMCCF/SMCCF announcement. Closer in spirit to ours, Gilchrist et al. (2020) use firm fixed effects and a longer time window to find that bonds included in Fed programs experienced more marked increases in prices than excluded bonds of the same firm. However, neither of these studies explores the currency dimension of the bond dynamics resulting from Fed action.

In sum, results in this section are insightful even without narrowly identifying the effect of a particular Fed program. They show that in the week following the announcement of PMCCF/SMCCF, when the market for corporate bonds 'turned', it was spreads of US dollar denominated bonds, particularly at the short-end, that compressed the most, even once one accounts for unobserved firm heterogeneity. This conforms to a reversion of the dynamics observed during the dash for dollars episode uncovered in Section 3.

7 Conclusion

During the first phase of the Covid-19 pandemic, global corporate bond markets were under severe distress, with credit spreads of companies around the globe spiking to historically elevated levels. One defining feature of this corporate bond spread widening was its heterogeneity across firms and bonds. This paper exploits a specific aspect of such heterogeneity, namely within-company variation in bond spread dynamics, to shed light on the nature of the shock hitting financial markets and its transmission mechanisms.

We show that the widening in corporate bond spreads during the initial phases of the acceleration in the Covid-19 outbreak was more marked for bonds denominated in US dollars, particularly at shorter-maturities, even when controlling for observed and unobserved firm-level characteristics. In contrast, it was spreads of longer maturity bonds that widened more for non-dollar bonds. Our findings are consistent with price pressures from investors selling US-dollar denominated securities in order to secure cash dollars. We interpret this dash for dollars as driven by the dollar's status of dominant currency in international financial and trade systems.

Our findings and methodology speak to a recent literature showing that US Treasury bonds carry a higher convenience yield relative to sovereign bonds of other countries—and thus highlighting the 'specialness' of US government-issued securities in global financial markets (Du et al., 2017, Jiang et al., 2018, Engel and Wu, 2018). Understanding the interaction between such specialness and the role of the US dollar as a dominant currency in the international monetary and financial system is an interesting avenue for future research.

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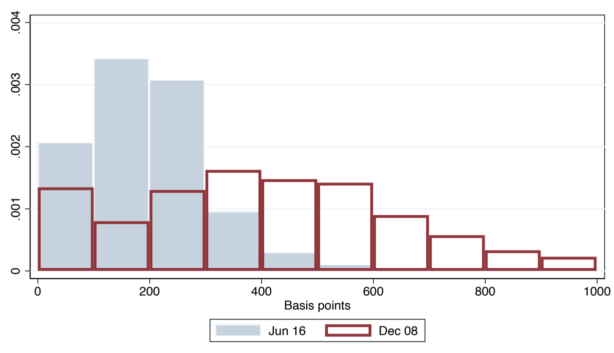
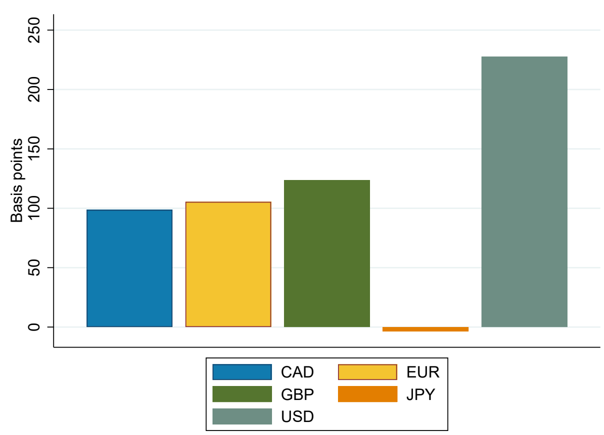
A Appendix: Additional descriptive statistics

Figure A.1 Distribution of spreads before and after GFC



Note. Empirical distribution of individual bonds option-adjusted spreads on June 16, 2008 (light blue bars) and on December 8, 2008 (transparent red bars) based on the constituents of the ICE Global Corporate Index. The chart truncates the distributions at 1,000 basis points, as there are only marginal differences between the alternative chart using all data. Source: ICE Bank of America Merrill Lynch.

Figure A.2 Average spread increase by currency



Note. Average increase of corporate bond spreads between February 28th and March 20th for bonds denominated in different currencies. Source: ICE Bank of America Merrill Lynch.

Table A.1 GLOBAL CORPORATE BOND DATA SET DURING GFC: DESCRIPTIVE STATISTICS

Observations	4068	
of which USD	2467	0.61
EUR	619	0.15
GBP	287	0.07
CAD	350	0.09
JPY	345	0.08
Firms	895	0.08
of which >=2 bonds	666	0.74
>= 2 currencies	159	0.18
Countries	44	
US bonds	2049	0.72
EA bonds	641	0.23
EM bonds	144	0.05

NOTE. USD stands for US dollar, EUR for euro, GBP for pound sterling, CAD for Canadian dollar and JPY for yen. US stands for United States, EA stands for Euro Area and EM for Emerging Markets. Sample based on the cross-section of senior unsecured bonds issued by non-financial corporates that are available from June to December 2008.

Table A.2 SUMMARY STATISTICS OF CORPORATE BOND CHARACTERISTICS DURING GFC

	Mean	Median	25th pctile	75th pctile
Face value (USD m.)	3000	500	300	800
Time to maturity (yrs)				
Full sample	10.5	7.0	4.1	12.0
USD	11.7	8.0	4.6	18.3
Non-USD	8.7	5.9	3.5	10.0

NOTE. Summary statistics for the corporate bonds in our sample. The sample consists of 4,068 bonds issued by 895 firms in 44 countries. Sample based on the cross-section of senior unsecured bonds issued by non-financial corporates that are available from June to December 2008.

B Appendix: Additional results

Table B.1 SPREAD WIDENING, CURRENCY DETAIL

	(1)	(2)	(3)	(4)
Maturity	-3.07***		-3.61***	-4.37***
	(0.23)		(0.24)	(0.25)
CAD		-106.57***	-115.32***	-170.83***
		(17.82)	(18.79)	(18.49)
EUR		-115.97***	-131.70***	-166.89***
		(7.13)	(7.22)	(8.43)
GBP		-85.99***	-88.28***	-129.35***
		(8.25)	(8.10)	(9.73)
JPY		-320.69***	-365.10***	-436.61***
		(76.07)	(76.93)	(142.94)
CAD x Maturity				4.63***
				(0.34)
EUR x Maturity				4.84***
				(0.33)
GBP x Maturity				3.85***
				(0.29)
JPY x Maturity				4.98
				(5.73)
Constant	174.95***	210.59***	238.05***	263.03***
	(6.27)	(4.27)	(5.00)	(5.61)
Observations	8,809	8,809	8,809	8,809
R-squared	0.09	0.12	0.24	0.27
Number of firms	1,814	1,814	1,814	1,814

NOTE. Results from specifications (1) and (2). USD stands for US dollar, EUR for euro, GBP for pound sterling, CAD for Canadian dollar and JPY for yen. Robust standard errors are reported in parentheses. Credit spread changes between 20th March and 28th February 2020 (dependent variable) are trimmed at the 1st and 99th percentiles. Coefficients corresponding to coupon type dummies and bond face value not reported.

Table B.2 Spread widening, alternative timing

	(1)	(2)	(3)
Sample end-point	13-Mar	18-Mar	20-Mar
Maturity	0.43***	0.61***	0.28*
	(0.10)	(0.15)	(0.15)
USD	44.73***	83.64***	163.11***
	(3.32)	(5.69)	(8.07)
USD x Maturity	-1.45***	-3.22***	-4.64***
	(0.14)	(0.22)	(0.27)
Constant	52.13***	88.93***	102.10***
	(2.00)	(3.59)	(4.96)
Observations	8,809	8,809	8,809
R-squared	0.10	0.16	0.26
Number of firms	1,814	1,814	1,814

Note. Results from specification (2) with alternative end-points. Robust standard errors are reported in parentheses. Credit spread changes between the different end-point (indicated in the table) and 28th February 2020 (dependent variable) are trimmed at the 1st and 99th percentiles. Coefficients corresponding to coupon type dummies and bond face value not reported.

Table B.3 The Way Down, robustness

	(1)	(2)	(3)	(4)
Maturity	-1.05***	0.12*	-0.33***	-0.16
	(0.13)	(0.07)	(0.11)	(0.11)
USD	-101.58***	21.61***	79.47***	118.38***
	(8.34)	(2.88)	(5.12)	(6.59)
USD x Maturity	2.52***	-0.89***	-1.42***	-3.18***
	(0.26)	(0.11)	(0.18)	(0.23)
Constant	39.33***	-0.89***	-1.42***	-3.18***
	(5.13)	(0.11)	(0.18)	(0.23)
Event (window)	SMCCF (10d)	FF-QE-CBSL1 (2d)	CBSL2 (2d)	FF-QE-CBSL1 (5d)
Observations	8,809	8,809	8,809	8,809
R-squared	0.09	0.04	0.11	0.19
Number of firms	1,814	1,814	1,814	1,814

Note. Results from specification (2), namely $\Delta s_{b,i} = \alpha + \delta_i + \beta_1 Matu_{b,i} + \beta_2 USD_{b,i} + \beta_3 Matu_{b,i} \times USD_{b,i} + \Gamma X_{b,i} + \varepsilon_{b,i}$. SMCCF stands for the announcement of the programme on March 23rd (AM, so we use close Friday 20th as starting point), FF-QE-CBSL1 for announcements of a cut in Fed Funds rate, a fresh round of QE and a cut in rate at which swap lines could be accessed (on Sunday March 15th, so we use close Friday 13th as starting point) and CBSL2 for the second Fed swap line announcement (an extension of the network on March 19th AM, so we use close March 18th as starting point). Robust standard errors are reported in parentheses. Credit spread changes (dependent variable) trimmed at the 1st and 99th percentiles. Coefficients corresponding to coupon type dummies and bond face value not reported.

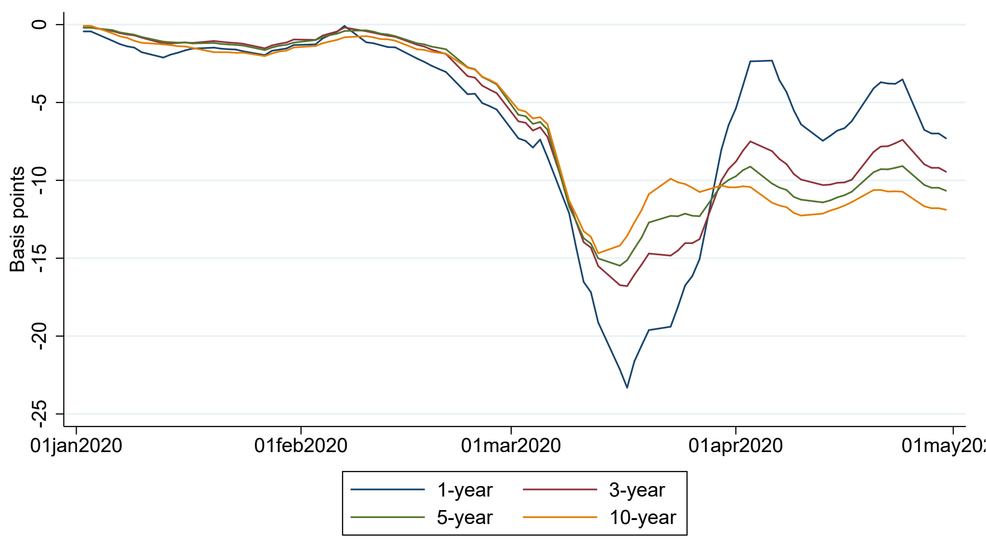
C Appendix: Exchange Rate Dynamics

C.1 CIP deviations

To provide further evidence supporting the dash for dollars hypothesis, in this section we report some facts on CIP deviations. CIP deviations measure the relative cost of obtaining US dollars 'synthetically', i.e. the difference between the dollar interest rate in the cash market and the implied dollar interest rate in the foreign exchange swap market. A negative CIP deviation means that borrowing dollars through FX swaps is more expensive than borrowing in the dollar money market.

The interpretation of our results through the lens of a dash for dollars hypothesis is consistent with dynamics in FX derivative markets. Figure C.1 shows that in the sample period under consideration there was a sharp increase in the relative cost of accessing US dollars 'synthetically' (i.e. via the use of FX derivatives), which has been interpreted as a sign of US dollar shortages (see Avdjiev et al., 2020, Eren et al., 2020, Bahaj and Reis, 2020).

Figure C.1 CIP Deviations by Maturity

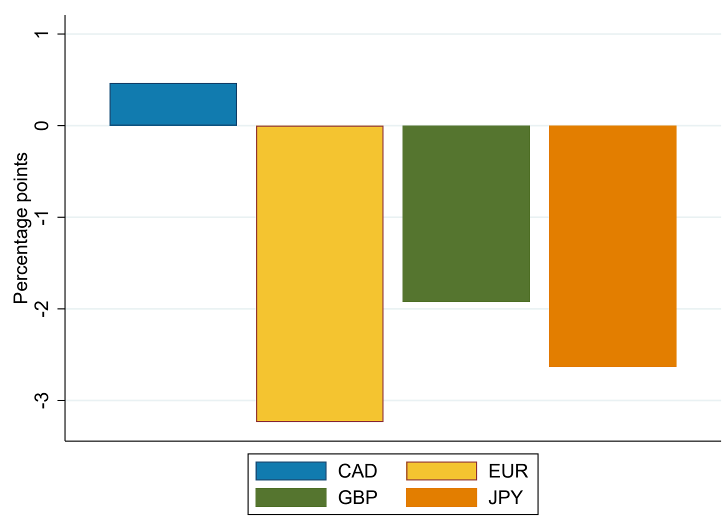


Note. Cumulative average Libor-based cross-currency bases between US dollar and euro, pound sterling, Canadian dollar and Japanese yen. Each line plots cumulative CIP deviations at a different maturity, namely 1-year, 3-year, 5-year, and 10-year. Centered 5-day moving average. Sample period: January to April 2020. Source: Bloomberg.

C.2 Exchange rate paths

In Figure C.2 we report the changes in the forward discount of the US dollar against the rest of the currencies in our sample between February 28th and March 20th (the window of study of our baseline regression). The forward discount is defined as the difference between the exchange rate implied by the price of an FX forward and the spot exchange rate. We report this measure for 5-year forwards in order to broadly match the median maturity of the bonds in our sample, but the picture looks very similar for alternative maturities. The bars measure the change between end-February and March 20th in the path implied by the difference between the spot exchange rate and the price of the 5-year forward exchange rate.[26] Exchange rates are defined as units of currency per US dollars. Thus, negative bars signal a worsening for the path of a currency vis-a-vis the US dollar between February 28th and March 20th. While it is not possible to get a direct read on expectations from these paths given the prominence of FX risk premia, the figure shows that the implied paths for the US dollar improved against the euro, pound sterling and yen over this period, and worsened only marginally against the Canadian dollar. Therefore, selling pressure arising from revised FX expectations are unlikely to constitute an alternative hypothesis to our baseline explanation centered on the special role of the US dollar.

Figure C.2 Changes in FX forward-implied paths against the US dollar



Note. Change between February 28th and March 20th of the difference between the spot exchange rate and the price of a 5-year forward, across a range of US dollar bilaterals. Negative values signal worsening implied paths for the currencies analysed against the US dollar. Source: Bloomberg.

[26] We report *changes* in the path so as to match the focus of our regressions on changes in bond spreads.