Bond Funds and Credit Risk

Finance Working Paper N° 639/2019
November 2019

Jaewon Choi
University of Illinois Urbana-Champaign and Yonsei University

Amil Dasgupta
London School of Economics, CEPR and ECGI

Ji Yeol Jimmy Oh
Hanyang University

ECGI Working Paper Series in Finance

Bond Funds and Credit Risk

Working Paper N° 639/2019

November 2019

Jaewon Choi
Amil Dasgupta
Ji Yeol Jimmy Oh

Abstract

We show that supply side effects arising from the bond holdings of open-end mutual funds affect corporate credit risk through a refinancing channel. In our framework, bond funds exposed to flow-performance relationships become excessively reluctant to refinance bonds of companies with poor cash flow prospects. This lowers refinancing prices, enhancing incentives for strategic default, thus engendering a positive association between bond funds' presence and credit risk. Empirically, we find that firms with a large share of mutual fund holdings experience increases in CDS spreads, particularly for funds that are more sensitive to flows. We address potential endogeneity issues by using fund acquisitions as exogenous shocks to funds' flow concerns.

Keywords: Fund flows, flow fragility, career concerns, bond rollover, default-liquidity loop

JEL Classifications: G23, G32

Jaewon Choi
Associate Professor of Finance
University of Illinois at Urbana-Champaign, Gies College of Business
515 E Gregory St.
Champaign, IL, 61820, United States
phone: +1 217 244 0840
e-mail: jaewchoi@illinois.edu

Amil Dasgupta*
Professor of Finance
London School of Economics, Department of Finance
Houghton Street
London, WC2A 2AE, United Kingdom
phone: +44 207 955 7458
e-mail: a.dasgupta@lse.ac.uk

Ji Yeol Jimmy Oh
Professor of Finance
Hanyang University, School of Business
222 Wangsimni-ro
Seongdong-gu, Seoul, South Korea
phone: +82 222 202 689
e-mail: jyjoh@hanyang.ac.kr

*Corresponding Author

Bond Funds and Credit Risk*

Jaewon Choi
University of Illinois Urbana-Champaign and Yonsei University

Amil Dasgupta
London School of Economics, CEPR, and ECGI

Ji Yeol Jimmy Oh
Hanyang University

This Draft: November 15, 2019

Abstract

We show that supply side effects arising from the bond holdings of open-end mutual funds affect corporate credit risk through a refinancing channel. In our framework, bond funds exposed to flow-performance relationships become excessively reluctant to refinance bonds of companies with poor cash flow prospects. This lowers refinancing prices, enhancing incentives for strategic default, thus engendering a positive association between bond funds' presence and credit risk. Empirically, we find that firms with a large share of mutual fund holdings experience increases in CDS spreads, particularly for funds that are more sensitive to flows. We address potential endogeneity issues by using fund acquisitions as exogenous shocks to funds' flow concerns.

JEL classification: G23, G32

Keywords: Fund flows, flow fragility, career concerns, bond rollover, default-liquidity loop

---

* Jaewon Choi, University of Illinois at Urbana-Champaign, 515 E Gregory St., Champaign, IL 61820; telephone: (217) 244-0840. E-mail: jaewchoi@illinois.edu. Amil Dasgupta, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom; telephone: +44 (0)20 7955 7458. E-mail: a.dasgupta@lse.ac.uk. Ji Yeol Jimmy Oh, School of Business, Hanyang University, Wangsimni-ro 222, Seongdong-gu, Seoul, Korea 04763; telephone: +82 (0)2 2220-2689. E- mail: jyjoh@hanyang.ac.kr.

Bond Funds and Credit Risk

This Draft: November 15, 2019

Abstract

We show that supply side effects arising from the bond holdings of open-end mutual funds affect corporate credit risk through a refinancing channel. In our framework, bond funds exposed to flow-performance relationships become excessively reluctant to refinance bonds of companies with poor cash flow prospects. This lowers refinancing prices, enhancing incentives for strategic default, thus engendering a positive association between bond funds' presence and credit risk. Empirically, we find that firms with a large share of mutual fund holdings experience increases in CDS spreads, particularly for funds that are more sensitive to flows. We address potential endogeneity issues by using fund acquisitions as exogenous shocks to funds' flow concerns.

JEL classification: G23, G32

Keywords: Fund flows, flow fragility, career concerns, bond rollover, default-liquidity loop

1. Introduction

Since the turn of the century, the U.S. corporate bond market has experienced a large shift in its investor base. As shown in Figure 1, the holding share of open-end mutual funds more than doubled from 8.4% to 18.8% between 1998 and 2017, whereas the combined share of pensions and insurance firms fell from 46.8% to 34.8% during the same period.

FIGURE 1 HERE

This shift in investor base implies a fundamental change in capital supply in corporate bond markets, as these open-end funds, unlike other institutional investors, face the risk of frequent investor redemptions. These investor redemptions, in turn, respond concavely to performance (Goldstein, Jiang, and Ng, 2017), leading to significant outflows for underperforming funds. The incentives generated by such flow-performance relationships may impact the willingness of bond mutual funds to roll over the maturing bonds of corporations. For example, a negative outlook for a company rolling over its debt may make bond funds more reluctant to refinance than other investors, because a potential default event may impose higher penalties on these funds. While financial losses from default events affect all refinancing investors, open-end funds are additionally exposed to potential outflows generated as a result of such financial losses. Thus, the flow motivations of bond funds may affect the rollover risk faced by corporations.[2] Yet, rollover risk can foster default risk because failure to negotiate favorable rollover prices strengthens equityholders' default incentives (He and Xiong, 2012), generating a feedback loop.[3] In other words, the incentives of the *suppliers* of capital for corporate bond refinancing may affect the nature of credit risk in the economy.

Despite the significant growth of open-end bond funds, the literature has not yet examined how the associated changes in the nature of capital supply affects credit risk. In this paper, we show that firms with high

---

[2] It is well known that firms face rollover risk. During the Global Financial Crisis, many suffered heavily as the rollover market for short-term debt froze (Acharya, Gale, and Yorulmazer, 2011; Gorton and Metrick, 2012; Brunnermeier and Oehmke, 2013; Covitz, Liang, and Suarez, 2013; Krishnamurthy, Nagel, and Orlov, 2014), and the market witnessed a similar freeze after the unexpected downgrade of General Motors and Ford in May 2005 (Acharya, Almeida, Ippolito, and Perez, 2014; Acharya, Schaefer, and Zhang, 2015; Choi, Hackbarth, and Zechner, 2018).

[3] Empirically, the interaction between default and liquidity risks can account for up to a quarter of the credit spreads of high yield bonds (Chen, Cui, He, and Milbradt, 2018).

fund holding shares—the proportion of their corporate bonds held by open-end bond funds— experience an increase in credit risk.

We begin by illustrating the link between the presence of flow-motivated bondholders at refinancing and the strategic default choice of the firm's equityholders, using a simple three-date model with binary cash flow at the terminal date. At the interim date, a firm's existing debt matures, which needs to be refinanced by the existing bondholders. Any loss that accrues from refinancing can be borne by the firm's equityholders, who have deep pockets.[4] However, we establish that, if the equilibrium price of refinancing is set too low, the equityholders will refuse to bear the losses and default on the existing debt. We then separately derive the equilibrium bond refinancing prices under flow-motivated bondholders ("funds") and standard profit-maximizers ("individuals"), respectively, and compare the two.

The difference between the two types of bondholders is as follows. Prior to participating in refinancing, all bondholders receive a signal about the terminal cash flow, which can either be high or low. Bondholders differ in the precision of their information about the firm but are unsure about the quality of their information. What distinguishes "funds" from "individuals" is their payoff function; in addition to the profit from bond investment, they derive additional payoff from being perceived to be good type by their principals, a short-hand for flow motivations. The fund managers thus contemplate whether their action, i.e., whether to buy the bond at refinancing, would enhance or damage the posterior probability of their being viewed as good type.

We first demonstrate that the equilibrium bond price with funds as bondholders carries a component that reflects their flow motivations; when refinancing the bond improves (hurts) posterior reputation (and thus future flows), the funds' equilibrium willingness to pay rises (falls). This leads bond refinancing prices to differ between whether a firm's refinancing bondholders are funds or individuals: in particular, refinancing prices are more sensitive to future firm prospects with funds.

[4] Thus in our model, as in He and Xiong (2012), there are no costs associated with the issuance of equity, and default arises purely endogenously.

From this set-up, we derive the following results. First, when a firm's future cash flow prospects are poor, funds are reluctant to refinance the bond because of its unfavorable implications on future flows, resulting in a comparatively lower bond price. This strengthens the equityholders' strategic default incentives, leading to a positive association between bond funds' presence and credit risk. Second, we expect the effect of the funds' presence to be asymmetric. To see this, note that flow motivations could lead funds to overbid at bond refinancing when the firm has strong cash flow prospects. However, under such circumstances, the equityholders are less likely to default in the first place, so their presence may not have a pronounced impact on credit risk. In contrast, for firms with poor cash flow prospects, their punitively low refinancing price exacerbates the strategic default incentives of the equityholders, resulting in an asymmetry. Third, the presence of open-ended funds results in a deeper price discount as their degree of flow motivation become more severe, thus exacerbating the effect on credit risk.

We empirically explore this link between bond funds and credit risk using the data on the bond holdings of mutual funds and the CDS spreads of bond issuers for the period between 2001 and 2014. For each firm at each month-end, we compute the share of its outstanding bonds held by 1,128 corporate and general bond mutual funds whose bond holdings data exist in Morningstar, which we refer to as a firm's "fund holding share" of its corporate bonds. We then examine whether this fund holding share has a material impact on a firm's credit risk as reflected in CDS spreads.[5]

In line with our conceptual framework, we find that a firm with a large share of corporate bond holdings by bond mutual funds tend to have higher CDS spreads. Specifically, a one-standard-deviation increase in the share of active bond funds is associated with an increase in the next-month five-year CDS spread of 13 bps—which corresponds to a tenth of the average CDS spread in our sample—compared to their credit rating peers, after controlling for a wide range of controls identified in the prior literature (e.g., Zhang, Zhou, and Zhu, 2009). This positive association between fund holding share and CDS spread is highly statistically

[5] The investor base of corporate bonds is segmented, with existing investors five times more likely to participate in the new issues of a firm's bond compared to those without prior holdings (Zhu, 2018). As a result, a firm's current bond investor base is a strong indication of the likely participants for future bond rollovers.

significant and found only among active funds—where a bond's default signals the manager's ability—but not among passive funds. Furthermore, we document strong asymmetry in the relationship, which is consistent with another prediction of our model that the effect of bond holdings should be stronger for higher credit risk firms. Whereas the statistical significance of the relationship between fund holding share and CDS spread disappears for high investment grade firms, we obtain strong statistical significance with large economic magnitude among those rated BBB or below. Similarly, interacting the fund holding share with the firm's one-year stock return reveals that the increased presence of bond funds has a more pronounced impact on a firm's credit risk for those with poor stock performance.

We also examine whether this positive relationship between fund holding share and CDS premium strengthens when the funds holding a firm's corporate bonds are likely to be particularly flow motivated. To this end, we sort funds into two groups at each month-end on the basis of whether their various characteristics are above or below the median of the same Lipper category. We then separately estimate the holding share of these high vs. low group funds. We find that the holding share of funds with poor recent return or high flow volatility has a more significant impact on the next-period CDS premium. On the other hand, the holding share of funds belonging to large families with better intra-family liquidity provisions (Bhattacharya, Lee, and Pool, 2013; Agarwal and Zhao, 2019) or those with a high share of load fee classes—which inhibits investor flow response—has a less pronounced impact on a firm's subsequent CDS premium.

Our model connects bond funds to credit risk through a refinancing channel, which implies that the empirical relationship between bond funds and credit risk should strengthen as a firm's corporate bond nears maturity. We find that this is indeed the case; a one-standard-deviation increase in the holding share of active funds increases the next-period five-year CDS premium by around 12 bps in the absence of a maturing bond, but the corresponding figure rises to 26 bps during the quarter preceding the maturity of a firm's existing bond, further emphasizing the importance of the bond rollover channel.

A potential endogeneity concern regarding our results is that there is a missing variable in the empirical analysis. Fund trading is driven largely by fund managers' information on the fundamentals of bond issuers, which is also likely to be correlated with credit risk. To address this endogeneity concern, we employ a setting wherein changes in the intensity of flow motivations are unrelated to changes in the credit risk of bond issuers so that we can establish a more causal relationship. In particular, we exploit the setting of fund acquisitions, specifically the cases where a target fund is acquired by another belonging to a larger family, which increases the fund's access to intra-family liquidity provisions (Bhattacharya, Lee, and Pool, 2013; Agarwal and Zhao, 2019). Thus, the exclusion restriction is that fund mergers do not affect the credit risk of bond issuers except through changes in flow sensitivity of fund performance. These funds that are merged into a larger family are likely to exhibit a weaker degree of flow-based concerns as a result of the acquisition. We re-estimate the relationship between fund holding share and CDS premium for a subsample of firms held by these target funds during the 12-month period prior to the acquisition, and we interact the fund holding share with fund acquisition dummy, which takes the value of one during the month of when one of the firm's bondholders is acquired into a larger family. Reassuringly, we find that the relationship between fund holding share and CDS premium significantly weakens during the month of such fund acquisition.

Another alternative story that can explain our findings is bond funds' self-selection into riskier bonds within the same rating category in an attempt to "reach for yield" (Becker and Ivashina, 2015; Di Maggio and Kacperczyk, 2017). Previous studies document such risk-chasing behavior to be prominent during periods of low interest rate and relative market calm (e.g., Choi and Kronlund, 2018). In light of these findings, we re-estimate our baseline regression results separately for credit-spread- and VIX-based subsample periods. We find the positive association between fund holding share and CDS spread to be significantly stronger during periods of high credit spreads and/or VIX, which stands in sharp contrast to the existing findings on the funds' "reaching for yield" behavior. Taken together, these additional empirical results suggest that our findings are distinct from "reaching for yield."

We contribute to the literature in several ways. First, we extend the vast existing literature on structural credit risk (e.g., Merton, 1974; Leland, 1994; Longstaff and Schwartz, 1995) that focuses on firm fundamentals and the "distance-to-default" in estimating a firm's credit risk. While the literature offers a rich discussion on how these demand-side characteristics interact with the incentives of debt- and equityholders, we highlight a novel supply-side factor, namely the flow motivations of a subset of bondholders, i.e., mutual funds. In short, *who* holds a firm's bonds may matter for its credit risk. Second, we provide new insights on the recent studies on the interaction between rollover risk and default risk (e.g., He and Xiong, 2012; He and Milbradt, 2014; Chen, Cui, He, and Milbradt, 2018). We provide both theoretical and empirical evidence that the increased presence of flow motivated bond funds in the corporate bond market could further exacerbate this channel of default-liquidity interaction, particularly among firms with poor credit quality. Third, our study is related to a growing literature on the real implications of flows into and out of open-end funds (e.g., Edmans, Goldstein, and Jiang, 2012; Hau and Lai, 2013). Our contribution lies in showing that these flows, through their effect on the incentives of fund manager, could not only affect the liquidity but also the credit risk of firms they hold by depressing their bond rollover prices. Finally, our study is related to the literature on the asset pricing implications of the flow motivations of mutual funds. For equities, Dasgupta, Prat, and Verardo (2011) find that trading behavior consistent with such flow motivations is associated with cross sectional return predictability. For bonds, Cai, Han, Li, and Li (2019) recently document that herding behavior consistent with flow motivations among bond funds generates price impact. We show how such flow motivations translate into real impact via their effect on corporate credit risk.

2. Model

2.1. Main Set-Up

To illustrate the potential effect of the presence of flow-motivated bond funds on corporate credit risk, we present a simple model of endogenous default and bond refinancing with dates $t = 1, 2$. Our model starts with a reduced-form, discrete-time version of continuous-time models of strategic default by equityholders (e.g., Leland and Toft, 1996; He and Xiong, 2012), and then extends it to introduce flow-motivated institutional bondholders, i.e., bond funds.

Suppose a firm generates terminal cash flow $V \in \{0, \bar{V}\}$ at $t = 2$ without any intermediate cash flow at $t = 1$. The firm is owned by equityholders with unlimited wealth but subject to limited liability. The firm has pre-existing debt in the form of a discount bond with face value 1 maturing at $t = 1$. The firm's maturing bond must be rolled over with a new discount bond with face value 1 maturing at $t = 2$. The firm's existing bondholders must decide whether to purchase this new bond, i.e., whether to refinance the firm, and how much to pay for it.[6] We denote by p the equilibrium price of the new bond.[7]

To repay the pre-existing bondholders, the shortfall $1 - p$ is made up by the firm's existing equityholders; by assuming unlimited wealth, we posit—as in He and Xiong (2012)—that there is no constraint to the issuance of new equity at $t = 1$ if the equityholders choose to bail out the bondholders. If the equityholders, on the other hand, decline to provide new equity, the firm defaults and all future cash flows are seized by the pre-existing bondholders. We assume the discount rate to be zero for simplicity, but a positive discount rate has no effect on the qualitative results. Finally, suppose that $\bar{V} > 1$ so that the equityholders will default at $t = 2$ only if the terminal cash flow turns out to be 0.

Let us denote the public's prior of V at $t = 1$ with $\gamma_V = \Pr(V = \bar{V})$, which reflects the firm's future cash flow prospects. Then, in the absence of a private signal, we have the following proposition with regards to strategic default at $t = 1$:

Proposition 1 (Interim strategic default). Strategic default occurs at $t = 1$ whenever $p \leq 1 - \gamma_V(\bar{V} - 1)$.

Proof. If the equityholders default at $t = 1$, their payoff is 0 because of their limited liability. However, if the equityholders decide to bail out the pre-existing bondholders, their expected payoff is given by:

---

6 We implicitly assume that existing bond holders will participate in refinancing. In the corporate bond market, it is well documented to be the case that the holders of a firm's existing bonds repeatedly participate in the firm's new bond issuances, that is, the investor base of corporate bonds is highly persistent. This can be because either issuer-underwriter-investor relationships are sticky or the costs associated with information acquisition of firms' credit risk. Zhu (2018), for example, shows that a firm's existing bondholders are five times more likely to buy its newly-issued bond shares compared to those with no prior bond ownership because of informational advantage of investing in the same firms. DiMaggio, Kermani, and Song (2017), Hendershott, Li, Livdan, and Schürhoff (2017), Nikolova, Wang, and Wu (2019), and Nagler and Ottonello (2019) all show that underwriter/dealer and investor relationships tend to be persistent because of underwriter favoritism, trading network relationships, or costly acquisition of information on issuers. Daetz, Dick-Nielsen, and Nielsen (2018) and Chakraborty and MacKinlay (2019) also show that issuer-underwriter relationships also tend to be highly persistent.

7 We assume for simplicity throughout that each bondholder is small relative to the size of the bond issue, and thus neglects the effect of his own refinancing decision on the possibility of strategic default by equityholders.

$$\underbrace{\gamma_V(\bar{V}-1)}_{\text{No default at } t=2} + \underbrace{(1-\gamma_V)\cdot 0}_{\text{Default at } t=2} - \underbrace{(1-p)}_{\text{Refinancing losses at } t=1} \tag{1}$$

Thus, equityholders will default strategically whenever (1) is less than or equal to 0, i.e., whenever $p \leq 1-\gamma_V(\bar{V}-1)$ as in the proposition. □

Now, let us introduce two different sets of potential (refinancing) bondholders, which will, in each case, lead to different equilibrium price p. Throughout our analysis, we will assume that these bondholders are in excess supply at the point of refinancing, which has two main implications. First, in the refinancing game, bondholders will bid up to their full willingness to pay. Second, for any given price, if there is any type of bondholders with their willingness to pay greater than or equal to the price, refinancing will be successful. Finally, from (1), it is apparent that, conditional on not choosing to strategically default at $t=1$, it is in the equityholders' interest to charge the highest possible price that would secure successful refinancing. Thus, p must be high enough to reduce their refinancing losses but not prohibitively high to the extent that potential bondholders would refuse to hold the bond. The assumption of bondholders being in excess supply at refinancing greatly simplifies the analysis in this illustrative model. However, as will become clear, since our interest is in excessively *low* refinancing prices, scarcity of refinancing bondholders and any associated rent extraction will simply exacerbate the phenomena below, at the cost of significant algebraic complexity.

2.2. Flow-Motivated Bondholders

Suppose first that the population of bondholders consists of bond funds, i.e., delegated agents, evaluated at $t=2$ by their principals. Funds conduct research on the firm's terminal cash flow and decide whether to buy the bond issued at $t=1$. Suppose that each fund can be one of two types, good or bad, denoted $\tau \in \{G, B\}$, with the ex ante probability of the fund is of the good type denoted $\gamma_\tau = \Pr(\tau = G)$. The two types differ in the precision of their information; each fund receives a signal at $t=1$, denoted s, which satisfies

$$\Pr(s = V^* | V = V^*, \tau = \tau^*) = \sigma_{\tau^*} \text{ for each } V^* \in \{0, \bar{V}\} \text{ and } \tau^* \in \{G, B\}. \quad (2)$$

To simplify the analysis, suppose that $\sigma_G = 1$ and $\sigma_B = 1/2$. In other words, the good types can uncover the firm's terminal cash flow with certainty, while the signal of a bad type is no more than a noise. However, in the tradition of signal jamming models beginning with Holmstrom and Ricart-i-Costa (1986), we assume that funds do not know their own types. Each fund's action is denoted a, with $a = 1$ if the fund chooses to buy the bond or $a = 0$ if not. We further assume that τ and V are determined independent of each other. We now state the fund's payoff at $t = 2$, which is given by:

$$\{\min(1, V) - p\} \cdot I(a = 1) + \kappa \Pr(\tau = G | a, V). \quad (3)$$

The first term of (3) represents the fund's profits from bond investment if the manager decides to buy the bond. The second term represents the fund's additional gains from taking actions likely to be viewed by the principal as being indicative of good type. In other words, the principal evaluates the manager on the basis of her action and the eventual cash flow, and if the action and the cash flows are such that the principal's posterior probability of a manager being of the good type improves, the manager is rewarded in the form of additional flows, for example. This flow additionally compensates the manager, and κ then measures the manager's intensity of flow motivation.[8] Microfoundations for such payoff functions can be found in Dasgupta and Prat (2008).[9]

In reputational cheap-talk models, it is usually possible for both pooling and separating behavior to arise in equilibrium. In the former type of equilibrium, funds choose actions that are not contingent on their private signals, while in the latter their actions are informative about their signals. It is only in separating equilibria that funds rewarded for performance, since performance is correlated with information, and information is correlated with underlying ability. Given the evidence on positive flow-performance relationships

[8] Bond funds face an increasing *concave* flow-performance relationship (e.g., Chen, Goldstein, and Jiang, 2010; Goldstein, Jiang, and Ng, 2017) rather than an increasing *convex* relationship faced by equity funds (e.g., Chevalier and Ellison, 1997; Sirri and Tufano, 1998). The theoretical mechanism arising from our model *only* relies on monotonicity in the flow-performance relationship, which arise *endogenously* in equilibrium (see below). However, as will be clear below, any concavity in the flow performance relationship, implying that bond funds face disproportionate flow penalties for performing poorly would strengthen our qualitative results.

[9] In a related study, Guerrieri and Kondor (2012) model asset price volatility arising from funds' flow motivations.

faced by bond funds (Goldstein, Jiang, and Ng, 2017), we focus on separating equilibria.[10] Then, upon assuming the payoff function as in (3), we derive the following proposition regarding the equilibrium price:

Proposition 2 (Equilibrium with flow-motivated bondholders). There exists an equilibrium where:

(i) The fund chooses $a = 1$ if $s = \bar{V}$,

(ii) The fund chooses $a = 0$ if $s = 0$,

(iii) The firm sets the price of the new bond at:

$$p = \Pr(V = \bar{V}|s = \bar{V}) + \kappa\{E(\Pr(\tau = G|a = 1, V)|s = \bar{V}) - E(\Pr(\tau = G|a = 0, V)|s = \bar{V})\}. \quad (4)$$

Proof. See Appendix A. □

In this equilibrium, only the funds with the high signal ($s = \bar{V}$) participate in the refinancing game and buy the bond, while those with the low signal decide not to participate. Knowing that only the high signal funds participate, the firm sets the price equal to their full willingness to pay, which contains two components. The first term in (4) is the high signal funds' expectation of the bond's terminal cash flow at $t = 2$. However, in addition to this fundamental value, the second term represents the fund managers' additional willingness to pay arising from their flow motivations. Upon receiving a favorable signal, managers evaluate how their purchase decision is likely to affect their principals' posterior assessment of their type being good or bad when the terminal cash flow is realized. If buying the bond (i.e., $a = 1$) increases the managers' likelihood of being viewed as "good type" at $t = 2$ compared to staying out of the refinancing game, managers have an incentive to pay more than their assessment of the bond's fundamental, while the reverse holds if the managers are less likely to be viewed as a "good type." In other words, high-signal funds may over- or underpay depending on whether the purchase of the bond is likely to have a favorable or unfavorable implication on their reputations.

It is worth underscoring that the equilibrium in Proposition 2 is consistent with an increasing flow-performance relationship found in the existing literature for bond funds (Goldstein, Jiang, and Ng, 2017). In

[10] For the interested reader, we argue in the appendix that, under reasonable off-equilibrium beliefs, the key effect of bond funds' career concerns on corporate credit risk remains qualitatively unchanged even in pooling equilibria.

the above equilibrium, posterior reputation—and thus, implicitly, flow—is positively correlated with realized profits; funds can only improve their $t = 2$ reputation relative to the $t = 1$ prior by refinancing at $t = 1$ the bonds that subsequently do *not* default at $t = 2$ (i.e., by generating buy-and-hold profits) or by declining at $t = 1$ to refinance bonds of companies that default at $t = 2$ (i.e., by avoiding buy-and-hold losses).

2.3. Bondholders without flow motivations

We now consider bondholders without flow motivations, which corresponds to the case of $\kappa = 0$. These bondholders may be casually referred to as "standard" profit-maximizing bondholders, whom we refer to as individuals to distinguish them from flow-motivated funds in the previous subsection. However, in practice, these bondholders need not be individuals; any institutional investor with less pronounced short-term flow considerations may behave in a similar manner. It then trivially follows that:

Proposition 3 (Equilibrium with standard profit-maximizers). There exists an equilibrium where:

(i) The individual chooses $a = 1$ if $s = \bar{V}$,

(ii) The individual chooses $a = 0$ if $s = 0$,

(iii) The firm sets the price of the new bond at $p = \Pr(V = \bar{V} | s = \bar{V})$.

Proof. Trivially follows from Proposition 2. □

Having derived the equilibrium bond price for two distinct sets of potential bondholders, i.e., flow-motivated vs. standard profit-maximizing bondholders, we now explore whether the composition of bondholders in the refinancing game has an impact on the equityholders' strategic default decision at $t = 1$.

2.4. Comparison of equilibria with flow-motivated vs. standard bondholders

We now compare the equilibrium bond prices derived in the previous two subsections. For ease of exposition, we refer to the equilibrium bond price with flow-motivated bondholders in Proposition 2 as p_f^*, and the price with standard bondholders in Proposition 3 as p^*. First, we note that the model has two parameters pertaining to the characteristics of the potential bondholders, namely γ_τ, the probability of a fund being a good type, and κ, the intensity of flow considerations in the funds' payoff function. The model, in addition, has two parameters with regards to the firm's cash flow characteristics, namely $\bar{V}$, the amount of successful cash flow, and γ_V, which refers to the public's ex ante assessment of cash flow prospects. In our subsequent analysis, we fix $(\gamma_\tau,\ \kappa,\ \bar{V})$ and vary γ_V. Then, we derive the following relationship between the two equilibrium bond prices:

Proposition 4 (Comparing equilibrium bond prices). For $\gamma_V < \frac{1}{2}(1-\gamma_\tau),\ p_f^* < p^*$.

Proof. See Appendix A. □

In other words, flow-motivated funds act as punitive buyers at refinancing in firms with relatively low prospects of generating successful cash flow. Moreover, a lower γ_V increases the refinancing price threshold at which the equityholders call for strategic default at $t = 1$ because of their unwillingness to bail out existing bondholders in light of low and uncertain cash flow prospects. In this instance, the presence of flow-motivated funds at refinancing leads not only to lower refinancing prices but also the ensuing increase in the likelihood of strategic default and hence increased credit risk.

Proposition 4 also highlights that the presence of flow-motivated funds has an asymmetric effect on firms with good vs. bad public news prior to refinancing. For high γ_V firms, p_f^* would actually be higher than p^*. However, this is less likely to impact the firm's strategic default decision, because strategic default is unlikely to occur under such circumstances anyway. Thus, the impact of flow-motivated funds' presence on credit risk will be manifest itself most acutely among firms with bad public news prior to refinancing.

However, it remains to be checked that potential bondholders' flow motivations are relevant from the equityholders' perspective. In other words, we need to rule out a case where the equityholders call for strategic default even in the absence of flow-motivated funds for all values of γ_V that satisfy $p_f^* < p^*$, for otherwise, the presence of flow-motivated bondholders has no bearing on the equityholders' decision-making. One way to rule out such case is to determine the strategic default threshold for the case of standard profit-maximizers and ensure that it is lower than $\frac{1}{2}(1-\gamma_\tau)$. In this instance, for a non-empty range of γ_V, $p_f^* < p^*$ but strategic default would not occur when standard profit-maximizers participate at the refinancing stage. From Proposition 1, strategic default occurs whenever

$$p^* \equiv \frac{\gamma_V(1+\gamma_\tau)}{1-\gamma_\tau+2\gamma_V\gamma_\tau} \leq 1-\gamma_V(\bar{V}-1). \tag{5}$$

The left hand side of (5) is increasing in γ_V for all $\gamma_\tau \in (0,1)$, with the derivative of $\frac{1-\gamma_\tau^2}{(1-\gamma_\tau+2\gamma_V\gamma_\tau)^2}$, while the right hand side, for all $\bar{V} > 1$, is decreasing in γ_V. Thus, it is easy to see that (5) will be satisfied as long as γ_V is less than or equal to some threshold $\bar{\gamma}_V(\bar{V})$ that is decreasing in $\bar{V}$. If so, for sufficiently large $\bar{V}$, it can always be guaranteed that $\bar{\gamma}_V(\bar{V}) < \frac{1}{2}(1-\gamma_\tau)$. Assuming this "infrequent strategic default" condition is satisfied, the presence of flow-motivated bondholders at the refinancing stage strictly increases the range of γ_V over which the equityholders choose to default strategically. Intuitively, this corresponds to a situation where the equityholders are promised with an unlikely but large cash flow in case of success at $t=2$. Thus, the equityholders have an incentive to roll over the existing debt and continue as long as the bond price is not set too low. If the standard profit-maximizers are willing to refinance at this price but not the flow-motivated bondholders, then strategic default occurs only when the latter group participate in the refinancing game.

2.5. Testable implications

The main testable implications of our model may be summarized as follows.

(i) (*Bond holdings of mutual funds and credit risk*) When a firm has sufficiently poor cash flow prospects, the presence of flow-motivated funds at refinancing strengthens equityholders' strategic default incentives and increases credit risk.

(ii) (*Asymmetry in the relationship*) Incremental bad news reduces the willingness of funds to pay at refinancing and increases strategic default; incremental good news increases the willingness of funds to pay at refinancing but may have no impact on strategic default.

(iii) (*Flow concerns and credit risk*) Funds with greater flow concerns will demonstrate more reluctance to refinance poorly performing firms, exacerbating the relationship between fund holdings and credit risk.

Given that the presence of flow-motivated funds reduces the price of refinanced bonds for firms with relatively bad prospects, the equityholders are less likely to absorb the losses from refinancing, opting to default instead. In this instance, their presence prior to refinancing will contribute toward the firm's credit risk. The effect of their presence, however, will be concentrated among poor-performing firms; for firms with good cash flow prospects, flow-motivated funds will overbid relative to standard profit-maximizing bondholders for the bond at refinancing. However, for these types of firms, the equityholders are unlikely to call for strategic default in the first place, so their presence is unlikely to have a pronounced impact on credit risk. On the other hand, for firms with poor future cash flow prospects, their subdued willingness to hold the bond is more likely to have a material impact on the equityholders contemplating a strategic default. Finally, we expect that, for funds with greater flow-related concerns (high κ), the relationship between mutual funds' bond holdings and credit risk would be exacerbated, because the flow-related component has a bigger impact on the managers' willingness to pay for the bond at refinancing. With this in mind, we now proceed to empirically test the model's implications using the data on mutual funds' bond holdings and credit default swap (CDS) spreads.

3. Data and Variable Construction

In this section, we outline how our main variables of interest and controls are constructed using several sources of data: (i) Morningstar Direct for the holdings of U.S. taxable bond funds, (ii) the Center for Research in Security Prices (CRSP) Mutual Funds database for information on fund characteristics, (iii) the Mergent Fixed Income Security Database (FISD), and the Markit credit default swap (CDS) database for CDS pricing data.

3.1. Mutual fund holdings data

Using the fund holdings data from Morningstar, we first match fund share-class level identifier used by Morningstar (*secid*) with that of the CRSP Mutual Funds database (*crsp_fundno*) using CUSIP in a similar manner to Pástor, Stambaugh, and Taylor (2015). We consider bond funds that are classified as corporate or general according to the CRSP objective code as in Goldstein, Jiang, and Ng (2017) and Choi and Kronlund (2018);[11] a total of 1,128 funds satisfy the criteria. Over a half of holdings information of these bond funds in Morningstar are in monthly frequency, with the rest mostly in quarterly or semi-annual frequencies, with the latter only in a few isolated instances. Following Elton, Gruber, and Blake (2011a; 2011b), we use the most frequent holdings information available; at each month-end, we use the latest available holdings information within the past six months.[12]

We obtain further information on each fund using the CRSP Mutual Funds databases, including fund returns and total net assets. This, in turn, allows us to calculate the flow of fund i at month t:

$$Flow_{i,t} = \frac{TNA_{i,t} - (1 + r_{i,t})TNA_{i,t-1}}{TNA_{i,t-1}}, \tag{6}$$

where $TNA_{i,t}$ and $r_{i,t}$ are fund i's total net assets (TNAs) and monthly return at t, respectively. Share class level data are aggregated at the fund level using the CRSP identifier *crsp_cl_ grp*, with TNAs at previous month-end as the weight. We also construct other control variables including active vs. index fund indicators, institutional fund indicator, load fees, and standard deviations of fund flows using the CRSP Mutual Fund data. See Appendix C for the detailed construction of these variables. We match these data to the bond-level holdings information in Morningstar.

We construct our main explanatory variable, fund holding share, using the holdings data and the bond-level data in Mergent FISD. At each month-end, we first sum the amount of bonds held by our sample bond funds for each bond classified as corporate bond by Morningstar, with Morningstar *sectype* code B, BF, or BI.[13] We also sum the amount of bonds held by funds that satisfy various fund-level characteristics, and we obtain total amount outstanding for each bond-month observation. In the last step, we aggregate each bond-month observation into firm-month observation and calculate the fund holding share by dividing the total mutual fund

[11] Specifically, these are funds with CRSP objective codes I, ICQH, ICQM, ICQY, ICDI, ICDS, or IC, which corresponds to Lipper objective codes A, BBB, IID, SII, SID, USO, HY, GB, FLX, MSI, or SFI.

[12] This carries an implicit assumption, that a fund that reports its holdings at quarterly frequency in March 2006, for example, does not change its holdings until the next reporting date, i.e., June 2006.

[13] Before doing so, we first delete a small number of duplicate portfolio holding entries using Morningstar's fund portfolio identifier (*fundid*).

holdings with the total amount outstanding. However, in isolated instances, Morningstar holdings and/or Mergent FISD amount outstanding have data entry errors, so we delete any observation with fund holding share exceeding 1.

3.2. CDS premium data

We measure the credit risk of bond issuers using CDS spreads. Unlike corporate bond spreads, CDS spreads are standardized (e.g. constant maturities) and less subject to market microstructure issues including illiquidity pricing premium and therefore are a cleaner measure of credit risk. The Markit CDS data provide daily CDS spreads for maturities ranging from 6 months to 30 years. We use five-year CDS spreads on senior unsecured obligations denominated in U.S. dollars as they are the most widely traded contracts.[14] Because of the frequency of fund holdings data, CDS data is converted to the monthly level using the ending values of each month.

3.3. Other controls

In addition to the aforementioned CDS premium and fund holdings data, we construct most of the control variables used in Collin-Dufresne, Goldstein, and Martin (2001) as well as Zhang, Zhou, and Zhu (2009). From CRSP, we construct 1-, 6-, and 12-month return of the firm's stock price, as well as the 12-month rolling historical volatility, skewness, and kurtosis of daily stock returns. Using Compustat, we further compute the firm's latest log assets, leverage, return on equity (ROE), and dividend payout per share using the latest quarterly data.[15] From the Federal Reserve Economic Data (FRED), we collect the latest 3-month T-bill and the term spread between the 3-month T-Bill and 10-year Treasury bond, and we further collect the data on VIX and the return on the S&P 500 index. For a detailed definition of each variable, refer to Appendix C.

3.4. Summary statistics

---

[14] We focus on contracts with modified restructuring documentation clause until April 2009 and those with no restructuring clause thereafter in light of the "CDS Big Bang."

[15] For more information on how each variable is constructed, refer to the variable descriptions in Appendix C.

Table 1 presents the summary statistics of our sample of 531 firms between Oct. 2001 and Sep. 2014, with firm-level fund holdings data constructed using 1,128 corporate and general fixed income funds. The average 5-year CDS spread for our sample is around 130 bps, but the spreads differ substantially on the basis of the firms' credit ratings. Whereas the average CDS spread of high investment grade (AAA to A) firms stands at around 60 bps, those of BBB and high yield firms are in excess of 110 bps and 320 bps, respectively. Our variable of interest, namely fund holding share, has mean and median of 35.3% and 32.8%, respectively. The corresponding figures fall to 28.6% and 24.6%, respectively, when we limit our attention to active funds only.[16] Above all, we observe substantial variation in fund holding share between the firms, with the standard deviation of all bond funds' holding share exceeding 21% and with the inter-quartile range of nearly 30%. We further report that, in line with the trend of sustained investor inflow into bond mutual funds throughout our sample period,[17] average fund holding share in our sample increases over time (untabulated); active funds' share of our sample funds' outstanding bonds, for example, increases from 21.7% in 2002 to 32.0% by 2013.

TABLE 1 HERE

4. Empirical Results

4.1. Fund holdings and credit risk

Our model predicts that, when a firm's cash flow prospects is sufficiently poor, the presence of flow-motivated funds can strengthen the strategic default incentives of equityholders and therefore contribute to a firm's credit risk. To test this, we employ the following panel regression:

$$CDS\ Premium_{i,t} = \alpha + \beta \cdot Fund\ Holding\ Share_{i,t-1} + \boldsymbol{\omega} \cdot \boldsymbol{Controls_{i,t-1}} + \varepsilon_{i,t} \quad (7)$$

where $CDS\ Premium_{i,t}$ is the 5-year CDS spread of firm i in month t. Following previous studies on credit risk including Collin-Dufresne, Goldstein, and Martin (2001) and Zhang, Zhou, and Zhu (2009), we

[16] This is somewhat higher than the average holding share of mutual funds and ETFs reported in the Federal Reserve Flow of Funds for corporate and foreign bonds (L.212), with the 2013 year-end value at around 20%. However, these are bonds with active CDS trading, so it is conceivable that funds' willingness to hold these bonds are higher given the additional option of hedging or gaining exposure through the use of CDS positions.

[17] Between 2009 and 2018, more than $2.2 trillion has moved into bond mutual funds, according to ICI Factbook (2019).

use the following control variables. First, we include the first four moments of stock returns: 1-year stock return, (historical) volatility, skewness, and kurtosis. For other firm characteristics, we include the recovery rate, log assets, leverage, return on equity, and dividend payout per share. For market-level characteristics, we include the latest one-month S&P 500 index return, 3-month T-Bill rate, term spread, and VIX, and we include the average credit rating dummies. In alternative specifications, we replace these market characteristics but include the credit-rating-by-month dummies. We use standard errors that are robust to heteroscedasticity and two-way clustered by firm and month.

In testing our model predictions using (7), we compare the effect of holding shares of active funds with passive funds by separately considering their holding shares. We expect the effect of holding shares of active bond funds on the next-period CDS premium to be stronger than those of passive bond funds. For active bond funds, losses incurred from a default signal the investors about their managers' ability and flows would respond accordingly. However, for funds that passively follow a benchmark, a default would not signal the manager's ability to the investors; they are more likely to be concerned about other measures such as tracking error. If so, the link between fund holding share and credit risk should be significantly positive only among active funds.[18]

TABLE 2 HERE

Table 2 presents the results of estimating the regression in (7). As predicted by the model, we find that, on average, a 1% increase in the share of bonds held by bond funds is associated with a 0.5 bps increase in the 5-year CDS spread. The corresponding figure rises to over 0.6 bps when we restrict our attention to the share of active bond funds only. In contrast, a 1% increase in the share of passive bond funds is associated with a decrease in the next period CDS spread by around 1.2 bps. This negative relationship between passive fund holding share and credit risk could be accounted for by the fact that firms whose bonds are included in the index become safer potentially because index inclusion ameliorates the firms' cost of capital. Alternatively, it

[18] In fact, given the steady growth of the passive bond funds' total assets during our sample period, from around 2.5% in 2002 to almost 17% by 2014, it is conceivable that their presence could lower the credit risk of a firm, because they are incentivized to replicate the index as closely as possible and thereby create "excess demand" for the index constituent bonds as they experience an abundance of capital.

can be driven by the fact that passive fund managers are primarily incentivized to replicate their benchmark index as closely as possible; given the huge inflows into passive bond funds during our sample period, it is possible that they were willing to overbid for the bond relative to standard profit-maximizing investors for the index constituent bonds to minimize their tracking error. In all instances, we find statistical significance at the 1% level, regardless of whether we use credit rating or credit-rating-by-month fixed effect.

In terms of economic magnitude, our results imply that a one-standard-deviation increase in the fund holding share of active funds (i.e., 20.5%) increases the next-period 5-year CDS premium by around 13 bps compared to other firms with the same average credit rating in a given month even after controlling for a wide array of other firm characteristics. However, these regression results only reveal correlations, not necessarily establishing any causal link between fund holding share and credit risk. We will address this issue later in Sections 4.4 through 4.6 by focusing on bond rollover decisions, turbulent market times, and shocks to fund flow sensitivity around fund mergers.

Overall, empirical evidence in Table 2, with statistically significant positive association between fund holding share and future credit risk found only among active but not among passive funds, is in line with the predictions of our model. Thus, for the remainder of the analysis, we focus on the overall fund holding share and that of active funds only.

4.2. Is there an asymmetry in the relationship between fund holding and credit risk?

Our model also predicts that the presence of flow-concerned funds would have an asymmetric effect on credit risk. When the issuing firm has good cash flow prospects, funds are likely to refinance maturing bonds. However, for these firms, equityholders are less likely to strategically default in the first place, so the presence of flow-motivated funds is unlikely to have a major impact on the equityholders' default decision. In contrast, when the firm's future cash flow prospects are poor, their lower willingness to participate in refinancing could severely intensify the strategic default incentives of equityholders. With this in mind, we now consider two sets of interactions. First, we interact fund holding share with BBB and high yield dummies. Second, we separately interact fund holding share with the firm's rolling 1-year stock return. Both sets of interactions are aimed at capturing whether the CDS market exhibits any asymmetric response to fund holding share depending on the firm's "fundamentals." Table 3 presents our results.

TABLE 3 HERE

Panel A of Table 3 reveals that the effect of fund holding share and the next-period CDS spread is statistically insignificant among our baseline firms with credit rating between AAA and A. However, for firms with BBB rating or below, we observe a statistically significant relationship between fund holding share and the next-period CDS spread. Moreover, the economic magnitude of fund holding share's interaction term with the high yield dummy is always greater than that of its interaction term with the BBB dummy. Thus, in line with our model's predictions, the effect of fund holding share on credit risk appears to increase monotonically as the firm's credit rating declines and is concentrated among those with BBB rating or below.

In Panel B, we report panel regression results with the addition of the interaction term between fund holding share and 1-year stock return, which similarly turns out to be significantly negative at the 1% level across all four specifications. The estimated coefficients imply that, for a firm with its 1-year stock return at the third quartile of our sample, i.e., 30.5%, a 1% increase in fund holding share increases the next-period CDS premium only by around 0.35 bp. In contrast, for a firm with its latest 1-year stock return at the first quartile of -8.0%, the figure doubles to around 0.7 bp.[19] Taken together, Table 3 highlights that the effect of mutual funds' bond holdings on the reference firm's credit risk is particularly prominent among those with poor fundamentals as our model suggests.

4.3. Credit risk and fund managers' flow concerns

One corollary of Proposition 2 in our model is that, whenever the flow-motivated funds find it in their interest to under-bid for the bond at the refinancing stage, the extent of under-bidding will be more severe as the intensity of their flow-motivated concerns increases, which in turn strengthens the equityholders' strategic default incentives. We now examine the circumstances under which fund managers' flow concerns are more

[19] In Table A.1, we consider shorter return horizons of one and six months, respectively, and re-estimate Tables 2 and 3. Results are qualitatively unchanged.

likely to be pronounced. First, given the evidence of concave flow-performance relationship documented for funds investing in illiquid securities—including corporate bonds—arising as a result of payoff complementarity (e.g., Chen, Goldstein, and Jiang, 2010; Goldstein, Jiang, and Ng, 2017), we expect flow concerns, especially those related to outflows, to be more severe for poorly-performing, i.e., lower-ranked, funds. Second, flow concerns will naturally be greater among funds whose investor base is not stable. Third, flow-motivated concerns will likely be more pronounced for funds belonging to a small family, because larger families have various means at their disposal to provide liquidity to those experiencing temporary outflows. For example, Bhattacharya, Lee, and Pool (2013) find that large families use affiliated funds of mutual funds, which invest only in other funds within the same family, to act as providers of liquidity insurance to avoid costly liquidation of holdings, which will alleviate outflow concerns of funds.[20] If so, for funds belonging to large families, outflow-related concerns will likely be less severe. Finally, the presence of a prohibitively high load fee should dampen investor response and alleviate the fund managers' flow-related concerns.

To analyze whether there exist differential effects of fund holding share on credit risk for funds with different characteristics, we proceed as follows. At each month-end, we split our sample of active funds into high vs. low groups based on the sample median of following characteristics for each Lipper category that a fund belongs to at the same point in time: (i) latest 12-month fund return, (ii) latest 12-month fund flow volatility, (iii) management firm size, and (iv) the asset share of load fee classes within the fund. Similar to Spiegel and Zhang (2013), we engage in Lipper category adjustments when forming high vs. low groups because these are funds' natural peers; investors are likely to assess a fund's performance relative to other funds with similar investment mandate.[21] We then re-estimate column (5) of Table 2 using the high- and low-group fund holding shares instead. In each instance, we further perform tests of coefficient equality between the two groups' holding shares and report the resulting F-statistics. Table 4 presents our results.

---

[20] Agarwal and Zhao (2019) further find that large families are more likely to apply for an interfund lending program in response to large temporary outflows, providing their affiliated funds with yet another means of liquidity management.

[21] In addition, a management firm's decision to charge a load fee differs substantially between funds with different investment mandates. For example, fund managers are thus more willing to charge load fees for high yield strategies given their high flow volatility; the average asset share of load fee classes for high yield bond funds is around 37%, much higher than the corresponding figure for investment grade bond funds at under 15%. Within-Lipper-category comparison addresses these concerns.

TABLE 4 HERE

Column (1) of Table 4 indicates that the holding share of funds with relatively low 12-month return compared to their peers has a larger positive impact on the next-period CDS premium, as shown by the coefficient estimate on the low-return dummy (0.896), which is statistically significant at the 1% level and also economically larger than the coefficient estimate on the high-return dummy (0.447). This result is consistent with the concave flow-performance relationship in corporate bond funds with poor-performing managers disproportionately punished with large outflows. Also in line with our model's predictions, column (2) clearly indicates that the holding share of high flow volatility funds has a substantially stronger impact on the CDS premium, with the coefficient difference between the high and low groups' holding shares significant at the 5% level. In fact, a one-standard-deviation increase in the holding share of active funds with relatively high flow volatility (of around 9.3%) increases the next-period CDS premium by 11 bps, compared to around 7 bps (15.7%×0.43) for the case of funds with relatively low flow volatility.

Column (3) further reveals that the holding share of funds belonging to smaller families appears to have a more pronounced effect on the CDS premium compared to that of large family funds. Whereas a one-standard-deviation increase in the holding share of active funds belonging to small families (10.4%) increases the next-period CDS spread by around 13 bps, the corresponding figure for a one-standard-deviation increase in the holding share of large family active funds (16.7%) is markedly smaller at around 7 bps. Once again, we find that the coefficient difference is significant at the 5% level. This may be due to large family funds' greater access to within-family liquidity as noted in Bhattacharya, Lee, and Pool (2013) or Agarwal and Zhao (2019). Finally, column (4) reveals that the holding share of funds with relatively low asset share of load fee classes have a significantly more pronounced impact on the next-period CDS premium, with the coefficient difference between the two groups' holding shares marginally significant at the 10% level. This is not surprising given that the presence of a prohibitively high load fee may act as an impediment to the investors' flow response, partially alleviating the fund managers' flow-related concerns.

4.4. Bond refinancing, fund holdings, and credit risk

Our model's mechanism suggests that fund managers' flow concerns may translate into heightened strategic default risk particularly at the point of refinancing. As a result, it is reasonable to believe that, the more imminent bond refinancing is, the more evident should be our effect. This is particularly likely when the current holders of its bonds are expected to participate in the upcoming issuance of new bonds, as is found to be the case in Zhu (2018). Thus, the presence of mutual funds will affect the credit risk of bond issuers especially when the issuers are facing refinancing risk. To explore whether this is the case empirically, we construct near-maturity dummy, which takes the value of 1 whenever the firm has a bond maturing within the next three or six months according to the maturity as stated in the Mergent FISD database. We then re-estimate columns (4) and (5) of Table 2 with the interaction of fund holding share and the near-maturity dummy. Table 5 presents our results.

TABLE 5 HERE

Table 5 reveals that the effect of fund holding share on the next-period CDS premium more than doubles around bond maturities. Our estimates in column (2) reveals that a one-standard-deviation increase in the holding share of active funds amounting to 20.5% increases the next-period 5-year CDS spread by around 12 bps in normal times, but the corresponding figure rises to around 26 bps during the quarter preceding the maturity of a firm's outstanding bond. Across all four specifications, the interaction term between fund holding share and the near-maturity dummy is significantly positive at the 5% level. Table 5 thus suggests that the presence of bond funds with flow concerns significantly increases a firm's credit risk particularly around the time of bond refinancing.

4.5. Is the effect of bond holding share on credit risk stronger during bad times?

One potential alternative explanation for the observed empirical patterns so far is that bond funds self-select into firms with relatively higher credit risk within the same rating because these firms are likely to promise higher yields. Becker and Ivashina (2015) find that insurance firms tilt their corporate bond portfolio toward firms with higher CDS spreads within the same rating category in order to "reach for yield,"[22] while Di Maggio

[22] This behavior is particularly prevalent during the relatively calm pre-crisis period between 2004 and 2007.

and Kacperczyk (2017) find similar risk-taking behavior among money market funds in response to prolonged periods of zero interest rate policy. Moreover, Choi and Kronlund (2018) report particularly prevalent "reaching for yield" behavior among corporate bond mutual funds during periods of low interest rate and default spread. These existing studies find that funds' risk-taking incentives are particularly heightened during periods of low interest rate and relative market calm; potential costs of risk-taking are high during periods of market stress owing to the high illiquidity and high credit risk of the corporate bond market (e.g., Chen, Lesmond, and Wei, 2007). Thus, we examine whether the relationship between fund holding share and CDS spread is affected by market conditions, and if so, whether the patterns are in line with the existing studies on the "reaching for yield" behavior.

To this end, we form two equal-sized subsamples on the basis of each of the following market proxies. First, we form subsamples using whether a given month's default spread, specifically the difference between Moody's seasoned Baa vs. Aaa corporate bond yields, is above or below the sample median. Second, we form subsamples in the identical manner using VIX. We then re-estimate our baseline regressions in columns (3) and (4) in Table 2 for each subsample. We further test the subsample difference in coefficients for the fund holding share term by running a pooled regression of the entire sample with every independent variable and fixed effect term interacted with the high default spread or high VIX subsample dummy. Table 6 presents our results.

TABLE 6 HERE

In Panel A, we form subsamples using the default spread. We find that a one-standard-deviation increase in fund holding share increases the next-month CDS spread by around 15 bps during periods of high default spread, with statistical significance at the 1% level, but the corresponding figure falls to around 5 bp for the low default spread subsample and statistical significance disappears. The subsample coefficient difference is also significant at the 5% level. We observe similar results when we focus our attention on the holding share of active funds only, with the subsample difference in coefficients significant at the 10% level. Regression results using VIX-based subsamples in Panel B are qualitatively similar, with the relationship between fund holding share and the next-period CDS spread substantially stronger during periods of high VIX. The observed patterns are different from those found in previous studies on the "reaching for yield" phenomenon, with the effect of fund holding share on credit risk *stronger* during periods of credit stress. While our model is silent on aggregate conditions, it seems natural that overall cash flow prospects at the firm level are likely to be lower during periods of stress, bringing our mechanism into play and thus consistent with our empirical findings in Table 6.[23]

4.6. Changes in the intensity of flow motivations: Cases of fund acquisition

A potential endogeneity concern in our empirical analyses is that fund holdings and issuer credit risk can be simultaneously determined. Fund trading decisions are likely to be driven by fundamental information about bond issuers, which can affect their CDS spreads. Although the empirical patterns found in Tables 5 and 6 alleviate the endogeneity concern to a certain degree, it is nevertheless still preferable to explore a more direct setting wherein changes in the intensity of flow motivations are unrelated to changes in the credit risk of bond issuers so that we can explore a more causal relationship.

We identify such instances of changes in flow intensity using fund mergers. Our identification strategy is based on the idea that funds belong to a larger fund family have better access to intra-family liquidity insurance in times of severe temporary outflows (Bhattacharya, Lee, and Pool, 2013; Agarwal and Zhao, 2019). Thus, we explore the setting of fund mergers where a fund is acquired by another fund belonging to a larger family. The exclusion restriction here is that fund mergers do not affect the credit risk of bond issuers except through changes in flow sensitivity of fund performance. We first identify all fund acquisitions using the "Delist Reason Flag" from the CRSP Mutual Funds database. Then, we focus on all inter-family acquisitions where the total net assets of the acquiring fund's family are larger than that of the target fund's family. During our sample period, we identify 54 instances where the target fund's holdings information exists in the Morningstar database. We then track the target fund's holdings over the one-year period prior to the acquisition, with the acquisition completion date determined using the target fund's last non-missing NAV entry on the CRSP Mutual Funds database's Daily NAV file. This allows us to identify all firm-month observations for which at least one of our

[23] In Table A.2 in the Appendix, we re-run the subsample regressions in Table 6 using the 3-month T-Bill rate or the term spread as the sorting variable instead. Though we do not find statistical significance for the subsample difference of coefficients, point estimates for the fund holding share are always higher for the high short-term rate or term spread subsample, which, once again, is distinct from the funds' strong risk-taking behavior amid zero interest rate policy found in Choi and Kronlund (2018) or Di Maggio and Kacperczyk (2017).

sample of target funds held non-zero holdings over the 12-month period leading up to its acquisition.[24] For this subsample, we estimate the following regression:

$$CDS\ Premium_{i,t} = \alpha + \beta \cdot Fund\ Holding\ Share_{i,t-1} + \gamma \cdot Fund\ Acquisition_{i,t-1}$$
$$+ \delta \cdot Fund\ Holding\ Share_{i,t-1} \times Fund\ Acquisition_{i,t-1} + \boldsymbol{\omega} \cdot \boldsymbol{Controls_{i,t-1}} + \varepsilon_{i,t}, \quad (8)$$

where $Fund\ Acquisition_{i,t-1}$ is an indicator function that takes the value of 1 if and only if a target fund that holds some amount of bonds issued by firm i is acquired by another fund belonging to a larger family during the next month, i.e., month t. We separately consider both the holding share of all corporate bond funds as well as active funds only.[25] Here, the coefficient δ measures how the previous-month fund holding share affects CDS premium of a firm during the month when at least one of its current flow-motivated bondholders is acquired by another fund with better intra-family resources, relative to the relationship between fund holding share and CDS premium estimated over the previous year. According to the predictions of our model, such fund acquisition would reduce the "average" flow motivation intensity of funds, which in turn would raise the funds' willingness to pay for the bond at refinancing, lowering the equityholders' strategic default incentives. If so, we ought to expect δ to be significantly negative; a given level of fund holding share will be viewed as less detrimental to a firm's credit risk following the fund acquisition. In contrast, it is less clear why having better access to intra-family liquidity resources would subdue a fund manager's risk-taking incentives after the merger. In this respect, a significantly negative δ would further delineate the predictions of our model from those of the risk-taking hypothesis. Table 7 presents our results.

TABLE 7 HERE

In line with the predictions of our model, we find that the interaction term between fund holding share and the fund acquisition dummy is significantly negative. As column (2) reveals, a one-standard-deviation increase in the holding share of active funds (amounting to 21.3% for our subsample) increases the next-period

[24] As revealed in Table A.3 in the Appendix, the results remain qualitatively unchanged when we consider a shorter window of 6 months.

[25] When we consider the holding share of active funds only, we require that the target funds in our subsample are also restricted to active funds, resulting in a smaller subsample.

CDS spread by 28 bps for our sample of firms held by target funds during the one-year period prior to the acquisition. However, the corresponding figure falls to 16 bps during the month of fund acquisition, with the interaction term significantly negative at the 1% level. A similar picture is obtained when we consider the holding share of all funds in column (1), with the interaction term significantly negative at the 5% level. In other words, once the target fund joins a larger family, fund holding share has a less pronounced effect on credit risk among firms for whom the fund serves as a bondholder; the fact that the fund now gain better access to alternative means of liquidity management and partially address its flow-motivated concerns calms CDS market participants' fear of potential rollover risk and the ensuring credit risk, as predicted by our model.

5. Conclusion

Through a simple illustrative model and a series of empirical exercises, we reveal that firms with a large share of their corporate bonds held by bond mutual funds subsequently experience an increase in credit risk. Our model reveals that the flow-based career concerns of bond funds reduce their willingness to pay for the bond at refinancing when a firm's cash flow prospects are poor, which in turn intensifies the equityholders' endogenous default incentives and worsens the firm's credit risk. The model further predicts that the positive relationship between bond funds and credit risk should strengthen as a firm's cash flow prospects become poorer, resulting in an asymmetry, and/or as the funds' intensity of career concerns becomes stronger. We thus demonstrate that, in addition to firm fundamentals and other demand-side characteristics, *who* holds the bonds could become a non-trivial factor in determining a firm's credit risk.

Our empirical analyses provide strong support for the model's main predictions. We find that a one-standard-deviation increase in the bond holding share of active bond funds increases a firm's next-period CDS premium by around 13 bps compared to its credit rating peers. This relationship becomes substantially stronger in statistical and economic significance for firms with low credit ratings and/or poor recent stock performance, and when the funds holding the firm's bonds are susceptible to flow fragility because of poor returns, high flow volatility, low TNA share of load fee classes, or small size of their fund families. The economic relevance of fund holding share on credit risk increases around a firm's debt maturity, further confirming the importance of this rollover-default channel. By engaging in subsample analysis based on market variables and by exploiting the setting of fund mergers, we provide further evidence that the observed patterns are less consistent with the "reaching for yield" behavior of bond funds and more likely in line with our model's predictions.

Our theoretical and empirical results carry strong economic relevance in the face of changing landscape of the market for corporate bonds. The holding share of bond funds in the corporate bond market has more than doubled in the previous two decades, and they are the only group of U.S. domestic institutional investors with a growing presence in the market, filling the gap created by the declining share of more traditional investors. Our results indicate that this could be a cause for concern from the issuers' perspective. The fragility of these funds' flow base and the resulting career concerns of fund managers could prove an obstacle to a firm's bond rollover and exacerbate its credit risk, particularly during times of credit stress and market uncertainty. If so, our results further suggest that better monitoring of a firm's existing bond investor base should form an integral part of future regulatory approaches to ensure financial stability of the market for corporate debt financing.

References

Acharya, Viral V., Douglas Gale, and Tanju Yorulmazer, 2011, Rollover risk and market freezes, *Journal of Finance* 66, 1177-1209.

Acharya, Viral V., Heitor Almeida, Filippo Ippolito, and Ander Perez, 2014, Credit lines as monitored liquidity insurance: Theory and evidence, *Journal of Financial Economics* 112, 287-319.

Acharya, Viral V., Stephen Schaefer, and Yili Zhang, 2015, Liquiity risk and correlation risk: A clinical study of the General Motors and Ford downgrade of May 2005, *Quarterly Journal of Finance* 5, 1-51.

Agarwal, Vikas, and Haibei Zhao, 2019, Interfund lending in mutual fund families: Role in liquidity management, *Review of Financial Studies* 32, 4079-4115.

Becker, Bo, and Victoria Ivashina, 2015, Reaching for yield in the bond market, *Journal of Finance* 70, 1863-1901.

Berk, Jonathan B., and Jules H. van Binsbergen, 2015, Measuring skill in the mutual fund industry, *Journal of Financial Economics* 118, 1-20.

Bhattacharya, Utpal, Jung H. Lee, and Veronika K. Pool, 2013, Conflicting family values in mutual fund families, *Journal of Finance* 68, 173-200.

Brunnermeier, Markus, and Martin Oehmke, 2013, The maturity rat race, *Journal of Finance* 68, 483-521.

Cai, Fang, Song Han, Dan Li, and Yi Li, 2019, Institutional herding and its price impact: Evidence from the corporate bond market, *Journal of Financial Economics* 131, 139-167.

Chakraborty, Indraneel, and Andrew MacKinlay, 2019, The effects of financing frictions in investment-grade debt markets. Unpublished working paper, University of Miami.

Chen, Hui, Rui Cui, Zhiguo He, and Konstantin Milbradt, 2018, Quantifying liquidity and default risks of corporate bonds over the business cycle, *Review of Financial Studies* 31, 852-897.

Chen, Long, David A. Lesmond, and Jason Wei, 2007, Corporate yield spreads and bond liquidity, *Journal of Finance* 62, 119-149.

Chen, Qi, Itay Goldstein, and Wei Jiang, 2010, Payoff complementarities and financial fragility: Evidence from mutual fund outflows, *Journal of Financial Economics* 97, 239-262.

Chevalier, Judith, and Glenn Ellison, 1997, Risk taking by mutual funds as a response to incentives, *Journal of Political Economy* 105, 1167-1200.

Choi, Jaewon, Dirk Hackbarth, and Josef Zechner, 2018, Corporate debt maturity profiles, *Journal of Financial Economics* 130, 484-502.

Choi, Jaewon, and Mathias Kronlund, 2018, Reaching for yield in corporate bond mutual funds, *Review of Financial Studies* 31, 1930-1965.

Colla, Paolo, Filippo Ippolito, and Kai Li, 2013, Debt specialization, *Journal of Finance* 68, 2117-2141.

Collin-Dufresne, Pierre, Robert S. Goldstein, and J. Spencer Martin, 2001, The determinants of credit spread changes, *Journal of Finance* 56, 2177-2207.

Covitz, Daniel, Nellie Liang, and Gustavo A. Suarez, 2013, The evolution of a financial crisis: Collapse of the asset-backed commercial paper market, *Journal of Finance* 68, 815-848.

Daetz, Stine Louise, Jens Dick-Nielsen, and Mads Stenbo Nielsen, 2018, The value of bond underwriter relationships,. Unpublished working paper, Copenhagen Business School.

Dasgupta, Amil, and Andrea Prat, 2008, Information aggregation in financial markets with career concerns, *Journal of Economic Theory* 143, 83-113.

Dasgupta, Amil, Andrea Prat, and Michela Verardo, 2011, Institutional trade persistence and long-term equity returns. *Journal of Finance* 66, 635-653.

Di Maggio, Marco, and Marcin Kacperczyk, 2017, The unintended consequences of the zero lower bound policy, *Journal of Financial Economics* 123, 59-80.

Di Maggio, Marco, Amir Kermani, and Zhaogang Song, 2017, The value of trading relations in turbulent times, *Journal of Financial Economics* 124, 266-284.

Edmans, Alex, Itay Goldstein, and Wei Jiang, 2012, The real effects of financial markets: The impact of prices on takeovers, *Journal of Finance* 67, 933-971.

Elton, Edwin J., Martin J. Gruber, and Christopher R. Blake, 2011a, Holdings data, security returns, and the selection of superior mutual funds, *Journal of Financial and Quantitative Analysis* 46, 341-367.

Elton, Edwin J., Martin J. Gruber, and Christopher R. Blake, 2011b, An examination of mutual fund timing ability using monthly holdings data, *Review of Finance* 16, 619-645.

Goldstein, Itay, Hao Jiang, and David T. Ng, 2017, Investor flows and fragility in corporate bond funds, *Journal of Financial Economics* 126, 592-613.

Gorton, Gary, and Andrew Metrick, 2012, Securitized banking and the run on repo, *Journal of Financial Economics* 104, 425-451.

Guerrieri, Veronica, and Péter Kondor, 2012, Fund managers, career concerns, and asset price volatility, *American Economic Review* 102, 1986-2017.

Harford, Jarrad, Sandy Klasa, and William F. Maxwell, 2014, Refinancing risk and cash holdings, *Journal of Finance* 69, 975-1012.

Hau, Harald, and Sandy Lai, 2013, Real effects of stock underpricing, *Journal of Financial Economics* 108, 392-408.

He, Zhiguo, and Wei Xiong, 2012, Rollover risk and credit risk, *Journal of Finance* 67, 391-429.

He, Zhiguo, and Konstantin Milbradt, 2014, Endogenous liquidity and defaultable bonds, *Econometrica* 82, 1443-1508.

Hendershott, Terrence, Dan Li, Dmitry Livdan, and Norman Schürhoff, 2017, Relationship trading in OTC markets. Unpublished working paper, University of California, Berkeley.

Holmstrom, Bengt, and Joan Ricart-i-Costa, 1986, Managerial incentives and capital management, *Quarterly Journal of Economics* 101, 835-860.

Krishnamurthy, Arvind, Stefan Nagel, and Dmitry Orlov, 2014, Sizing up repo, *Journal of Finance* 69, 2381-2417.

Leland, Hayne, 1994, Corporate debt value, bond covenants, and optimal capital structure, *Journal of Finance* 49, 1213-1252.

Leland, Hayne, and Klaus Bjerre Toft, 1996, Optimal capital structure, endogenous bankruptcy, and the term structure of credit spreads, *Journal of Finance* 51, 987-1019.

Longstaff, Francis, and Eduardo Schwartz, 1995, A simple approach to valuing risky fixed and floating rate debt, *Journal of Finance* 50, 789-819.

Ma, Linlin, Yuehua Tang, and Juan-Pedro Gómez, 2019, Portfolio manager compensation in the U.S. mutual fund industry, *Journal of Finance* 74, 587-638.

Merton, Robert, 1974, On the pricing of corporate debt: The risk structure of interest rates, *Journal of Finance* 29, 449-470.

Nagler, Florian, and Giorgio Ottonello, 2019, Inventory capacity and corporate bond offerings. Unpublished working paper, Bocconi University.

Nikolova, Stanislava (Stas), Liying Wang, and J. (Julie) Wu, 2019, Institutional allocations in the primary market for corporate bonds, *Journal of Financial Economics*, forthcoming.

Parise, Gianpaolo, 2018, Threat of entry and debt maturity: Evidence from airlines, *Journal of Financial Economics* 127, 226-247.

Pástor, Ľuboš, Robert F. Stambaugh, and Lucian A. Taylor, 2015, Scale and skill in active management, *Journal of Financial Economics* 116, 23-45.

Rauh, Joshua D., and Amir Sufi, 2010, Capital structure and debt structure, *Review of Financial Studies* 23, 4242-4280.

Sirri, Erik R., and Peter Tufano, 1998, Costly search and mutual fund flows, *Journal of Finance* 53, 1589-1622.

Spiegel, Matthew, and Hong Zhang, 2013, Mutual fund risk and market share-adjusted fund flows, *Journal of Financial Economics* 108, 506-528.

Thompson, Samuel B., 2011, Simple formulas for standard errors that cluster by both firm and time, *Journal of Financial Economics* 99, 1-10.

Zhang, Benjamin Yibin, Hao Zhou, and Haibin Zhu, 2009, Explaining credit default swap spreads with the equity volatility and jump risks of individual firms, *Review of Financial Studies* 22, 5099-5131.

Zhu, Qifei, 2018, Capital supply and corporate bond issuances: Evidence from mutual fund flows. Unpublished working paper, Nanyang Technological University.

Appendix A. Proofs

Proof of Proposition 2. Suppose that the firm sets the price of the bond as in (4). We then verify in steps that an equilibrium exists as outlined in the proposition.

Without loss of generality, consider a fund with $s = \bar{V}$. If the fund chooses to buy the bond, i.e., $a = 1$, its expected payoff from the bond is

$$\underbrace{\Pr(V = \bar{V}|s = \bar{V}) \cdot 1}_{\text{No default at } t=2} + \underbrace{\Pr(V = 0|s = \bar{V}) \cdot 0}_{\text{Default at } t=2} - p + \kappa E(\Pr(\tau = G|a = 1, V)|s = \bar{V}). \quad \text{(A.1)}$$

Substituting the price as stated in (4) yields this quantity to be $\kappa E(\Pr(\tau = G|a = 0, V)|s = \bar{V})$. Thus, upon receiving a high signal, the fund is indifferent between buying and not buying the bond; this represents the high signal funds' full willingness to pay for the bond. Thus, an equilibrium with $a = 1$ can be sustained.

Now consider a fund with $s = 0$. If the fund chooses $a = 1$, its expected payoff is

$$\underbrace{\Pr(V = \bar{V}|s = 0) \cdot 1}_{\text{No default at } t=2} + \underbrace{\Pr(V = 0|s = 0) \cdot 0}_{\text{Default at } t=2} - p + \kappa E(\Pr(\tau = G|a = 1, V)|s = 0), \quad \text{(A.2)}$$

which, upon substituting in the price, becomes

$$\Pr(V = \bar{V}|s = 0) - \Pr(V = \bar{V}|s = \bar{V}) + \kappa\{E(\Pr(\tau = G|a = 0, V)|s = \bar{V}) +$$
$$E(\Pr(\tau = G|a = 1, V)|s = 0) - E(\Pr(\tau = G|a = 1, V)|s = \bar{V})\}. \quad \text{(A.3)}$$

Now, let $\sigma \equiv \gamma_\tau \sigma_G + (1 - \gamma_\tau)\sigma_B$ be the average precision of the fund. Knowing that $\sigma_G = 1$ and $\sigma_B = 1/2$, this quantity becomes $\sigma = \gamma_\tau + \frac{1}{2}(1 - \gamma_\tau) = \frac{1}{2}(1 + \gamma_\tau)$.

In this instance, we have the following:

$$\Pr(V = \bar{V}|s = \bar{V}) = \frac{\gamma_V \sigma}{\gamma_V \sigma + (1 - \gamma_V)(1 - \sigma)} = \frac{\gamma_V(1 + \gamma_\tau)}{1 - \gamma_\tau + 2\gamma_V \gamma_\tau}, \quad \text{(A.4)}$$

$$\Pr(V = \bar{V}|s = 0) = \frac{\gamma_V(1 - \sigma)}{\gamma_V(1 - \sigma) + (1 - \gamma_V)\sigma} = \frac{\gamma_V(1 - \gamma_\tau)}{1 + \gamma_\tau - 2\gamma_V \gamma_\tau}. \quad \text{(A.5)}$$

As long as $\gamma_\tau > 0$, we have $\Pr(V = \bar{V}|s = \bar{V}) > \Pr(V = \bar{V}|s = 0)$, i.e., the signal is informative. Let us now suppose that, as stated in the proposition, a fund chooses $a = 1$ if and only if $s = \bar{V}$. Then, due to the symmetric nature of the set-up, we have:

$$\Pr(\tau = G|a = 1, V = \bar{V}) = \Pr(\tau = G|a = 0, V = 0) = \frac{2\gamma_\tau}{1+\gamma_\tau}, \tag{A.6}$$

$$\Pr(\tau = G|a = 0, V = \bar{V}) = \Pr(\tau = G|a = 1, V = 0) = 0. \tag{A.7}$$

If so, we have the following set of quantities:

$$E(\Pr(\tau = G|a = 1, V)|s = \bar{V}) = \frac{\gamma_V(1+\gamma_\tau)}{1-\gamma_\tau+2\gamma_V\gamma_\tau}\frac{2\gamma_\tau}{1+\gamma_\tau}, \tag{A.8}$$

$$E(\Pr(\tau = G|a = 0, V)|s = \bar{V}) = \left(1 - \frac{\gamma_V(1+\gamma_\tau)}{1-\gamma_\tau+2\gamma_V\gamma_\tau}\right)\frac{2\gamma_\tau}{1+\gamma_\tau}, \tag{A.9}$$

$$E(\Pr(\tau = G|a = 1, V)|s = 0) = \frac{\gamma_V(1-\gamma_\tau)}{1+\gamma_\tau-2\gamma_V\gamma_\tau}\frac{2\gamma_\tau}{1+\gamma_\tau}, \tag{A.10}$$

$$E(\Pr(\tau = G|a = 0, V)|s = 0) = \left(1 - \frac{\gamma_V(1-\gamma_\tau)}{1+\gamma_\tau-2\gamma_V\gamma_\tau}\right)\frac{2\gamma_\tau}{1+\gamma_\tau}. \tag{A.11}$$

A simple inspection reveals $E(\Pr(\tau = G|a = 1, V)|s = 0) - E(\Pr(\tau = G|a = 1, V)|s = \bar{V}) < 0$, because $\Pr(V = \bar{V}|s = 0) < \Pr(V = \bar{V}|s = \bar{V})$, i.e., $\frac{\gamma_V(1-\gamma_\tau)}{1+\gamma_\tau-2\gamma_V\gamma_\tau} < \frac{\gamma_V(1+\gamma_\tau)}{1-\gamma_\tau+2\gamma_V\gamma_\tau}$. This, along with the fact that $\Pr(V = \bar{V}|s = 0) < \Pr(V = \bar{V}|s = \bar{V})$, ensures (A.3) is strictly less than $\kappa E(\Pr(\tau = G|a = 0, V)|s = \bar{V})$.

We still need to compute the fund's payoff from choosing $a = 0$ when $s = 0$. This quantity is simply given by $\kappa E(\Pr(\tau = G|a = 0, V)|s = 0)$. However, from (A.9) and (A.11), it immediately follows that

$$E(\Pr(\tau = G|a = 0, V)|s = 0) > E(\Pr(\tau = G|a = 0, V)|s = \bar{V}),$$

because $\Pr(V = 0|s = 0) > \Pr(V = 0|s = \bar{V})$. This, along with our earlier result regarding the low signal fund's payoff, ensures that any fund with $s = 0$ will be strictly better off choosing $a = 0$.

The results so far indicate that, if the price is set as in (4), neither the high nor the low signal funds will have any incentive to deviate from the strategy outlined in the proposition. However, we still need to check the optimal strategy of the equityholders. Given that there is excess supply of potential bondholders, the firm does not need to lower the bond's issuance price to attract the funds with low signal, i.e., $s = 0$. Then, knowing that the bond will be held only by those with $s = \bar{V}$, the firm will charge up to their full willingness to pay, which, from our earlier part of the proof, is given by (4). Implicit in our proof is the argument that, if the firm were to charge a higher off-equilibrium price, the principals of the funds will not change their inferences conditional on the funds' actions. If so, $s = \bar{V}$ funds would not pay a price higher than their full willingness to pay, i.e., (4), and refinancing would fail. □

Proof of Proposition 4. First, note that:

$$p_f^* - p^* = \kappa\{E(\Pr(\tau = G|a = 1, V)|s = \bar{V}) - E(\Pr(\tau = G|a = 0, V)|s = \bar{V})\}. \qquad \text{(A.12)}$$

Using (A.8) and (A.9), this quantity will be negative whenever

$$\frac{\gamma_V(1 + \gamma_\tau)}{1 - \gamma_\tau + 2\gamma_V\gamma_\tau} < 1 - \frac{\gamma_V(1 + \gamma_\tau)}{1 - \gamma_\tau + 2\gamma_V\gamma_\tau},$$

which, upon rearranging, reduces to $\gamma_V < \frac{1}{2}(1 - \gamma_\tau)$. □

Appendix B. A Short Discussion on Refinancing under Pooling Equilibria

As discussed above, pooling equilibria are less natural in our context given that they do not generate a positive flow-performance relationship on the equilibrium path. That said, flow-motivated funds' reluctance to pay at refinancing for firms with weak prospects survives qualitatively unchanged in pooling equilibria with reasonable off-equilibrium beliefs. To see this, consider the only possible pooling equilibrium with refinancing, in which flow-motivated bondholders with signals $s = 0$ and $s = \bar{V}$ *both* buy (i.e., $a = 1$). Suppose the off-equilibrium choice of $a = 0$ is associated with the receipt of signal $s = 0$. This would indeed be the on-equilibrium inference if there was an infinitesimal measure of funds that refinanced "naively," i.e., bought if and only if they received the high signal. If so, these off-equilibrium beliefs are natural and robust.

It is easy to see, by analogy to Proposition 2, that the optimal pricing set by firms at refinancing in such an equilibrium would be as follows:

$$p = \Pr(V = \bar{V}|s = 0) + \kappa\{\gamma_\tau - E(\Pr(\tau = G|s = 0, V)|s = 0)\}. \tag{B.1}$$

The second term of (B.1) represents the difference between the posterior reputation obtained by buying, which corresponds to the prior as no learning occurs in a pooling equilibrium, and the off-equilibrium reputation associated with not buying (under the off-equilibrium beliefs specified earlier). At such prices the fund manager with signal $s = 0$ would be indifferent between buying and not, while the fund manager with signal $s = \bar{V}$ would strictly prefer to buy.

It is clear that, for sufficiently low values of γ_V, we have:

$$p = \Pr(V = \bar{V}|s = 0) + \kappa\{\gamma_\tau - E(\Pr(\tau = G|s = 0, V)|s = 0)\} < \Pr(V = \bar{V}|s = 0), \tag{B.2}$$

because when the firm's prospects are sufficiently poor, the likely way to enhance reputation for a fund is to indicate via their action that they received $s = 0$. Thus, once again, poor corporate prospects will lead to lowered willingness to pay and result in a lower refinancing price. This is further reinforced in a pooling equilibrium by the fact that $\Pr(V = \bar{V} | s = 0) < \Pr(V = \bar{V} | s = \bar{V})$, further lowering the refinancing price relative to that in Proposition 3.

Appendix C. Variable Descriptions

In this appendix, we describe in detail how each variable used in our empirical analysis is constructed. Data source is denoted in parentheses.

C.1. Fund holding share data

Fund holding share (Morningstar, CRSP Mutual Funds, TRACE, and Mergent FISD): For each bond at every month-end, we calculate the amount of bonds held by funds with the first two digits of CRSP objective codes "IC" or CRSP objective code "I," using each fund's latest available monthly or quarterly holdings data. We also compute the amount of funds satisfying various characteristics, such as whether the previous 12-month return, rolling 12-month return volatility, or rolling 12-month flow volatility is above or below the sample median at the same point in time. For each fund, we further calculate the percentage of total assets held in institutional classes or classes with a load fee, with the latter defined as rear load fee applicable at the holding period of one month or minimum front load fee. We determine whether a fund is an index fund using the index fund flag in the CRSP Mutual Funds database, complemented with the name-based index fund identification of Berk and van Binsbergen (2015), and separately compute the amount of bonds held by active funds. We do so for every bond with Morningstar *sectype* code B, BF, or BI. We further obtain the latest amount outstanding of each bond from Mergent FISD. We then sum fund holdings and amount outstanding of all bonds issued by a firm satisfying the criteria above and divide the former with the latter to arrive at a fund-month level fund holding share of corporate bonds.

C.2. CDS Premium Data

5-year CDS spread (Markit): Month-end CDS spread on 5-year senior unsecured obligation contracts issued in U.S. dollars with modified restructuring clause until April 2009 and no restructuring clause thereafter.

C.3. Controls

Average credit rating and recovery rate (Markit): These are as reported in the Markit database.

Historical stock return (CRSP): 1-, 6-, and 12-month stock returns computed using the CRSP database.

Historical return volatility, skewness, and kurtosis (CRSP): Rolling 12-month standard deviation, skewness, and kurtosis of daily stock returns using the CRSP database.

S&P 500 return (Compustat): Latest monthly return of the S&P 500 index.

VIX (Chicago Board of Exchange): Month-end VIX as reported by the Chicago Board of Exchange.

3-month T-Bill and term spread (FRED): 3-month T-Bill rate and the difference between the 10-year Treasury bond and 3-month T-Bill, respectively.

Log assets (Compustat): Log of total assets (*ATQ*) as reported in Compustat.

Leverage ratio (Compustat): The sum of current and long-term debt (*DLCQ* + *DLTTQ*), divided by the sum of current and long-term debt plus total stockholder equity (*DLCQ* + *DLTTQ* + *SEQQ*)

Return on equity (Compustat): Total income before extraordinary items (*IBQ*) divided by total stockholder equity (*SEQQ*)

Dividend payout per share (Compustat): Dividend payout per share (*DVPSPQ*) as reported in Compustat.

Table 1. Summary statistics

In this table, we report summary statistics on the sample of 531 firms with 5-year CDS spread data available on Markit and non-missing coverage of at least one of its corporate bonds in the Morningstar fund holdings data. Our sample period is between October 2001 and September 2014, with the holdings data of 1,128 corporate and general fixed income funds. The observations are at the firm-month level. All firm-level continuous variables are winsorized at the 1% and 99% levels, and we report the summary statistics computed using winsorized values. For a detailed description of how each variable is constructed, refer to Appendix C.

	Obs.	Mean	St. Dev.	P25	P50	P75
CDS premium characteristics						
5-year CDS spread (bps)	33,436	129.93	199.92	35.56	64.24	133.33
of which:						
AAA to A	12,353	59.83	76.18	24.00	40.39	67.26
BBB	15,272	112.31	138.22	41.91	71.60	127.01
BB or below	5,811	325.25	343.57	93.62	211.83	400.00
Fund holding characteristics						
Fund holding share (%)	33,436	35.39	21.58	19.82	32.89	48.63
Active fund holding share (%)	33,436	28.61	20.47	13.46	24.80	39.81
Passive fund holding share (%)	33,436	6.573	7.011	0.000	5.113	11.01
Other characteristics						
Recovery rate (%)	33,436	39.65	2.271	39.55	40.00	40.00
1-month stock return (%)	33,435	1.017	8.996	-3.633	1.060	5.562
6-month stock return (%)	33,436	6.271	24.21	-6.299	6.389	18.68
12-month stock return (%)	33,436	12.71	36.15	-7.999	11.64	30.54
Historical volatility (annualized %)	33,436	33.51	19.22	21.26	28.22	38.62
Historical skewness	33,436	0.093	0.819	-0.214	0.101	0.422
Historical kurtosis	33,436	4.369	6.440	1.078	2.179	4.689
Total assets ($ millions)	33,436	51,307.4	130,498.9	6,338.2	15,288.7	33,597.0
Leverage (%)	33,436	46.40	22.05	30.56	42.79	58.63
Return on equity (%)	33,436	5.475	12.44	2.731	5.365	8.337
Dividend payout per share ($\times 100$)	33,436	0.503	0.520	0.116	0.412	0.716
S&P 500 index return (%)	33,436	0.912	18.75	-11.07	-2.869	10.60
3-month T-Bill rate (%)	33,436	1.758	1.780	0.140	1.140	3.150
Term spread (%)	33,436	1.973	1.237	0.820	2.310	3.000
VIX	33,436	20.56	9.173	14.00	17.59	24.51

Table 2. Fund Holding and Credit Risk

In this table we report the firm-month level panel regression results of the 5-year credit default swap (CDS) spread on the fund holding share of a firm's outstanding corporate bonds as well as other controls. For the definition of each variable used in the analysis, refer to Appendix C. In columns (1) and (4), we consider the holding share of all mutual funds, while we restrict our attention to active funds or passive funds separately in columns (2)-(3) and (5)-(6). In columns (1) through (3), we control for credit rating dummies, while we omit market-level characteristics and add credit-rating-by-month fixed effects in columns (4) through (6). All controls are lagged by one month. *t*-statistics based on standard errors that are robust to heteroskedasticity and two-way clustered by firm and month are reported in parentheses below the coefficient estimates. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: 5-year CDS spread (bps)					
	(1) All funds	(2) Active only	(3) Passive only	(4) All funds	(5) Active only	(6) Passive only
Fund holding share (%)	**0.507*** (3.33)**	**0.651*** (4.05)**	**-1.195*** (-3.12)**	**0.503*** (3.48)**	**0.642*** (4.06)**	**-1.350*** (-3.58)**
1-year stock return (%)	-0.851*** (-6.52)	-0.859*** (-6.61)	-0.820*** (-6.39)	-1.068*** (-9.15)	-1.073*** (-9.19)	-1.041*** (-9.06)
Historical volatility (%)	4.660*** (9.03)	4.615*** (8.95)	4.649*** (8.99)	6.133*** (12.83)	6.086*** (12.74)	6.120*** (12.77)
Historical skewness	3.362 (1.29)	3.468 (1.34)	2.761 (1.06)	7.757*** (3.08)	7.848*** (3.12)	6.975*** (2.78)
Historical kurtosis	-0.083 (-0.21)	-0.057 (-0.14)	-0.024 (-0.06)	-0.811** (-2.05)	-0.794** (-2.01)	-0.775* (-1.95)
Recovery rate	-14.450*** (-5.51)	-14.438*** (-5.51)	-14.303*** (-5.46)	-14.328*** (-4.89)	-14.348*** (-4.90)	-14.069*** (-4.79)
Log assets	-0.017 (-0.01)	0.446 (0.15)	2.916 (0.95)	-2.620 (-0.99)	-2.263 (-0.87)	0.229 (0.08)
Leverage (%)	1.476*** (7.06)	1.465*** (7.04)	1.487*** (7.12)	1.359*** (7.34)	1.352*** (7.33)	1.385*** (7.41)
ROE (%)	-0.398 (-1.47)	-0.385 (-1.43)	-0.389 (-1.46)	-0.149 (-0.70)	-0.139 (-0.65)	-0.140 (-0.66)
Dividend payout per share ($\times 100$)	-8.743 (-1.47)	-8.334 (-1.41)	-8.865 (-1.49)	3.731 (0.74)	4.040 (0.81)	3.298 (0.64)
1-month S&P 500 return (%)	0.721*** (3.76)	0.725*** (3.79)	0.760*** (3.94)			
3-month T-Bill rate (%)	-11.440*** (-2.97)	-12.685*** (-3.47)	-18.775*** (-4.81)			
Term spread (%)	-14.454** (-2.58)	-15.606*** (-2.88)	-22.259*** (-3.94)			
VIX	-0.067 (-0.09)	-0.095 (-0.13)	-0.193 (-0.26)			
Credit rating FE	YES	YES	YES	NO	NO	NO
Credit-rating-by-month FE	NO	NO	NO	YES	YES	YES
Adjusted R-squared	0.579	0.580	0.577	0.662	0.663	0.661
No. of obs.	33,436	33,436	33,436	33,262	33,262	33,262

Table 3. Fund Holding, Credit Risk, and Cash Flow Prospects

In Panel A of this table we report the firm-month level panel regression results re-estimating those reported in Table 2, albeit with an interaction term between fund holding share and BBB and HY dummies. Then, in Panel B, we report the panel regression results with an interaction term between fund holding share and 1-year stock return. In both panels, control variables are identical to those used in Table 2, whose coefficient estimates we do not report. In Panel A, we further report F-statistic testing the hypothesis that fund holding share and the interaction term are equal but opposite in sign. *t*-statistics based on standard errors that are robust to heteroskedasticity and two-way clustered by firm and month are reported in parentheses below the coefficient estimates. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Interaction with the high investment grade dummy

	Dependent variable: 5-year CDS spread (bps)			
	(1) All funds	(2) Active only	(3) All funds	(4) Active only
Fund holding share (%)	0.098	-0.028	0.027	-0.070
	(0.65)	(-0.18)	(0.17)	(-0.41)
Fund holding share × BBB dummy	0.348*	0.668***	0.512**	0.790***
	(1.97)	(3.16)	(2.45)	(3.43)
Fund holding share × HY dummy	0.855**	1.142***	0.827*	1.094**
	(2.10)	(2.80)	(1.90)	(2.53)
Controls	YES	YES	YES	YES
Credit rating FE	YES	YES	NO	NO
Credit-rating-by-month FE	NO	NO	YES	YES
Adjusted R-squared	0.580	0.582	0.663	0.665
No. of obs.	33,436	33,436	33,262	33,262

Panel B. Interaction with 1-year stock return

	Dependent variable: 5-year CDS spread (bps)			
	(1) All funds	(2) Active only	(3) All funds	(4) Active only
Fund holding share (%)	0.636***	0.848***	0.624***	0.805***
	(3.53)	(4.46)	(3.71)	(4.37)
Fund holding share × 1-year stock return (%)	-0.920***	-1.339***	-0.859***	-1.089***
	(-2.98)	(-4.18)	(-3.09)	(-3.74)
1-year stock return (%)	-0.484***	-0.387***	-0.728***	-0.694***
	(-3.15)	(-2.79)	(-5.14)	(-5.45)
Controls	YES	YES	YES	YES
Credit rating FE	YES	YES	NO	NO
Credit-rating-by-month FE	NO	NO	YES	YES
Adjusted R-squared	0.580	0.583	0.663	0.665
No. of obs.	33,436	33,436	33,262	33,262

Table 4. Fund Characteristics, Fund Holdings, and Credit Risk

In this table, we re-compute holding shares of active funds, this time separately for those with high vs. low (i) 12-month fund return, (ii) 12-month fund flow volatility, (iii) management firm size, and (iv) TNA-share of fund classes with a load fee. To divide the funds into high vs. low groups, we first calculate the median for each Lipper objective code at each month-end using the latest available fund-level data. We then check whether a fund's latest value is above or the median of its Lipper category at the same point in time. Controls are identical to column (5) of Table 2, with credit-rating-by-month dummies. In each case, we further report F-statistic testing the hypothesis that the coefficients of high- and low-group holding shares are equal. *t*-statistics based on standard errors that are robust to heteroskedasticity and two-way clustered by firm and month are reported in parentheses below the coefficient estimates. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: 5-year CDS spread (bps)			
	(1)	(2)	(3)	(4)
Fund characteristic of interest	1-year fund return	1-year fund flow volatility	Management firm size	TNA-share of load fee classes
High-group holding share (%)	0.453***	1.177***	0.447***	0.519***
	(2.62)	(4.42)	(2.79)	(3.00)
Low-group holding share (%)	0.906***	0.436**	1.262***	1.040***
	(4.46)	(2.31)	(3.96)	(3.84)
F-statistic	5.35**	5.48**	6.46**	3.36*
Controls	YES	YES	YES	YES
Credit-rating-by-month FE	YES	YES	YES	YES
Adjusted R-squared	0.663	0.663	0.664	0.664
No. of obs.	33,262	33,262	33,262	33,262

Table 5. Fund Holding and Credit Risk around Bond Maturities

In this table we report the firm-month level panel regression results re-estimating those reported in Table 2, albeit with an interaction term between fund holding share and the near-maturity dummy. Near-maturity dummy takes the value of one if the firm has a maturing bond within the next three or next six months. Controls are identical to columns (4) and (5) in Table 2, whose coefficient estimates we do not report. *t*-statistics based on standard errors that are robust to heteroskedasticity and two-way clustered by firm and month are reported in parentheses below the coefficient estimates. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: 5-year CDS spread (bps)			
	(1) All funds	(2) Active only	(3) All funds	(4) Active only
Bond maturing within:	3 months		6 months	
Fund holding share (%)	0.455***	0.577***	0.431***	0.543***
	(3.16)	(3.69)	(2.96)	(3.45)
Fund holding share × Near-maturity dummy	0.536**	0.752**	0.446**	0.618**
	(2.25)	(2.39)	(2.26)	(2.44)
Near-maturity dummy	-19.180**	-21.502***	-15.491**	-17.345***
	(-2.50)	(-2.82)	(-2.22)	(-2.69)
Controls	YES	YES	YES	YES
Credit-rating-by-month FE	YES	YES	YES	YES
Adjusted R-squared	0.662	0.664	0.662	0.664
No. of obs.	33,262	33,262	33,262	33,262

Table 6. Fund Holdings and Credit Risk: Do Market Conditions Matter?

In this table, we re-estimate columns (4) and (5) in Table 2, albeit dividing our sample into two equal-sized subsamples based on whether the (i) default spread, namely the difference between Moody's Seasoned Baa vs. Aaa corporate bond yields (constant maturity), or (ii) VIX is above or below the sample median. Controls are identical to columns (3) and (4) in Table 2, and we include credit-rating-by-month fixed effects in all instances. In columns (3) and (6), we report the subsample coefficient difference test results. Specifically, we test the difference in coefficient estimates between the two subsamples by running a pooled regression with each variable interacted with the high credit spread or high VIX dummy, respectively, and report the corresponding *t*-statistics. *t*-statistics based on standard errors that are robust to heteroskedasticity and two-way clustered by firm and month are reported in parentheses below the coefficient estimates. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Default-spread-based subsamples

	Dependent variable: 5-year CDS spread (bps)					
	All funds			Active only		
	(1)	(2)	(3)	(4)	(5)	(6)
	High default spread	Low default spread	Coeff. diff. test (*t*-stat)	High default spread	Low default spread	Coeff. diff. test (*t*-stat)
Fund holding share (%)	0.707***	0.241	0.467**	0.867***	0.373**	0.494**
	(3.42)	(1.56)	(2.06)	(3.83)	(2.22)	(2.01)
Controls	YES	YES		YES	YES	
Credit-rating-by-month FE	YES	YES		YES	YES	
Adjusted R-squared	0.665	0.621		0.666	0.622	
No. of obs.	17,100	16,162		17,100	16,162	

Panel B. VIX-based subsamples

	Dependent variable: 5-year CDS spread (bps)					
	All funds			Active only		
	(1)	(2)	(3)	(4)	(5)	(6)
	High VIX	Low VIX	Coeff. diff. test (*t*-stat)	High VIX	Low VIX	Coeff. diff. test (*t*-stat)
Fund holding share (%)	0.686***	0.258	0.428*	0.847***	0.385**	0.462*
	(3.25)	(1.63)	(1.78)	(3.66)	(2.22)	(1.75)
Controls	YES	YES		YES	YES	
Credit-rating-by-month FE	YES	YES		YES	YES	
Adjusted R-squared	0.669	0.605		0.670	0.606	
No. of obs.	16,635	16,627		16,635	16,627	

Table 7. Fund Acquisitions and Credit Risk

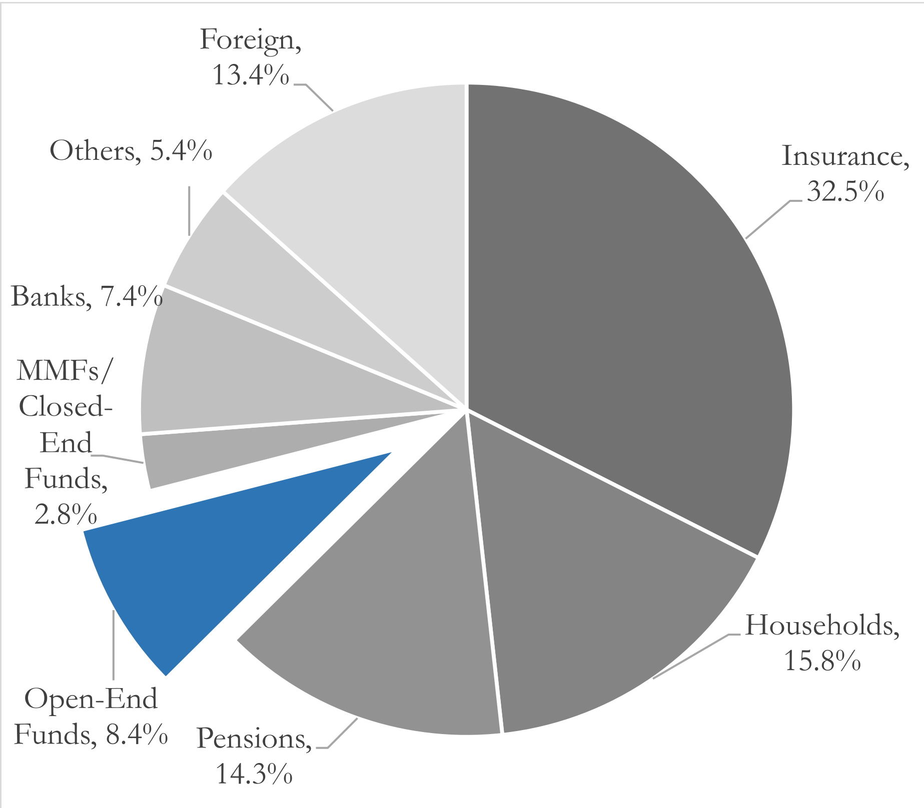
In this table we estimate the effect of fund acquisitions on credit risk. We identify all instances of fund acquisitions using the "Delist Reason Flag" in the CRSP Mutual Fund database. We then focus on 54 acquisitions where (i) a fund was acquired by another fund belonging to a different family with larger total net assets, and (ii) the acquired fund's holdings information exists on Morningstar. We then track our target funds' holdings during the 12-month period preceding the month of fund acquisition, defined as the month of the target funds' last non-missing NAV entries on the Daily NAV file in the CRSP Mutual Fund database. Then, we identify all firm-month observations where at least one of our target funds held non-zero amount of the firm's outstanding bonds in the 12-month pre-acquisition period. When we consider the holding share of active funds only, we only consider active target funds, resulting in a smaller subsample. We then create a fund acquisition dummy, an indicator variable that takes the value of one if at least one of the target funds that holds non-zero amount of the firm's bond is acquired by another fund belonging to a larger family during the next month. We then re-estimate columns (4) and (5) of Table 2 for our subsample, with fund holding share interacted with fund acquisition dummy. All controls are identical to columns (4) and (5) of Table 2, whose coefficient estimates are omitted, and we include credit-rating-by-month dummies. *t*-statistics based on standard errors that are robust to heteroskedasticity and two-way clustered by firm and month are reported in parentheses below the coefficient estimates. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: 5-year CDS spread (bps)	
	(1) All funds	(2) Active only
Fund holding share (%)	1.153*** (5.56)	1.336*** (6.04)
Fund holding share × Fund acquisition dummy	-0.492** (-2.06)	-0.600*** (-2.73)
Fund acquisition dummy	8.740 (0.96)	8.879 (1.26)
Controls	YES	YES
Credit-rating-by-month FE	YES	YES
Adjusted R-squared	0.648	0.669
No. of obs.	3,591	3,309

Figure 1. Who Holds Corporate Bonds? 1998 vs. 2017

Figures are from the Federal Reserve's Flow of Funds (L.213).

Panel A. 1998 Year-End



Panel B. 2017 Year-End

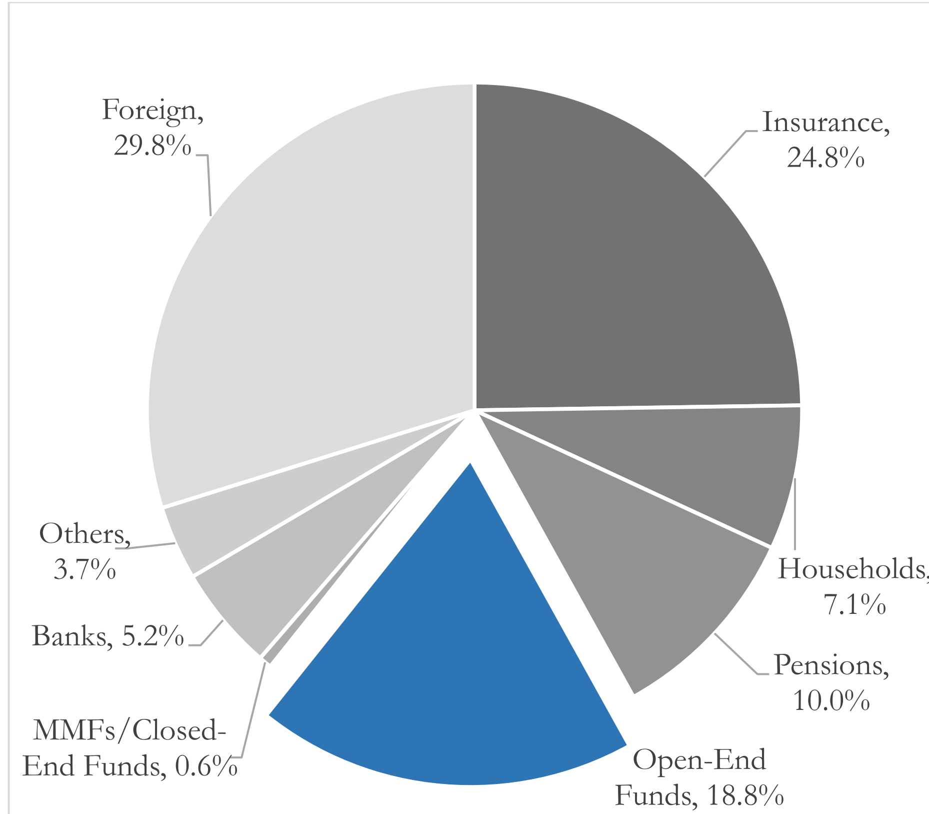


Table A.1. Robustness Check: Alternative Return Horizons

In Panels A and B of this table we re-estimate the results using the holding share of all funds and active funds only in Tables 2 and 3 using 1- and 6-month stock returns instead. In Panel A we report our baseline results, while we consider the interaction between stock return measure and fund holding share in Panel B. Controls are identical to those in Table 1, whose coefficient estimates we do not report. *t*-statistics based on standard errors that are robust to heteroskedasticity and two-way clustered by firm and month are reported in parentheses below the coefficient estimates. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Main regressions

	Dependent variable: 5-year CDS spread (bps)							
	Return measure: 1-month return				Return measure: 6-month return			
	(1) All funds	(2) Active only	(3) All funds	(4) Active only	(1) All funds	(2) Active only	(3) All funds	(4) Active only
Fund holding share (%)	0.399***	0.534***	0.418***	0.553***	0.482***	0.615***	0.460***	0.599***
	(2.66)	(3.34)	(2.86)	(3.44)	(3.28)	(3.94)	(3.20)	(3.80)
Stock return measure (%)	-1.959***	-1.964***	-1.464***	-1.466***	-1.885***	-1.889***	-1.532***	-1.536***
	(-5.04)	(-5.07)	(-5.76)	(-5.77)	(-10.18)	(-10.23)	(-9.53)	(-9.57)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Credit rating FE	YES	YES	NO	NO	YES	YES	NO	NO
Credit-rating-by-month FE	NO	NO	YES	YES	NO	NO	YES	YES
Adjusted R-squared	0.569	0.570	0.645	0.646	0.600	0.601	0.662	0.663
No. of obs.	33,435	33,435	33,261	33,261	33,436	33,436	33,262	33,262

Panel B. Interaction with stock return measures

	Dependent variable: 5-year CDS spread (bps)							
	Return measure: 1-month return				Return measure: 6-month return			
	(1) All funds	(2) Active only	(3) All funds	(4) Active only	(1) All funds	(2) Active only	(3) All funds	(4) Active only
Fund holding share (%)	0.415***	0.557***	0.436***	0.575***	0.589***	0.759***	0.553***	0.719***
	(2.74)	(3.44)	(2.96)	(3.55)	(3.72)	(4.50)	(3.59)	(4.25)
Fund holding share × stock return measure (%)	-1.688*	-2.376**	-1.936**	-2.287***	-1.646***	-2.128***	-1.436***	-1.774***
	(-1.93)	(-2.42)	(-2.59)	(-2.76)	(-3.58)	(-4.37)	(-3.25)	(-3.78)
Stock return measure (%)	-1.326***	-1.191***	-0.742***	-0.729***	-1.256***	-1.171***	-0.982***	-0.940***
	(-3.51)	(-3.23)	(-2.61)	(-2.82)	(-5.66)	(-5.61)	(-5.00)	(-5.27)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Credit rating FE	YES	YES	NO	NO	YES	YES	NO	NO
Credit-rating-by-month FE	NO	NO	YES	YES	NO	NO	YES	YES
Adjusted R-squared	0.569	0.571	0.646	0.647	0.602	0.605	0.663	0.665
No. of obs.	33,435	33,435	33,261	33,261	33,436	33,436	33,262	33,262

Table A.2. Fund Holdings and Credit Risk: Treasury-Yield-Based Subsamples

In this table, we re-estimate Table 6, using two equal-sized subsamples based on either (i) the 3-month T-Bill rate, or (ii) the term spread instead. Controls are identical to Table 6, and we include credit-rating-by-month fixed effects in all instances. In columns (3) and (6), we report the subsample coefficient difference test results. Specifically, we test the difference in coefficient estimates between the two subsamples by running a pooled regression with each variable interacted with the high T-Bill rate or high term spread dummy, respectively, and report the corresponding *t*-statistics. *t*-statistics based on standard errors that are robust to heteroskedasticity and two-way clustered by firm and month are reported in parentheses below the coefficient estimates. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. 3-month T-Bill rate subsamples

	Dependent variable: 5-year CDS spread (bps)					
	All funds			Active only		
	(1)	(2)	(3)	(4)	(5)	(6)
	High T-Bill rate	Low T-Bill rate	Coeff. diff. test (*t*-stat)	High T-Bill rate	Low T-Bill rate	Coeff. diff. test (*t*-stat)
Fund holding share (%)	0.530***	0.389*	0.140	0.671***	0.522**	0.150
	(3.08)	(1.97)	(0.60)	(3.66)	(2.38)	(0.59)
Controls	YES	YES		YES	YES	
Credit-rating-by-month FE	YES	YES		YES	YES	
Adjusted R-squared	0.652	0.675		0.653	0.676	
No. of obs.	15,414	17,848		15,414	17,848	

Panel B. Term spread subsamples

	Dependent variable: 5-year CDS spread (bps)					
	All funds			Active only		
	(1)	(2)	(3)	(4)	(5)	(6)
	High term spread	Low term spread	Coeff. diff. test (*t*-stat)	High term spread	Low term spread	Coeff. diff. test (*t*-stat)
Fund holding share (%)	0.624***	0.368**	0.256	0.772***	0.507***	0.265
	(3.19)	(2.36)	(1.26)	(3.60)	(2.96)	(1.20)
Controls	YES	YES		YES	YES	
Credit-rating-by-month FE	YES	YES		YES	YES	
Adjusted R-squared	0.663	0.650		0.665	0.652	
No. of obs.	16,863	16,399		16,863	16,399	

Table A.3. Fund Acquisitions and Credit Risk: Alternative Sample Window

In this table we engage in a robustness check on Table 7 by considering a shorter sample window. For the same 54 inter-family fund acquisitions identified in Table 7, we track our target funds' holdings for the 6-month period preceding the acquisition month and restrict our sample to all firm-month observations where one of our target funds held non-zero amount of the firm's outstanding bonds in the 6-month pre-acquisition period. When we consider the holding share of active funds only, we only consider active target funds, resulting in a smaller subsample. All controls are identical to Table 7. *t*-statistics based on standard errors that are robust to heteroskedasticity and two-way clustered by firm and month are reported in parentheses below the coefficient estimates. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: 5-year CDS spread (bps)	
	(1) All funds	(2) Active only
Fund holding share (%)	0.991***	1.153***
	(4.59)	(5.34)
Fund holding share × Fund acquisition dummy	-0.557*	-0.669**
	(-1.95)	(-2.43)
Fund acquisition dummy	14.979	14.299*
	(1.52)	(1.78)
Controls	YES	YES
Credit-rating-by-month FE	YES	YES
Adjusted R-squared	0.673	0.684
No. of obs.	1,886	1,726

about ECGI

The European Corporate Governance Institute has been established to improve *corporate governance through fostering independent scientific research and related activities.*

The ECGI will produce and disseminate high quality research while remaining close to the concerns and interests of corporate, financial and public policy makers. It will draw on the expertise of scholars from numerous countries and bring together a critical mass of expertise and interest to bear on this important subject.

The views expressed in this working paper are those of the authors, not those of the ECGI or its members.

Electronic Access to the Working Paper Series

The full set of ECGI working papers can be accessed through the Institute's Web-site (www.ecgi.org/wp) or SSRN:

Finance Paper Series	http://www.ssrn.com/link/ECGI-Fin.html
Law Paper Series	http://www.ssrn.com/link/ECGI-Law.html