Bond Portfolio Rebalancing and the COVID-19 Outbreak*

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Abstract

Using a granular dataset of bond funds' portfolio holdings at the security level for the US and the Euro area during the onset of the COVID-19 epidemic, we study the effects of economic shutdowns on the portfolios of non-banking financial intermediaries (NBFIs). We find that during portfolio reallocation, funds are mindful of the balance of risks as these are reflected by credit ratings. We also provide evidence that the documented elsewhere dash-for-cash was not confined to AAA-rated bonds, but rather it also affected bond holdings belonging in the investment-grade category. Finally, our findings suggest that funds holding proportionately more highly-rated bonds did not sell as aggressively across lower credit ratings as did other funds, while they also managed to moderate the adverse effect of the COVID-19 shock on their portfolio returns.

Keywords: non-banking financial intermediaries, credit ratings, portfolio allocations
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1 Introduction

This paper examines two seemingly opposite forces that affect bond portfolio rebalancing during times of crisis. On one hand, during instances of economic turmoil bond funds can easily unload highly-rated bonds with minimal price impact to satisfy liquidity needs (dash-for-cash) due to investors and fund shareholders liquidating their positions (e.g., Vissing-Jorgenssen (2021)). On the other hand, funds are constrained by their investment mandates to hold portfolios with a specific risk profile as indicated by the composition of bonds across credit ratings (Baghai et al. (2024)). To study the effects of these two motives on fund performance and portfolio composition, we focus on the onset of COVID-19, given that this crisis originated from a purely exogenous unanticipated shock, and examine the behavior of non-bank financial intermediaries (NBFIs) because of their increasing importance in bond markets.

Specifically, since the 2007-2008 financial crisis, the significance of non-bank financial intermediaries (NBFIs), in the global economy has increased. According to data from the Financial Stability Board (FSB), financial assets held by non-banks, involved in credit intermediation, have more than doubled, in the period following the GFC, standing at 63 trillion USD, in 2022 and from 28 trillion USD, in 2009 (see Figure A.1 in the Internet Appendix). In GDP-related terms, in 2022 the financial assets held by non-banks represented 74% of the GDP from the 29 jurisdictions monitored by FSB, up from 67% in 2009. According to FSB, the NBFI sector is very broad and consists of five economic functions. Entities, such as investment funds, which belong to economic function 1, have experienced much faster growth, as their financial assets almost tripled in the period of 2009-2022.[1]

The expansion of NFBIs' financial assets and banks' tightening of credit criteria have strengthened the role of markets in financing the economy. This is evident in Figure A.3 of the Internet Appendix and supported by the body of existing literature, e.g., Altavilla et al. (2019). As a result, the growth in assets held by non-banks, in the period of 2009-2022, has been about 39% higher than that held by banks'.[2] This, also, implies that market-based funding (e.g., in the form of bond issuances) and, thus, non-banks are becoming increasingly necessary for economic sector actors like firms. Due to their procyclical nature and vulnerability to runs (see, for example, Raddatz &

[1] Following the classification put forth by the FSB, NBFIs may be classified into 5 categories, termed as "economic functions." Economic function 1 is defined as "collective investment vehicles susceptible to runs" and includes entities such as money market funds, fixed-income funds and mixed funds. Economic function 2 is defined as "loan provision based on short-term funding" and includes entities such as finance, leasing, and factoring companies, Economic function 3 relates to "intermediation in market activities" (e.g., broker-dealers), Economic function 4 is defined as "facilitation of credit creation" and Economic function 5 relates to "securitization-based credit intermediation". Figure A.2 of the Internet Appendix shows the composition of NBFIs.

[2] In the finance literature, bank-based and market-based financing of the economy are frequently categorized separately. However, this does not suggest that one is more efficient than the other; moreover, Acharya et al. (2024) argue that banks and non-banks should be seen as intertwined, rather than separated.

Schmukler (2012)) certain forms of NBFIs, such as investment funds, gained greater attention from policy makers as their influence in the economy grew (Goldstein et al. (2017)).

The broader goal of this study is to investigate how NBFIs react, in terms of portfolio rebalancing, vis-á-vis an unforeseen shock and balance the dash-for-cash effect, i.e., unloading of highly-rated securities to satisfy liquidity needs, with their investment mandates. This research agenda provides valuable insights on the stability of the NBFI-based financial system during times of turmoil. To this end, we build a dataset that combines accounting information for fund holdings with security-level data such as credit ratings and other characteristics of the securities held by these funds.

Using this dataset, we infer the factors that determine the portfolio allocation process of bond funds during the period around the COVID-19 shock. Our dataset covers bond fund holdings at the security-level of six trillion US dollars, which represents about one-third of the market for US and Euroarea (EA) bond funds. In particular, it covers approximately half of the total value of the portfolios of US and EA bond funds that report their holdings on a monthly basis. Since US and EA bond funds combined represent approximately 80% of the global market, our dataset may be considered representative of the global market of funds investing in bonds. We examine the portfolio allocation of these funds based on the security-level information of their holdings. Specifically, by using information on the rating of each security held by bond funds in each period, we can dynamically examine the portfolio allocation of bond funds and their determinants. Therefore, an additional strand of literature that our study is connected to is documenting the relation between investment funds' portfolio allocation with credit risks and ratings.

Previous studies (e.g., Choi et al. (2022)) find a close relation between bond mutual funds' portfolio allocation and credit risk. In addition, Baghai et al. (2024) document the close connection between bond funds' investment strategies and credit ratings. In particular, using a textual analysis of funds' mandates, the study's findings imply that bond mutual funds' mandates dictate their investment policies by using credit ratings. Credit ratings are a key strategic allocation parameter for 94% of US funds, 65% of European funds, and 89% of funds, referring to the HY/IG (High Yield/Investment Grade) threshold in their mandates. Further, Baghai et al. (2024) was the first to document the relation between credit ratings and bond funds' investment strategies, as described in their mandates. However, Choi et al. (2022) provide evidence that funds may not accurately report the ratings of their holdings. Thus, holding data must be combined with security-level market-based information to accurately classify investment fund holdings into credit risk categories.

The COVID-19 shock period is particularly interesting for risk-based portfolio decisions. As shown in Figure 1, on February 15th, 2020, the implied volatility indices for the equity and bond markets started rising and peaked around mid-March 2020, a development coupled with a sharp

deterioration in financial conditions. Even if the spike dissipated, financial market volatility remained at elevated levels compared with historical averages for a prolonged period that ended long after central banks and fiscal authorities proceeded with liquidity provision, asset purchases, and other expansionary policy measures. At the same time, during this period the non-bank financial sector was at the epicenter of the disaster, as the COVID-19 shock created a spike in liquidity needs of investment funds and other key market participants, through which the exogenous shock was transformed into a systemic turbulence factor.

In particular, Vissing-Jorgenssen (2021) finds that US mutual funds, during the COVID-19 shock, faced sharp liquidity needs and cash outflows that originated from shareholders' liquidations of their positions, which were addressed by fund managers selling US Treasury bonds. The effects of the COVID-19 liquidity shock faced by funds were not restricted to US Treasury bonds and financial markets. The shock affected corporates as well, with firms drawing bank credit to be able to address adverse liquidity and capital shocks (e.g., Acharya & Sascha (2020)). In addition, similar liquidity needs drove European funds to liquidate their positions, adversely affecting their role in supporting corporate funding during turmoils (e.g., Nicoletti et al. (2024)).

The existing literature has not yet examined whether the reduction in highly-rated liquid bonds exercised spillover effects on other assets. In particular, as investment funds' mandates dictate the binding distributions of their portfolios across classes of risks reflected by credit ratings (e.g., see Baghai et al. (2024)), it is possible that a shock affecting the higher-rated class of holdings will also be transmitted horizontally to other risk classes. Thus, we pursue the idea that the COVID-19 shock led to a reduction in highly rated bonds in funds' portfolios, which then spilled over to lower-rated bonds, resulting in a widespread sell-off of bonds. Our analysis consists of four steps. *First* we investigate the relation of funds' portfolio allocation with credit ratings. *Second* we examine the price effects of changes in funds' portfolios. *Third*, we examine whether changes in holdings of AAA bonds affect holdings in lower-rated categories. *Fourth*, we examine the differentiated effects on funds' portfolio rebalancing and returns based on the credit quality of their bond holdings.

This study makes several contributions to existing literature. First, to the best of our knowledge, this is the first paper to measure the sensitivity of fund bond holdings to credit ratings using security-level data. Second, our findings show that the COVID-induced liquidity shock, which, in dollar terms, mostly affected highly-rated bonds held by funds, was transmitted to lower-rated bonds, indicating that a widespread sell-off with potential systemic effects was sprouting in March 2020. Third, we find that funds that held highly-rated bonds as the majority of their portfolio holdings sold lower-rated bonds less aggressively than the average fund in March 2020, while they also experienced a more moderate negative effect on their portfolio returns.

By testing several other factors that may have determined the portfolio allocation of US and

EU bond funds during the COVID-19 shock (e.g., contemporaneous returns, past returns, sector of issuer, location of issuer), we find that the most prominent answer to the question of what determined US and European bond fund portfolio reallocation during COVID-19, is the relation between fund holdings reallocations and the underlying securities' credit ratings. In particular, we find a close connection between funds' bond portfolios and the underlying securities' credit ratings. We show that credit ratings drive portfolio reallocation by funds since lower-rated holdings are, on average throughout our sample, more heavily downsized in dollar terms than higher-rated holdings. To the contrary, at the onset of COVID-19, the reduction in funds' bond portfolio holdings seemed to have significantly impacted in dollar terms the holdings of higher-rated bonds as compared to lower-rated bonds. This is particularity true for US funds, which hold a significantly larger part of their bond portfolio in AAA-rated bonds compared to their European counterparts. This is consistent with the evidence reported in Vissing-Jorgenssen (2021).

Similar to the average effect of credit ratings on dollar changes in bond holdings discussed above, on average throughout our sample, the worse the credit rating of a security, the more its holdings are reduced in percentage terms relative to the previous holdings. More importantly, our data indicates that funds substantially decreased their holdings of lower-rated bonds in March 2020 as compared to their previous holdings, i.e., in percentage terms, and this is more pronounced for Euroarea-based NBFIs. Specifically, we find that during the onset of COVID-19, lower-rated bonds were also sold by bond funds, and that this effect is stronger when we examine percentage changes in holdings. Hence, our results imply that, while the dash-for-cash resulted in a significant liquidation of AAA-rated bonds in dollar terms, especially in the US, it also resulted in a significant reduction of funds' holdings on lower-rated bonds held by funds in percentage terms, i.e., relative to previous holdings for each rating category, and this effect is stronger for Euroarea-based NBFIs.

For instance, consider a fund that in February 2020 holds \$10 in AAA-bonds and \$5 dollar in C-rated bonds. In March 2020, due to the COVID-induced liquidity shock, the fund unloads \$1 of the AAA-bond and \$0.75 of the C-bond. Hence, in dollar terms, the selloff due to COVID-19 mostly affected highly-rated bonds. Yet, in percentage terms, the reduction is more important for lower-rated bonds (-15% vs. -10%). This novel finding is consistent with the expected relation between funds' portfolio allocation and credit ratings: funds reduced their lower-rated bond holdings by relatively higher proportions. In this regard, we find evidence corroborating both the liquidity needs of funds associated with the economic effects of the COVID-19 shock and investors' credit risk concerns in light of rising credit risks (see Acharya & Sascha (2020)).

Additionally, by inferring the elasticity of funds' holdings on the underlying securities' credit ratings, we examine the impact of the COVID-19 shock on underlying bonds' pricing. We find that the portfolio reallocation of investment funds after the COVID-19 shock mostly affected the pricing

of lower-rated securities as compared to highly-rated ones. These results suggest a post-COVID cash rush from investment funds. Hence, our findings are consistent with those of Vissing-Jorgenssen (2021) regarding developments in the US Treasury market during the COVID-19 shock that resulted in a series of market interventions by the Fed. Overall, our findings show that the COVID-19 shock produced a widespread sell-off of bonds across several rating categories: the dash-for-cash that resulted directly in the liquidation of AAA bonds spilled over to lower-rated bonds. Thus, the COVID-19 shock potentially had the prospect of resulting in a systemic crisis. Our findings justify active market interventions by the Fed during the COVID-19 period.

The final contribution of our paper is in the strand of literature the examines the behavior of NBFIs. Recently, in line with the increasing importance of the NBFI sector, research on investment funds and their portfolio allocations has grown substantially. Studies on this topic usually focus on flow-level data flows into and out of funds as a result of shifts in market conditions (e.g., Hau & Lai (2016), Ciminelli et al. (2022), and Hau & Lai (2023)). Similarly, most studies in the extant literature rely on funds' declared focus and aggregate fund flows, either at the fund or country level, into sectors of the economy as a reflection of their portfolio allocation (e.g., Banegas et al. (2022), Kaufmann (2023), Giuzzio et al. (2021), Hodge & Weber (2023)).[3] However, by relying on flow-level data, the portfolio allocation of investment funds can only be indirectly measured. Our granular data data provide direct description of portfolio composition at the bond-fund level. Importantly, throughout our analysis we provide comparative insights across American and Euroarea NBFIs as this geographic comparison can be valuable for policy initiatives across the two sides of the Atlantic.

The remainder of this paper is organized as follows: Section 2 discusses issues related to the construction of the micro security-level datasets and key variables for the purposes of our analysis. Section 3 presents the first set of empirical results regarding portfolio allocation by bond funds, focusing on the COVID-19 shock that occurred in the early spring of 2020. Section 4 presents the second set of empirical results regarding the dash-for-cash spillover effect in bond funds' portfolio holdings and their returns. Finally, Section 5 concludes the study and briefly discusses the policy implications of the findings.

2 Data and methodology

2.1 Data

Our focus is on non-banking financial intermediaries funds investing mainly in bond markets, that is, so-called bond funds, from the United States and Europe during the COVID-19 period. We

[3]Few studies, however, use security-level data. For example, Choi & Kromlund (2018) use data on corporate bond holdings of mutual funds and examine the returns of different investment strategies at the fund level.

collect monthly frequency data reflecting portfolio compositions of US and European investment funds related to bonds for the period from December 2018 to January 2021. These datasets are at the security level, thus resulting in a granular dataset that is largely representative of the global market for bond funds.The dataset was built by combining security-level data on fund holdings with market-based data on the characteristics of these securities. Lipper for Investment Management is the source of the monthly funds' portfolio composition. Fund-level data includes monthly information pertaining to the residence of each fund, its market focus (e.g., equities, bonds, mixed, etc.), and its portfolio composition.

Our dataset is representative of the global market for bond funds and is even more representative of the US and EA markets. In particular, according to statistics provided by the International Investment Funds Association, in 2021:Q1 the aggregate total net asset value of US and EA bond funds stood at 10.4 trillion USD.[4] The total asset value of US and EA bond funds in Lipper stood at 9.8 trillion USD in the same period; however, only about two-thirds of these funds report their holdings regularly each month. As a result, as shown in Figure 2, our sample represents approximately half of the aggregate total asset value of the US and EA bond funds, which report their holdings each month.[5]

We construct our dataset by applying qualitative and quantitative filters. For example, we exclude security-level information on portfolios' equity shares, shares of funds, and non-rated bonds. In this way, the portfolios we work with are bonds with credit ratings by at least one agency among Fitch, Moody's, or Standard and Poor's. In addition, we require that funds regularly report their holdings each month in the sample period to enable a balanced panel dataset. Finally, we employed a quantitative threshold related to the size of the funds to ensure a manageable granular sample that is representative of the market. To this end, we filtered out US funds with a total asset value (TAV) of less than 1.5 billion USD and EA funds with a TAV of less than 1 billion USD.

Our dataset also has an advantage related to the information it provides. This is associated with the use of a granular, security-level dataset on the funds' portfolios; for the funds in our sample, we collected monthly security-level information about the identity and values of the bonds held in their portfolios. This is an important step that differentiates our study from the rest of the literature, as security-level studies, let alone bond funds, are scarce in the non-bank financial intermediation literature. The importance of our granular information is enhanced due to a high likelihood of

[4] These figures are for the total net asset value of open-end regulated funds, excluding funds-of-funds. See the International Investment Funds Association report entitled "Worldwide regulated open-end fund assets and flows, first quarter of 2021."

[5] Our sample includes a total of 432 funds that regularly report their holdings on a monthly basis. It constitutes 276 US resident funds and 156 Euro-resident funds. Note that the number of funds included in our study is comparable, albeit lower, than that in other studies; for example, the sample in Chen et al. (2010) and Moneta (2015) includes approximately 1,000 funds.

misclassification of the level of risk of funds' holdings when the dataset relies on fund managers' self-classifications of their securities; in particular, Chen et al. (2021) find that 31.4% of funds classify their bond portfolio holdings as safer than what is implied by the actual credit ratings of the bonds therein. We address this misclassification problem by matching the security-level information with other characteristics of the securities with portfolio holdings.

We collect reports on bond fund holdings at the security level from LSEG's Lipper for Investment Management. From these reports, we gather the securities holdings for each portfolio, by aggregating these entries according to security identities (ISINs and/or CUSIPs). We measure the holdings of bond funds, both in book and market value terms, at the security level. As standard practice, we do so in both absolute terms, i.e., security-level holdings measured in US dollars, and relative terms, that is, security-level holdings relative to the overall portfolio of each fund.[6] The value of fund holdings for each security is dynamic in our dataset, meaning that it varies per month. Therefore, we can infer that the fund changes its exposure to a specific security. In light of this, we use both book value and market value information about funds' holdings. Changes in book value holdings suggest an addition or reduction of the funds' positions to a specific asset When comparing these observations to those we take from changes in market value holdings, we can infer price developments for each security, as these are accounted for by investment managers.

Next, we collect security-level data from LSEG Refinitiv for the bonds included in funds' portfolios, and we used this information to classify the securities according to their characteristics. The data may be static or dynamic; in the former, they belong to characteristics such as the type of security, the sector of the issuer, and its residence, whereas in the latter, they belong to characteristics such as the bond's remaining term to maturity and the credit rating of the issuer. We collect credit ratings assigned at the issuer or bond level in that order of priority by one or more of the three largest rating agencies, that is, Fitch, Moody's, and Standard & Poor's. If the issuer or bond is rated by more than one rating agency, we considered the first-best rating assigned to the bond.

After merging the two datasets, we appply additional filters by removing observations with missing identifiers, currencies, duplicates, and par values. Observations with missing identifiers included cash and cash equivalents, as well as other items such as derivatives, accounts payable, accounts receivable, management fees, administrative fees, and taxes. Assets with missing currencies were deleted because we converted the par values of fixed-income securities from the local currency to US dollars for comparability purposes. Finally, we remove a negligible number of duplicate observations, that is, multiple observations of the same asset held by a fund on a particular date. The

[6]Note that while bond funds mainly invest in fixed-income securities, mainly bonds, they may also hold cash or other financial instruments, but in minimal proportions relative to the overall portfolios. More importantly, we excluded the holdings of funds that correspond to the shares of other funds. In this regard, we restricted our analysis to only the bond holdings of funds to obtain a comprehensive and informative dataset.

imposition of these filters somewhat decreased the total market value of our funds to around 2.58 trillion USD for US funds and 408 billion USD for EA funds, that is, a reduction of approximately 4.9% and 4.7% in market value terms.

Table 1 shows aggregate summary statistics for our sample of bond portfolios across ratings of bond/issuer, sector of issuer, and headquarter of issuer for US and EA NBFIs. According to these statistics, US funds hold about half of their portfolios in AAA-rated bonds, while in total, the investment-grade (IG) bonds included in US funds' portfolios account for about 90% of their portfolios. For EA funds, IG bonds also account for a comparable 86% of their total portfolios, but the proportion of low-IG, that is, A and BBB, bonds is higher than that of the highly rated AAA and AA bonds.

[Insert Table 1, around here]

The summary information from Table 1 is also illustrated in Figure 3. Specifically, Figure 3 shows the classification of funds' aggregate bond holdings per month according to three broad criteria: Panel A classifies aggregate funds' holdings, in percentage terms, across credit rating categories from investment-grade ones (AAA, AA, A, and BBB) to high-yield (BB, B, CCC, C/D); Panel B classifies funds' holdings across sectors (government bonds, non-financial corporations, financials, and other, including US federal agencies); finally, Panel C, classifies funds' holdings by the residence of the issuer across ten regions (US, euro area, UK, rest of Europe, Japan, Oceania, Australia, Latin America, Asia, others).

As shown in Figure 3, the funds' portfolio allocation across rating categories, sectors, and regions is remarkably stable over time. The stability in bond holdings highlights the importance of the COVID-19 period, from March to May 2020, during which US funds' holdings of AAA-rated bonds were downsized by about 5 percentage points. This observation, combined with a similar downward move in the government bond category held by US funds in the same period (see Panel B in Figure 3), may be explained as a dash-for-cash that resulted in the turbulence observed in the US Treasury market, according to Vissing-Jorgenssen (2021).

Figure 3 (Panel B) also shows that US funds hold in their portfolios approximately the same proportion of government bonds as EA funds. If we combine this observation with the one in Panel C, indicating that US funds hold about 70% of their portfolios in US bonds and EA ones hold about 50% of their portfolios in EA bonds, the reasons for the lower, on average, rating of bonds included in EA funds' portfolios than those in US funds' portfolios are clarified: since bonds issued by the EA governments are rated lower than the US Treasuries, EA funds' holdings of bonds issued by EA governments results in relatively larger holdings of A- and BBB-rated bonds than in US funds' portfolios.

In addition to the aggregate summary results from Table 1 and Figure 3, Table 2 shows summary statistics at the bond-fund level across ratings, sectors, and headquarters for US and EA NBFIs. These results are broadly consistent from the aggregate summary statistics in Table 1. Funds, both in the US and the EA, tend to hold highly-rated, government bonds from issuers that are headquartered in a geographic proximity to the fund's domicile.

[Insert Table 2, around here]

2.2 The estimation setup

We focus on investment fund portfolio allocations and dynamics. Thus, our main variable of interest reflects the changes in fund holdings over time. When we set up the dependent variable, we are mindful of the endogeneity issue with regard to price changes and their effects on investment fund portfolios. Thus, to isolate the price effects, we used book value holdings. Specifically, each fund j reports the book and market values of each security i it holds at each time point t. For each bond, book value entries correspond to the face value of the purchased bonds, whereas market values correspond to the current market valuation of the fund's bonds based on market pricing.

The distinction between the book and market values is crucial in reflecting the decisions of the funds' portfolio allocation. On the one hand, changes in market valuations may not necessarily reflect portfolio allocation decisions; they may simply reflect market movements due to the implementation of the mark-to-market valuation principle. On the other hand, changes in book value terms reflect changes in quantities; book value entries of funds' holdings are the product of the quantities purchased by the fund and the nominal price (P_0) of bonds. Therefore, book values will not change due to price changes, but only if new bonds are introduced in the portfolio or the quantities of existing bonds change (increase if additional units are bought or decrease if funds sell part or all of their exposure). Consequently, such changes do not reflect changes in market prices but rather investment decisions regarding portfolio rebalancing of the fund.

We present three cases of portfolio allocation decisions, which are clearly reflected by our book value measure: (i) **Additions of new bonds in the portfolio**: If a hypothetical fund adds a bond to its portfolio in month t that was not held in the previous month, the bond's ID, that is, its ISIN, or its CUSIP, will appear in the portfolio of this fund in month t. This holding is recorded in the fund's book value account according to the amount spent to acquire the bonds, which is equal to the bond's purchased quantity Q at price P of the transaction, that is, $Q \times P$. Contrary to market values, book values do not vary across time unless the fund changes the quantity of bonds.[7]

[7]Note that investment funds record these transactions in the bond's local currency, that is, the currency the bond is denominated to. For bonds denominated in currencies other than the US dollar, we transformed all values into US dollars, from local currency, by taking the foreign exchange rates at the end of each month.

(ii) **Increase in holdings of existing bonds**: If the hypothetical fund already holds a bond, its ISIN or CUSIP appears in the fund's accounts with a specific book value. If the book value changes and this change is positive, then the fund has increased its exposure to this bond by purchasing additional dollars of the security. This transaction is of interest because it reflects an investment decision to increase the portfolio's exposure to the bond in question. Thus, an increase in book value terms of the amount held for a specific bond will reflect an investment decision to increase holdings and will not reflect the market pricing effects of existing bond holdings.

(iii) **Decrease in the holdings of existing bonds**: In this case, the sales of bonds are reflected by a reduction in the amount recorded for the bond in book value terms. The potential difference between the price at which the fund purchased the bond vis-à-vis the one at which the fund sold part or all of its exposure to the said bond will not affect the book-value account record but will be recorded as a net profit/loss of the fund in another account. Again, this change reflects an investment decision and does not reflect a decrease in the amount recorded for a given quantity owing to a decline in the bond's market price.

In summary, we use the changes in book value to capture fund portfolio rebalancing at the security level. Thus, the first variable of interest is the monthly change in the book value of bond i held by fund j:

$$\Delta BV_{i,j,t} \quad = \quad BV_{i,j,t} - BV_{i,j,t-1}, \tag{1}$$

where $BV_{i,j,t}$ is NBFI j's book value holdings (in US dollars) of bond i at time t, and $BV_{1,j,t-1}$ is NBFI j's book value holdings of bond i in the previous month, i.e.,$t-1$.

We also distinguish between changes in holdings in absolute and relative book values. While changes in funds' exposure to absolute values are easily understood, in practice, funds allocate their portfolios in relative terms. In this regard, previous studies have focused on portfolio performance based on the proportions of portfolios across factors such as the proportions of assets held by funds across currencies (e.g., Camanho et al. (2022) and Maggiori et al. (2020)), countries (e.g., Raddatz & Schmukler (2012)), and the state of free capital mobility (e.g., Forbes et al. (2016)). As Raddatz et al. (2018) show, bond (and equity) mutual fund portfolio allocations are affected by benchmark index performances. Thus, funds map the changes in their benchmark index weights to their portfolios. Overall, it is reasonable to examine whether funds adjust their portfolio allocations across their holdings in relative terms; this is probably more representative of funds' investment strategies. Thus, we also consider percentage changes of book value holdings of bonds vis-à-vis

their holdings of these bonds in the previous month:

$$\%\Delta BV_{i,j,t} \quad = \quad (BV_{i,j,t} - BV_{i,j,t-1})/BV_{i,j,t-1}. \tag{2}$$

First, we examine whether there has been a systematic change in the composition of bond fund portfolios during the onset of COVID-19 and, if so, what explains it. Thus, we first examine several determinants of the potential rebalancing of fund portfolios specifically during March 2020. Such determinants may be related to the credit ratings of the holdings, i.e., the bonds held by funds,[8] their sector of economic activity,[9] or their residence.[10] This examination, particularly the AAA-rated bond holdings of investment funds, is expected to reflect the dash-for-cash or other drivers of portfolio rebalancing. In the same setup, we control for other factors, such as changes in bond prices or fund characteristics such as funds' residence, which also affect portfolio rebalancing.

Second, we examine whether portfolio rebalancing of funds during the COVID-19 shock has exercised broader spillover effects. In particular, in the extant literature the COVID-19 shock is shown to have resulted in the liquidation of high-quality liquid assets, such as US Treasury bonds (see Vissing-Jorgenssen (2021)), while liquidity needs were coupled with increased reluctance to fund highly risky borrowers (see Acharya & Sascha (2020)). At the same time, since the extant literature on portfolio allocation by investment funds relies on aggregated flow data,[11] the spillover effects of a specific rating category to another have not yet been examined. We fill this gap in the literature and investigate spillover effects from AAA bonds to lower-rated bonds.

Finally, our study examines the performance across funds with different levels of highly rated bonds in their portfolios. In particular, we test whether the performance of funds during the COVID-19 shock, is related to their relative holdings of AAA-rated bonds. To do so, we construct a variable that captures returns on portfolio funds' by summing the returns of all bonds held by

[8] We converted credit ratings from an alphanumeric scale originally provided by rating agencies to a numeric scale that is uniform across different agencies. In particular, we use the long-term issuer credit ratings provided by Fitch Moody's, and S&P, following the first-best regulatory principle, which means that if a given issuer is rated differently by two or more agencies, we use the best among the various ratings for this issuer. The transformation from the alphanumeric to numeric scale is as follows: AAA=1, AA/Aa=2, A=3, BBB/Baa=4, BB/Ba=5, B=6, CCC/Caa=7, lower than CCC/Caa=8; that is, higher values in the numeric scale reflect lower-rated/riskier positions.

[9] We consider economic sectors derived from the NAICS system (for US entities) and the Refinitiv Business Classification system (for all other entities). We divide these sectors into four large groups: government, financial, non-financial, and other. The government sector also includes agencies and supranational entities, whereas the financial sector includes banks and nonbank financial intermediaries (such as securitization vehicles).

[10] We group residences at the country level into the following ten groups: US, EA, Canada, UK, Japan, Latin America, Oceania, Asia, rest of Europe, and others.

[11] e.g., Forbes et al. (2016) and Chari et al. (2022).

funds at each point in time. For bond i, the returns are calculated as follows:

$$Return_{i,t} = \% \left(\frac{MarketValue_{i,t}/ParValue_{i,t}}{MarketValue_{i,t-1}/ParValue_{i,t-1}} - 1 \right). \quad (3)$$

The market value of bond i is defined as the number of bonds ($Q_{i,t}$) multiplied by its price $P_{i,t}$ ($MarketValue_{i,t} = Q_{i,t} \times P_{i,t}$), while the par value is the number of bonds multiplied by the face value $P_{i,0}$ ($ParValue_{i,t} = Q_{i,t} \times P_{i,t}$). When bond holdings are constant ($Q_{i,t} = Q_{i,t-1}$), then $ParValue_{i,t} = ParValue_{i,t-1}$ and bond returns become

$$Return_{i,t} = \% \left(\frac{MarketValue_{i,t}}{MarketValue_{i,t-1}} - 1 \right) \quad (4)$$

Thus, from equation (4), we obtain the return on each bond i. Summing up all the returns of the holdings of each fund j at each point in time, weighted by their market values (MV) at time t, we derive the returns at the fund level. This variable of interest is shown in equation (5):

$$Return_{j,t} = \sum_{i=1,\ i \in j}^{N} \frac{MV_i \times Return_{i,t}}{\sum_{i=1}^{N} MarketValue_{i,t}}. \quad (5)$$

We use fund returns to examine whether and how fund valuations were affected during the COVID-19 period and, more importantly, whether there have been heterogeneous effects across funds according to their risk profile, as measured by their holdings of highly rated bonds. In light of the procyclicality of fund portfolio allocation, this is an important issue since fund returns are documented to affect portfolio allocation (see, e.g., Timmer (2018)). Similarly, during the COVID-19 period funds were shown to be reluctant to provide funding to the economy (see, Nicoletti et al. (2024)). In this regard, if the effect of the COVID-19 shock on funds' returns depends on the specific risk-composition of their portfolios, this also extends to the intensity of the procyclicality of funds' funding in the economy. In particular, portfolio holdings that reduce the vulnerability of fund returns are expected to support market-based funding in the economy.

In terms of exposition of results, most of our tests are conducted separately on two samples: US-based NBFIs and Euroarea-based NBFIs with a focus on the credit rating aspect of bond portfolios. This is done to highlight the differential effects of the COVID-19 shock on the US and EA NBFIs. For completeness, we repeat our analysis for the full sample in the Internet Appendix (Tables A.1, A.2, A.3, A.4, A.7, A.8, A.11, A.12, A.13, and A.14), where we also include results based on the sector (Tables A.5, A.9) and geographic location (Tables A.6, A.10) of the bond issuer.

3 Portfolio rebalancing during COVID-19

3.1 Preliminary findings

First, we report the results of portfolio rebalancing using a two-way fixed effects specification across the time and bond-NBFI dimensions. This specification is expressed in equation (6)

$$\Delta Holdings_{i,j,t} \quad = \quad b\ \mathbf{T}_t + Controls_{i,j,t} + a_{i,j} + u_{i,j,t}, \tag{6}$$

where $\Delta Holdings_{i,j,t}$ is either $\Delta BV_{i,j,t}$, that is, changes in the absolute book value of bond i held by fund j or $\%\Delta BV_{i,j,t}$, that is, the percentage change of bond i holdings by fund j. $Controls_{i,j,t}$ are the contemporaneous (at time t) and lagged (at t-1) returns of security i held by fund j. $a_{i,j}$ captures the security-fund fixed effects and $\mathbf{T}_t$ the time fixed effect. The results, which are summarized in Table 3, are grouped according to different specifications. Columns (1) to (4) report the changes in fund holdings in absolute book-value terms (in million USD) per bond in each fund, and columns (5) to (8) report the percentage changes per bond in each fund. Panel A of the table reports the results for US NBFIs and Panel B for EA NBFIs. In each panel, columns (1) and (5) report the specification results under a two-way fixed-effects model, while columns (2) and (6) include the contemporaneous return of bond i in each fund j's book-value accounts. Then, in Columns (3) and (7), lagged $(t-1)$ returns are included. Finally, in Columns (4) and (8), both contemporaneous and lagged returns are included.

[Insert Table 3, around here]

In summary, this table demonstrates that funds substantially decreased their holdings of each bond in March 2020, although there was little to no indication of a comparable time-specific portfolio change during the rest of our sample. These results are also illustrated in Figure 4, which shows that March 2020 is clearly the time period when the COVID-19 shock hit the bond portfolio holdings, both in dollar and percentage terms. In dollar book-value terms, the average, per bond, holdings by US funds was reduced in March 2020 by about 250 thousand USD, when we take into account effects from bonds' returns in time t and $t-1$ (i.e., column (4), in Panel A); in percentage terms, this reduction represents 1.4% of the average security-level holdings at the beginning of March 2020 (column (8), in Panel A). EA funds reduced their holdings, on average for each security, by about 441 thousand USD, in March 2020 (column (4), Panel B) and this represents a 5.5% reduction in the holdings of the previous month (column (8), Panel B). Thus, these results suggest that European funds reacted to COVID-19 by selling bonds more aggressively than their US counterparts.

With regards to bond returns, our findings show that there is a positive sign of lagged returns in the specifications under column (8) for EA funds under columns (4) and (8) for EA funds. This is in line with the anticipated procyclicality of funds' portfolio allocation (Timmer (2018)). At the same time, given that this variable is a strong control for the portfolio allocation by funds, it confirms our main finding, which implies that the COVID-19 shock exercised substantial reduction effects on funds' bond holdings. Next, we investigate wether the credit ratings of bond holdings played a role in funds' decisions to reduce their positions during the COVID-19 turbulence.

3.2 Effects of credit ratings (microdata)

Credit ratings are important in bond-fund portfolio allocation decisions. In the COVID-19 turbulence period, a wave of credit rating downgrades caused bond valuations to decline as the risk of downgrades for bonds rose (e.g., see Financial Stability Board (2020)). This development may spark concerns about the credit-quality prospects of bonds in investment fund portfolios. The question raised here is whether rebalancing, which we find to have occurred in fund portfolios during the COVID-19 shock, relates to credit ratings or other characteristics of the fund's bond holdings.

The reasons for such a rebalancing may be related to credit ratings being associated with the use of the latter as input to investment decisions (see, e.g., Goldstein & Huang (2020) and Baghai et al. (2024)). In particular, due to the presence of a downgrade cycle, such as the one witnessed during the COVID-19 shock period, investment managers may be concerned in particular about their holdings around or near the investment grade (IG) threshold.[12] If this is the case, then while the dash-for-cash affected highly rated bond holdings (rated AAA), bonds rated at lower rating categories may also have been affected by the COVID-19 shock.

In this regard, the granularity of our dataset enables us to ask whether the COVID-19 shock had wider implications, for bond portfolio allocation, than the documented in the dash-for-cash literature. This research question is quite interesting: if at the same time when a liquidity shock hits investment portfolios, credit risk concerns arise, the probability of widespread, systemic turbulence increases. Therefore, we examined the significance of credit ratings in fund portfolio rebalancing during the onset of COVID-19. To achieve this, we employed the following specifications:

$$\Delta\text{Holdings}_{i,j,t} = \tag{7}$$

[12] Investment grade (IG) includes the rating categories AAA, AA, A, and BBB, while non-investment grade (NIG) bonds (that is, those rated at BB, B, and lower) are considered speculative. Several studies such as Altman (1998), Cantor & Packer (1996), and Acharya & Sascha (2020) highlight the nonlinearity of the effects of a rating change at the IG threshold.

$$b_1 Ratings_{i,t} + b_2 \mathbf{1}(March\ 2020) + b_3 Ratings_{i,t} \times \mathbf{1}(March\ 2020) + \text{Controls}_{i,j,t} + a_{i,j} + u_{i,j,t}.$$

In equation (7), $Ratings_{i,t}$ is the credit rating of bond i in month t (AAA=1, AA=2, A=3, BBB=4, etc.) and $\mathbf{1}(March\ 2020)$ is an indicator variable for March 2020. The results of these specifications are listed in Table 4.

[Insert Table 4, around here]

Table 4 reports estimation results for the changes in bond fund holdings, in absolute dollar terms (columns (1) and (2)) and in percentage terms (columns (3) and (4)). The dependent variable reflects changes at the fund-security level, that is, changes in either USD values or in percentages of the holdings of bond i by fund j. Estimations include fund-security fixed effects and the contemporaneous and lagged returns of bond i as reported in the fund's j portfolio accounts. The table consists of two panels: Panel A reports results for US funds and Panel B shows results for EA funds.

The results in Table 4 confirm the significance of ratings for fund portfolio allocations. Results presented under columns (1) and (3) in both panels suggest that throughout our sample, bond funds' portfolio rebalancing is negatively affected by the ratings variable, yet the strength of this relation depends on whether we consider changes in dollar terms or in percentages relative to previous asset holdings. In dollar terms, the negative relation between bond funds' portfolio rebalancing and credit ratings is only important for US funds (column (1), Panel A). If a US bond were to be downgraded from AAA to AA, then US funds on overage would unload 25 thousand of this bond.

For percentage changes, the negative relation between bond funds' portfolio rebalancing and credit rating is significant for both US and EA funds' portfolio allocation (column (3), Panels A and B). The negative sign of the coefficient of the ratings variable in column (3) of both panels implies that, on average, funds tend to moderate positive percentage changes (i.e., buy less) or intensify negative percentage changes (i.e., sell more) for lower-rated bonds. Note that, while these results are consistent with expectations formed by other strands of the literature, to the best of our knowledge, this is the first tangible evidence of the relationship between portfolio holdings and credit ratings using actual portfolio-holding data, at the security level.

Baghai et al. (2024) also report such a relation of bond funds' portfolio investment decisions with credit ratings, but they rely on textual analysis of funds' mandates and not their actual security holdings. As a result, their analysis is subject to the critique that using the funds' own-reports can result in misclassifications (Chen et al. (2021)). The remainder of the previous literature is primarily based on analyzing flows and not on security-level data. Finally, this result is consistent with the literature on bond mutual fund performance, which inherently treats them as risk-averse

investors (see, e.g., Blake et al. (1993) and Fama & French (2010)).

The similarity of the values for the ratings coefficients in column (3) across US and EA funds is striking. Funds, in general, tend to reduce their holdings by about 1% more than the average bond-specific percentage change for every rating category below AAA. This means that if, for example, they add on average, 10% of a given bond with an AAA rating, they would add only 9% if its rating were AA, 8% if it were A, 7% if it were BBB, and so on. Alternatively, if they reduce by 1% of their position to an AAA-rated bond, a similar ceteris paribus bond with an AA rating would be reduced by 2%, an A-rated bond by 3%, a BBB by 4%, and so on. This effect is very similar for both the US and EA bond funds.

Further, the results for the March 2020 coefficient in columns (1) and (3) in all panels of Table 4 confirm that, in March 2020, a widespread reduction in bond fund holdings occurred. US funds reduced their holdings by 331 thousand USD per bond (column(1), Panel A), or by 1.5% (column(3), Panel A) of their initial positions, while EA funds reduced them by 416 thousand USD (column(1), Panel B), or by 5% (column(3), Panel B). These results, by and large, confirm the ones presented in Table 2, in the previous section.

In column (2) of the two panels in Table 4, we also consider the interaction of the COVID-19 shock with credit rating effects. Based on these tests, in March 2020, US funds are found to sell significantly more ($141,000), in dollar terms, of each highly-rated bond as indicated by the positive coefficient of the interaction of the COVID-19 shock with credit rating (column(2), Panel A). To the contrary, Euroarea funds in March 2020 tend to sell similar quantities of bonds across rating categories as implied by the insignificant coefficient of the interaction of the COVID-19 shock with credit rating (column(2), Panel B).

In column (4) of the two panels in Table 4, we normalize dollar changes during March 2020 with the level of previous-month's dollar holdings of each bond. In this case, results are different to those for dollar changes. In particular, the results in column (4), Panel A suggest that in March 2020, US fund sales of lower-rated bonds were 40% higher per bond than during the entire sample, i.e., -1.7%(=-1%-0.7%) in March 2020 versus -1% for the full sample. Similarly, column (4) in Panel B shows that for lower-rated bonds, EA funds more than doubled their negative propensity of changes in holdings per bond, i.e., -1.8%(=-0.7%-1.1%) in March 2020 versus -0.7%.

In sum, the results in Table 4 indicate that US funds sold more, in absolute dollar terms, of each highly rated bond; this result fits well to the documented response of funds to their need for liquidity at the onset of the COVID-19 shock (see Vissing-Jorgenssen (2021)). At the same time, we report for the first time that this reduction indeed follows the expected relation between funds' portfolio allocation and credit ratings: funds reduced their holdings of each lower-rated bond by relatively higher proportions from previous dollar holdings. In this regard, we find evidence corroborating

both the liquidity needs of funds associated with the economic effects of the COVID-19 shock and investors' credit risk concerns in light of rising credit risks (see Acharya & Sascha (2020)).

This seemingly contradictory finding can be explained by the fact that on a per-bond basis, funds hold, on average, large amounts of highly-rated bonds and small amounts of lower-rated bonds (see Tables 1 and 2, Panel A). Specifically, US funds hold on average $12.78 million of each AAA bond, and EA funds hold $9.19 million. To the contrary, US funds hold on average $6.45 million of each non-AAA bond, and EA funds hold $4.06 million. As a result, since the initial amount of US bond holdings for each AAA-rated bond is relatively large, it is quite reasonable for US funds to sell more of the AAA-bonds in dollar terms in March 2020 for the additional reason that selling these bonds has minimal price impact as we shall see below (Table 5). Note that for EA funds, the interaction term between March 2020 and credit ratings in the regression for changes of holdings in dollar terms is not significant (column(2), Panel B of Table 4). On the other had, in terms of percentage changes, i.e., dollar changes divided by previous-month's holdings of the same bond, the relation between bond holding rebalancing and credit ratings in March 2020 is negative and significant (column(4), Panels A and B of Table 4) because the dollar holdings of each AAA-bond are large, whereas the dollar holdings of each non-AAA bond are relatively small.

We can shed additional light on the differential effect of dollar versus percentages sales across credit ratings during the COVID-19 period with some back-of-the-envelope calculations. The average dollar decrease of each AAA-bond in a US fund portfolios during March 2020 was 790 thousand USD, while the average decrease of each non-AAA bond was 123 thousand USD. Hence, in March 2020, US-based funds sold 663 thousand USD more of each AAA-bond. For EA funds, the average dollar decrease of each AAA-bond in March 2020 was 940 thousand USD, while the average decrease of each non-AAA bonds was 483 thousand USD. Thus, in March 2020, EA-based funds sold 457 thousand USD more of each AAA-bond.

However, when we normalize these dollar changes by the previous month's (February 2020) average dollar holdings of each bond (US: $12.78 mil. AAA, $6.45 mil non-AAA; EA: $9.19 mil. AAA, $4.06 mil non-AAA), US-funds decreased the holdings of each AAA-bond by 4.28% ($790,000/$12.78 mil. versus $123,000/$6.45 mil.) more than of each non-AAA bond. To the contrary, EA-funds increased the holdings of each AAA-bond ($940,000/$9.19 mil. versus $483,000/$4.06 mil.) by 1.65% more than for each non-AAA bond. Consequently, for EA-based bonds, the positive relation between dollar bond sales and credit ratings (more dollar sales of each highly-rated bond) that holds during March 2020, becomes negative when we consider bond sales as a percentage of prior bond dollar holdings (less percentage sales of each highly-rated bond).

These findings are also illustrated in Panel A of Figures 5 and 6, which respectively show the

dollar and percentage changes of aggregate bond holdings by credit rating in our NBFI sample.[13] Panel A in Figure 5 shows that US-based NBFIs significantly reduced their dollar positions in AAA bonds in March 2020. This reduction in AAA bonds was much higher, in absolute dollar magnitude, than the dollar decreases for the rest of the ratings. A similar pattern holds for EA-based NBFIs, for which the decrease in the dollar value of AAA holdings during March 2020 is larger than the decrease for most of the ratings, yet this decrease differential across ratings for EA-based NBFIs is not as pronounced as that for US-NBFIs.

To the contrary, as shown in Panel A of Figure 6, the extreme magnitude of the dollar decreases in AAA holdings during March 2020, especially for US funds, does not translate into extreme decreases in relative terms (percentages). This is because, as shown in Figure 3, AAA bonds dominate the composition of portfolio holdings. Hence, as a result during March 2020, US-based NBFIs decrease in percentage terms their aggregate bond holdings almost uniformly across ratings. To the contrary EA-based funds, in percentage terms, decrease their holdings of lower-rated bonds more than they decrease their holding of high-rated bonds.[14]

3.3 Rating-specific returns (aggregate)

What do these results say about the price development in funds' bond holdings? To answer this question, we turn to rating-specific market-value returns, which we regress on the rating variables, the indicator for March 2020, and their interactions:

$$Returns_{c,t} = b_1 Ratings_t + b_2 \mathbf{1}(March\ 2020) + b_2 Ratings_t \times \mathbf{1}(March\ 2020) + u_{c,t} \qquad (8)$$

Based on the above setup, we examine whether changes in prices differed across rating categories in March 2020. As opposed to the analysis in Tables 3 and 4, which are conducted at the bond-fund level, the returns tests are based on the aggregated per-rating portfolio holdings of US and EA bond funds; see Table 5 below.

[Insert Table 5, around here]

These results indicate that in March 2020 the prices of lower-rated bonds significantly decreased

[13] Figure A.4 of the Appendix illustrates the differential effects of credit ratings on the dollar and percentage changes from data at the bond-NBFI level. These graphs are consistent with the Figures 5 and 6, which show the ratings effects at the aggregate level.

[14] Table A.3 and Figure A.5 of the Internet Appendix highlight the non-linearity of the ratings effect on the dollar and percentage changes of bond holdings. To do so, we use rating-specific indicator variables to capture rating-specific differences in changes in funds' portfolio rebalancing. Table A.4 of the Internet Appendix allows for differential effects of the COVID-19 crisis across funds by replacing the March 2020 indicator with the outflows of each fund in March 2020 as a percentage of its each book value.

compared to higher-rated bonds. By summing the effect of the indicator for March 2020 with that of its interaction with each rating category, we find that the market value of the holdings of bonds rated AAA barely fell on a monthly basis. To the contrary for each rating category below AAA, bond returns decreased by 2% in March 2020 (-2% for AA, -4% for A, etc.). This means that BB-rated bonds lost -8% more of their market values than AAA ones during March 2020.[15]

The combined results in Tables 4 and 5 can be interpreted as follows. The results in Table 4 indicate that the COVID-19 shock exercised large reduction effects on AAA-rated bonds held by US funds in book value terms, which probably is a reflection of a dash-for-cash as referenced above. At the same time, however, the price reduction effects, as shown in Table 5, are weak for this rating category, which suggests that prices of AAA-rated bonds were more resilient against the market turbulence that the COVID-19 shock brought about.

These price results may be explained by other developments that occurred in March 2020, such as interventions by the Fed that helped reverse the initial price reactions of US Treasury bonds.[16] Finally, the reductions in book-value holdings of bonds held by US funds are not reflected in a larger-than-average fall in prices of lower-rated bonds; if anything, the decrease in bond prices from the AA or the A rating categories is much smaller in magnitude than the decrease implied by the March 2020 indicator. To the contrary, bond prices for lower rating categories do not exhibit significant differences from the cross-sectional average. Consequently, our results suggest that the prices of highly-rated bonds are more resilient to shocks, such as those originating from the COVID-19 pandemic.

The results in Table 5 are also illustrated in Figures 7 and 8, Panel A, which show the time series of bond returns both at the aggregate level and by credit rating. According to these figures, bond prices on average faced an unprecedented decrease in March 2020. Importantly, as shown in Panel A of Figure 7, these decreases are mainly driven by the negative returns of lower-rated bonds and not from the returns of the highly-rated ones, which exhibit a remarkable resilience during the onset of COVID-19.

[15]Table A.8 of the Internet Appendix highlights the non-linearity of the ratings effect on average bond returns. To do so, we use rating-specific indicator variables to capture rating-specific differences in average bond returns.

[16]This is shown by Vissing-Jorgenssen (2021). Unfortunately, our dataset does not provide adequate information to examine the effects of the Fed's interventions in March 2020 because we only have data on monthly frequencies. Such an investigation would have required higher frequency data. Table A.15 of the Internet Appendix summarize the Fed and the ECB interventions during the onset of COVID-19.

4 Effects of the dash-for-cash

4.1 Spillover effects across rating categories

Next, we examine the connection between the dash-for-cash during March 2020 and the reduction in funds' holdings of lower-rated bonds. Specifically, the hypothesis we test in this section is that, in light of the liquidity needs faced due to the COVID-19 shock, as documented in the dash-for-cash literature, funds sold high-quality liquid assets (HQLA), but at the same time they were aware of the need to retain a balance of risks in their portfolios as prescribed by their investment mandates. Therefore, as they reduced their highly-rated positions, which are also the categories in which they invested more, they liquidated lower-rated bonds to follow a proportionate portfolio allocation.

In particular, according to previous studies, some of which have been cited earlier in this paper, the percentage of AAA-rated bonds sold in March 2020 reflects the dash-for-cash effect. In March 2020, when the COVID-19 shock unfolded, funds sold a large part of their AAA bond holdings, as shown in Figure 6 (Panel A); US funds sold about 5% of their AAA bond holdings in that month. This observation, combined with the fact that, as shown in Panel B of the same figure, they also sold a similar proportion of government bonds, aligns with the findings of Vissing-Jorgenssen (2021) regarding the role of investment funds during the COVID-19 turbulence in the US Treasury market. In this regard, a change in funds' AAA bond holdings reflects a dash-for-cash effect.

Based on these arguments, we now examine whether and how the dash-for-cash affected funds' holdings in other rating categories. In particular, if the changes in funds' AAA bond holdings positively and significantly affected holdings belonging to other rating categories, then this implies that the dash-for-cash, which was the reason for the reduction in funds' AAA-rated bond holdings, spilled over to lower-rated bond holdings. This may have occurred to gather liquidity and to retain a balance of risks in the funds' portfolios. Liquidity needs should be reflected in absolute dollar changes of bond holdings, whereas the balance of risks should be reflected in proportionate changes in holdings across rating categories. Equation (9) illustrates this relation:

$$\Delta\text{Holdings}^{c}_{i,j,t} = \tag{9}$$
$$b_1\overline{\Delta\text{Holdings}^{AAA}_{j,t}} + b_2\mathbf{1}(March\ 2020) + b_3\overline{\Delta\text{Holdings}^{AAA}_{j,t}} \times \mathbf{1}(March\ 2020) + \text{Controls}_{i,j,t} + a_{i,j} + \epsilon_{i,j,t}.$$

Again, the dependent variable ($\Delta\ Holdings^{c}_{i,j,t}$) has two forms: we use either $\Delta BV_{i,j,c,t}$, that is, changes in the absolute book value of bond i held by fund j, or $\%\Delta BV_{i,j,c,t}$, i.e., percentage changes in bond i holdings by fund j. The superscript c signifies that the estimation is performed separately for each rating category (i.e., c=AA, c=A, or c=BBB), which enables the estimation setup to be rating-specific. The main explanatory variance in this setup is $\overline{\Delta\text{Holdings}^{AAA}_{j,t}}$, which captures the

average monthly change in AAA-rated bonds AAA holdings by fund j. Finally, the setup with microdata includes fund-security fixed effects and controls, reflecting the contemporaneous and lagged returns of bond i in the fund's j accounts.

Tables 6 and 7 report the results of this estimation setup for $\Delta\ BV_{i,j,c,t}$ and $\%\Delta\ BV_{i,j,c,t}$, respectively. Both tables include rating-specific results in which the heading of each column indicates the rating category of the holdings under examination. In this regard, the first column corresponds to the estimation results for AA-rated bond holdings, the second to A-rated bond holdings, the third to BBB, and so on. Again, the two tables are separated into two panels: panel A reports the results for US funds, and panel B reports the results for EA funds.

[Insert Table 6, around here]

Table 6 reports estimates of spillover effects from average changes in each AAA-rated bond to other rating categories in absolute dollar terms. For the entire period, there is very little evidence that the average change per fund in each AAA bond, for both US and EA funds, affect holdings of bonds belonging to other rating categories. This is evidenced by the insignificance of the coefficient of the average dollar change for each AAA-rated bond ($\overline{\$\Delta BV(i,j,AAA,t)}$) in Panels A (US funds) and B (EA funds) of Table 6. However, when we focus on what happens in March 2020, i.e., by interacting the average change in each AAA-rated bond with the March 2020 indicator ($\overline{\$\Delta BV(i,j,AAA,t)}\times$ March 2020), an interesting pattern is revealed: changes in the holdings of each bond belonging to other IG rating categories, i.e., AA, A, or BBB, are significantly affected by the average reduction per fund in each AAA-bond. The positive sign of the interaction coefficient in columns (1) to (3) in Panels A and B implies that the average reduction in each AAA-bond resulted to a reduction in other IG-rated parts of the funds' portfolios.

Hence, the dash-for-cash, which has been the documented cause for reductions in the AAA holdings of funds at least for the U.S., probably spilled over outside the AAA category, i.e., to other assets with an IG rating. This finding is reported for the first time in the present study. It likely reflects the treatment, regulation, and market practice of IG bonds as High-Quality Liquid Assets (HQLA), through which market participants can absorb liquidity in the case of a liquidity shock, such as the one at the onset of COVID-19.

In particular, in several regulatory frameworks, portfolio holdings with credit ratings within the IG category are considered High-Quality Liquid Assets (HQLA). For example, the definition of HQLA by the Basel Committee on Banking Supervision (see Basel Committe on Banking Supervision (2019)), which includes several criteria, describes them as low-risk, with the possibility of easy and immediate conversion into cash, ideally eligible for central banks' liquidity provision operations. For example, both the US (see United States Department of Treasury (2014) and Board

of Governors of the Federal Reserve (2019)) and the European regulatory framework (see European Commission (2015)) require that securities are investment grade to be considered HQLA.[17]

The implementation of new supervisory rules made banks more resilient during the COVID-19 shock (e.g., Giese & Haldane (2020) and Duncan et al. (2022)). In addition, this regulatory framework affects the functioning of secondary bond markets, as it applies to central counterparties, which can only lend cash against HQLA in order to mitigate counterparty risk (Aldasoro et al. (2023)). Hence, HQLA securities may affect market liquidity by affecting fund liquidity, in line with the findings of Macchiavelli & Zhou (2022). Similarly, bond funds in our sample seem to have liquidated IG bonds for the same reason as they liquidated AAA bonds: to tap liquidity.

Thus, we interpret the results reported in Table 6 as suggesting that the dash-for-cash during the COVID-19 shock in financial markets had more widespread consequences than previously reported. These results have important policy implications: in the face of a liquidity shock, such as the one experienced during COVID-19, funds implement a practice for tapping liquidity from the market, which follows the regulatory principles for defining high-quality liquid assets. Consequently, implementing such a rule may have stabilizing effects on bond funds, similar to banks and other financial institutions.

Next, we examine the effects of dash-for-cash on the percentage changes in book value holdings of each bond held by funds. The results are summarized in Table 7. Regarding the percentage changes in holdings per rating category, our investigation suggests that bond funds are aware of the need to retain a balance of risks in their portfolios. This is shown by the positive and significant effects of the average percentage changes of each bond in the AAA category ($\overline{\%\Delta BV(i,j,AAA,t)}$) to all other rating categories, except for very low ratings (C and lower).

[Insert Table 7, around here]

The effects of the average percentages changes of AAA bonds on percentage changes of non-AAA bonds are different across IG and HY classes during the COVID-19 shock. On the one hand, holdings in the IG category were reduced proportionately in close connection with AAA-rated holdings. Specifically, the average percentage change in fund j's AAA-rated bonds positively and significantly affects the percentage changes of its bond holdings in other IG categories in March 2020. However, some heterogeneity exists when comparing US and EA funds. For US funds in particular, the average percentage changes of each AAA-bond in March 2020 ($\overline{\%\Delta BV(i,j,AAA,t)}\times$March 2020) affect only the percentage changes in BBB-rated holdings, and thus, AA and A bond positions are not reduced proportionately to AAA bonds. For EA funds, the average percentage changes of each AAA-rated bond in March 2020 affect all IG bonds. This finding seems to indicate that US

[17] In the European framework, government bonds are considered HQLA by definition.

funds reduced their positions in A's for the same reasons, probably due to the dash-for-cash effect. While they were aware of the need to retain a balance of risks, they reduced BBB-rated bonds proportionately to their percentage change in their AAA-rated holdings. In either case, the funds seem to follow a strategy that partially retains the balance of risks, either across the IG category or between higher- and lower-rated IG holdings.

On the other hand, HY fund holdings during the COVID-19 shock, were mostly negatively affected by the average percentage changes in each AAA-bond for US funds, but remained unaffected by the average percentage changes in each AAA-bond for Euroarea funds. Thus for US funds, as AAA-rated holdings decrease, HY holdings seem to increase proportionately to their positions in February 2020. This result is a reflection of the fact that liquidations of HY positions in dollar terms for US funds, during COVID-19, were not significantly greater than those explained by the across-the-board effects of the COVID-19 shock (as shown in Table 6).

Hence, as the COVID-19 shock manifested itself mainly by reducing AAA and other IG holdings in bond portfolios of US funds, the relative importance of the holdings of HY bonds increased. Since the HY holdings are very small in proportion to the overall funds' portfolios (that is, less than 10% for US funds; see Table 1, Panel B and Figure 3, Panel A), a negative change in the larger parts of the portfolios, i.e., in IG bond holdings, will have significantly increasing effects on the proportion of the portfolios held in HY bonds. At the same time, to infer the overall effect of the COVID-19 shock on the percentage changes in each HY bond for US funds, we must also account for the effects of overall market development, as these are reflected by the coefficient of the March 2020 indicator variable. In this regard, the increase in relative holdings exercised by the reduction of AAA and other IG bonds, mainly due to dash-for-cash, is moderated to a large extent by the fact that during the COVID-19 shock, funds sold bonds in percentage terms across the board.

4.2 Funds' portfolio allocation and performance

We conclude our analysis by examining whether the AAA-ratings composition of investment funds affects how these funds react to the COVID-19 shock and whether the returns they earned in their portfolios during that period differ according to the credit quality of their bond holdings. To this end, we estimate fund portfolio rebalancing and returns with fund-level data. The two difference-in-difference setups are expressed in equations (10) and (11), as follows:

$$\$\Delta \mathrm{BV}_{j,t}^{non-AAA}/\$\mathrm{BV}_{j,all\ rated,t} = b_1 \mathbf{1}\{\%BV_{j,1/2019}^{AAA} < median(\%BV_{j,1/2019}^{AAA})\}_j \tag{10}$$
$$+b_2 \mathbf{1}\{\%BV_{j,1/2019}^{AAA} < median(\%BV_{j,1/2019}^{AAA})\}_j \times \mathbf{1}\{March2020\} + b_3 \mathbf{1}\{March2020\} + a_j + e_{j,t}$$

$$Return_{j,t} = b_1 \mathbf{1}\{\%BV_{j,1/2019}^{AAA} < median(\%BV_{j,1/2019}^{AAA})\}_j \tag{11}$$

$$+b_2\mathbf{1}\{\%BV^{AAA}_{j,1/2019} < median(\%BV^{AAA}_{j,1/2019})\}_j \times \mathbf{1}\{March2020\} + b_3\mathbf{1}\{March2020\} + a_j + e_{j,t}.$$

Based on equation (10), we differentiate across the effects exercised on the changes in fund portfolio weights for bonds rated lower than AAA ($\Delta BV^{non-AAA}_{j,t}/BV_{j,all-rated,t}$) focusing on funds that on January 2019, that is, at the very beginning of our sample, hold AAA-rated bonds in low proportions compared to the median for each region for that month ($\%BV^{AAA}_{j,1/2019} < median(\%BV^{AAA}_{j,1/2019})$).[18] In equation (11), we conduct the same analysis for fund returns ($Return_{j,t}$).

In both cases, the variable of interest is the indicator variable $\mathbf{1}\{\%BV^{AAA}_{j,1/2019} < median(\%BV^{AAA}_{j,1/2019})\}$, which classifies funds according to whether they hold a low proportion of AAA bonds in January 2019, compared to the median of the region (US or Euroarea) at the beginning of the sample. Thus, by comparing the results implied by this indicator, we may infer whether funds belonging to the group that held a low proportion of AAA bonds, rebalanced their portfolios differently than funds holding a high proportion of AAA bonds (%BV(j,AAA,1/2019)> $median(\%BV(j, AAA, 1/2019))$. A time indicator variable that captures broader market conditions in March 2020 is included in the setup. Finally, the setup is estimated using one-way robust standard errors at the fund level.[19]

Table 8 presents the findings of these tests. The results in Panel A of Table 8 correspond to the estimation of equation (10) and those in Panel B of equation (11). In each panel, the values in the first column report the results for all funds, results for US funds are reported under the second column, and EA funds are reported in the third column.[20]

[Insert Table 8, around here]

The estimations reported in Panel A of Table 8 show that funds holding a lower-than-median proportion of AAA-rated bonds, i.e., the treated group, in the beginning of the sample, tend to add 2.3% more of their total holdings in book-value terms in non-AAA bonds than the average fund; US funds add 3.2% and EA funds 1.8%. Focusing on March 2020, funds with a lower-than-median holding of AAA bonds, reduced their non-AAA holdings by 5.1% more than the control group, i.e., funds that held above median proportions of AAA bonds in the beginning of the sample.

Nevertheless, there is substantial heterogeneity across US and EA funds. In March 2020, US

[18] The medians (medians conditional on non-zero AAA holdings) for $\%BV^{AAA}_j$ in January 2019 are 8% (27%) for the full sample, 17% (47%) for US NBFIs, and 1.5% (15%) for EA-based NBFIs.

[19] In Table A.14 of the Internet Appendix, we report results of these tests where the main explanatory variable is the percentage of AAA-holdings $\%BV^{AAA}_{j,t}$ of fund j at month t instead of the indicator variable $\mathbf{1}\{\%BV^{AAA}_{j,1/2019} < median(\%BV^{AAA}_{j,1/2019})\}$.

[20] To complement the analysis in Table 8 and verify the parallel trends assumption of the Dif-in-Dif tests, Figure A.6 in the Internet Appendix shows the time series of the dependent variables, i.e., non-AAA bonds sold as a percentage of fund value ($\Delta BV^{non-AAA}_{j,t}/BV_{j,all-rated,t}$) and bond-fund returns ($Return_{j,t}$) before and after the COVID-19 shock for the two NBFI groups (above or below median AAA-holdings as percentage of fund value at the beginning of the sample) in the US and the EA.

funds that held low proportions of AAA bonds in the beginning of our sample sold 4.8% more of non-AAA bonds, than did US funds that hold a large proportion of AAA bonds. Similarly, treated EA funds sold 7.5% more of non-AAA bonds, compared to the control group, i.e., EA funds with AAA holdings larger than the median for EA funds in January 2019. Hence, during the onset of COVID-19, the effect of AAA-rated bond holdings is stronger for EA funds. Overall, the findings in Panel A, Table 8 suggest that when a systemic shock as acute as the COVID-19 shock occurs, a sufficiently large proportionate holding in AAA-rated bonds induces greater stability in the bond holdings of funds, even in those holdings belonging to lower rating categories. Hence, a sufficiently large proportionate holding in AAA-rated bonds could be a remedy to the procyclicality of funds' investment activities (see e.g., Goldstein et al. (2017)). This result is not confined to US funds, which hold the largest portion of their assets in US Treasury bonds, but also to EA funds.

Finally, our results in Panel B of Table 8 also suggest that funds holding low proportions of their portfolios in AAA-rated bonds also suffered less negative returns compared to other funds that did not belong to this group. In particular, the overall effect of the COVID-19 shock on all funds' returns is -9.5%, which is further analyzed to -7.6% for US funds and -12.3% for EA funds. However, funds holding low proportions of AAA bonds, exhibit an even more pronounced negative effect on their returns: all NBFI's suffer an additional loss of about -9% during March 2020, which is relatively the same for US and EA funds alike. In sum, the findings in Panel B of Table 8 suggest that funds holding AAA-rated in smaller proportions than the average in their region, exhibited a sharper market value loss, due to the COVID-19 shock.

This is an important result that once again relates to the procyclicality of portfolio allocation by funds. In particular, if we assume that funds allocate their portfolios based *inter alia* on past returns, as shown in Timmer (2018), then negative returns that occur because of COVID-19 shock result in the reluctance of funds' investment managers to finance economic activity.[21] In this regard, the economic effects of the COVID-19 shock may be accentuated by a lack of funding, consistent with the results of Acharya & Sascha (2020). Hence, our findings provide a remedy, even if partial, to the negative feedback loop: investment funds that hold high-quality bonds experience more moderate effects from adverse systemic shocks, which could be important for the funding they provide to the real economy.

5 Concluding Remarks

In this study, we examine the changes in the portfolio allocation of bond funds across credit rating categories with a special focus on the COVID-19 shock in March 2020. Our results indicate that

[21] See also Nicoletti et al. (2024).

portfolio allocation and rebalancing are closely connected to credit ratings. Throughout our sample, we find that funds tend, on average, to sell more lower-rated bonds, and this relation is stronger when we consider changes in proportion to initial holdings, i.e., percentage changes. As a result, based on actual security holdings by bond funds, we document for the first time that portfolio reallocation is implemented to retain the balance of risks, as reflected by credit ratings.

We also find that during the COVID-19 shock, in March 2020, funds liquidated more of their highly rated positions in absolute dollar terms, a finding that is in line with documented evidence for a dash-for-cash effect that characterized the onset of the COVID-19 crisis. This is particularly true for US NBFIs. However, we also show that the effects of the dash-for-cash were widespread and not confined to the US Treasury bonds, or AAA-rated bonds, as previously thought. In particular, when we examine the spillover effects from AAA-rated holdings on the holdings of bonds belonging to lower rating categories, we find that these were significant for bonds rated in the IG category, especially for Euroarea-based funds. Consequently, we argue that dash-for-cash affects the portfolio holdings of bond funds across several credit ratings and, thus, has the potential to become a widespread systemic crisis.

At the same time, we find that funds holding a large proportion of AAA-rated bonds managed to moderate, during the COVID-19 shock, both the reduction of their holdings of lower-rated bonds and the adverse effect of the shock on their portfolio returns. In light of the procyclicality in funds' portfolio allocation and the increased importance of this sector for funding the economy, our findings have important policy implications: if funds hold a large proportion of their portfolios in high-quality liquid assets, they would mitigate at least part of the adverse effects of shocks as acute as those originating from COVID-19.

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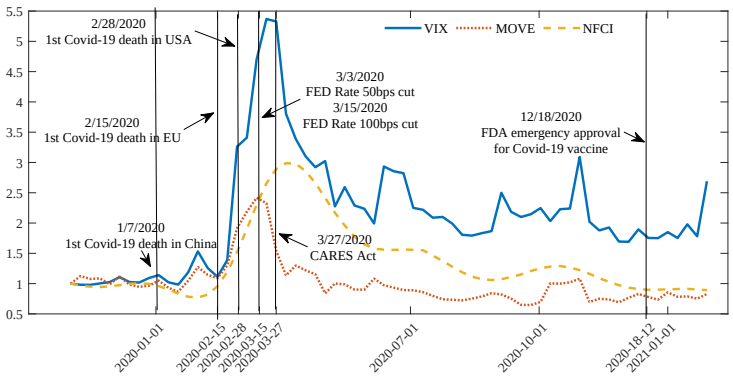
Figures

Figure 1 Financial Indicators at the Onset of the COVID-19 Pandemic

This figure illustrates the time series of several financial indicators during the onset of the COVID-19 pandemic from November 2019 to January 2021. Panel A shows the time series of the VIX, the Option Volatility Estimate (MOVE), and the National Financial Conditions Index (NFCI). The NFCI has been re-scaled by adding one to each observation. All three indexes have been scaled by their first observation in the sample. Panel B shows the time series of the Composite Index for Systemic Stress (CISS) for the US and the Euroarea.

Panel A: VIX, MOVE, NFCI Nov. 2019 - Jan. 2021



Panel B: CISS US and Euroarea Nov. 2019 - Jan. 2021

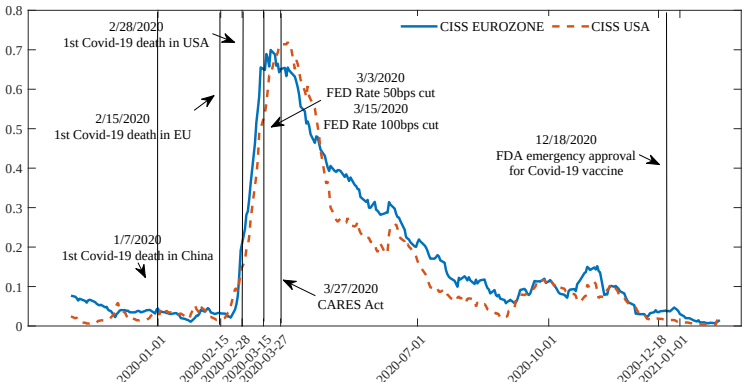


Figure 2 Availability of NBFI Data for Different Value Thresholds

This figure shows the representativeness of our sample based on reporting frequency and assets under management at the fund level for the US and the Euroarea (EA). Data is from Dec. 2018 to Jan. 2021.

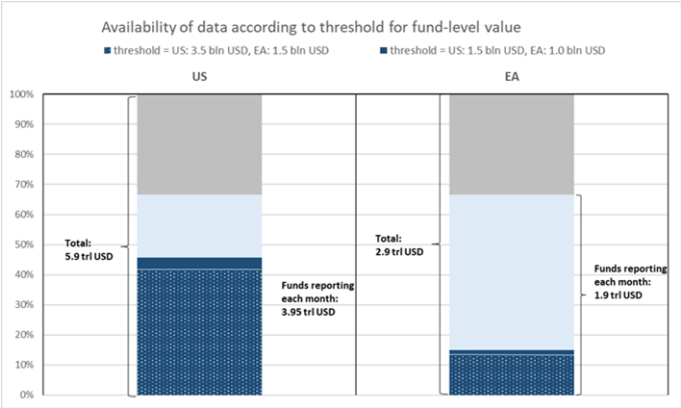
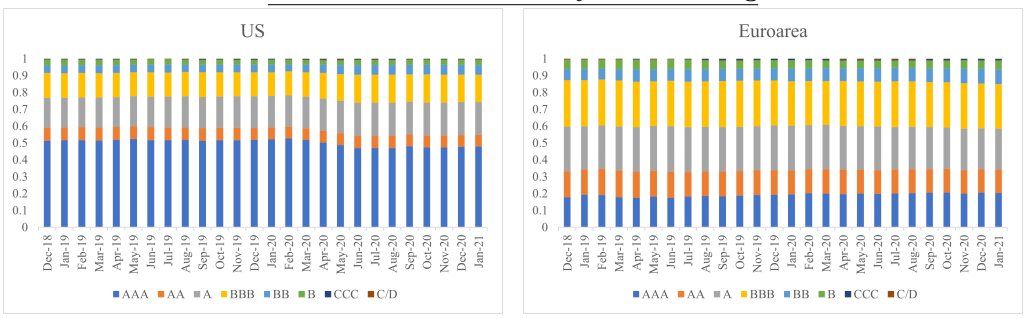


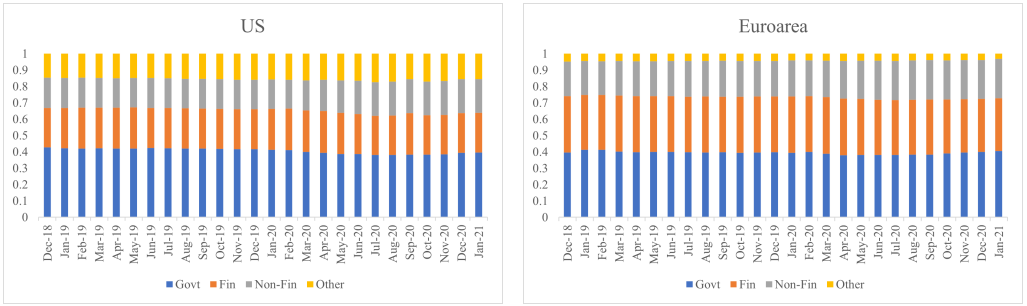
Figure 3 Value-Weighted Composition of NBFI Bond Holdings in the US and the Euroarea (2019-2021)

This figure illustrates the aggregate composition of NBFI bond holdings in the US and the Euroarea. The composition of bond portfolios is the book value of each bond category as a percentage the total book value of NBFI bond holdings in a given month. Panel A shows aggregate bond portfolio weights by credit rating. Credit ratings are from three rating agencies: S&P, Moody's, and Fitch. The composition of aggregate bond portfolios by credit ratings is with respect the set of rated bonds. Panel B reports aggregate bond portfolio weights by sector of the issuing institutions, and Panel C shows aggregate bond portfolio weights by the headquarters of the issuing institution. Data is for Dec. 2018 to Jan. 2021.

Panel A: Bond Portfolios by Credit Rating



Panel B: Bond Portfolios by Sector of Issuer



Panel C: Bond Portfolios by Location of Issuer

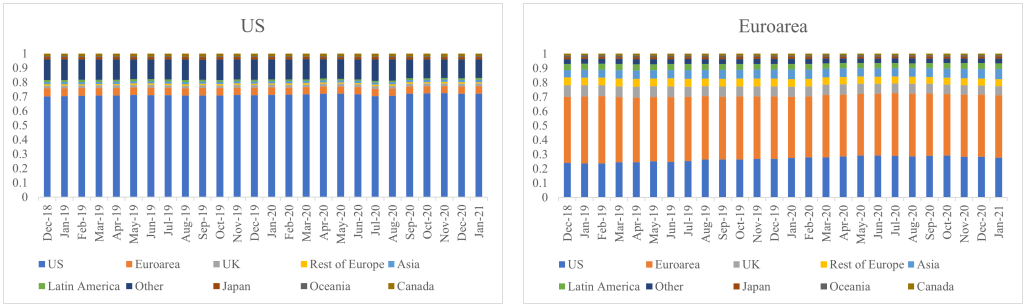
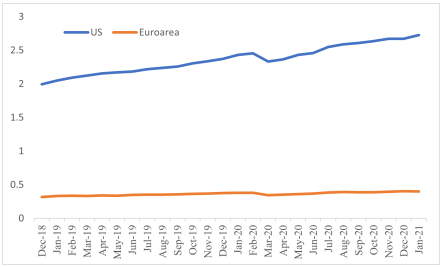


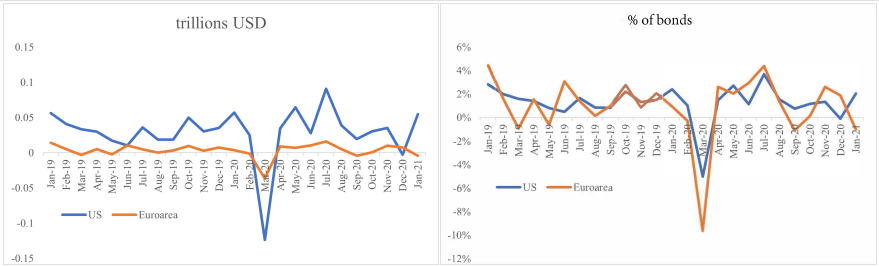
Figure 4 Total Book Value of NBFI Bond Holdings (2019-2021)

This figure shows the total NBFI bond holdings in book values in the US and Euroearea. Panel A shows the total asset holdings in trillions USD. Panel B shows the changes in total asset holdings, both in trillions USD and as a percentage of the total value in the previous month. Panel C shows all purchases of bonds by NBFIs and Panel D shows all sales of bonds, both in trillions USD and as a percentage of total value in the previous month. Data is for Jan. 2019 to Jan. 2021.

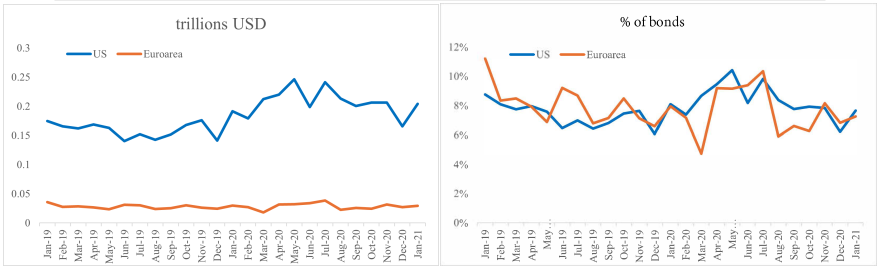
Panel A: Total Book Value (trillions USD)



Panel B: Changes in Total Book Value (trillions USD and % of total bond value)



Panel C: Bond Purchases (trillions USD and % of total bond value)



Panel D: Bond Sales (trillions USD and % of total bond value)

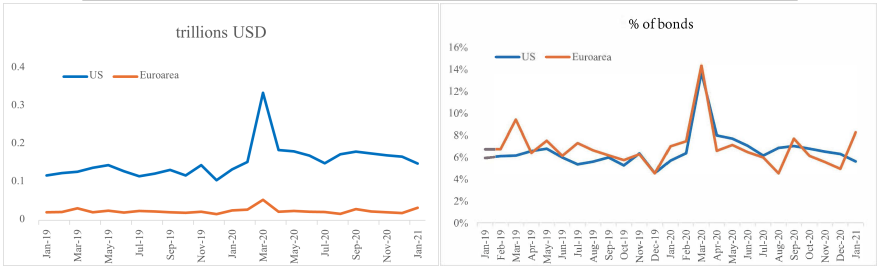
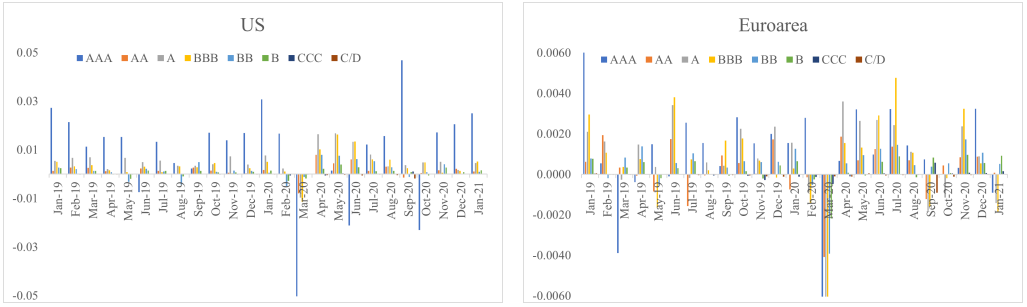


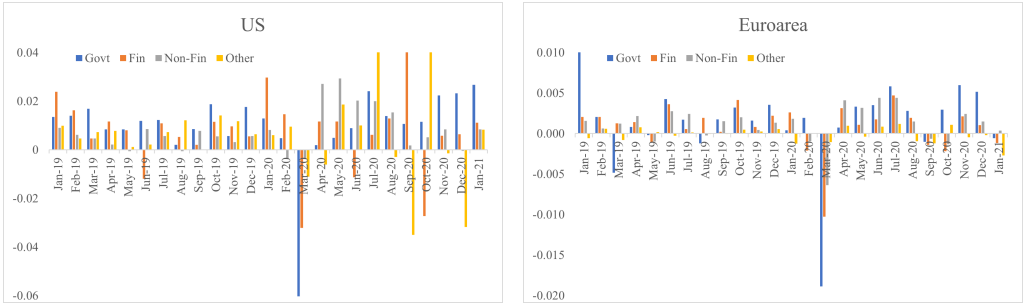
Figure 5 Dollar Changes in the Composition of NBFI Bond Holdings in the US and the Euroarea (2019-2021)

This figure illustrates the changes in the composition of aggregate NBFI bond holdings in the US and the Euroarea by bond categories (ratings, sector, headquarters). Dollar changes ($\Delta BV(t)$) are the monthly changes in the aggregate book value of each bond category in trillions USD. Panel A shows dollar changes in aggregate bond holdings by credit rating. Credit ratings are from three rating agencies: S&P, Moody's, and Fitch. The composition of aggregate bond portfolios by credit ratings is with respect the set of rated bonds. Panel B shows changes in aggregate bond holdings by sector of the issuing institutions, and Panel C shows the changes in aggregate bond holdings by the headquarter location of the issuing institution. Data is for Jan. 2019 to Jan. 2021.

Panel A: Changes in Bond Holdings by Credit Rating (trillions USD)



Panel B: Changes in Bond Holdings by Sector of Issuer (trillions USD)



Panel C: Changes in Bond Holdings by Location of Issuer (trillions USD)

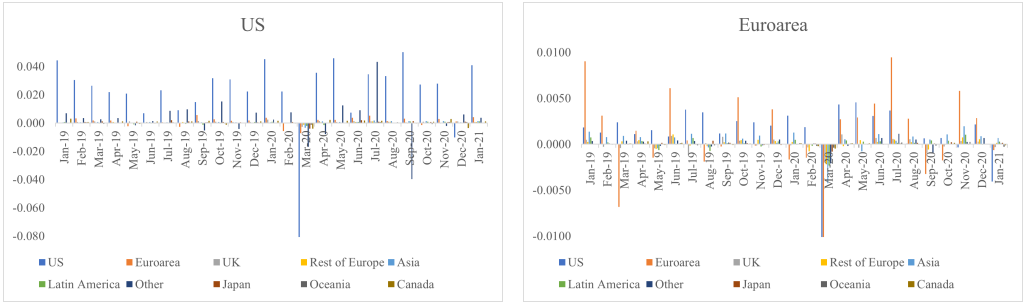
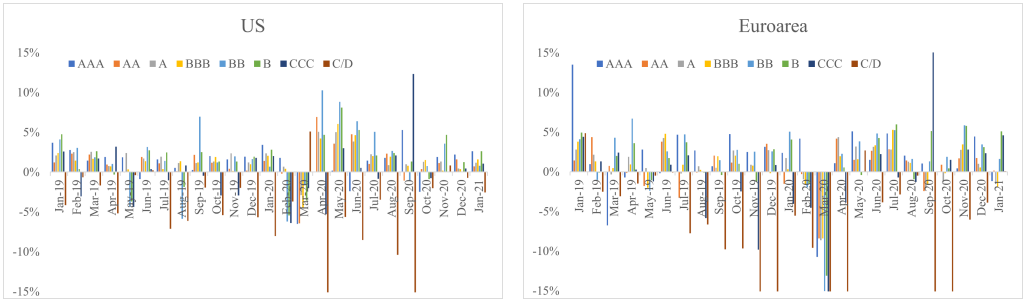


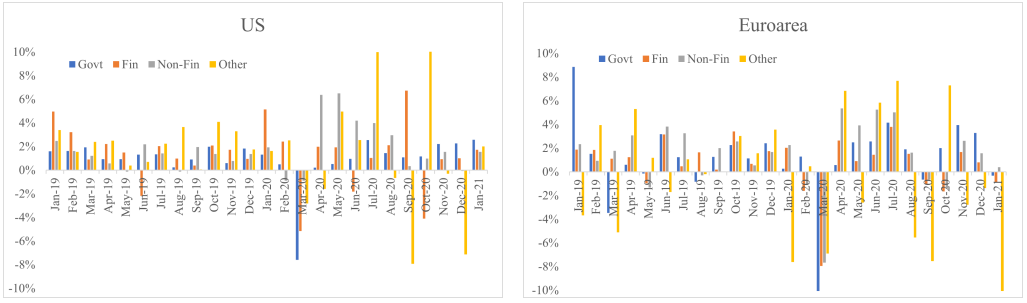
Figure 6 Percentage Changes in the Composition of NBFI Bond Holdings in the US and the Euroarea (2019-2021)

This figure illustrates the percentage changes in the composition of aggregate NBFI bond holdings in the US and the Euroarea by bond categories (ratings, sector, headquarters). Percentage changes (%ΔBV(t)) are the month-to-month percentage changes in the aggregate book value of each bond category. Panel A shows percentage changes in aggregate bond holdings by credit rating. Credit ratings are from three rating agencies: S&P, Moody's, and Fitch. The composition of aggregate bond portfolios by credit ratings is with respect the set of rated bonds. Panel B shows changes in aggregate bond holdings by sector of the issuing institutions, and Panel C shows the changes in aggregate bond holdings by the headquarter location of the issuing institution. Data is for Jan. 2019 to Jan. 2021.

Panel A: Changes in Bond Holdings by Credit Rating (%)



Panel B: Changes in Bond Holdings by Sector of Issuer (%)



Panel C: Changes in Bond Holdings by Location of Issuer (%)

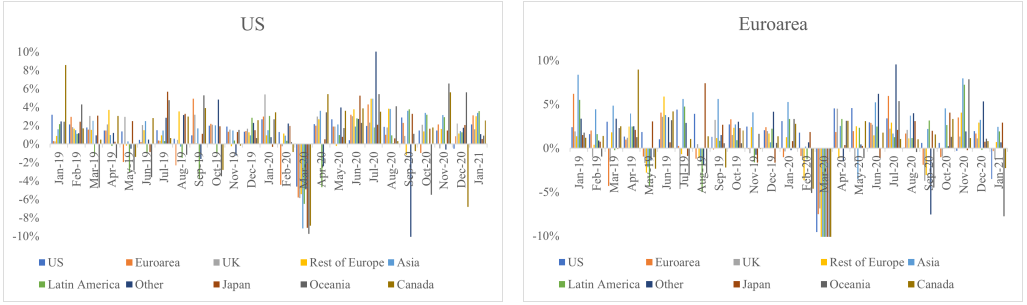
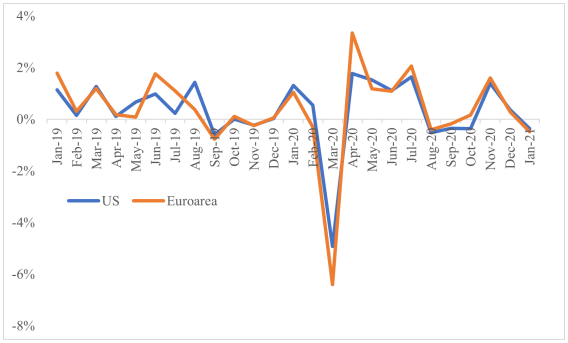


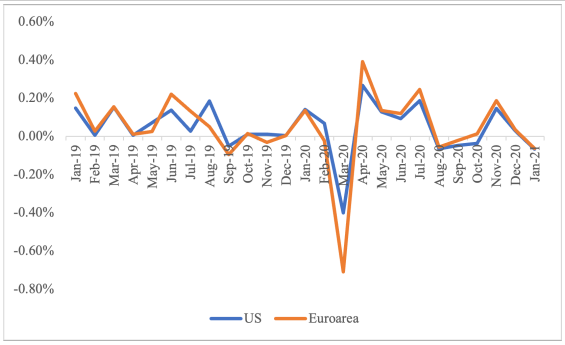
Figure 7 Aggregate Average Returns for NBFI Bond Holdings (2019-2021)

This figure shows aggregate monthly returns of NBFI bond holdings in the US and Euroearea. Panel A shows simple averages of returns of all bond holdings. Panel B shows average returns of bond portfolios value-weighted by credit rating. Credit ratings are from three rating agencies: S&P, Moody's, and Fitch. The composition of aggregate bond holdings by credit ratings is with respect the set of rated bonds. Panel C shows average returns of bond portfolios value-weighted by sector of the issuing institutions, and Panel D shows average returns of bond portfolios value-weighted by the headquarter location of the issuing institution. Bond returns are from clean prices, and are winsorized at the 0.5% level. Data is for Jan. 2019 to Jan. 2021.

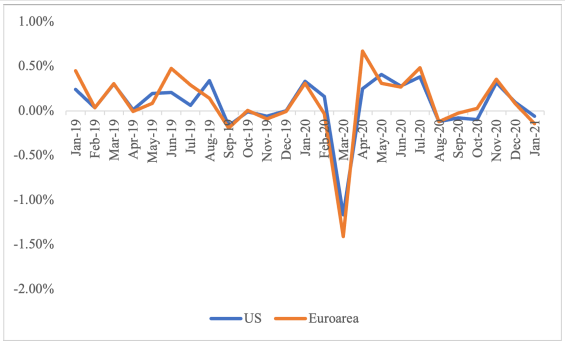
Panel A: Aggregate Average Bond Returns (equal-weighted)



Panel B: Aggregate Average Bond Returns (value-weighted by credit rating)



Panel C: Aggregate Average Bond Returns (value-weighted by sector)



Panel D: Aggregate Average Bond Returns (value-weighted by HQ)

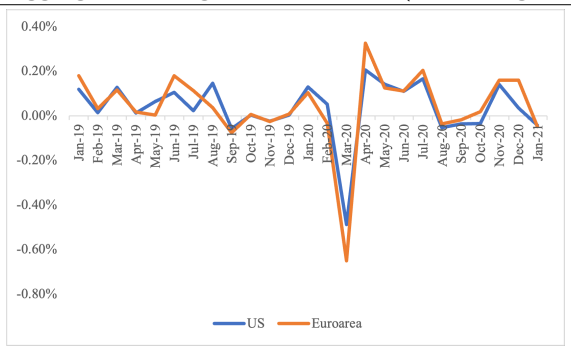
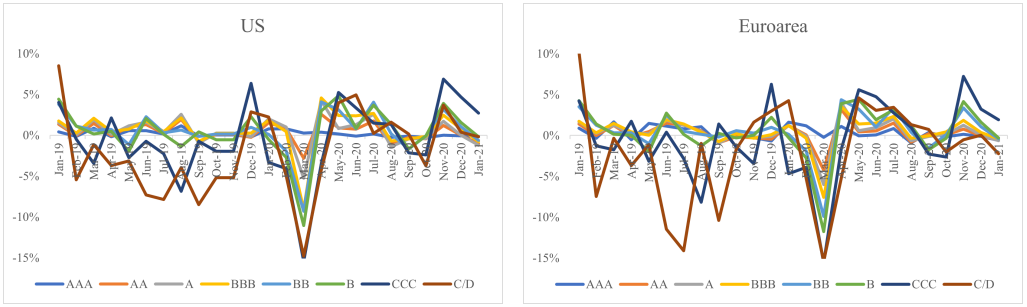


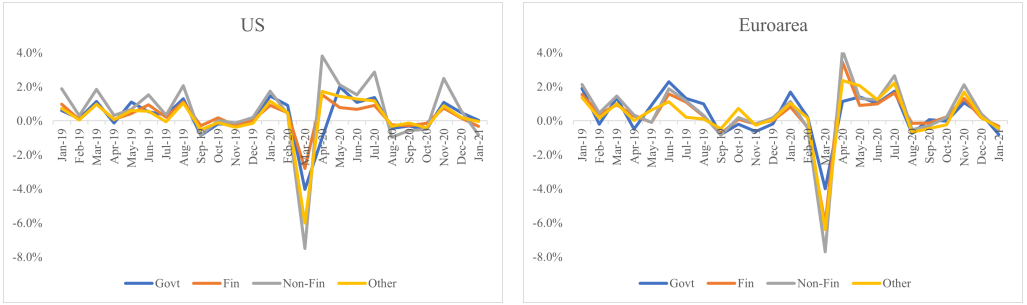
Figure 8 Average Returns by Bond Categories for NBFIs in the US and the Euroarea (2019-2021)

This figure illustrates the average monthly returns by bond categories (ratings, sector, headquarters) for NBFIs in the US and the Euroarea. Bond returns are from clean prices, and are winsorized at the 0.5% level. Average returns are simple averages across all bonds in the same ratings/sector/headquarter category. Panel A shows average returns of bond holdings by credit rating. Credit ratings are from three rating agencies: S&P, Moody's, and Fitch. The composition of aggregate bond portfolios by credit ratings is with respect the set of rated bonds. Panel B shows average returns of bond holdings by the sector of the issuing institutions, and Panel C shows average returns of bond holdings by the headquarter location of the issuing institution. Data is for Jan. 2019 to Jan. 2021.

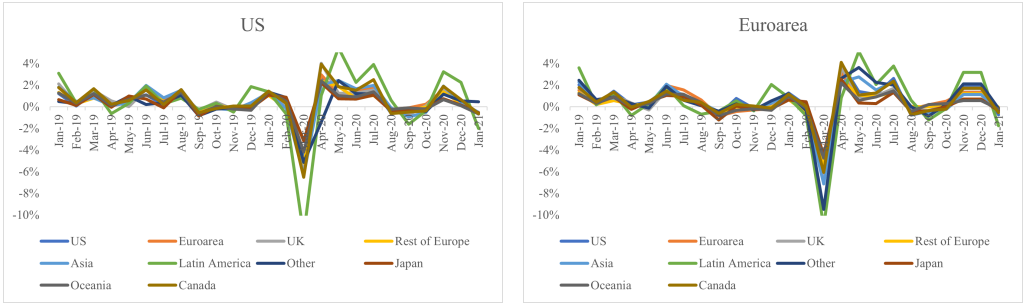
Panel A: Average Bond Returns by Credit Rating



Panel B: Average Bond Returns by Sector of Issuer



Panel C: Average Bond Returns by Location of Issuer



Tables

Table 1 Summary Statistics for NBFI Bond Holdings: Aggregate Level

This table reports summary statistics for key variables in our sample at the aggregate level. Summary statistics are estimated each month at the NBFI headquarter (US or Euroarea). Panel A reports summary statistics by bond category (ratings, sector, headquarters) for aggregate book values of NBFI bond holdings in the US and the Euroarea (trillion USD). Panel B reports summary statistics by bond category for aggregate portfolio weights of NBFI bond holdings in the US and the Euroarea. Aggregate portfolio weights are the book values of each category as a percentage of the total book value of all NBFI bond holdings in a given month. Panel C reports summary statistics, by category, for aggregate portfolio changes (trillion USD) in book value of NBFI bond holdings (ΔBV(t)). Panel D reports summary statistics, by category, for aggregate portfolio percentage changes in book value of NBFI bond holdings (%ΔBV(t)). Panel E reports summary statistics, by category, for average monthly bond returns (Returns(t)). Credit ratings are from three rating agencies: S&P, Moody's, and Fitch. The composition of aggregate bond portfolios by credit rating is with respect the set of rated bonds. Average returns are simple averages across all bonds in the same ratings/sector/headquarter category. Returns are from clean prices, and are winsorized at the 0.5% level. N is the number of time-series observations. Data is for Dec. 2018 to Jan. 2021.

Panel A: Summary Statistics for Aggregate Bond Portfolio Book Values in trillion USD ($N = 26$)

Aggregate Bond Portfolio Book Values by Credit Rating

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
AAA	0.869	0.057	0.743	0.972	AAA	0.064	0.008	0.050	0.076
AA	0.126	0.008	0.112	0.140	AA	0.048	0.002	0.043	0.051
A	0.326	0.042	0.259	0.395	A	0.085	0.005	0.075	0.091
BBB	0.263	0.040	0.212	0.331	BBB	0.088	0.006	0.078	0.099
BB	0.086	0.018	0.065	0.116	BB	0.025	0.004	0.019	0.033
B	0.053	0.004	0.047	0.063	B	0.016	0.001	0.014	0.019
CCC	0.008	0.002	0.004	0.011	CCC	0.002	0.001	0.001	0.004
C/D	0.003	0.001	0.001	0.006	C/D	0.001	0.000	0.000	0.002

Aggregate Bond Portfolio Book Values by Sector of Issuer

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
Govt	0.957	0.056	0.852	1.083	Govt	0.144	0.009	0.126	0.163
Fin	0.583	0.050	0.482	0.665	Fin	0.123	0.007	0.131	0.131
Non-Fin	0.451	0.066	0.368	0.562	Non-Fin	0.082	0.009	0.067	0.097
Other	0.372	0.048	0.292	0.447	Other	0.015	0.001	0.013	0.017

Aggregate Bond Portfolio Book Values by Location of Issuer

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
US	1.683	0.161	1.400	1.964	US	0.098	0.012	0.077	0.115
Euroarea	0.122	0.008	0.110	0.140	Euroarea	0.160	0.008	0.146	0.175
UK	0.044	0.005	0.035	0.052	UK	0.026	0.001	0.024	0.027
Rest of Europe	0.023	0.002	0.020	0.027	Rest of Europe	0.019	0.001	0.017	0.021
Asia	0.036	0.004	0.030	0.045	Asia	0.022	0.003	0.016	0.028
Latin America	0.030	0.002	0.027	0.033	Latin America	0.014	0.001	0.012	0.016
Other	0.328	0.025	0.286	0.384	Other	0.012	0.001	0.011	0.013
Japan	0.041	0.004	0.034	0.047	Japan	0.005	0.000	0.005	0.006
Oceania	0.012	0.001	0.011	0.014	Oceania	0.004	0.000	0.003	0.004
Canada	0.045	0.004	0.036	0.053	Canada	0.004	0.000	0.003	0.004

Panel B: Summary Statistics for Aggregate Bond Portfolio Weights ($N = 26$)

Aggregate Bond Portfolio Weights by Credit Rating

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
AAA	50.26%	2.07%	47.00%	52.67%	AAA	19.27%	0.99%	17.56%	20.56%
AA	7.28%	0.33%	6.75%	7.74%	AA	14.57%	0.58%	13.83%	15.72%
A	18.73%	0.74%	17.58%	19.78%	A	25.84%	0.79%	24.13%	26.93%
BBB	15.09%	1.00%	14.09%	16.78%	BBB	26.83%	0.42%	25.71%	27.51%
BB	4.94%	0.60%	4.22%	5.92%	BB	7.61%	0.64%	6.41%	8.89%
B	3.09%	0.22%	2.75%	3.60%	B	5.00%	0.47%	4.38%	5.74%
CCC	0.44%	0.10%	0.25%	0.64%	CCC	0.62%	0.26%	0.24%	0.97%
C/D	0.16%	0.07%	0.08%	0.36%	C/D	0.26%	0.13%	0.07%	0.53%

Aggregate Bond Portfolio Weights by Sector of Issuer

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
Govt	40.63%	1.67%	38.11%	42.72%	Govt	39.49%	0.89%	38.06%	41.23%
Fin	24.70%	0.48%	23.91%	25.50%	Fin	33.87%	0.64%	32.34%	34.66%
Non-Fin	19.00%	1.20%	17.52%	20.79%	Non-Fin	22.43%	1.17%	20.59%	24.18%
Other	15.68%	0.79%	14.64%	17.41%	Other	4.21%	0.32%	3.12%	4.78%

Aggregate Bond Portfolio Weights by Location of Issuer

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
US	71.20%	0.66%	70.20%	72.34%	US	26.85%	1.86%	23.65%	29.16%
Euroarea	5.19%	0.17%	4.95%	5.54%	Euroarea	44.02%	1.17%	42.45%	46.82%
UK	1.84%	0.06%	1.73%	1.91%	UK	7.09%	0.42%	6.44%	8.02%
Rest of Europe	0.96%	0.02%	0.92%	1.00%	Rest of Europe	5.18%	0.28%	4.72%	5.54%
Asia	1.51%	0.05%	1.43%	1.66%	Asia	6.12%	0.46%	5.12%	7.05%
Latin America	1.28%	0.14%	1.12%	1.55%	Latin America	3.90%	0.26%	3.48%	4.33%
Other	13.89%	0.54%	12.81%	15.06%	Other	3.38%	0.14%	3.09%	3.55%
Japan	1.72%	0.05%	1.63%	1.79%	Japan	1.41%	0.08%	1.26%	1.55%
Oceania	0.51%	0.04%	0.47%	0.59%	Oceania	0.97%	0.09%	0.83%	1.11%
Canada	1.89%	0.04%	1.80%	1.99%	Canada	1.09%	0.05%	1.02%	1.18%

Panel C: Summary Statistics for Aggregate Bond Portfolio Changes ΔBV(t) in trillion USD ($N = 25$)

Aggregate Bond Portfolio Changes by Credit Rating

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
AAA	0.0093	0.0206	-0.0614	0.0469	AAA	0.0010	0.0026	-0.0075	0.0068
AA	0.0015	0.0027	-0.0079	0.0079	AA	0.0003	0.0013	-0.0041	0.0019
A	0.0055	0.0050	-0.0097	0.0167	A	0.0008	0.0023	-0.0078	0.0036
BBB	0.0037	0.0049	-0.0114	0.0163	BBB	0.0006	0.0023	-0.0075	0.0048
BB	0.0016	0.0032	-0.0049	0.0079	BB	0.0005	0.0011	-0.0039	0.0017
B	0.0008	0.0015	-0.0028	0.0039	B	0.0002	0.0006	-0.0022	0.0010
CCC	0.0000	0.0003	-0.0006	0.0011	CCC	0.0000	0.0002	-0.0005	0.0006
C/D	-0.0002	0.0004	-0.0018	0.0001	C/D	-0.0001	0.0002	-0.0009	0.0000

Aggregate Bond Portfolio Changes by Sector of Issuer

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
Govt	0.0091	0.0187	-0.0765	0.0268	Govt	0.0014	0.0051	-0.0189	0.0112
Fin	0.0072	0.0152	-0.0322	0.0420	Fin	0.0008	0.0029	-0.0103	0.0047
Non-Fin	0.0077	0.0085	-0.0039	0.0294	Non-Fin	0.0012	0.0022	-0.0064	0.0044
Other	0.0052	0.0161	-0.0350	0.0411	Other	-0.0001	0.0009	-0.0027	0.0012

Aggregate Bond Portfolio Changes by Location of Issuer

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
US	0.0226	0.0253	-0.0811	0.0523	US	0.0014	0.0029	-0.0101	0.0046
Euroarea	0.0012	0.0030	-0.0071	0.0056	Euroarea	0.0011	0.0046	-0.0121	0.0094
UK	0.0007	0.0009	-0.0027	0.0023	UK	0.0000	0.0007	-0.0018	0.0011
Rest of Europe	0.0003	0.0005	-0.0013	0.0011	Rest of Europe	0.0001	0.0006	-0.0022	0.0011
Asia	0.0006	0.0009	-0.0034	0.0018	Asia	0.0005	0.0011	-0.0042	0.0020
Latin America	0.0001	0.0008	-0.0020	0.0011	Latin America	0.0001	0.0006	-0.0023	0.0010
Other	0.0027	0.0135	-0.0397	0.0433	Other	0.0001	0.0006	-0.0021	0.0010
Japan	0.0005	0.0011	-0.0039	0.0021	Japan	0.0000	0.0002	-0.0008	0.0004
Oceania	0.0001	0.0005	-0.0012	0.0008	Oceania	0.0000	0.0001	-0.0004	0.0003
Canada	0.0006	0.0017	-0.0041	0.0031	Canada	0.0000	0.0001	-0.0005	0.0003

Panel D: Summary Statistics for Aggregate Bond Portfolio Percentage Changes %ΔBV(t) ($N = 25$)

Aggregate Bond Portfolio Percentage Changes by Credit Rating

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
AAA	1.12%	2.33%	-6.50%	5.28%	AAA	1.72%	4.32%	-10.74%	13.49%
AA	1.19%	2.29%	-6.43%	6.91%	AA	0.64%	2.73%	-8.40%	4.36%
A	1.74%	1.55%	-2.88%	5.07%	A	0.96%	2.67%	-8.62%	4.35%
BBB	1.40%	1.88%	-4.48%	6.05%	BBB	0.75%	2.72%	-8.41%	5.26%
BB	1.86%	3.97%	-6.21%	10.27%	BB	1.92%	4.23%	-15.07%	6.70%
B	1.58%	3.03%	-5.46%	8.11%	B	1.41%	3.88%	-13.10%	5.97%
CCC	0.07%	3.63%	-6.41%	12.30%	CCC	-0.07%	7.59%	-20.03%	26.73%
C/D	-5.63%	9.23%	-44.89%	5.09%	C/D	-8.50%	12.05%	-55.50%	4.84%

Aggregate Bond Portfolio Percentage Changes by Sector of Issuer

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
Govt	0.97%	1.91%	-7.59%	2.55%	Govt	1.08%	3.60%	-12.45%	8.85%
Fin	1.30%	2.59%	-5.15%	6.74%	Fin	0.72%	2.33%	-7.94%	3.78%
Non-Fin	1.72%	1.90%	-0.89%	6.49%	Non-Fin	1.49%	2.74%	-7.66%	5.35%
Other	1.56%	4.00%	-7.93%	10.12%	Other	-0.60%	5.84%	-17.70%	7.68%

Aggregate Bond Portfolio Percentage Changes by Location of Issuer

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
US	1.37%	1.50%	-4.64%	3.16%	US	1.52%	2.90%	-9.55%	4.55%
Euroarea	1.00%	2.59%	-5.80%	4.92%	Euroarea	0.76%	2.99%	-7.52%	6.19%
UK	1.56%	1.99%	-5.87%	5.37%	UK	0.09%	2.65%	-6.87%	4.48%
Rest of Europe	1.28%	2.08%	-5.46%	4.91%	Rest of Europe	0.51%	3.25%	-10.97%	5.86%
Asia	1.64%	2.56%	-9.18%	4.91%	Asia	2.35%	4.89%	-16.74%	8.37%
Latin America	0.33%	2.69%	-6.51%	3.77%	Latin America	0.74%	4.39%	-15.87%	7.23%
Other	0.91%	3.93%	-10.34%	12.70%	Other	0.99%	4.76%	-15.71%	9.55%
Japan	1.31%	2.66%	-9.09%	5.66%	Japan	0.73%	3.74%	-14.48%	7.38%
Oceania	0.81%	4.06%	-9.75%	6.57%	Oceania	-0.15%	3.96%	-10.60%	7.85%
Canada	1.40%	3.73%	-8.86%	8.55%	Canada	0.80%	3.69%	-11.90%	8.96%

Panel E: Summary Statistics for Average Bond Returns (Return(t))

Average Bond Portfolio Returns by Credit Rating ($N = 25$)

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
AAA	0.18%	0.40%	-0.30%	1.16%	AAA	0.30%	0.81%	-0.94%	1.64%
AA	0.40%	1.17%	-2.80%	2.57%	AA	0.27%	1.31%	-4.25%	3.19%
A	0.54%	1.79%	-5.25%	4.22%	A	0.35%	1.69%	-6.01%	3.98%
BBB	0.64%	2.42%	-9.10%	4.57%	BBB	0.43%	1.96%	-7.58%	3.55%
BB	0.49%	2.63%	-9.31%	4.07%	BB	0.50%	2.70%	-9.90%	4.36%
B	0.38%	3.10%	-11.05%	4.82%	B	0.43%	3.24%	-11.78%	4.40%
CCC	-0.56%	4.75%	-15.43%	6.86%	CCC	-0.50%	4.93%	-15.58%	7.21%
C/D	-2.04%	5.10%	-14.82%	8.48%	C/D	-1.99%	6.11%	-15.42%	10.20%

Average Bond Portfolio Returns by Sector of Issuer

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
Govt	0.23%	1.18%	-4.02%	1.99%	Govt	0.37%	1.30%	-3.99%	2.29%
Fin	0.28%	0.83%	-2.79%	1.53%	Fin	0.30%	1.60%	-6.06%	3.45%
Non-Fin	0.54%	2.10%	-7.50%	3.80%	Non-Fin	0.42%	2.06%	-7.71%	4.14%
Other	0.17%	1.44%	-6.00%	1.73%	Other	0.29%	1.65%	-6.39%	2.37%

Average Bond Portfolio Returns by Location of Issuer

	US					Euroarea			
	mean	st. dev.	min	max		mean	st. dev.	min	max
US	0.36%	1.32%	-4.56%	2.56%	US	0.52%	1.84%	-6.34%	4.00%
Euroarea	0.43%	1.64%	-6.20%	2.94%	Euroarea	0.35%	1.66%	-6.16%	3.21%
UK	0.45%	1.72%	-6.03%	4.00%	UK	0.36%	1.75%	-6.58%	3.59%
Rest of Europe	0.33%	1.39%	-5.21%	2.37%	Rest of Europe	0.29%	1.41%	-5.49%	2.47%
Asia	0.40%	1.72%	-6.32%	2.41%	Asia	0.42%	1.87%	-7.13%	2.75%
Latin America	0.50%	3.11%	-11.87%	5.45%	Latin America	0.48%	2.97%	-11.05%	5.12%
Other	0.19%	1.38%	-5.15%	2.41%	Other	0.48%	2.38%	-9.50%	3.61%
Japan	0.27%	1.01%	-3.15%	2.23%	Japan	0.17%	1.21%	-4.44%	2.54%
Oceania	0.32%	1.21%	-4.21%	2.38%	Oceania	0.24%	1.25%	-4.77%	2.18%
Canada	0.51%	1.85%	-6.51%	3.93%	Canada	0.45%	1.75%	-6.08%	4.10%

Table 2 Summary Statistics for NBFI Bond Holdings: Bond-NBFI Level

This table reports summary statistics (mean, standard deviation, minimum, and maximum) for key variables in our sample at the bond-NBFI level. Panel A reports summary statistics by bond category (ratings, sector, headquarters) for book values in million USD of NBFI bond holdings in the US and the Euroarea. Panel B reports summary statistics by bond category for percentage weights of NBFI bond holdings in the US and the Euroarea. Percentage weights are the book values of each bond in the NBFI portfolio divided by the total book value of bond holdings of each NBFI. Panel C reports summary statistics, by category, for the changes in million USD (ΔBV(i,j,t)) in the book value of each bond i in the portfolio of NBFI j at time t. Panel D reports summary statistics, by category, for percentage changes (%ΔBV(i,j,t)) in the book value of each bond in the NBFI portfolio, winsorized at the -100% and 100% levels. Panel E reports summary statistics, by category, for monthly returns of each bond in the NBFI portfolio (Return(i,j,t)). Credit ratings are from three rating agencies: S&P, Moody's, and Fitch. The composition of bond portfolios by credit ratings is with respect the set of rated bonds. Returns are from clean prices, and are winsorized at the 0.5% level. N is the number of observations. Data is for Dec. 2018 to Jan. 2021.

Panel A: Summary Statistics for Bond Book Values in million USD

Bond Book Values by Credit Rating

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
AAA	12.68	70.55	-1,436	6,372	1,781,420	AAA	9.19	34	-102	1,762.17	179,757
AA	7.37	20.34	0	805	443,933	AA	3.79	12.89	-2	1,433	327,726
A	5.49	14.33	0	783	1,541,507	A	2.66	7.72	-30	537	829,016
BBB	4.48	11.50	-4	1,024	1,526,417	BBB	2.93	14.37	-32	1,481	781,882
BB	5.50	24.98	0	5,534	408,323	BB	4.06	6.68	-5	158	160,778
B	6.28	12.00	0	387	220,725	B	4.40	6.60	-1	503	96,589
CCC	6.35	14.42	0	390	31,449	CCC	4.75	8.50	0	150	11,414
C/D	9.71	21.53	0	307	7,516	C/D	5.86	8.09	0	84	3,743

Bond Book Values by Sector of Issuer

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
Govt	14.87	74.73	-198	6,372	1,671,733	Govt	10.58	34.20	-2	1,762	352,498
Fin	4.91	16.43	-1,436	1,986	3,082,669	Fin	2.72	6.98	-102	1,433	1,174,362
Non-Fin	4.27	14.34	-8	3,179	2,740,283	Non-Fin	2.11	4.36	-32	1,249	1,006,809
Other	6.82	37.45	-852	7,662	1,416,186	Other	2.79	9.70	-6	668	141,961

Bond Book Values by Location of Issuer

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
US	7.34	40.36	-1,436	6,372	5,959,485	US	2.84	11.89	-102	907	896,778
Euroarea	9.03	38.83	-4	5,534	352,282	Euroarea	3.89	18.03	-32	1,762	1,067,304
UK	6.91	16.98	0	445	163,948	UK	3.40	7.89	-2	348	196,165
Rest of Europe	8.26	17.29	0	528	71,571	Rest of Europe	4.16	8.89	0	170	117,233
Asia	6.58	14.96	0	475	141,454	Asia	5.15	7.94	0	144	112,698
Latin America	6.84	15.46	0	555	114,032	Latin America	5.79	11.96	0	406	63,425
Other	4.74	35.36	-607	7,662	1,793,516	Other	4.36	8.02	-6	170	73,141
Japan	13.21	39.16	0	620	79,822	Japan	3.01	7.89	0	379	44,110
Oceania	7.37	16.89	0	395	42,341	Oceania	2.01	4.16	0	82	45,422
Canada	6.03	21.95	0	3,307	192,420	Canada	1.74	4.35	0	79	59,354

Panel B: Summary Statistics for Bond Weights

Bond Weights by Credit Rating

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
AAA	0.10%	0.54%	-26.22%	35.67%	1,781,420	AAA	0.39%	1.09%	-0.84%	49.31%	179,757
AA	0.05%	0.11%	0%	4.33%	443,933	AA	0.18%	0.66%	-0.05%	66.80%	327,726
A	0.04%	0.11%	-0.03%	10.43%	1,541,507	A	0.10%	0.32%	-1.28%	100.00%	829,016
BBB	0.04%	0.10%	-0.01%	9.37%	1,526,417	BBB	0.11%	0.35%	-1.13%	88.61%	781,882
BB	0.09%	0.21%	0%	21.31%	408,323	BB	0.16%	0.25%	-0.53%	15.26%	160,778
B	0.12%	0.26%	0%	8.97%	220,725	B	0.20%	0.48%	-0.17%	30.09%	96,589
CCC	0.11%	0.39%	0%	25.00%	31,449	CCC	0.22%	0.47%	0%	9.08%	11,414
C/D	0.14%	0.28%	0%	5.98%	7,516	C/D	0.24%	0.45%	0%	8.46%	3,743

Bond Weights by Sector of Issuer

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
Govt	0.16%	0.58%	-26.22%	35.67%	1,671,733	Govt	0.45%	1.05%	-0.05%	49.31%	352,498
Fin	0.04%	0.16%	-10.48%	24.98%	3,082,669	Fin	0.11%	0.33%	-0.84%	100%	1,174,362
Non-Fin	0.05%	0.19%	-0.10%	51.30%	2,740,283	Non-Fin	0.09%	0.23%	-1.29%	88.60%	1,006,809
Other	0.09%	0.60%	-4.19%	100%	1,416,186	Other	0.12%	1.07%	-0.48%	100%	141,961

Bond Weights by Location of Issuer

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
US	0.07%	0.39%	-26.22%	100%	5,959,485	US	0.11%	0.41%	-0.84%	49.31%	896,778
Euroarea	0.06%	0.19%	0%	20.89%	352,282	Euroarea	0.16%	0.67%	-1.28%	100%	1,067,304
UK	0.06%	0.17%	0%	10.63%	163,948	UK	0.16%	0.56%	-0.05%	100%	196,165
Rest of Europe	0.08%	0.23%	0%	9.88%	71,571	Rest of Europe	0.16%	0.34%	0%	21.78%	117,233
Asia	0.07%	0.16%	0%	5.85%	141,454	Asia	0.22%	0.34%	0%	12.39%	112,698
Latin America	0.08%	0.22%	0%	10.43%	114,032	Latin America	0.23%	0.48%	0%	21.60%	63,425
Other	0.10%	0.40%	-4.19%	53.31%	1,793,516	Other	0.21%	0.51%	-0.48%	19.29%	73,141
Japan	0.06%	0.21%	0%	9.65%	79,822	Japan	0.14%	0.29%	0%	6.03%	44,110
Oceania	0.07%	0.23%	0%	13.31%	42,341	Oceania	0.09%	0.20%	0%	5.30%	45,422
Canada	0.06%	0.20%	0%	15.45%	192,420	Canada	0.08%	0.19%	0%	5.29%	59,354

Panel C: Summary Statistics for Changes in Bond Holdings ΔBV(i,j,t) in million USD

Changes in Bond Holdings by Credit Rating

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
AAA	0.131	29.98	-5,375	5,738	1,767,828	AAA	0.136	13.43	-1,444	1,762	183,211
AA	0.082	5.83	-500	553	439,302	AA	0.022	6.90	-1,433	686	325,541
A	0.089	4.81	-535	607	1,530,154	A	0.023	2.68	-385	392	823,950
BBB	0.060	4.26	-364	597	1,524,743	BBB	0.019	6.62	-1,002	1,077	780,589
BB	0.097	8.34	-2,628	2,582	410,463	BB	0.072	2.23	-158	107	161,648
B	0.093	3.77	-387	387	221,243	B	0.058	2.91	-499	496	96,558
CCC	-0.001	4.68	111	390	32,355	CCC	-0.019	3.18	-68	150	11,862
C/D	-0.576	6.23	-301	72	8,381	C/D	-0.458	3.27	-69	54	4,029

Changes in Bond Holdings by Sector of Issuer

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
Govt	0.137	28.93	-5,375	5,738	1,653,237	Govt	0.103	14.43	-1,444	1,762	349,920
Fin	0.058	9.92	-1,986	1,986	3,061,431	Fin	0.017	3.68	-1,433	686	1,174,417
Non-Fin	0.070	3.51	-999	500	2,727,968	Non-Fin	0.029	2.26	-1,235	1,236	1,004,428
Other	0.092	16.94	-3,305	2,902	1,408,760	Other	-0.018	4.96	-567	500	143,268

Changes in Bond Holdings by Location of Issuer

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
US	0.095	17.19	-5,375	5,738	5,928,784	US	0.037	4.05	-796	827	901,225
Euroarea	0.085	11.80	-2,628	2,682	350,317	Euroarea	0.026	8.57	-1,444	1,762	1,061,995
UK	0.100	5.65	-335	335	163,135	UK	0.001	2.72	-344	345	195,059
Rest of Europe	0.101	5.12	-251	251	71,088	Rest of Europe	0.018	2.37	-112	121	116,686
Asia	0.104	4.13	-213	270	141,275	Asia	0.106	2.50	-93	111	112,721
Latin America	0.021	5.48	-535	390	113,981	Latin America	0.036	2.89	-104	150	63,160
Other	0.037	11.93	-2,138	2,855	1,769,919	Other	0.035	2.58	-71	70	73,671
Japan	0.161	10.28	-398	415	79,078	Japan	0.019	3.06	-373	379	43,544
Oceania	0.055	6.41	-296	395	42,107	Oceania	-0.004	1.62	-82	82	44,903
Canada	0.073	15.57	-3,305	2,864	191,712	Canada	0.011	1.43	-75	71	59,039

Panel D: Summary Statistics for Percentage Changes in Bond Holdings %ΔBV(i,j,t)

Percentage Changes in Bond Holdings by Credit Rating

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
AAA	-1.19%	26.64%	-100%	100%	1,767,828	AAA	1.67%	35.97%	-100%	100%	183,211
AA	2.29%	28.04%	-100%	100%	439,302	AA	2.35%	29.25%	-100%	100%	325,541
A	2.72%	28.35%	-100%	100%	1,530,154	A	2.79%	29.75%	-100%	100%	823,950
BBB	2.64%	30.65%	-100%	100%	1,524,743	BBB	2.59%	31.07%	-100%	100%	780,589
BB	3.73%	34.62%	-100%	100%	410,463	BB	3.75%	35.03%	-100%	100%	161,648
B	3.48%	35.56%	-100%	100%	221,243	B	3.47%	34.51%	-100%	100%	96,589
CCC	-0.18%	34.27%	-100%	100%	32,355	CCC	-0.31%	35.84%	-100%	100%	11,862
C/D	-10.01%	39.59%	-100%	100%	8,381	C/D	-9.50%	35.20%	-100%	100%	4,029

Percentage Changes in Bond Holdings by Sector of Issuer

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
Govt	1.19%	26.03%	-100%	100%	1,653,237	Govt	2.83%	30.00%	-100%	100%	349,920
Fin	0.34%	27.57%	-100%	100%	3,061,431	Fin	2.20%	31.36%	-100%	100%	1,174,418
Non-Fin	2.85%	30.08%	-100%	100%	2,727,968	Non-Fin	2.97%	31.58%	-100%	100%	1,004,428
Other	0.11%	28.26%	-100%	100%	1,408,760	Other	0.03%	34.02%	-100%	100%	143,268

Percentage Changes in Bond Holdings by Location of Issuer

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
US	1.18%	29.16%	-100%	100%	5,928,784	US	2.46%	33.08%	-100%	100%	901,255
Euroarea	2.14%	29.36%	-100%	100%	350,317	Euroarea	2.52%	30.48%	-100%	100%	1,061,995
UK	2.18%	29.44%	-100%	100%	163,135	UK	1.71%	29.83%	-100%	100%	195,059
Rest of Europe	2.32%	28.75%	-100%	100%	71,088	Rest of Europe	2.17%	29.79%	-100%	100%	116,686
Asia	3.04%	31.28%	-100%	100%	141,275	Asia	3.84%	32.73%	-100%	100%	112,721
Latin America	1.73%	31.86%	-100%	100%	113,981	Latin America	2.05%	30.57%	-100%	100%	63,160
Other	0.75%	23.59%	-100%	100%	1,769,919	Other	2.08%	33.99%	-100%	100%	73,671
Japan	2.52%	27.31%	-100%	100%	79,078	Japan	3.23%	28.83%	-100%	100%	43,544
Oceania	1.81%	28.79%	-100%	100%	42,107	Oceania	1.53%	27.79%	-100%	100%	44,903
Canada	2.52%	30.19%	-100%	100%	191,712	Canada	2.74%	29.82%	-100%	100%	59,039

Panel E: Summary Statistics for Bond Returns (Return(i,j,t))

Bond Returns by Credit Rating

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
AAA	0.16%	1.47%	-16.98%	12.67%	1,661,794	AAA	0.27%	1.92%	-16.98%	12.67%	163,497
AA	0.39%	1.94%	-16.98%	12.67%	413,094	AA	0.25%	2.18%	-16.98%	12.67%	305,718
A	0.50%	2.59%	-16.98%	12.67%	1,436,919	A	0.32%	2.54%	-16.98%	12.67%	771,713
BBB	0.62%	3.33%	-16.98%	12.67%	1,414,335	BBB	0.42%	2.92%	-16.98%	12.67%	726,074
BB	0.49%	3.76%	-16.98%	12.67%	374,652	BB	0.49%	4.00%	-16.98%	12.67%	147,500
B	0.41%	4.89%	-16.98%	12.67%	201,000	B	0.44%	5.16%	-16.98%	12.67%	88,514
CCC	-0.75%	8.88%	-16.98%	12.67%	29,447	CCC	-0.53%	8.69%	-16.98%	12.67%	10,672
C/D	-1.52%	10.43%	-16.98%	12.67%	7,125	C/D	-1.46%	9.96%	-16.98%	12.67%	3,562

Bond Returns by Sector of Issuer

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
Govt	0.23%	2.37%	-16.98%	12.67%	1,558,756	Govt	0.35%	3.11%	-16.98%	12.67%	328,010
Fin	0.26%	2.087%	-16.98%	12.67%	2,870,793	Fin	0.28%	2.54%	-16.98%	12.67%	1,087,596
Non-Fin	0.52%	3.41%	-16.98%	12.67%	2,538,686	Non-Fin	0.41%	3.30%	-16.98%	12.67%	932,445
Other	0.16%	2.97%	-16.98%	12.67%	1,317,101	Other	0.28%	3.41%	-16.98%	12.67%	130,400

Bond Returns by Location of Issuer

	US						Euroarea				
	mean	st. dev.	min	max	N		mean	st. dev.	min	max	N
US	0.34%	2.77%	-16.98%	12.67%	5,529,634	US	0.43%	3.24%	-16.98%	12.67%	826,362
Euroarea	0.41%	2.80%	-16.98%	12.67%	327,117	Euroarea	0.28%	2.50%	-16.98%	12.67%	991,720
UK	0.43%	2.70%	-16.98%	12.67%	152,184	UK	0.29%	2.77%	-16.98%	12.67%	182,353
Rest of Europe	0.30%	2.34%	-16.98%	12.67%	66,563	Rest of Europe	0.23%	2.26%	-16.98%	12.67%	109,023
Asia	0.38%	3.23%	-16.98%	12.67%	130,073	Asia	0.37%	3.83%	-16.98%	12.67%	104,025
Latin America	0.48%	4.90%	-16.98%	12.67%	104,942	Latin America	0.44%	5.12%	-16.98%	12.67%	58,844
Other	0.19%	2.43%	-16.98%	12.67%	1,682,625	Other	0.42%	4.08%	-16.98%	12.67%	67,019
Japan	0.25%	1.60%	-16.98%	12.67%	74,355	Japan	0.12%	2.08%	-16.98%	12.67%	41,292
Oceania	0.31%	2.12%	-16.98%	12.67%	39,389	Oceania	0.20%	2.04%	-16.98%	12.67%	42,595
Canada	0.49%	3.15%	-16.98%	12.67%	178,454	Canada	0.37%	2.97%	-16.98%	12.67%	55,218

Table 3 NBFI Bond Portfolio Rebalancing During the Onset of COVID-19

This table reports the direction and magnitude of NBFI bond portfolio rebalancing during the onset of COVID-19. Panel A shows the results for US-based NBFIs, and Panel B reports the results for Euroarea-based NBFIs. The dependent variables are the changes in NBFI's j book-value holdings of bond i at time t, both in million USD ($\$\Delta$BV(i,j,t)) and in percentages ($\%\Delta$BV(i,j,t)). The explanatory variables are month-year indicators (e.g., March 2020), contemporaneous bond returns (Return(i,j,t)), and lag returns (Return(i,j,t-1)). Returns are from clean prices, and are winsorized at the 0.5% level. All specifications also control for bond-NBFI fixed effects. Numbers in parentheses are t-statistics based on two-way cluster-robust standard errors by date and bond-NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

Panel A: Changes in Bond Holdings, US NBFIs

	$\$\Delta$BV(i,j,t)				$\%\Delta$BV(i,j,t)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Jan-2020	0.122	-0.017	-0.002	-0.014	0.033**	-0.002	-0.000	-0.002
	(0.88)	(-1.00)	(-0.04)	(-0.98)	(2.15)	(-1.16)	(-0.10)	(-1.33)
Feb-2020	0.009	-0.030*	-0.038	-0.033**	0.006	0.001	-0.000	-0.001
	(0.06)	(-1.67)	(-0.69)	(-2.23)	(0.37)	(0.90)	(-0.12)	(-0.70)
March 2020	-0.421***	-0.251***	-0.443***	-0.245***	-0.021	-0.015***	-0.026***	-0.013***
	(-2.74)	(-6.19)	(-8.75)	(-6.58)	(-1.31)	(-3.54)	(-3.80)	(-3.83)
Apr-2020	-0.021	-0.023	-0.089	-0.030	-0.001	0.001	-0.004	0.002
	(-0.13)	(-1.31)	(-1.51)	(-1.39)	(-0.09)	(0.68)	(-0.60)	(1.30)
May-2020	0.027	-0.015	-0.080*	-0.013	0.002	0.001	-0.009	-0.000
	(0.16)	(-0.82)	(-1.83)	(-0.78)	(0.13)	(0.59)	(-1.31)	(-0.33)
June-2020	-0.103	0.012	-0.042	0.011	-0.005	0.002	-0.006	0.000
	(-0.61)	(0.64)	(-0.94)	(0.81)	(-0.28)	(1.13)	(-0.84)	(0.43)
Return(i,j,t)		-0.459		-0.439		-0.055		-0.023
		(-0.74)		(-0.69)		(-0.90)		(-0.50)
Return(i,j,t-1)			0.300	-0.070			0.120**	0.042*
			(0.64)	(-0.22)			(2.48)	(1.92)
Constant	0.091	0.029**	-0.137***	0.006	0.011	0.005***	-0.019***	0.003**
	(1.15)	(1.98)	(-4.44)	(0.57)	(0.99)	(2.93)	(-3.72)	(1.97)
Bond-NBFI FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	8,831,067	8,260,236	7,900,156	7,695,478	8,831,067	8,260,236	7,900,156	7,695,478
R-squared	0.038	0.091	0.153	0.077	0.105	0.153	0.161	0.149

Panel B: Changes in Bond Holdings, Euroarea NBFIs

	ΔBV(i,j,t)				%ΔBV(i,j,t)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Jan-2020	-0.004	-0.002	-0.024	0.010	0.020	0.009*	0.008	0.011**
	(-0.07)	(-0.10)	(-0.70)	(0.55)	(1.12)	(1.95)	(0.92)	(2.46)
Feb-2020	-0.061	-0.073***	-0.088***	-0.078***	-0.006	-0.007	-0.013	-0.008*
	(-0.84)	(-3.79)	(-2.58)	(-4.34)	(-0.35)	(-1.46)	(-1.49)	(-1.89)
March 2020	-0.397***	-0.445***	-0.334***	-0.441***	-0.073***	-0.054***	-0.063***	-0.055***
	(-5.49)	(-8.17)	(-9.38)	(-7.90)	(-3.77)	(-7.10)	(-6.56)	(-7.25)
Apr-2020	0.004	0.078***	0.063	0.139***	0.018	0.016***	0.018	0.028***
	(0.07)	(2.68)	(1.20)	(2.72)	(0.91)	(2.77)	(1.35)	(3.28)
May-2020	-0.026	0.006	-0.097***	-0.022	0.012	0.010**	-0.012	0.003
	(-0.37)	(0.34)	(-3.31)	(-1.16)	(0.58)	(2.08)	(-1.44)	(0.86)
June-2020	-0.013	0.039*	-0.023	0.036*	-0.003	0.009*	-0.014	0.006
	(-0.20)	(1.89)	(-0.77)	(1.91)	(-0.14)	(1.70)	(-1.53)	(1.41)
Return(i,j,t)		-2.487***		-2.591***		-0.143		-0.162*
		(-3.31)		(-3.24)		(-1.58)		(-1.95)
Return(i,j,t-1)			1.198**	0.778*			0.272***	0.178**
			(2.68)	(1.69)			(3.02)	(2.35)
Constant	0.048	0.035**	-0.091***	0.015	0.025	0.016***	-0.013	0.011**
	(1.04)	(2.02)	(-3.74)	(0.93)	(1.71)	(3.46)	(-1.76)	(2.48)
Bond-NBFI FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2,665,507	2,470,256	2,360,292	2,292,528	2,665,507	2,470,256	2,360,292	2,292,528
R-squared	0.047	0.088	0.164	0.089	0.088	0.089	0.128	0.082

Table 4 NBFI Bond Portfolio Rebalancing by Credit Rating During the Onset of COVID-19

This table reports the direction and magnitude of NBFI bond portfolio rebalancing by credit rating during the onset of COVID-19. Panel A reports the results for US-based NBFIs, and Panel B reports the results for Euroarea-based NBFIs. The dependent variables are the changes in NBFI's j book value holdings of bond i at time t, both in million USD (ΔBV(i,j,t)) and in percentages (%ΔBV(i,j,t)). The explanatory variables are an indicator for March 2020, a ratings variable, and their interaction. Ratings is a numeric variable according to the rating of the bond or its issuer by one of the three big rating agencies (Fitch, Moody's S&P). The transformation from alphanumeric to numeric values follows the rule: AAA=1, AA=2, A=3, BBB=4, BB=5, B=6, CCC=7, lower than CCC=8. All specifications also control for bond-NBFI fixed effects as well as contemporaneous and lag returns (Return(i,j,t), Return(i,j,t-1)). Returns are from clean prices, and are winsorized at the 0.5% level. Numbers in parentheses are t-statistics based on two-way cluster-robust standard errors by date and bond-NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

Panel A: Changes in Bond Holdings by Rating, US NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
Ratings	-0.025*	-0.038***	-0.010***	-0.010***
	(-1.93)	(-2.96)	(-5.78)	(-5.72)
March 2020	-0.331***	-0.693***	-0.015***	0.003*
	(-5.83)	(-14.58)	(-3.79)	(1.90)
Ratings×March 2020		0.141***		-0.007***
		(6.23)		(-4.06)
Constant	0.080**	0.111**	0.036***	0.035***
	(2.14)	(2.75)	(6.57)	(6.66)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	5,138,513	5,138,513	5,138,513	5,138,513
R-squared	0.121	0.121	0.139	0.139

Panel B: Changes in Bond Holdings by Rating, Euroarea NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
Ratings	-0.013	-0.011	-0.008**	-0.007**
	(-0.63)	(-0.56)	(-2.55)	(-2.22)
March 2020	-0.416***	-0.323***	-0.050***	-0.013***
	(-7.92)	(-7.47)	(-7.42)	(-3.38)
Ratings×March 2020		-0.029		-0.011***
		(-1.20)		(-5.52)
Constant	0.064	0.057	0.042***	0.039***
	(0.91)	(0.86)	(3.84)	(3.50)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	2,052,304	2,052,304	2,052,304	2,052,304
R-squared	0.106	0.106	0.079	0.080

Table 5 Average Bond Returns Across Ratings

This table studies average returns in the NBFI sample across rating categories during the onset of COVID-19. The dependent variables are average bond returns (Return(t)) at time t. Average returns are simple average returns for each credit rating. The explanatory variables are an indicator for March 2020, the ratings variable, and their interaction. The ratings variable is a numeric variable according to the rating of the bond or its issuer by one of the three big rating agencies (Fitch, Moody's S&P). The transformation from alphanumeric to numeric values follows the rule: AAA=1, AA=2, A=3, BBB=4, BB=5, B=6, CCC=7, lower than CCC=8. The numbers in parenthesis are t-statistics. Standard errors are clustered by rating (Ratings SE). Asterisks(*,** and ***) denote significance at the 10%, 5% and 1% levels. Data is for Jan. 2019 to Jan. 2021.

	All NBFIs	US NBFIs	Euroarea NBFIs
	Return(t)	Return(t)	Return(t)
	(1)	(2)	(3)
Ratings	-0.001	-0.001	-0.001
	(-1.21)	(-1.22)	(-1.19)
Ratings×March 2020	-0.020***	-0.020***	-0.020***
	(-7.21)	(-6.77)	(-7.52)
March 2020	0.001	0.004	-0.000
	(0.15)	(0.33)	(-0.07)
Constant	0.010**	0.011**	0.010**
	(2.09)	(1.98)	(2.18)
Ratings SE	Yes	Yes	Yes
Observations	400	200	200
R-squared	0.403	0.423	0.386

Table 6 Effects of AAA Bonds on NBFI Bond Portfolio Changes Across Ratings

This table studies the effects of AAA-rated bonds on NBFI bond portfolio rebalancing across rating categories during the onset of COVID-19. Panel A reports the results for US-based NBFIs, and Panel B reports the results for Euroarea-based NBFIs. The dependent variables are the changes in million USD of NBFI's j book-value holdings of bond i at time t when bond i belongs to the rating category Z (ΔBV(i,j,Z,t)). The explanatory variables are an indicator for March 2020, the average, at the NBFI level, change in million USD of NBFI's j book-value holdings of AAA bonds at time t ($\overline{\$\Delta BV(i,j,AAA,t)}$), and their interaction. We control for contemporaneous bond returns (Return(i,j,t)), and lag returns (Return(i,j,t-1)). Returns are from clean prices, and are winsorized at the 0.5% level. All specifications also control for bond-NBFI fixed effects. Numbers in parentheses are t-statistics based on two-way cluster-robust standard errors by date and bond-NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

Panel A: Spillover Effects of AAA Bonds on Bond Holding Changes Across Ratings, US NBFIs

	ΔBV(i,j,AA,t) (1)	ΔBV(i,j,A,t) (2)	ΔBV(i,j,BBB,t) (3)	ΔBV(i,j,BB,t) (4)	ΔBV(i,j,B,t) (5)	ΔBV(i,j,CCC,t) (6)	ΔBV(i,j,C/D,t) (7)
$\overline{\$\Delta BV(i,j,AAA,t)}$	0.001	0.001	0.001*	0.000	0.001	0.000	-0.000
	(0.95)	(1.34)	(1.84)	(0.77)	(0.86)	(0.08)	(-0.94)
March 2020	-0.384***	-0.203***	-0.107***	0.206***	0.157**	-0.055	0.248
	(-15.06)	(-7.39)	(-5.45)	(3.10)	(2.24)	(-0.98)	(0.75)
$\overline{\$\Delta BV(i,j,AAA,t)}$×March 2020	0.014***	0.006***	0.003***	0.000	0.002	0.003	0.002
	(4.03)	(4.74)	(3.79)	(0.37)	(1.42)	(0.48)	(1.02)
Constant	0.067***	0.038***	0.025***	0.001	0.012	0.001	-0.052
	(5.77)	(4.58)	(3.67)	(-0.18)	(0.39)	(0.55)	(-1.32)
Return Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	382,745	1,334,315	1,307,136	340,630	181,449	27,122	6,118
R-squared	0.084	0.099	0.098	0.215	0.161	0.180	0.357

Panel B: Spillover Effects of AAA Bonds on Bond Holding Changes Across Ratings, Euroarea NBFIs

	ΔBV(i,j,AA,t) (1)	ΔBV(i,j,A,t) (2)	ΔBV(i,j,BBB,t) (3)	ΔBV(i,j,BB,t) (4)	ΔBV(i,j,B,t) (5)	ΔBV(i,j,CCC,t) (6)	ΔBV(i,j,C/D,t) (7)
$\overline{\$\Delta BV(i,j,AAA,t)}$	0.008	0.004	0.004	-0.002	-0.001	-0.005	0.031
	(0.82)	(1.62)	(1.22)	(-1.03)	(-0.50)	(-0.78)	(1.17)
March 2020	-0.358***	-0.247***	-0.279***	-0.788***	-0.678***	-0.640***	-0.601***
	(-3.17)	(-7.66)	(-8.11)	(-5.84)	(-4.91)	(-12.10)	(-4.81)
$\overline{\$\Delta BV(i,j,AAA,t)}$×March 2020	0.146***	0.013*	0.020***	0.000	-0.003	0.037**	-0.494**
	(7.17)	(1.78)	(3.72)	(0.10)	(-0.79)	(2.47)	(-2.12)
Constant	0.024	0.008	0.003	0.060**	0.042*	0.042***	-0.067
	(1.33)	(0.76)	(0.32)	(2.24)	(1.74)	(3.06)	(-1.34)
Return Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	284,638	716,423	671,719	134,364	80,491	9,849	3,194
R-squared	0.058	0.093	0.258	0.107	0.017	0.210	0.214

Table 7 Effects of AAA Bonds on NBFI Bond Portfolio Percentage Changes Across Ratings

This table studies the effects of AAA-rated bonds on NBFI bond portfolio rebalancing across rating categories during the onset of COVID-19. Panel A reports the results for US-based NBFIs, and Panel B reports the results for Euroarea-based NBFIs. The dependent variables are the percentage changes in NBFI's j book-value holdings of bond i at time t when bond i belongs to the rating category Z (%ΔBV(i,j,Z,t)). The explanatory variables are an indicator for March 2020, the average, at the NBFI level, contemporaneous percentage changes in NBFI's j book-value holdings of AAA bonds at time t ($\overline{\%\Delta BV(i,j,AAA,t)}$), and their interaction. We control for contemporaneous bond returns (Return(i,j,t)), and lag returns (Return(i,j,t-1)). Returns are from clean prices, and are winsorized at the 0.5% level. All specifications also control for bond-NBFI fixed effects. Numbers in parentheses are t-statistics based on two-way cluster-robust standard errors by date and bond-NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

Panel A: Spillover Effects of AAA Bonds on Percentage Changes in Bond Holdings Across Ratings, US NBFIs

	%ΔBV(i,j,AA,t) (1)	%ΔBV(i,j,A,t) (2)	%ΔBV(i,j,BBB,t) (3)	%ΔBV(i,j,BB,t) (4)	%ΔBV(i,j,B,t) (5)	%ΔBV(i,j,CCC,t) (6)	%ΔBV(i,j,C/D,t) (7)
$\overline{\%\Delta BV(i,j,AAA,t)}$	0.119***	0.114***	0.110***	0.027**	0.029***	0.017	-0.011
	(5.34)	(5.35)	(5.34)	(1.99)	(3.19)	(1.33)	(-1.42)
March 2020	-0.025***	-0.020***	-0.024***	-0.001	-0.009	-0.011*	-0.014
	(-13.73)	(-7.76)	(-6.59)	(-0.24)	(-1.59)	(-1.94)	(-1.17)
$\overline{\%\Delta BV(i,j,AAA,t)}$×March 2020	-0.000	0.026	0.041***	-0.030***	-0.054***	-0.065***	-0.018
	(-0.03)	(1.55)	(2.63)	(-2.68)	(-6.37)	(-5.64)	(-1.35)
Constant	0.011***	0.011***	0.011***	0.018***	0.019***	0.012***	-0.000
	(7.84)	(8.61)	(7.98)	(6.00)	(6.30)	(4.43)	(-0.13)
Return Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	382,745	1,334,315	1,307,136	340,630	181,449	27,122	6,118
R-squared	0.116	0.133	0.118	0.127	0.140	0.179	0.301

Panel B: Spillover Effects of AAA Bonds on Changes in Bond Holdings Across Ratings, Euroarea NBFIs

	%ΔBV(i,j,AA,t) (1)	%ΔBV(i,j,A,t) (2)	%ΔBV(i,j,BBB,t) (3)	%ΔBV(i,j,BB,t) (4)	%ΔBV(i,j,B,t) (5)	%ΔBV(i,j,CCC,t) (6)	%ΔBV(i,j,C/D,t) (7)
$\overline{\%\Delta BV(i,j,AAA,t)}$	0.299***	0.233***	0.214***	0.052***	0.077***	-0.007	0.061
	(7.15)	(6.22)	(7.13)	(2.91)	(2.94)	(-0.79)	(1.13)
March 2020	-0.025***	-0.029***	-0.049***	-0.111***	-0.102***	-0.093***	-0.056***
	(-4.44)	(-4.16)	(-6.50)	(-6.86)	(-7.81)	(-8.51)	(-4.51)
$\overline{\%\Delta BV(i,j,AAA,t)}$×March 2020	0.159***	0.073**	0.055**	0.027	-0.020	0.105***	-0.162
	(3.87)	(2.17)	(2.21)	(1.45)	(-0.81)	(5.02)	(-1.57)
Constant	-0.000	0.001	0.003	0.020***	0.017***	0.015***	-0.009
	(-0.11)	(0.47)	(1.17)	(3.85)	(3.83)	(4.28)	(-1.52)
Return Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	284,638	716,423	671,719	134,364	80,491	9,849	3,194
R-squared	0.124	0.111	0.104	0.101	0.119	0.168	0.244

Table 8 Effects of AAA Bonds on NBFI Portfolio Rebalancing and Returns

This table studies the effects of AAA-rated bonds on NBFI bond portfolio rebalancing and returns during the onset of COVID-19. In Panel A, the dependent variables are the changes in NBFIs j book value holdings of non-AAA bonds as a percentage of the total book value of NBFIs j rated bond portfolio (ΔBV(j,non-AAA,t)/$BV(j,all rated,t)), winsorized for values less than -100%. In Panel B, the dependent variables are NBFI returns (Return(j,t)), which are defined as the market value of NBFI j at time t over its market value at time $t-1$. The explanatory variables are an indicator for March 2020, an indicator of whether NBFI j's holdings of AAA bonds on January 2019, i.e., the beginning of our sample, as a percentage of the total book value of rated bonds in the NBFI are less than the sample median $\left(\mathbf{1}\left\{\%BV(j, AAA, 1/2019) < median(\%BV(j, AAA, 1/2019))\right\}\right)$ for the same period (Jan/2019), as well as the interaction of these two variables. Numbers in parentheses are t-statistics based on one-way cluster-robust standard errors by NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

Panel A: Changes in non-AAA Bond Holdings as Percentages of Total NBFI Rated Portfolios

	All NBFIs ΔBV(j,non-AAA,t)/$BV(j,all rated,t) (1)	US NBFIs ΔBV(j,non-AAA,t)/$BV(j,all rated,t) (2)	Euroarea NBFIs ΔBV(j,non-AAA,t)/$BV(j,all rated,t) (3)
$\mathbf{1}\{\%BV(j, AAA, 1/2019) < median(1/2019)_{(sub)sample}\}$	0.023***	0.032***	0.018***
	(5.99)	(6.56)	(3.17)
March 2020	-0.009**	0.005	-0.024***
	(-2.24)	(1.43)	(-3.18)
$\mathbf{1}\{\%BV(j, AAA, 1/2019) < median(1/2019)_{(sub)sample}\}\times$March 2020	-0.051***	-0.048***	-0.075***
	(-4.39)	(-3.27)	(-4.15)
Constant	0.025***	0.020***	0.030***
	(10.66)	(9.25)	(7.65)
Obs.	10,447	6,552	3,895
R-squared	0.027	0.047	0.031

Panel B: NBFI Bond Portfolio Returns

	All NBFIs Return(j,t) (1)	US NBFIs Return(j,t) (2)	Euroarea NBFIs Return(j,t) (3)
$\mathbf{1}\{\%BV(j, AAA, 1/2019) < median(1/2019)_{(sub)sample}\}$	0.003	0.003	0.003
	(1.09)	(0.96)	(0.58)
March 2020	-0.095***	-0.076***	-0.123***
	(-9.49)	(-5.76)	(-8.40)
$\mathbf{1}\{\%BV(j, AAA, 1/2019) < median(1/2019)_{(sub)sample}\}\times$March 2020	-0.087***	-0.089***	-0.090***
	(-6.77)	(-5.35)	(-4.71)
Constant	0.025***	0.024***	0.027***
	(9.94)	(9.10)	(5.60)
Obs.	10,447	6,552	3,895
R-squared	0.045	0.044	0.049

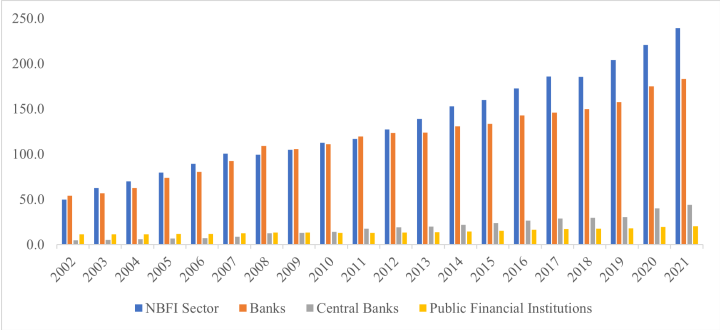
Online Appendix

Appendix A Supplemental Figures

Figure A.1 Global Assets Under Management for Various Types of Financial Intermediaries (2008-2021)

This figure shows the global assets under management for various types of financial intermediaries for the 2008-2021 period. Non-banking financial intermediaries (NBFI) include insurance companies, pension funds, investment funds, money market funds, hedge funds, broker-dealers, real estate investment funds, trust funds, etc. Panel A reports assets under management for each type of financial intermediary in trillions of U.S. dollars. Panel B reports assets under management for each type of financial intermediary as a percentage of the total. The data is from the Global Monitoring Report on Non-Bank Financial Intermediation 2022. The report covers 22 jurisdictions that account for more than 80% of global GDP: Argentina, Australia, Brazil, Canada, Cayman Islands, Chile, China, Euroarea, Hong Kong, India, Indonesia, Japan, Korea, Mexico, Russia, Saudi Arabia, Singapore, South Africa, Switzerland, Turkey, United Kingdom, United States.

Panel A: Assets Under Management 2008-2021 (Trillions USD)



Panel B: Assets Under Management 2008-2021 (%)

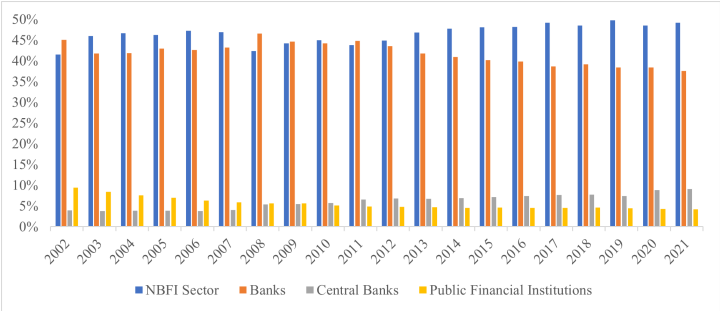


Figure A.2 Composition of Non-banking Financial Intermediaries (2008-2021)

This figure shows the global composition as percentage of assets under management for various types of non-banking financial intermediaries (NBFI) for the 2008-2021 period. Non-banking financial intermediaries include insurance companies, pension funds, investment funds, money market funds, hedge funds, broker-dealers, real estate investment funds, trust funds, etc. The data is from the Global Monitoring Report on Non-Bank Financial Intermediation 2022. The report covers 29 jurisdictions that account for more than 80% of global GDP: Argentina, Australia, Brazil, Canada, Cayman Islands, Chile, China, Hong Kong, India, Indonesia, Japan, Korea, Mexico, Russia, Saudi Arabia, Singapore, South Africa, Switzerland, Turkey, United Kingdom, United States, Belgium, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Spain.

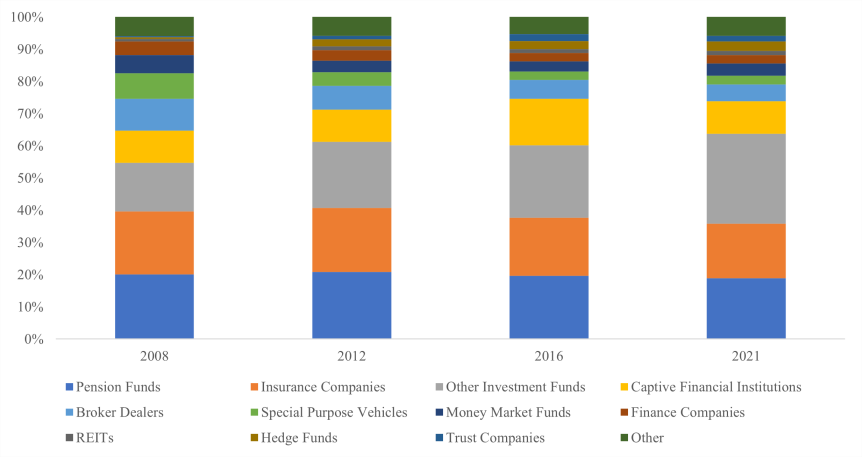
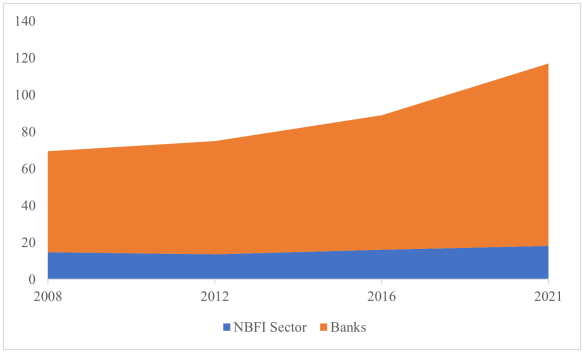


Figure A.3 Global Credit Assets: Loan and Non-loan Credit Assets for Banks and NBFIs (2008-2021)

This figure shows the global credit assets (loans + non-loan credit assets) for various types of financial intermediaries for the 2008-2021 period. Non-banking financial intermediaries (NBFI) include insurance companies, pension funds, investment funds, money market funds, hedge funds, broker-dealers, real estate investment funds, trust funds, etc. Panel A reports loan credit assets in trillions of U.S. dollars. Panel B reports non-loan credit assets also in trillions of U.S. dollars. Non-loan credit assets include bills, bonds, commercial paper, and deposits. The data is from the Global Monitoring Report on Non-Bank Financial Intermediation 2022. The report covers 22 jurisdictions that account for more than 80% of global GDP: Argentina, Australia, Brazil, Canada, Cayman Islands, Chile, China, Euroarea, Hong Kong, India, Indonesia, Japan, Korea, Mexico, Russia, Saudi Arabia, Singapore, South Africa, Switzerland, Turkey, United Kingdom, United States.

Panel A: Loan Credit Assets 2008-2021 (Trillions USD)



Panel B: Non-loan Credit Assets 2008-2021 (Trillions USD)

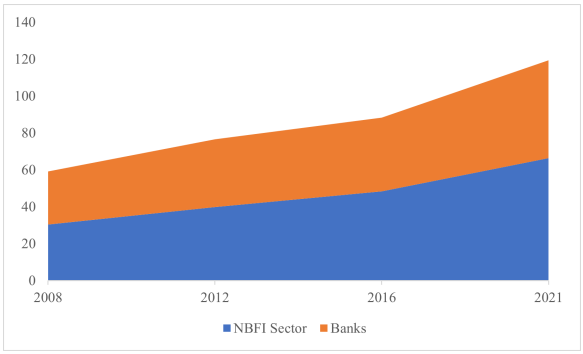
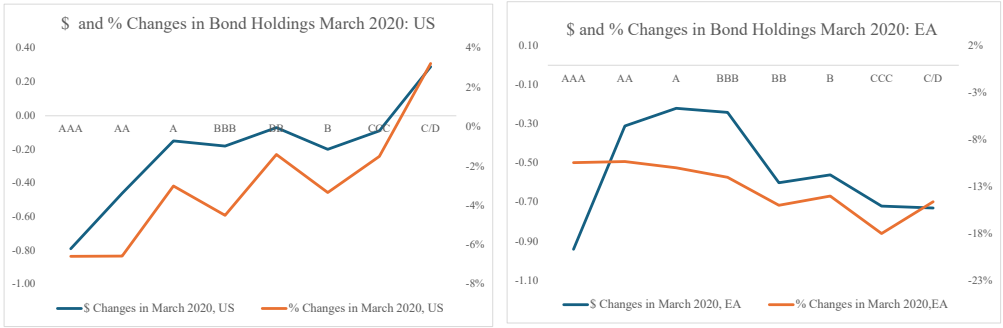


Figure A.4 Bond Portfolio Rebalancing: Dollar and Percentage Economic Effects of Credit Ratings

This figure illustrates the differential economic effects of credit ratings on dollar and percentage terms rebalancing of bond i at time t by NBFI j during the onset of COVID-19. Dollar rebalancing refers to changes in book value in millions USD of bond i held from fund j at time t, $\Delta BV(i,j,t)$, and percentage rebalancing refers to percentage changes in book value of bond i held from fund j at time t, $\%\Delta BV(i,j,t)$. Panel A shows the economic effects of credit ratings in dollar and percentages terms of bond portfolio rebalancing jointly for US and Euroarea NBFIs. Panel B shows the economic effects of credit ratings in dollar and percentages terms of bond portfolio rebalancing separately for US and Euroarea NBFIs. Data is from Table 2 and average bond portfolio changes during March 2020. Credit ratings are from three rating agencies: S&P, Moody's, and Fitch. The composition of bond portfolios by credit ratings is with respect the set of rated bonds.

Panel A: Economic Effects of Credit Ratings in Dollar and Percentage Terms for US (left) and EA (right)



Panel B: Economic Effects of Credit Ratings in Dollar Terms (left) and Percentage Terms (right)

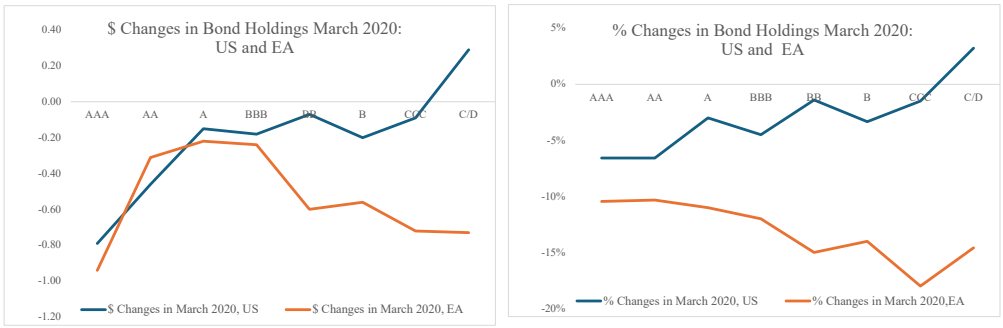
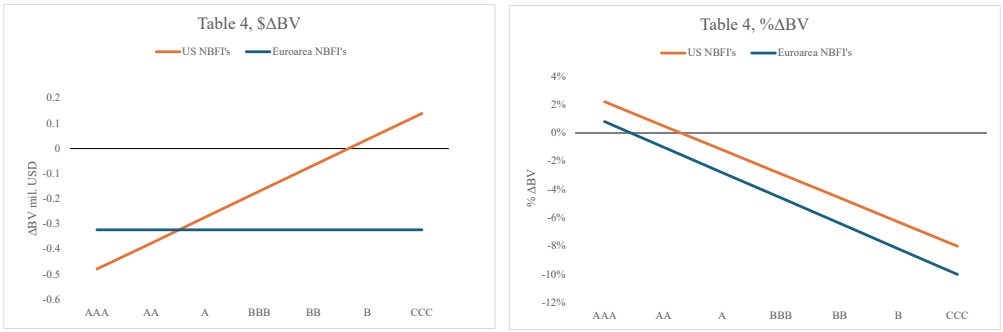


Figure A.5 Bond Portfolio Rebalancing: Economic Effects of Credit Ratings

This figure illustrates the economic effects of credit ratings on the rebalancing of bond i at time t by NBFI j during the onset of COVID-19. Rebalancing refers to changes in book value in millions USD, $\Delta BV(i,j,t)$, and percentage changes in book value, $\%\Delta BV(i,j,t)$. Panel A shows the economic effects of credit ratings in bond portfolio rebalancing for US and Euroarea NBFIs based on the estimates from Table 4. Panel B shows the economic effects of credit ratings for US and Euroarea NBFIs based on the estimates from Table A.3. In Table 4, where ratings are measured by the ratings variable, economic effects are the sum of all relevant coefficients multiplied by the credit rating. In Table A.3, where ratings are measured by the categorical indicator variables for ratings, economic effects are the sum of all relevant coefficients by credit rating. In both cases, statistically insignificant coefficients are set to zero. Credit ratings are from three rating agencies: S&P, Moody's, and Fitch. The composition of bond portfolios by credit ratings is with respect the set of rated bonds. Data is for Dec. 2018 to Jan. 2021.

Panel A: Economic Effects of Credit Ratings based on Estimates from Table 4



Panel B: Economic Effects of Credit Ratings based on Estimates from Table A.3

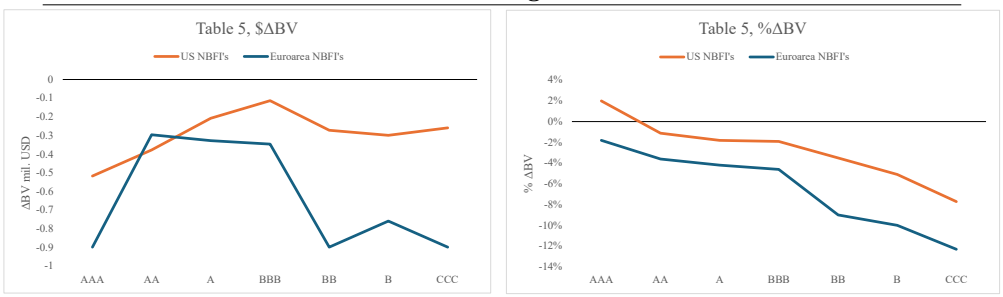
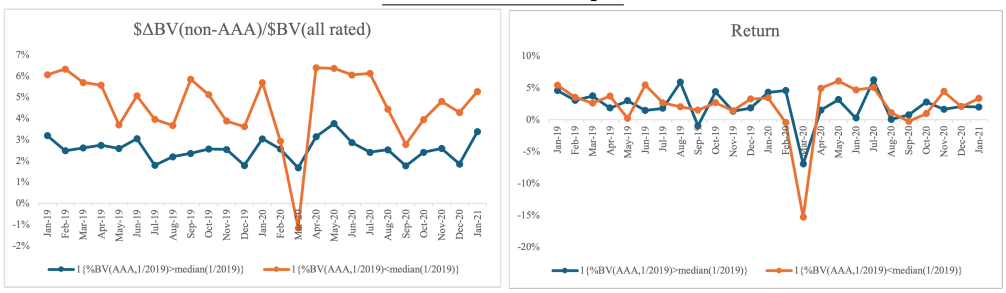


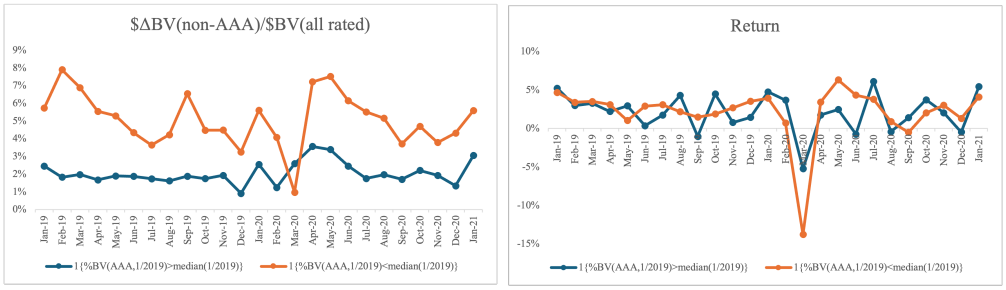
Figure A.6 Time Series of Average Changes in non-AAA Bond Holdings as Percentages and Bond Portfolio Returns

This figure illustrates the time series of average changes in non-AAA bond holdings as percentages (ΔBV(j,non-AAA,t)/$BV(j,all rated,t)) and bond portfolio returns (Returns(j,t)) of the NBFIs in our sample. The time series are grouped based on whether NBFI j's holdings of AAA bonds on January 2019, i.e., the beginning of our sample, as a percentage of the total book value of rated bonds in the NBFI are less (light line) or greater (dark line) than the sample median ($\mathbf{1}\{\%BV(j, AAA, 1/2019) < median(\%BV(j, AAA, 1/2019))\}_j$) for the same period (Jan/2019). Panel A shows the time series for the full sample. Panel B shows the time series for US-based NBFIs, and Panel C shows the time series for the EU-based NBFIs. These graphs can be used for the interpretation of the results in Table 9. The data is for Jan. 2019 to Jan. 2021.

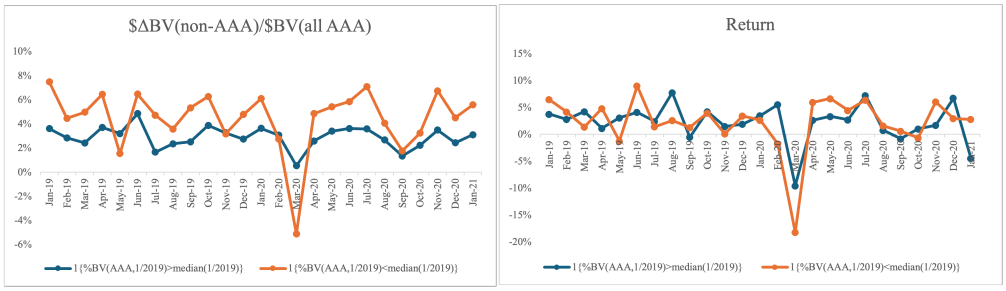
Panel A: Full Sample



Panel B: US Sample



Panel C: EU Sample



Appendix B Supplemental Tables

Table A.1 NBFI Bond Portfolio Rebalancing During the Onset of COVID-19: Full Sample

This table reports the direction and magnitude of NBFI bond portfolio rebalancing during the onset of COVID-19 for all NBFIs in the sample. The dependent variables are the changes in NBFI's j book-value of holdings of bond i at time t, both in million USD (ΔBV(i,j,t)) and in percentages (%ΔBV(i,j,t)). The explanatory variables are month-year indicators (e.g., March 2020), contemporaneous bond returns (Return(i,j,t)), and lag returns (Return(i,j,t-1)). Returns are from clean prices, and are winsorized at the 0.5% level. All specifications also control for bond-NBFI fixed effects. Numbers in parentheses are t-statistics based on two-way cluster-robust standard errors by date and bond-NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

	ΔBV(i,j,t)				%ΔBV(i,j,t)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Jan-2020	0.092	-0.012	-0.007	-0.007	0.030*	0.000	0.001	0.001
	(0.76)	(0.80)	(-0.17)	(-0.56)	(1.90)	(0.17)	(0.20)	(0.49)
Feb-2020	-0.007	-0.036**	-0.05	-0.040***	0.003	-0.000	-0.004	-0.002
	(-0.05)	(-2.15)	(-1.02)	(-2.93)	(0.19)	(-0.03)	(-0.52)	(-1.38)
March 2020	-0.416***	-0.290***	-0.419***	-0.286***	-0.033**	-0.024***	-0.035***	-0.022***
	(-3.10)	(-8.47)	(-9.14)	(-9.23)	(-1.96)	(-5.85)	(-4.83)	(-6.47)
Apr-2020	-0.015	-0.005	-0.057	0.001	0.003	0.004*	0.000	0.007**
	(-0.11)	(-0.33)	(-1.04)	(0.05)	(0.17)	(1.64)	(0.10)	(2.51)
May-2020	0.014	-0.008	-0.081**	-0.011	0.005	0.003	-0.097	0.000
	(0.10)	(-0.49)	(-2.07)	(-0.81)	(0.25)	(1.29)	(-1.33)	(0.31)
June-2020	-0.081	0.018	-0.038	0.016	-0.004	0.004	-0.008	0.001
	(-0.57)	(1.05)	(-0.95)	(1.26)	(-0.25)	(1.45)	(-1.10)	(0.89)
Return(i,j,t)		-0.929**		-0.935**		-0.067		-0.048
		(-2.06)		(-2.04)		(-1.24)		(-1.02)
Return(i,j,t-1)			0.491	0.133			0.159***	0.078**
			(1.15)	(0.45)			(3.08)	(2.34)
Constant	0.082	0.030**	-0.126***	0.009	0.014	0.008***	-0.018***	0.005***
	(1.14)	(2.10)	(-4.38)	(0.73)	(1.21)	(3.57)	(-3.26)	(2.58)
Bond-NBFI FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	11,496,574	10,730,492	10,260,448	9,988,006	11,496,574	10,730,492	10,260,448	9,988,006
R-squared	0.038	0.091	0.154	0.078	0.100	0.131	0.151	0.126

Table A.2 NBFI Bond Portfolio Rebalancing by Credit Rating During the Onset of COVID-19: Full Sample

This table reports the direction and magnitude of NBFI bond portfolio rebalancing by credit rating during the onset of COVID-19 for all NBFIs in our sample. The dependent variables are the changes in NBFI's j book-value holdings of bond i at time t, both in million USD ($\$\Delta$BV(i,j,t)) and in percentages ($\%\Delta$BV(i,j,t)). The explanatory variables are a month-year indicator for March 2020, a ratings variable, and their interaction. Ratings is a numeric variable according to the rating of the bond or its issuer by one of the three big rating agencies (Fitch, Moody's S&P). The transformation from alphanumeric to numeric values follows the rule: AAA=1, AA=2, A=3, BBB=4, BB=5, B=6, CCC=7, lower than CCC=8. All specifications also control for bond-NBFI fixed effects as well as contemporaneous and lag returns (Return(i,j,t), Return(i,j,t-1)). Returns are from clean prices, and are winsorized at the 0.5% level. Numbers in parentheses are t-statistics based on two-way cluster-robust standard errors by date and bond-NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

	$\$\Delta$BV(i,j,t)		$\%\Delta$BV(i,j,t)	
	(1)	(2)	(3)	(4)
Ratings	-0.021*	-0.030**	-0.009***	-0.009***
	(-1.65)	(-2.12)	(-6.00)	(-5.34)
March 2020	-0.351***	-0.615***	-0.024***	0.001
	(-7.73)	(-15.24)	(-6.79)	(0.85)
Ratings×March 2020		0.097***		-0.009***
		(5.32)		(-6.93)
Constant	0.076*	0.097**	0.038***	0.035***
	(1.84)	(2.16)	(7.36)	(6.85)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	7,190,817	7,190,817	7,190,817	7,190,817
R-squared	0.119	0.119	0.117	0.117

Table A.3 NBFI Bond Portfolio Rebalancing by Credit Rating During the Onset of COVID-19: Rating Indicators

This table reports the direction and magnitude of NBFI bond portfolio rebalancing by credit rating during the onset of COVID-19 for all NBFIs in our sample. Panel A reports results for the full sample, Panel B shows results for the US-based NBFIs, and Panel C reports results for Euroarea funds. The dependent variables are the changes in BFI's j book-value holdings of bond i at time t, both in million USD (ΔBV(i,j,t)) and in percentages (%ΔBV(i,j,t)). The explanatory variables are an indicator for March 2020, a categorical ratings variable, and their interaction. In these tests, the ratings score has been substituted by a categorical variable that takes the value one when the rating falls in each category (i.e., AAA, AA, A, etc.) and zero otherwise. All specifications also control for bond-NBFI fixed effects as well as contemporaneous and lag returns (Return(i,j,t), Return(i,j,t-1)). Returns are from clean prices, and are winsorized at the 0.5% level. Numbers in parentheses are t-statistics based on two-way cluster-robust standard errors by date and bond-NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

Panel A: Changes in Bond Holdings, All NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
March 2020	-0.352***	-0.029	-0.024***	-0.034***
	(-7.74)	(-0.21)	(-6.75)	(-3.70)
AAA×March 2020		-0.584***		0.034***
		(-3.83)		(3.87)
AA×March 2020		-0.293**		-0.000
		(-2.26)		(-0.10)
A×March 2020		-0.205*		0.001
		(-1.68)		(0.16)
BBB×March 2020		-0.160		-0.003
		(-1.44)		(-0.52)
BB×March 2020		-0.205*		-0.008
		(-1.94)		(-1.35)
B×March 2020		-0.219**		-0.013**
		(-2.17)		(-2.34)
CCC×March 2020		-0.233**		-0.006
		(-2.45)		(-1.16)
AAA		0.285**		0.078***
		(2.21)		(5.93)
AA		0.206**		0.072***
		(2.17)		(6.40)
A		0.199**		0.066***
		(2.21)		(5.82)
BBB		0.200**		0.063***
		(2.36)		(5.91)
BB		0.101		0.050***
		(1.38)		(5.68)
B		0.080		0.036***
		(1.23)		(6.02)
CCC		0.035**		0.013***
		(0.63)		(2.62)
Constant	0.010	-0.200	0.008***	-0.057***
	(0.81)	(-2.25)	(4.62)	(-5.42)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	7,190,817	7,190,817	7,190,817	7,190,817
R-squared	0.119	0.119	0.117	0.118

Panel B: Changes in Bond Holdings, US NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
March 2020	-0.332***	0.347*	-0.015***	-0.024**
	(-5.85)	(1.86)	(-3.79)	(-2.14)
AAA×March 2020		-0.943***		0.027***
		(-4.77)		(2.62)
AA×March 2020		-0.724***		-0.006
		(-4.19)		(-0.68)
A×March 2020		-0.546***		-0.002
		(-3.35)		(0.27)
BBB×March 2020		-0.452***		-0.005
		(-3.05)		(-0.83)
BB×March 2020		-0.349**		0.003
		(-2.43)		(0.58)
B×March 2020		-0.377***		-0.001
		(-2.78)		(-0.18)
CCC×March 2020		-0.337**		0.006
		(-2.52)		(1.08)
AAA		0.348***		0.081***
		(2.86)		(5.50)
AA		0.269***		0.077***
		(2.92)		(6.19)
A		0.261***		0.070***
		(2.96)		(5.81)
BBB		0.261***		0.069***
		(3.12)		(5.93)
BB		0.126		0.053***
		(1.54)		(5.33)
B		0.098		0.037***
		(1.42)		(5.37)
CCC		0.042		0.011**
		(0.67)		(2.14)
Constant	0.007	-0.269***	0.006***	-0.064***
	(0.46)	(3.06)	(3.94)	(-5.53)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	5,138,513	5,138,513	5,138,513	5,138,513
R-squared	0.121	0.121	0.139	0.139

Panel C: Changes in Bond Holdings, Euroarea NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
March 2020	-0.416***	-0.898***	-0.050***	-0.057***
	(-7.93)	(6.75)	(-7.40)	(-4.42)
AAA×March 2020		0.072		0.020
		(0.43)		(1.54)
AA×March 2020		0.602***		0.016
		(5.72)		(1.53)
A×March 2020		0.571***		0.012
		(6.07)		(1.25)
BBB×March 2020		0.552***		0.005
		(6.46)		(0.64)
BB×March 2020		0.085		-0.040***
		(1.06)		(-5.41)
B×March 2020		0.140*		-0.041***
		(1.75)		(-5.44)
CCC×March 2020		-0.092		-0.046***
		(-1.15)		(-5.85)
AAA		0.147		0.077***
		(0.83)		(3.28)
AA		0.055		0.059***
		(0.41)		(3.15)
A		0.052		0.053***
		(0.40)		(2.97)
BBB		0.057		0.049***
		(0.46)		(3.15)
BB		0.057		0.045***
		(0.66)		(3.45)
B		0.041		0.036***
		(0.52)		(3.79)
CCC		0.021		0.018***
		(0.32)		(2.80)
Constant	0.020	-0.040	0.014***	-0.038**
	(1.42)	(-0.33)	(3.79)	(-2.33)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	2,052,304	2,052,304	2,052,304	2,052,304
R-squared	0.106	0.106	0.079	0.080

Table A.4 NBFI Bond Portfolio Rebalancing by Credit Rating During the Onset of COVID-19: Fund Outflows in March 2020

This table reports the direction and magnitude of NBFI bond portfolio rebalancing by credit rating the onset of COVID-19. Panel A reports the results for all funds, Panel B shows the results for US-based NBFIs, and Panel C reports the results for Euroarea-based NBFIs. The dependent variables are the changes in NBFI's j book-value holdings of bond i at time t, both in million USD (ΔBV(i,j,t)) and in percentages (%ΔBV(i,j,t)). The explanatory variables are fund outflows in March 2020 as percentage of the fund's book value, a ratings variable, and their interaction. Fund outflows in March 2020 are the changes in cash minus the changes in the book value of the fund ($\$\Delta Cash_{j,3/2020} - \$\Delta BV_{j,3/2020}$) normalized by the fund book value in March 2020 ($\$\Delta BV_{j,3/2020}$). Ratings is a numeric variable according to the rating of the bond or its issuer by one of the three big rating agencies (Fitch, Moody's S&P). The transformation from alphanumeric to numeric values follows the rule: AAA=1, AA=2, A=3, BBB=4, BB=5, B=6, CCC=7, lower than CCC=8. All specifications also control for bond-NBFI fixed effects as well as contemporaneous and lag returns (Return(i,j,t), Return(i,j,t-1)). Returns are from clean prices, and are winsorized at the 0.5% level. Numbers in parentheses are t-statistics based on two-way cluster-robust standard errors by date and bond-NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

Panel A: Changes in Bond Holdings by Rating, All NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
Ratings	-0.024*	-0.029**	-0.010***	-0.009***
	(-1.82)	(-2.05)	(-5.98)	(-5.91)
Fund Outflows in March 2020	-0.060***	-0.095***	-0.004***	-0.001***
	(-30.61)	(-34.00)	(-30.97)	(-12.83)
Ratings×Fund Outflows in March 2020		0.012***		-0.001***
		(13.38)		(-19.09)
Constant	0.083**	0.096**	0.038***	0.037***
	(1.97)	(2.11)	(7.26)	(7.26)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	7,190,817	7,190,817	7,190,817	7,190,817
R-squared	0.120	0.120	0.121	0.117

Panel B: Changes in Bond Holdings by Rating, US NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
Ratings	-0.028**	-0.032***	-0.010***	-0.010***
	(-2.28)	(-2.67)	(-5.75)	(-5.85)
Fund Outflows in March 2020	-0.069***	-0.099***	-0.003***	-0.001
	(-27.62)	(-28.34)	(-20.82)	(-6.34)
Ratings×Fund Outflows in March 2020		0.011***		-0.001***
		(8.69)		(-11.60)
Constant	0.087**	0.096***	0.037***	0.036***
	(2.39)	(2.62)	(6.47)	(6.59)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	5,138,513	5,138,513	5,138,513	5,138,513
R-squared	0.121	0.121	0.141	0.142

Panel C: Changes in Bond Holdings by Rating, Euroarea NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
Ratings	-0.013	-0.018**	-0.008**	-0.008**
	(-0.66)	(-0.81)	(-2.55)	(-2.44)
Fund Outflows in March 2020	-0.047***	-0.075***	-0.006***	-0.004***
	(-18.43)	(-11.73)	(-22.36)	(-16.47)
Ratings×Fund Outflows in March 2020		0.008***		-0.001***
		(4.38)		(-4.99)
Constant	0.062	0.078	0.042***	0.041***
	(0.91)	(1.04)	(3.85)	(3.74)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	2,052,304	2,052,304	2,052,304	2,052,304
R-squared	0.106	0.106	0.086	0.086

Table A.5 NBFI Bond Portfolio Rebalancing by Sector During the Onset of COVID-19

This table reports the direction and magnitude of NBFI portfolio rebalancing during the onset of COVID-19 by sector of issuer. Panel A reports the results for all funds, Panel B shows the results for US-based NBFIs, and Panel C reports the results for Euroarea-based NBFIs. The dependent variables are the changes in NBFI's j book-value holdings of bond i at time t, both in million USD (ΔBV(i,j,t)) and in percentages (%ΔBV(i,j,t)). The explanatory variables are an indicator for March 2020 and its interaction with the sector variable. Sector is a categorical variable that takes the value one for the issuer's sector (i.e., Govt, Fin, Non-Fin, etc.) and zero otherwise. All specifications also control for bond-NBFI fixed effects as well as contemporaneous and lag returns (Return(i,j,t), Return(i,j,t-1)). Returns are from clean prices, and are winsorized at the 0.5% level. Numbers in parentheses are t-statistics based on two-way cluster-robust standard errors by date and bond-NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

Panel A: Changes in Bond Holdings, All NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
March 2020	-0.284***	-0.111***	-0.022***	-0.014***
	(-9.35)	(-2.78)	(-6.88)	(-3.89)
Govt×March 2020		-0.828***		-0.009***
		(-17.38)		(-6.32)
Fin×March 2020		-0.026		-0.004***
		(-0.81)		(-2.75)
Non-Fin×March 2020		-0.037		-0.017***
		(-1.19)		(-12.18)
Constant	0.007	0.006	0.005***	0.005***
	(0.72)	(0.64)	(3.50)	(3.51)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	9,988,006	9,988,006	9,988,006	9,988,006
R-squared	0.078	0.078	0.126	0.126

Panel B: Changes in Bond Holdings, US NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
March 2020	-0.243***	-0.075	-0.013***	-0.013***
	(-6.56)	(-1.55)	(-3.97)	(-3.29)
Govt×March 2020		-0.801***		-0.002
		(-14.93)		(-1.35)
Fin×March 2020		-0.025		0.006***
		(-0.66)		(4.60)
Non-Fin×March 2020		-0.015		-0.009***
		(-0.42)		(-8.26)
Constant	0.003	0.002	0.003**	0.003**
	(0.33)	(0.25)	(2.44)	(2.46)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	7,695,478	7,695,478	7,695,478	7,695,478
R-squared	0.077	0.077	0.149	0.149

Panel C: Changes in Bond Holdings, Euroarea NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
March 2020	-0.436***	-0.279***	-0.054***	-0.017***
	(-7.87)	(-4.90)	(-7.52)	(-2.87)
Govt×March 2020		-0.924***		-0.045***
		(-15.46)		(-12.09)
Fin×March 2020		-0.012		-0.036***
		(-0.83)		(-10.98)
Non-Fin×March 2020		-0.043**		-0.039***
		(-2.02)		(-10.74)
Constant	0.020	0.019	0.013***	0.013***
	(1.37)	(1.29)	(3.55)	(3.54)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	2,292,528	2,292,528	2,292,528	2,292,528
R-squared	0.089	0.089	0.081	0.081

Table A.6 NBFI Bond Portfolio Rebalancing by Headquarter During the Onset of COVID-19

This table reports the direction and magnitude of NBFI portfolio rebalancing during the onset of COVID-19 by headquarter of issuer. Panel A reports the results for all funds, Panel B shows the results for US-based NBFIs, and Panel C reports the results for Euroarea-based NBFIs. The dependent variables are the changes in NBFI's j book-value holdings of bond i at time t, both in million USD (ΔBV(i,j,t)) and in percentages (%ΔBV(i,j,t)). The explanatory variables are an indicator for March 2020 and its interaction with the headquarter variable. Headquarter is a categorical variable that takes the value one for the issuer's headquarter region (i.e., US, Eurozone, UK, etc.) and zero otherwise. All specifications also control for bond-NBFI fixed effects as well as contemporaneous and lag returns (Return(i,j,t), Return(i,j,t-1)). Returns are from clean prices, and are winsorized at the 0.5% level. Numbers in parentheses are t-statistics based on two-way cluster-robust standard errors by date and bond-NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

Panel A: Changes in Bond Holdings, All NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
March 2020	-0.284***	-0.366***	-0.022***	-0.040***
	(-9.35)	(-6.11)	(-6.88)	(-10.71)
US×March 2020		0.068		0.024***
		(1.36)		(16.78)
Eurozone×March 2020		0.072		-0.009***
		(1.44)		(-3.14)
UK×March 2020		0.066		0.000
		(1.37)		(0.38)
Rest EU×March 2020		-0.156***		-0.011***
		(-3.20)		(-4.90)
Asia×March 2020		-0.255***		-0.016***
		(-4.96)		(-5.42)
Latin America×March 2020		-0.306***		-0.018***
		(-4.61)		(-5.50)
Other×March 2020		0.270***		0.030***
		(4.74)		(15.74)
Japan×March 2020		-0.283***		0.011***
		(-4.06)		(5.18)
Oceania×March 2020		0.022		-0.005**
		(0.45)		(-2.35)
Constant	0.007	0.007	0.005***	0.005***
	(0.72)	(0.74)	(3.50)	(3.53)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	9,988,006	9,988,006	9,988,006	9,988,006
R-squared	0.078	0.078	0.126	0.126

Panel B: Changes in Bond Holdings, US NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
March 2020	-0.243***	-0.378***	-0.013***	-0.035***
	(-6.56)	(-4.74)	(-3.97)	(-8.21)
US×March 2020		0.108		0.022***
		(1.64)		(15.65)
Eurozone×March 2020		-0.006		0.010***
		(-0.10)		(6.87)
UK×March 2020		0.075		0.009
		(1.15)		(6.06)
Rest EU×March 2020		-0.145**		-0.003**
		(-2.23)		(-2.15)
Asia×March 2020		-0.049		-0.003**
		(-0.76)		(-2.03)
Latin America×March 2020		-0.021		-0.003
		(-0.25)		(-0.92)
Other×March 2020		0.330***		0.028***
		(4.61)		(14.32)
Japan×March 2020		-0.511***		0.007***
		(-5.13)		(3.01)
Oceania×March 2020		-0.108		-0.001
		(-1.55)		(-0.44)
Constant	0.003	0.003	0.003**	0.003**
	(0.33)	(0.34)	(2.44)	(2.45)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	7,695,478	7,695,478	7,695,478	7,695,478
R-squared	0.077	0.077	0.149	0.149

Panel C: Changes in Bond Holdings, Euroarea NBFIs

	ΔBV(i,j,t)		%ΔBV(i,j,t)	
	(1)	(2)	(3)	(4)
March 2020	-0.436***	-0.316***	-0.054***	-0.057***
	(-7.87)	(-5.92)	(-7.52)	(-8.61)
US×March 2020		-0.111***		0.019***
		(-6.08)		(8.67)
Eurozone×March 2020		-0.036**		-0.005*
		(-2.00)		(-1.68)
UK×March 2020		-0.060***		0.002
		(-3.56)		(0.66)
Rest Europe×March 2020		-0.277***		-0.005**
		(-14.50)		(-2.10)
Asia×March 2020		-0.622***		-0.025***
		(-19.84)		(-4.27)
Lat. America×March 2020		-0.918***		-0.041***
		(-15.35)		(-6.79)
Other×March 2020		-0.468***		-0.015***
		(-12.25)		(-2.87)
Japan×March 2020		0.054***		0.022***
		(2.58)		(5.19)
Oceania×March 2020		0.049***		-0.001
		(2.73)		(-0.45)
Constant	0.020	0.021	0.013***	0.013***
	(1.37)	(1.41)	(3.55)	(3.55)
Return Controls	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes
Obs.	2,292,528	2,292,528	2,292,528	2,292,528
R-squared	0.089	0.089	0.081	0.081

Table A.7 Aggregate NBFI Bond Portfolio Rebalancing Across Ratings

This table studies aggregate portfolio rebalancing in the NBFI sample across rating categories during the onset of COVID-19. The dependent variables are aggregate changes in trillion USD ($\$\Delta BV(t)$) and percentages ($\%\Delta BV(t)$) in bond book value across credit ratings at time t. In specifications (1), (3), (5), (7), (9), and (11), the explanatory variables are an indicator for March 2020, a ratings variable, and their interaction. The ratings variable is a numeric variable according to the rating of the bond or its issuer by one of the three big rating agencies (Fitch, Moody's S&P). The transformation from alphanumeric to numeric values follows the rule: AAA=1, AA=2, A=3, BBB=4, BB=5, B=6, CCC=7, lower than CCC=8. In specifications (1), (3), (5), (7), (9), and (11), standard errors are clustered by rating (Ratings SE). In specifications (2), (4), (6), (8), (10), and (12), the ratings score is replaced by a categorical variable that takes the value one when the bond rating falls within each raying category (i.e., AAA, AA, A, etc.) and zero otherwise. The explanatory variables in specifications (2), (4), (6), (8), (10), and (12) consist of the March 2020 indicator, interaction of the March 2020 indicator with the ratings categorical variable, and the ratings categorical variables. In specifications (2), (4), (6), (8), (10), and (12), standard errors are not clustered. The numbers in parenthesis are t-statistics. Asterisks(*,** and ***) denote significance at the 10%, 5% and 1% levels. Data is for Jan. 2019 to Jan. 2021.

	All NBFIs				US NBFIs				Euroarea NBFIs			
	ΔBV(t)		%ΔBV(t)		ΔBV(t)		%ΔBV(t)		ΔBV(t)		%ΔBV(t)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Ratings	-0.000***		-0.007		-0.001***		-0.007*		-0.000***		-0.008	
	(-2.92)		(-1.60)		(-2.74)		(-1.67)		(-4.30)		(-1.51)	
Ratings×March 2020	0.004**		0.006		0.007**		0.019**		0.001***		-0.006	
	(2.45)		(0.91)		(2.11)		(2.48)		(4.95)		(-0.93)	
March 2020	-0.029***	0.000	-0.111***	0.008	-0.048**	0.000	-0.120***	0.111***	-0.010***	-0.000	-0.101***	-0.095*
	(-2.77)	(0.05)	(-5.21)	(0.25)	(-2.31)	(0.05)	(-4.77)	(2.70)	(-6.08)	(-0.03)	(-3.97)	(-1.74)
AAA×March 2020		-0.041***		-0.113**		-0.073***		-0.191***		-0.008***		-0.035
		(-7.90)		(-2.31)		(-8.61)		(-3.27)		(-5.30)		(-0.46)
AA×March 2020		-0.007		-0.095*		-0.010		-0.190***		-0.004***		0.000
		(-1.39)		(-1.94)		(-1.17)		(-3.27)		(-2.72)		(0.00)
A×March 2020		-0.013**		-0.082*		-0.016*		-0.159***		-0.008***		-0.005
		(-2.39)		(-1.68)		(-1.88)		(-2.73)		(-5.35)		(-0.07)
BBB×March 2020		-0.012**		-0.086*		-0.015*		-0.172***		-0.008***		-0.000
		(-2.33)		(-1.77)		(-1.86)		(-2.96)		(-5.09)		(-0.01)
BB×March 2020		-0.004		-0.114**		-0.003		-0.146**		-0.004***		-0.082
		(-0.74)		(-2.34)		(-0.37)		(-2.51)		(-2.73)		(-1.08)
B×March 2020		-0.003		-0.110**		-0.003		-0.165***		-0.002		-0.056
		(-0.52)		(-2.26)		(-0.35)		(-2.83)		(-1.49)		(-0.74)
CCC×March 2020		-0.000		-0.123**		-0.000		-0.133**		-0.000		-0.113
		(-0.09)		(-2.52)		(-0.06)		(-2.28)		(-0.27)		(-1.48)
AAA		0.006***		0.089***		0.012***		0.075***		0.001***		0.103***
		(6.60)		(9.11)		(7.23)		(6.42)		(4.29)		(6.76)
AA		0.001		0.083***		0.002		0.075***		0.000		0.091***
		(1.24)		(8.52)		(1.19)		(6.48)		(1.63)		(5.96)
A		0.003***		0.087***		0.006***		0.080***		0.001***		0.094***
		(3.59)		(8.91)		(3.69)		(6.85)		(3.59)		(6.19)
BBB		0.002***		0.084***		0.004***		-0.173***		0.001***		0.092***
		(2.64)		(8.65)		(2.63)		(6.61)		(3.08)		(6.04)
BB		0.001		0.094***		0.001		0.080***		0.000**		0.107***
		(1.26)		(9.59)		(1.11)		(6.91)		(2.18)		(7.01)
B		0.000		0.089***		0.001		0.078***		0.000		0.101***
		(0.73)		(9.17)		(0.66)		(6.73)		(1.20)		(6.61)
CCC		0.000		0.075**		0.000		0.062***		0.000		0.088***
		(0.14)		(7.71)		(0.12)		(5.33)		(0.25)		(5.80)
Constant	0.005***	-0.000	0.039**	-0.070***	0.009***	-0.000	0.037**	-0.060***	0.001***	0.001***	0.041	-0.081
	(3.33)	(-0.19)	(2.45)	(-10.23)	(3.11)	(-0.17)	(2.51)	(-7.35)	(5.17)	(-0.31)	(2.33)	(-7.49)
Ratings SE	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Obs.	400	400	400	400	200	200	200	200	200	200	200	200
R-squared	0.246	0.335	0.170	0.327	0.361	0.540	0.147	0.323	0.481	0.544	0.244	0.404

Table A.8 Average Bond Returns Across Ratings

This table studies average returns in the NBFI sample across rating categories during the onset of COVID-19. The dependent variables are average bond returns (Return(t)) at time t. Average returns are simple average returns for each credit rating. The explanatory variables are an indicator for March 2020, the ratings variable, and their interaction. The ratings variable is a categorical variable that takes the value one when the bond rating falls within each rating category (i.e., AAA, AA, A, etc.) and zero otherwise. The numbers in parenthesis are t-statistics. Asterisks(*,** and ***) denote significance at the 10%, 5% and 1% levels. Data is for Jan. 2019 to Jan. 2021.

	All NBFIs	US NBFIs	Euroarea NBFIs
	Return(t)	Return(t)	Return(t)
	(1)	(2)	(3)
March 2020	-0.136***	-0.133***	-0.139***
	(-7.66)	(-5.49)	(-5.15)
AAA×March 2020	0.134***	0.133***	0.134***
	(5.32)	(3.91)	(3.50)
AA×March 2020	0.096***	0.099***	0.092**
	(3.82)	(2.91)	(2.42)
A×March 2020	0.073***	0.072**	0.073**
	(2.90)	(2.13)	(1.92)
BBB×March 2020	0.044*	0.031	0.056
	(1.75)	(0.92)	(1.47)
BB×March 2020	0.031	0.030	0.031
	(1.24)	(0.90)	(0.82)
B×March 2020	0.013	0.014	0.012
	(0.53)	(0.41)	(0.33)
CCC×March 2020	-0.019	-0.021	-0.017
	(-0.77)	(-0.63)	(-0.45)
AAA	0.017***	0.168**	0.017**
	(3.41)	(2.46)	(2.28)
AA	0.019***	0.020***	0.018**
	(3.90)	(2.98)	(2.46)
A	0.021***	0.022***	0.020***
	(4.29)	(3.34)	(2.66)
BBB	0.023***	0.025***	0.021***
	(4.70)	(3.72)	(2.86)
BB	0.023***	0.024***	0.023***
	(4.73)	(3.51)	(3.08)
B	0.023***	0.023***	0.023***
	(4.68)	(3.44)	(3.08)
CCC	0.015***	0.015**	0.015***
	(3.10)	(2.28)	(2.03)
Constant	-0.014***	-0.015***	-0.014*
	(-4.12)	(-3.11)	(-2.63)
Observations	400	200	200
R-squared	0.444	0.471	0.422

Table A.9 Aggregate NBFI Portfolio Rebalancing and Average Bond Returns Across Sectors

This table studies aggregate portfolio rebalancing and average bond returns in the NBFI sample across sector of issuer during the onset of COVID-19. The dependent variables are aggregate changes in trillion USD of bond book value ($\$\Delta BV(t)$), aggregate percentage changes in bond book value ($\%\Delta BV(t)$), and average returns (Return(t)) of bond holdings across sectors at time t. Sector is a categorical variable that takes the value one for the issuer's sector (i.e., Govt, Fin, Non-Fin, etc.) and zero otherwise. The explanatory variables include the March 2020 indicator, interaction of the March 2020 indicator with the sector categorical variable, and sector fixed effects. The numbers in parenthesis are t-statistics. Asterisks(*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

	All NBFIs			US NBFIs			Euroarea NBFIs		
	ΔBV(t)	%ΔBV(t)	Return(t)	ΔBV(t)	%ΔBV(t)	Return(t)	ΔBV(t)	%ΔBV(t)	Return(t)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
March 2020	-0.008	-0.056***	-0.066***	-0.016	-0.047*	-0.064***	-0.000	-0.065*	-0.069***
	(-1.27)	(-2.62)	(-9.93)	(-1.39)	(-1.87)	(-7.23)	(-0.48)	(-1.91)	(-6.84)
Govt×March 2020	-0.046***	-0.060**	0.022**	-0.072***	-0.045	0.019	-0.020***	-0.075	0.024*
	(-4.62)	(-1.98)	(2.32)	(-4.19)	(-1.27)	(1.59)	(-6.89)	(-1.55)	(1.68)
Fin×March 2020	-0.017*	-0.021	0.017*	-0.023	-0.017	0.032*	-0.011***	-0.024	0.003
	(-1.73)	(-0.69)	(1.87)	(-1.39)	(-0.50)	(2.57)	(-3.60)	(-0.50)	(0.23)
Non-Fin×March 2020	-0.000	-0.005	-0.017*	0.004	0.019	-0.019	-0.006**	-0.029	-0.015
	(-0.10)	(-0.17)	(-1.81)	(0.29)	(0.54)	(-1.55)	(-2.34)	(-0.61)	(-1.04)
Constant	0.005***	0.013***	0.005***	0.008***	0.016***	0.005***	0.001***	0.010***	0.006***
	(7.18)	(6.18)	(8.47)	(7.29)	(6.30)	(5.94)	(6.03)	(3.09)	(6.04)
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	200	200	200	100	100	100	100	100	100
R-squared	0.295	0.241	0.648	0.428	0.220	0.663	0.632	0.305	0.660

Table A.10 Aggregate NBFI Portfolio Rebalancing and Average Bond Returns Across Headquarters

This table studies aggregate portfolio rebalancing and average bond returns in the NBFI sample across headquarter of bond issuer during the onset of COVID-19. The dependent variables are aggregate changes in trillion USD of bond book value ($\$\Delta BV(t)$), aggregate percentage changes in bond book value ($\%\Delta BV(t)$), and average returns (Return(t)) of NBFI bond holdings across headquarters at time t. Headquarter is a categorical variable that takes the value one for the issuer's headquarter region (i.e., USA, Euroarea, UK, etc.) and zero otherwise. The explanatory variables include the March 2020 indicator, interaction of the March 2020 indicator with the headquarter categorical variable, and headquarter (HQ) fixed effects. The numbers in parenthesis are t-statistics. Asterisks(*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

	All NBFIs			US NBFIs			Euroarea NBFIs		
	$\$\Delta$BV(t)	$\%\Delta$BV(t)	Return(t)	$\$\Delta$BV(t)	$\%\Delta$BV(t)	Return(t)	$\$\Delta$BV(t)	$\%\Delta$BV(t)	Return(t)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
March 2020	-0.002	-0.119***	-0.070***	-0.004	-0.106***	-0.073***	-0.000	-0.132***	-0.067***
	(-0.58)	(-6.51)	(-9.24)	(-0.75)	(-4.46)	(-6.93)	(-0.38)	(-4.93)	(-6.10)
US×March 2020	-0.057***	0.030	0.009	-0.103***	0.044	0.021	-0.011***	0.017	-0.003
	(-8.70)	(1.18)	(0.86)	(-11.30)	(1.31)	(1.47)	(-5.64)	(0.45)	(-0.22)
Eurozone×March 2020	-0.008	0.041	0.002	-0.003	0.036	0.004	-0.013***	0.046	0.000
	(-1.30)	(1.58)	(0.20)	(-0.42)	(1.07)	(0.27)	(-6.55)	(1.21)	(0.01)
UK×March 2020	-0.000	0.044*	0.001	0.001	0.029	0.005	-0.001	0.059	-0.004
	(-0.00)	(1.72)	(0.07)	(0.15)	(0.87)	(0.38)	(-0.66)	(1.58)	(-0.27)
Rest of Europe ×March 2020	0.000	0.024	0.011	0.003	0.036	0.015	-0.001	0.012	0.007
	(0.11)	(0.95)	(1.07)	(0.35)	(1.08)	(1.04)	(-0.90)	(0.34)	(0.49)
Asia×March 2020	-0.001	-0.036	-0.003	0.000	-0.006	0.003	-0.004**	-0.066*	-0.010
	(-0.28)	(-1.39)	(-0.35)	(0.08)	(-0.17)	(0.21)	(-2.17)	(-1.75)	(-0.68)
Lat. America×March 2020	0.000	-0.002	-0.054***	0.0032	0.036	-0.055***	-0.001	-0.040	-0.052***
	(0.05)	(-0.10)	(-5.00)	(0.29)	(1.05)	(-3.74)	(-0.97)	(-1.07)	(-3.31)
Other×March 2020	-0.008	0.002	-0.009	-0.015*	0.046	0.017	-0.001	-0.042	-0.035***
	(-1.31)	(0.09)	(-0.85)	(-1.70)	(1.36)	(1.17)	(-0.86)	(-1.10)	(-2.28)
Japan×March 2020	-0.000	-0.013	0.028***	0.000	-0.001	0.037***	-0.000	-0.025	0.019
	(-0.01)	(-0.53)	(2.66)	(0.02)	(-0.04)	(2.51)	(-0.17)	(-0.69)	(1.27)
Oceania×March 2020	0.001	0.010	0.020*	0.003	-0.003	0.026*	0.000	0.023	0.015
	(0.28)	(0.39)	(1.93)	(0.38)	(-0.09)	(1.74)	(0.07)	(0.62)	(1.00)
Constant	0.002***	0.014***	0.007***	0.003***	0.015***	0.006***	0.000***	0.013***	0.006***
	(6.89)	(12.36)	(13.58)	(8.72)	(9.91)	(9.57)	(5.51)	(8.07)	(9.54)
HQ FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	500	500	500	250	250	250	250	250	250
R-squared	0.403	0.446	0.656	0.710	0.377	0.656	0.482	0.554	0.677

Table A.11 Effects of AAA Bonds on NBFI Bond Portfolio Changes Across Ratings

This table studies the effects of AAA-rated bonds on NBFI bond portfolio rebalancing across rating categories during the onset of COVID-19 for all NBFIs in our sample. The dependent variables are the changes in million USD of NBFI's j book-value holdings of bond i at time t when bond i belongs to the rating category Z (ΔBV(i,j,Z,t)). The explanatory variables are an indicator for March 2020, the average, at the NBFI-level, change in million USD in NBFI's j book-value holdings of AAA bonds at time t ($\overline{\$\Delta BV(i,j,AAA,t)}$), and their interaction. We control for contemporaneous bond returns (Return(i,j,t)), and lag returns (Return(i,j,t-1)). Returns are from clean prices, and are winsorized at the 0.5% level. All specifications also control for bond-NBFI fixed effects. Numbers in parentheses are t-statistics based on two-way cluster-robust standard errors by date and bond-NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

	ΔBV(i,j,AA,t) (1)	ΔBV(i,j,A,t) (2)	ΔBV(i,j,BBB,t) (3)	ΔBV(i,j,BB,t) (4)	ΔBV(i,j,B,t) (5)	ΔBV(i,j,CCC,t) (6)	ΔBV(i,j,C/D,t) (7)
$\overline{\$\Delta BV(i,j,AAA,t)}$	0.001	0.001	0.001**	0.000	0.001	-0.000	-0.000
	(1.18)	(1.51)	(2.14)	(0.49)	(0.77)	(-0.07)	(-0.88)
March 2020	-0.373***	-0.216***	-0.169***	-0.080	-0.100	-0.205***	-0.036
	(-7.77)	(-8.15)	(-9.45)	(-1.25)	(-1.41)	(-4.29)	(-0.16)
$\overline{\$\Delta BV(i,j,AAA,t)}$×March 2020	0.039***	0.007***	0.005***	0.002**	0.003*	0.005	0.004***
	(8.39)	(4.96)	(6.98)	(1.98)	(1.76)	(0.75)	(2.66)
Constant	0.050***	0.028***	0.018**	0.013	0.020	0.021	-0.050
	(3.57)	(3.17)	(2.35)	(0.56)	(0.76)	(1.02)	(-1.31)
Return Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	667,383	2,050,738	1,978,855	474,994	261,940	36,971	9,312
R-squared	0.075	0.097	0.198	0.210	0.095	0.181	0.339

Table A.12 Effects of AAA Bonds on NBFI Bond Portfolio Percentage Changes Across Ratings

This table studies the effects of AAA-rated bonds on NBFI bond portfolio rebalancing across rating categories during the onset of COVID-19 for all NBFIs in our sample. The dependent variables are the percentage changes in NBFI's j book-value holdings of bond i at time t when bond i belongs to the rating category Z (%ΔBV(i,j,Z,t)). The explanatory variables are an indicator for March 2020, the average, at the NBFI level, contemporaneous percentage changes in NBFI's j book-value holdings of AAA bonds at time t ($\overline{\%\Delta BV(i,j,AAA,t)}$), and their interaction. We control for contemporaneous bond returns (Return(i,j,t)), and lag returns (Return(i,j,t-1)). Returns are from clean prices, and are winsorized at the 0.5% level. All specifications also control for bond-NBFI fixed effects. Numbers in parentheses are t-statistics based on two-way cluster-robust standard errors by date and bond-NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

	%ΔBV(i,j,AA,t) (1)	%ΔBV(i,j,A,t) (2)	%ΔBV(i,j,BBB,t) (3)	%ΔBV(i,j,BB,t) (4)	%ΔBV(i,j,B,t) (5)	%ΔBV(i,j,CCC,t) (6)	%ΔBV(i,j,C/D,t) (7)
$\overline{\%\Delta BV(i,j,AAA,t)}$	0.215***	0.173***	0.161***	0.037***	0.049***	0.010	0.003
	(7.77)	(7.42)	(8.86)	(3.25)	(3.94)	(0.95)	(0.22)
March 2020	-0.027***	-0.023***	-0.033***	-0.032***	-0.037***	-0.032***	-0.028***
	(-7.95)	(-6.81)	(-8.28)	(-4.68)	(-5.55)	(-6.01)	(-3.11)
$\overline{\%\Delta BV(i,j,AAA,t)}$×March 2020	0.060**	0.046**	0.052***	-0.015	-0.046***	-0.016	-0.023
	(2.40)	(2.29)	(3.38)	(-1.56)	(-4.57)	(-1.61)	(-1.55)
Constant	0.005***	0.007***	0.008***	0.018***	0.018***	0.013***	-0.003***
	(2.68)	(3.90)	(4.41)	(5.72)	(5.80)	(5.28)	(-0.94)
Return Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond-NBFI FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	667,383	2,050,738	1,978,855	474,994	261,940	36,971	9,312
R-squared	0.116	0.111	0.112	0.116	0.131	0.173	0.279

Table A.13 Aggregate Effects of AAA Bonds on NBFI Bond Portfolios Changes for non-AAA Bonds

This table studies the aggregate rebalancing effects of AAA-rated bonds for non-AAA bonds during the onset of COVID-19 in the NBFI sample. The dependent variables are the changes (trillion USD and percentages) in the aggregate book value of non-AAA rated bonds ($\$\Delta$BV(non-AAA,t), $\%\Delta$BV(non-AAA,t)). The explanatory variables are an indicator for March 2020, the aggregate changes (trillion USD or percentages) in the book-value of AAA bonds ($\$\Delta$BV(AAA,t), $\%\Delta$BV(AAA,t)), and their interaction. All specifications also control for ratings fixed effects. Numbers in parentheses are t-statistics based one-way cluster-robust standard errors by rating. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

	All NBFIs		US NBFIs		Euroarea NBFIs	
	$\$\Delta$BV(non-AAA, t)	$\%\Delta$BV(non-AAA, t)	$\$\Delta$BV(non-AAA, t)	$\%\Delta$BV(non-AAA, t)	$\$\Delta$BV(non-AAA, t)	$\%\Delta$BV(non-AAA, t)
	(1)	(2)	(3)	(4)	(5)	(6)
$\$\Delta$BV(AAA,t)	-0.020**		-0.039*		-0.011	
	(-2.24)		(-1.82)		(-1.58)	
$\$\Delta$BV(AAA,t)×March 2020	-0.012*		-0.148**		0.093**	
	(-1.82)		(-2.90)		(2.32)	
March 2020	-0.006***	0.015	-0.012***	0.140	-0.001	-0.035
	(-2.85)	(0.15)	(-3.70)	(1.31)	(-0.79)	(-0.62)
$\%\Delta$BV(AAA,t)		-0.059		0.054		-0.155
		(-0.70)		(0.51)		(-0.99)
$\%\Delta$BV(AAA,t)×March 2020		1.173		1.803*		1.336**
		(0.96)		(1.84)		(2.00)
Constant	0.001***	0.004***	0.002***	0.003	0.000***	0.003*
	(10.54)	(3.39)	(12.19)	(1.29)	(7.39)	(1.69)
Ratings FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	350	350	175	175	175	175
R-squared	0.290	0.312	0.480	0.286	0.472	0.392

Table A.14 Effects of AAA Bonds on NBFI Bond Portfolio Rebalancing and Bond Returns: Percentage of AAA holdings

This table studies the effects of AAA-rated bonds on NBFI bond portfolio rebalancing and returns during the onset of COVID-19. In Panel A, the dependent variables are the changes in NBFIs j book value of non-AAA bond holdings as a percentage of the total book value of NBFIs j rated bond portfolio (ΔBV(j,non-AAA,t)/$BV(j,all rated,t)). In Panel B, the dependent variables are NBFI returns (Return(j,t)), which are defined as the market value of NBFI j at time t over its market value at time $t-1$. The explanatory variables are an indicator for March 2020, NBFI j's holdings of AAA bonds at time t as a percentage of the total book value of rated bonds in the NBFI ($\%BV(j, AAA, t)$), and their interaction. All specifications also control for NBFI fixed effects. Numbers in parentheses are t-statistics based on one-way cluster-robust standard errors by NBFI. Asterisks (*,** and ***) denote significance at the 10%, 5% and 1% levels, respectively. Data is for Jan. 2019 to Jan. 2021.

Panel A: Changes in non-AAA Bond Holdings as Percentages of Total NBFI Portfolio

	All NBFIs ΔBV(j,non-AAA,t)/$BV(j,all rated,t) (1)	US NBFIs ΔBV(j,non-AAA,t)/$BV(j,all rated,t) (2)	Euroarea NBFIs ΔBV(j,non-AAA,t)/$BV(j,all rated,t) (3)
$\%BV(j, AAA, t)$	-0.067***	-0.056***	-0.147***
	(-4.04)	(-3.52)	(-2.64)
March 2020	-0.056***	-0.036***	-0.082***
	(-6.35)	(-2.88)	(-6.94)
$\%BV(j, AAA, t)\times$March 2020	0.077***	0.054***	0.104***
	(6.45)	(3.27)	(5.86)
Constant	0.056***	0.054***	0.066***
	(12.07)	(10.31)	(6.42)
NBFI FE	Yes	Yes	Yes
Obs.	10,557	6,662	3,895
R-squared	0.266	0.321	0.210

Panel B: Returns of NBFI Bond Portfolios

	All NBFIs Return(j,t) (1)	US NBFIs Return(j,t) (2)	Euroarea NBFIs Return(j,t) (3)
$\%BV(j, AAA, t)$	-0.018	-0.003	-0.123
	(-0.33)	(-0.07)	(-0.59)
March 2020	-0.177***	-0.172***	-0.184***
	(-24.00)	(-17.86)	(-16.12)
$\%BV(j, AAA, t)\times$March 2020	0.142***	0.154***	0.084**
	(5.97)	(5.35)	(2.27)
Constant	0.032**	0.027	0.052
	(2.06)	(1.43)	(1.35)
NBFI FE	Yes	Yes	Yes
Obs.	10,557	6,662	3,895
R-squared	0.105	0.101	0.111

Table A.15 FED and ECB Interventions at the Onset of COVID-19

This table summarizes the interventions by the FED and the ECB during the onset of the COVID-19 epidemic.

Panel A: FED Interventions

Monetary Policy Decisions (FOMC Statements)

Name	Form of Support	Institutions	Sector	Date of Announcement	Date of Implementation	End Date	Maximum Capacity ($ bn)
Rate cut	Interest rate	Fed	Economy wide	3/3/2020	3/3/2020		
Rate cut	Interest rate	Fed	Economy wide	3/15/2020	3/15/2020		
Asset purchases	Open market operations	Fed	Economy wide	3/23/2020	3/23/2020		unlimited

Emergency Lending Programs

Name	Form of Support	Institutions	Sector	Date of Announcement	Date of Implementation	End Date	Maximum Capacity ($ bn)
Commercial Paper Funding Facilitiy (CPFF)	Liquidity & funding	Fed, US Treasury	Commercial paper market	3/17/2020	4/14/2020	3/17/2021	unlimited
Primary Dealer Credit Facility (PDCF)	Liquidity & funding	Fed	Broker-Dealers	3/17/2020	3/20/2020	3/31/2021	unlimited
Money Market Mututal Fund Liquidity Facility (MMLF)	Liquidity & funding	Fed, US Treasury	Money market mututal funds	3/18/2020	3/20/2020	3/31/2021	unlimited
Primary Market Corporate Credit Facility (PMCCF)	Credit to the economy	Fed	Large businesses	3/23/2020	6/29/2020	12/31/2020	750*
Secondary Market Corporate Credit Facility (SMCCF)	Credit to the economy	Fed, US Treasury	Large businesses, exchange-traded funds	3/23/2020	5/12/2020	12/31/2020	750*
Term Asset-Backed Securities Loan Facility (TALF)	Credit to the economy	Fed, US Treasury	Securities markets	3/23/2020	6/17/2020	12/31/2020	100
Foreign and international monetary authorities (FIMA) repo facility	Liquidity & funding	Fed & International authorities	Securities markets	3/31/2020			unlimited
Main Street Lending Facility (MSLF)	Credit to the economy	Fed, US Treasury	Small business, non-for-profit	4/9/2020	7/6/2020	1/8/2021	600
Municipal Liquidity Facility (MLF)	Credit to the economy	Fed, US Treasury	State and local governments	4/9/2020	5/26/2020	12/31/2020	500
Paycheck Protection Program Liquidity Facility (PPPLF)	Credit to the economy	Fed, US Treasury	Small business	4/9/2020	4/16/2020	7/30/2021	953

Panel B: ECB Interventions

Asset Purchase Programs

Name	Form of Support	Institutions	Sector	Date of Announcement	Date of implementation	End Date	Maximum Capacity (€ bn)
APP	Purchases of securities	ECB & Eurosystem NCBs	Government and corporate bonds	3/20/2020	3/20/2020		120
PEPP	Purchases of securities	ECB & Eurosystem NCBs	Government and corporate bonds	3/18/2020	3/18/2020	June 2022	750
PEPP	Purchases of securities	ECB & Eurosystem NCBs	Government and corporate bonds	6/4/2020	6/4/2020	June 2021	1350

Emergency Lending Programs

Name	Form of Support	Institutions	Sector	Date of Announcement	Date of implementation	End Date	Maximum Capacity (€ bn)
Additional LTROs	Liquidity provision	ECB & Eurosystem NCBs	Eligible EA banks	3/20/2020	3/20/2020		unlimited
Targeted LTRO-III	Targeted liquidity provision	ECB & Eurosystem NCBs	Eligible EA banks extending credit to the economy	3/20/2020	6/4/2020	June 2022	unlimited
PELTRO	Liquidity provision	ECB & Eurosystem NCBs	Eligible EA banks	4/30/2020	4/30/2020		unlimited

Collateral Easing

Name	Form of Support	Institutions	Sector	Date of Announcement	Date of implementation	End Date	Maximum Capacity (€ bn)
Use of credit claim (loans) as collateral in refinancing operations	T&C of liquidity provision	ECB & Eurosystem NCBs	Eligible EA banks	4/7/2020			unlimited
Use of marketable assets as collateral	T&C of liquidity provision	ECB & Eurosystem NCBs	Eligible EA banks	4/7/2020			unlimited
Valuation haircuts	T&C of liquidity provision	ECB & Eurosystem NCBs	Eligible EA banks	4/7/2020			unlimited
Easing of minimum rating requirement	T&C of liquidity provision	ECB & Eurosystem NCBs	Eligible EA banks	4/22/2020		September 2021	unlimited