Bond Funds and Credit Risk*

Jaewon Choi
University of Illinois
Urbana-Champaign

Amil Dasgupta
London School of Economics
and ECGI

Ji Yeol Jimmy Oh
Hanyang University

This Draft: March 14, 2020

Abstract

We show that supply side effects arising from the bond holdings of open-end mutual funds affect corporate credit risk. In our model, funds exposed to flow-performance relationships are reluctant to refinance bonds of companies with poor cash flow prospects fearing future investor outflows as a result of potential default events. This lowers refinancing prices, enhancing incentives for strategic default by equityholders, engendering a positive association between bond funds' presence and credit risk. Empirically, we find that in firms with poor cash flow prospects, mutual fund bond holdings is associated with increased CDS spreads, more so when funds are more sensitive to flows. We address endogeneity issues by using the acquisitions of management companies as 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. We are grateful to audiences at the Bank of England, the Conference on Asia-Pacific Financial Markets (CAFM), Cornell, and at UNIST for helpful comments. Dasgupta acknowledges financial support from the ESRC via Research Grant ES/S016686/1.

Bond Funds and Credit Risk

This Draft: March 14, 2020

Abstract

We show that supply side effects arising from the bond holdings of open-end mutual funds affect corporate credit risk. In our model, funds exposed to flow-performance relationships are reluctant to refinance bonds of companies with poor cash flow prospects fearing future investor outflows as a result of potential default events. This lowers refinancing prices, enhancing incentives for strategic default by equityholders, engendering a positive association between bond funds' presence and credit risk. Empirically, we find that in firms with poor cash flow prospects, mutual fund bond holdings is associated with increased CDS spreads, more so when funds are more sensitive to flows. We address endogeneity issues by using the acquisitions of management companies as 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 investor redemptions. Funds care about investor flows since they are compensated via flat assets under management fees, and thus reductions in future flow affect their payoffs directly; in other words, open-ended bond funds are *flow-motivated*. Investor flows, in turn, respond positively to fund performance generating so-called *flow-performance relationships*.[1] These two factors, when combined with the strategic default incentives of equityholders, can increase the credit risk of corporations. For example, a negative outlook for a company rolling over its debt may make bond funds reluctant to refinance, because a potential subsequent default event may impose higher penalties on funds. While financial losses from default affect all investors, open-end funds are additionally exposed to potential outflows, reducing their willingness to participate in refinancing, thus increasing rollover risk faced by corporations. Rollover risk fosters credit risk because failure to negotiate favorable rollover prices strengthens equityholders' default incentives, generating a feedback loop. In other words, the incentives of the *suppliers* of capital for corporate bonds may affect the nature of credit risk in the economy.

The literature has not yet examined how the changes in the composition of capital supply, as represented by the emergence of open-end funds, affects rollover risk, focusing instead either on demand-side (i.e., borrower-level) factors or on the role of aggregate market conditions. The former strand of the literature emphasizes how—in the presence of credit market imperfections—firms may face difficulty rolling over short

[1] There is a long list of papers documenting the positive flow-performance relationship, for example, Chevalier and Ellison (1997), Sirri and Tufano (1998), and Spiegel and Zhang (2013) among many others. Chen, Goldstein, and Jiang (2010) and Goldstein, Jiang, and Ng (2017) show that the relationship is positive but concave for funds holding illiquid securities including corporate bonds.

term debt when faced with declining collateral values (e.g., Diamond, 1991, Titman, 1992, and Gopalan, Song, Yerramilli, 2014; Chen, Xu, and Yang, 2019). The latter strand emphasizes how changes in market conditions can exacerbate rollover risk and thus affect credit risk (e.g., Acharya, Gale, and Yorulmazer 2011; He and Xiong 2012; He and Milbradt 2014; Valenzuela, 2016; Chen, Cui, He, and Milbradt 2017; and Nagler 2019). In this paper, we propose a novel *supply-side* (i.e., lender-level) channel through which rollover risk may interact with credit risk. We show theoretically that the incentive schemes of capital suppliers may exacerbate rollover risk and confirm empirically that the extent to which a firm's bonds are held by open-end funds is robustly associated with an increase in its 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 flows. At the interim date, a firm's existing debt matures and needs to be refinanced by bondholders. Any loss that accrues from refinancing can be borne by the firm's equityholders, who have deep pockets.[2] However, if the equilibrium refinancing price is too low, equityholders will refuse to bear the losses and strategically default on the existing debt. We then separately derive the equilibrium refinancing prices under flow-motivated bondholders ("funds") and standard profit-maximizers ("individuals"), respectively, and compare the two.

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 that—in addition to profit or losses from bond investment—funds derive additional utility from being perceived to be well-informed by their principals. This is a short-hand for flow motivations: since investors prefer to invest with well-informed funds, being viewed as being well-informed is likely to enhance future investor flows. Funds thus contemplate whether their action, i.e., whether to buy the bond at refinancing, would enhance or damage their posterior probability of their being viewed as being well informed.

[2] 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.

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 in the presence of open-ended funds.

From this set-up, we derive the following empirical implications. First, when a firm's future cash flow prospects are poor, funds are reluctant to refinance because of its unfavorable implications on future flows, resulting in a comparatively lower bond price. This strengthens equityholders' strategic default incentives, leading to a positive association between bond funds' presence and credit risk for such firms. Our analysis also shows that flow motivations have an asymmetric effect. That is, while flow motivations could also lead funds to overbid at bond refinancing when the firm has strong cash flow prospects, under such circumstances, equityholders will not default in the first place, so the presence of funds will not have an impact on credit risk. Thus, the effect of flow-motivated bondholders will be asymmetric, clustered amongst firms with poor cash flow prospects. Second, the presence of open-ended funds results in a deeper price discount as their degree of flow motivation becomes more severe, thus exacerbating the effect on credit risk.

The empirical literature on bond fund flows suggests that there is asymmetry (concavity) in the flow-performance relationship due to a first-mover advantage for withdrawing investors (Chen, Goldstein, Jiang, 2010; Goldstein, Jiang, and Ng 2017). We emphasize that our results do not rely on any notion of first-mover advantage. The asymmetry in the credit-risk impact of flow-motivated bond funds is a combined consequence of (i) funds being rewarded for making informed choices and (ii) the strategic default incentives of shareholders. This distinction is particularly relevant from a policy perspective because, while various regulations such as swing pricing are being put into place to limit the effect of first-mover advantage (and thereby mitigate concavity in flow-performance sensitivity), our analysis suggests that this will *not* eliminate the effect of bond funds 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, which we use as a cleaner measure of credit risk than bond spreads following He and Xiong (2012).

Consistent with our fist theoretical prediction, we document a strong asymmetry in the relationship: the positive relationship between fund holding share and CDS spread is only in evidence among firms rated BBB or below, i.e., firms with poor cash flow prospects. Specifically, a one-standard-deviation increase in the share of bond funds among firms rated BBB or below is associated with an increase in the next-month five-year CDS spread of 19 bps—which corresponds to over a tenth of the average CDS spread for such firms. In contrast, we do not find a significant relationship between fund holding share and CDS spread among firms rated A or above. Similarly, interacting 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. In both instances, the statistically significant relationship between holding share and CDS spreads is more pronounced when we consider the holding share of active funds only, for whom a default within their holding serves as an informative signal about their ability. This is consistent with the underlying mechanism of our model.

We then examine our second prediction: that the positive relationship between fund holding share and CDS premium strengthens for more flow-motivated funds. Our proxies for funds' exposure to outflow risk include fund flow volatility, past fund performance, management company size, and rear-load fees. We find that the holding share of funds with poor recent return or high flow volatility has a more significant positive impact on the next-period CDS spreads. Likewise, 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. As before, these effects are concentrated amongst firms with poor cash flow prospects, further confirming our first theoretical prediction.

The results described to date leave open the possibility that, instead of an increase in fund holding share driving a subsequent increase in a firm's credit risk as our model posits, mutual funds are drawn to firms with higher credit spreads in an attempt to "reach for yield" (Becker and Ivashina, 2015, Di Maggio and Kacperczyk, 2017, Choi and Kronlund, 2018). We address the possibility of such reverse causality through two additional analyses. First, in our conceptualization, the presence of bond funds *at refinancing* elevates a firm's level of credit risk because flow motivated funds are less likely to rollover expiring bonds with poor cash flow prospects. If so, the effect of high fund holding share on credit spreads should be *stronger* when refinancing events are imminent. In contrast, to generate a similar "imminence" effect from reverse causality would require that funds especially want to hold high credit-spread firms right before refinancing events, which seems less plausible. We thus interact fund holding share with a near-maturity dummy, which takes the value of 1 if a firm has a maturing bond within the next 3 or 6 months, and our theoretical framework suggests a significantly positive coefficient for this interaction term. We find this to be 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. As before, these results are also concentrated amongst lower-rated firms, consistent with our underlying prediction on the role of poor cash flow prospects.

Second, previous studies document reaching-for-yield behavior to be prominent during periods of low interest rate and relative market calm because in such periods the costs of risk taking is lower while the benefits are higher (e.g., Choi and Kronlund, 2018). In light of these findings, we re-estimate our baseline regression results separately for default-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 default 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 funds' reaching-for-yield behavior.

Nevertheless, it is still possible that some omitted aspect of firm fundamentals could simultaneously drive both its CDS spread as well as fund holdings, thereby generating a spurious relationship. Fund trading is driven largely by fund managers' information on the fundamentals of bond issuers, which is also likely to be correlated with the credit risk of the issuers. 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 family of a target fund is acquired by 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 merger decisions are made at the family level for reasons unrelated to the fundamentals of member firms' holdings so that the mergers affect the credit risk of bond issuers only through changes in the 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.

We contribute to the literature in several ways. At the broadest level, we extend the literature on 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. That literature offers a rich discussion on how these demand-side (i.e., firm-level) characteristics interact with the incentives of debt and equity holders. A strand of the literature on debt rollover risk (e.g., Diamond, 1991; Titman, 1992; Gopalan, Song, and Yerramilli 2014; Chen, Xu, and Yang, 2019) also focuses on demand-side characteristics. In contrast, following the 2008 financial crisis, an influential new strand of the literature on rollover risk emphasizes how changes in market conditions can exacerbate rollover risk and thus affect credit risk (e.g., Acharya, Gale, and Yorulmazer, 2011, He and Xiong, 2012; He and Milbradt, 2014; and Chen, Cui, He, and Milbradt, 2017). In contrast to all of these papers, 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. 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. Second, 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.[3] We denote by p the equilibrium price of the new bond.[4]

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 prior of V at $t=1$ with $\gamma_V=\Pr(V=\bar{V})$, which reflects the firm's future cash flow prospects. Then:

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

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:

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

[3] 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.

[4] 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.

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 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 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, good types observe the firm's terminal cash flow with certainty, while the signal of a bad type is no better than 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. While this assumption—common in the signal jamming literature—simplifies the analysis, it is worth noting that Dasgupta and Prat (2008) show that incentives in this class of models are qualitatively unchanged even if agents know their types, as long as such self-knowledge isn't perfect. 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 independent of each other. We now state the fund's payoff at $t = 2$, given by:

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

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 fund 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 fund being of the good type, i.e., the fund's "reputation," improves, the manager is rewarded in the form of additional flows, for example. This flow additionally compensates the fund, and κ then measures the fund's intensity of flow motivation.[5] Microfoundations for such payoff functions can be found in Dasgupta and Prat (2008).[6]

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 are rewarded (or penalized) for making correct (or incorrect) choices on the equilibrium

[5] 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.

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

path, since choices are correlated with information, and information is correlated with underlying ability. Given the evidence on positive flow-performance relationships faced by bond funds (e.g., Goldstein, Jiang, and Ng, 2017), we focus on separating equilibria.[7] 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 funds with 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, funds 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 funds' likelihood of being viewed as the good type at $t = 2$ compared to staying out of the refinancing game, they have an additional reason to participate in the refinancing; the reverse holds if funds are less likely to be viewed as being of the good type. The second term in (4) captures the expected reputation gain or loss – i.e. flow rewards or penalties – to high signal funds from participating in the refinancing vs. not doing so. Thus, the price in (4) extracts the high-signal

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

funds' full willingness to pay. At the equilibrium price, therefore, high-signal funds are indifferent between refinancing or not. Given that high-signal funds are indifferent between refinancing or not at equilibrium prices, the less optimistic low-signal funds will clearly strictly prefer not to participate, thus completing the equilibrium argument.

In the above equilibrium, posterior reputation—and thus, implicitly, flow—is positively correlated with correct choices; 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 $t = 2$ or by declining at $t = 1$ to refinance bonds of companies that do default at $t = 2$.

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. The following proposition, which we state without proof, then follows immediately:

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 $p = \Pr(V = \bar{V} | s = \bar{V})$.

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^*. We show that:

Proposition 4 (Comparing equilibrium bond prices). $p_f^* \leq p^*$ if and only if $\gamma_V \leq \frac{1}{2}(1-\gamma_\tau)$.

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. This is because, as γ_V gets progressively smaller, despite having observed $s = \bar{V}$, high signal funds believe it to be progressively less likely that V will turn out to be $\bar{V}$, and thus – since in equilibrium it is only desirable to be "seen to have participated" when $V = \bar{V}$, their flow-driven willingness to pay diminishes, progressively reducing p_f^* relative to p^*. The oppose is true as γ_V gets progressively large.

Moreover, a lower γ_V increases the refinancing price threshold at which 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 potentially to an increase in the likelihood of strategic default and hence increased credit risk. We explore this connection next.

2.5. Asymmetric impact of flow motivations

We show that the presence of flow-motivated bondholders has an *asymmetric* effect. That is, these investors are willing to underpay (overpay) for low (high) cash-flow prospect firms, but such behavior affects default risk only for low cash-flow prospect firms.

We first check that potential bondholders' flow motivations are relevant from equityholders' perspective. In other words, we need to rule out a case where 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 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, strategic default would not arise when standard profit-maximizers participate at the refinancing stage but does arise with flow-motivated participants. 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 equityholders choose to default strategically. At $\bar{\gamma}_V(\bar{V})$, equity holders would be exactly indifferent between strategically defaulting or not with profit-motivated bondholders, whereas with flow-motivated bondholders, they would strictly prefer to default. By continuity, for a positive-measure region to the immediate right of $\bar{\gamma}_V(\bar{V})$, there would be no strategic default if and only if bondholders are flow-motivated. Intuitively, the infrequent strategic default condition corresponds to a situation where equityholders are promised with an unlikely but large cash flow in case of success at $t=2$. Thus, 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.

It is clear that, under the infrequent strategic default condition, default never arises even with profit-motivated bondholders when $\gamma_V > \frac{1}{2}(1-\gamma_\tau) > \bar{\gamma}_V(\bar{V})$. For such "positive cash-flow prospects" firms, the presence of flow-motivated bondholders makes no difference to strategic default incentives, even though they are willing to "overpay" at refinancing ($p_f^* > p^*$). Thus, the presence of flow-motivated bondholders has an *asymmetric* effect: it affects the default probability only for firms with *low* cash-flow prospects.

2.6. Testable implications

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

(i) (*Mutual funds' bond holdings and credit risk*) When a firm has poor cash flow prospects, the presence of flow-motivated funds at refinancing increases credit risk.

(ii) (*Flow concerns and credit risk*) Funds with greater flow concerns will demonstrate more reluctance to refinance poorly performing firms, increasing the effect of fund holdings on future credit risk.

Given that the presence of flow-motivated funds reduces the price of refinanced bonds for firms with relatively bad prospects, 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 firms' credit risk. The effect of their presence, however, will be concentrated among poorly performing firms. For firms with good cash flow prospects, flow-motivated funds may be tempted to overbid relative to standard profit-maximizing bondholders for bonds at refinancing. But, for these types of firms, equityholders are unlikely to call for strategic default in the first place, so the presence of flow motivated funds is unlikely to impact credit risk.

Furthermore, we expect that, for funds with greater flow-related concerns (high κ), the effect of funds' bond holdings on credit risk would be stronger, because such funds will be more unwilling to purchase bonds at refinancing, leading to greater default risk. We now proceed to empirically test the model's implications using the data on mutual funds' bond holdings and credit 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 data

Using the fund holdings data from Morningstar from 2001 through 2014, 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);[8] 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 latest available holdings information within the past six months.[9] We obtain further information on each fund using the CRSP Mutual Funds databases.

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.[10] 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. Main variable construction

We construct our main explanatory variable, fund holding share, defined as the fraction of total bond amounts of an issuer held by bond funds, using our holdings data. At each month-end, we first sum bond amounts held by our sample funds for each corporate bond.[11] We then aggregate each bond-month

[8] 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.

[9] 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.

[10] 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."

[11] Bonds with Morningstar *sectype* code B, BF, or BI are classified as corporate bonds.

observation into firm-month observation and calculate fund holding share by dividing the total mutual fund holdings with the total amount outstanding.

Using fund returns and total net assets from the CRSP Mutual Funds databases, we 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. For a detailed definition of each variable in our study, refer to Appendix C.

3.4. Summary statistics

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. While 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. We observe substantial cross-sectional variation in fund holding share, 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 funds throughout our sample period,[12] average fund holding share in our sample increases over time (untabulated); the fund holding share of active funds, for example, increases from 21.7% in 2002 to 32.0% by 2013.

TABLE 1 HERE

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

4. Empirical Results

4.1. Fund holdings and credit risk

We first examine the effect of fund holding share on CDS premium. Our model predicts that the presence of flow-concerned funds should have a significant impact on credit risk *only* among firms with poor cash flow prospects. To test this prediction, we consider two proxies of firms' cash flow prospects. First, we interact fund holding share with two mutually exclusive dummy variables, one for those rated A and above and another for those rated BBB or below.[13] Second, we interact fund holding share with rolling 1-year stock returns of bond issuers. We then run the following set of panel regressions:

$$CDS\ Premium_{i,t} = \alpha + \beta \cdot Fund\ Holding\ Share_{i,t-1} \times I(A\ or\ above) + \gamma \cdot Fund\ Holding\ Share_{i,t-1} \times I(BBB\ or\ below) + \boldsymbol{\omega} \cdot \boldsymbol{Controls_{i,t-1}} + \varepsilon_{i,t} \quad (7)$$

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

where $CDS\ Premium_{i,t}$ is the 5-year CDS spread of firm i in month t. The control variables are based on the previous studies on credit risk, for example, Collin-Dufresne, Goldstein, and Martin (2001) and Zhang, Zhou, and Zhu (2009). As firm-level variables, we include the first four moments of stock returns (1-year stock return, volatility, skewness, and kurtosis), log assets, leverage, return on equity, dividend payout per share, recovery rate, and dummy variables for credit rating. As market-level variables, we include one-month S&P 500 index return, 3-month T-Bill rate, term spread, and VIX. 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) and (8), we also perform subsample analyses of active funds only to compare the effect of holding shares on credit risk between active funds and passive funds. We expect the effect of holding shares to be pronounced particularly in active funds because losses incurred from default

[13] We split our credit rating subsample at the A-BBB boundary rather than the traditional IG-HY boundary of BBB-BB because high yield firms constitute a relatively small percentage of our sample, as shown in Table 1.

should provide a stronger signal of managerial skills and flows would respond accordingly. For passive funds, 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. In addition to the fund holding share's interaction with credit rating dummies or one-year stock return, we also present the baseline regressions of CDS premium on fund holding share. Table 2 presents our results.[14]

TABLE 2 HERE

Panel A of Table 2 first presents the baseline effect of fund holding share on CDS premium across all firms. Regardless of how fund holding share is measured, and regardless of the fixed effect specification, we find a significantly positive association between fund holding share and the next-period CDS premium. Crucially, as predicted by our model, Panel B reveals that the effect of fund holding share and the next-period CDS spread is statistically significant among firms with credit rating below BBB. For firms with A rating or above, we fail to observe a statistically significant relationship between fund holding share and the next-period CDS spread. 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 rated BBB or below. In terms of economic magnitude, column (4) of Panel B implies that a one-standard-deviation increase in active funds' holding share among firms rated BBB or below (22.32%) is associated with a 19 bp increase in the next-period CDS premium. Given that the average CDS spread of the firms rated BBB or below stands at around 171 bps, the increase amounts to over a tenth of the average spread.

The fact that we observe a statistically significant relationship between fund holding share and the next-period CDS spread among firms with poor credit ratings further highlights the importance of the changing *supply-side* landscape of the market for corporate bonds and the relevance of our theoretical framework. These firms with relatively poor credit ratings are deemed unattractive from an investment perspective for a vast majority of heavily risk-constrained long-money institutions such as pensions and life insurance firms, making them more dependent on flow-concerned mutual funds as a potential provider of debt capital.

[14] For brevity, we do not report the coefficients of our control variables. The full estimation results for Table 2 Panel A is presented in Appendix Table A.1.

In Panel C, 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.[15]

As a robustness check, in Table A.2 in the Appendix, we estimate the results reported in columns (3) and (4) of Panels A and B, albeit with CDS spread, fund holding share, and all controls expressed in change rather than in level forms, to account for the fact that a firm's CDS spread tends to exhibit high autocorrelation. Even with this change-on-change specification, an increase in fund holding share is associated with a significant increase in the next-period CDS spread among firms rated BBB or below, with statistical significance at the 5% level. Taken together, Table 2 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. 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 4.3 and 4.4 by focusing on bond rollover decisions, turbulent market times, and shocks to fund flow sensitivity around fund mergers.

4.2. Credit risk and fund 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 circumstances under which fund managers' flow concerns are more 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.,

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

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.[16] 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 compare a fund's characteristics against their Lipper category median because these are funds' natural peers; investors are likely to assess a fund's performance relative to other funds with similar investment mandate.[17] In Panel A of Table 3, we then re-estimate column (4) of Table 2 Panel A 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. In Panel B, we interact the fund holding share of high- and low-group with the mutually exclusive credit rating dummies, as in Table 2 Panel B. Table 3 presents our results.

[16] 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.

[17] 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 3 HERE

Column (1) of Table 3 Panel A 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) of Panel A 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) of Panel A 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) of Panel A 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.

In Panel B, we examine whether the incremental effect of the holding share of funds with higher flow-related concerns on credit risk is concentrated around poor cash flow prospect firms. Results indicate that the incremental effect of flow-concerned funds' holding share on credit risk is particularly concentrated among firms rated BBB or below. Whereas the subsample coefficient of difference between the high and the low groups' holding shares is always significant at the 10% level for firms rated BBB or below, statistical significance is much weaker among firms rated A or above. This is in line with our model's predictions, with the degree of flow motivations (i.e., κ) exacerbating the relationship between fund holding share and credit risk mainly among firms with poor cash flow prospects.

4.3. Rollover channel or reaching for yield?

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. In other words, our observed empirical patterns may arise as a result of reverse causality. 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,"[18] while Di Maggio 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 prevalent reaching-for-yield behavior among corporate bond mutual funds during periods of low interest rate and default spread.

To address this reverse causality issue, we engage in a number of additional analyses. First, our model's conceptual 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. In contrast, to generate a similar effect from reverse causality would require that funds specially want to hold high credit-spread firms right before refinancing events. This alternative story

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

seems less plausible because it implies that funds would increase holdings in high credit risk firms particularly before bond maturities even when other covariates including credit risk are being controlled for.

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 (3) and (4) of Table 2 Panel A with the interaction of fund holding share and the near-maturity dummy. In Panel B, we then separately consider the effect of the near-maturity dummy for firms rated A and above vs. BBB or below, by first interacting fund holding share with two mutually exclusive credit rating dummies, and then interacting the resulting two variables with the near-maturity dummy. Table 4 presents our results.

TABLE 4 HERE

Table 4 Panel A 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. In Panel B, we further find that the heightened relationship between fund holding share and CDS spread around bond maturities is particularly pronounced for poor cash flow prospect firms, i.e., those rated BBB or below. While the fund holding share has insignificant effect on CDS spread for firms rated A or above, be it during normal times or around bond maturities, we find that a one-standard-deviation increase in the holding share of active funds increases the CDS spread of firms rated BBB or below by more than 34 bps during the quarter preceding a firm's bond maturity. Table 4 thus highlights the relevance of our rollover channel.

In addition to our analysis of fund holding share and CDS spread around bond maturities, we also examine the overall market conditions. Existing studies on "reaching for yield" 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 main regressions using active funds' holding share in column (4) of Table 2 Panels A and B for each subsample. We further test the subsample difference in coefficients for the fund holding share terms 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 5 presents our results.

TABLE 5 HERE

In Panel A, we find that a one-standard-deviation increase in active funds' holding share increases the next-month CDS spread by around 18 bps during periods of high default spread, with statistical significance at the 1% level, but the corresponding figure falls to around 8 bp for the low default spread subsample and statistical significance disappears. The subsample coefficient difference is also significant at the 5% level. Regression results using VIX-based subsamples are qualitatively similar, with the relationship between fund holding share and the next-period CDS spread substantially stronger during periods of high VIX. In Panel B, we confirm that the subsample difference is only significantly positive among firms rated BBB or below, regardless of whether the subsamples are formed using default spread or 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 5.[19]

[19] In Table A.4 in the Appendix, we re-run the subsample regressions in Table 5 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

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

Another potential endogeneity concern in our empirical analyses is that fund holdings and issuer credit risk may be simultaneously determined, and thus an omitted variable could affect both the firm's credit risk as well as fund holdings. After all, fund trading decisions are likely to be driven by fundamental information about bond issuers, which can also affect their CDS spreads. Any omitted firm-level fundamental affecting both the credit risk and fund holdings could thus generate a spurious relationship. Although the empirical patterns found in Tables 4 and 5 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 sample of target funds held non-zero holdings over the 12-month period leading up to its acquisition.[20] For this subsample, we estimate the following regression:

from the funds' strong risk-taking behavior amid zero interest rate policy found in Choi and Kronlund (2018) or Di Maggio and Kacperczyk (2017).

[20] As revealed in Table A.5 in the Appendix, the results remain qualitatively unchanged when we consider a shorter window of 6 months.

$$CDS\ Premium_{i,t} = \alpha + \beta \cdot Fund\ Holding\ Share_{i,t-1} + \gamma \cdot Fund\ Acquisition_{i,t-1}$$

$$+ \delta \cdot Fund\ Holding\ Share_{i,t-1} \times Fund\ Acquisition_{i,t-1} + \boldsymbol{\omega} \cdot \boldsymbol{Controls_{i,t-1}} + \varepsilon_{i,t}, \tag{9}$$

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. Given our earlier results, we focus on the holding share of active funds only. 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. We also separate the effect of fund acquisition between rich and poor cash flow prospect firms by interacting the fund holding share with the two mutually exclusive credit rating dummies and then interact the fund acquisition dummy with the two resulting variables.

Moreover, in order to instill further confidence in our analysis of fund acquisition, we also engage in a "placebo" analysis. Instead of the fund acquisition dummy, we construct a "placebo" dummy with a three-month lag. In other words, instead of the indicator variable taking the value of one when a fund acquisition occurs during the following month, our placebo dummy takes the value of one when a fund acquisition occurs in four months' time. If the fund acquisition is the main driver of a reduced CDS premium, we ought to observe a significantly negative δ when the true fund acquisition dummy is used but not when we use the placebo fund acquisition dummy instead. Table 6 presents our results.

TABLE 6 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 (1) reveals, a one-standard-deviation increase in the holding share of active funds (amounting to 21.3% for our subsample) increases the next-period 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. Though the effect of active funds' holding share falls both for high and low credit rating firms during the month of fund acquisition, as shown in column (2), both the statistical significance and the economic magnitude are stronger for firms rated BBB or below, in line with our theoretical framework. 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, particularly for firms with poor cash flow prospects; 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. In contrast, interacting the active funds' holding share with the "placebo" fund acquisition dummy yields insignificant results, further highlighting the relevance of our setting of fund acquisitions.

5. Conclusion

Through a simple illustrative model and a series of empirical analyses, we show that firms with a large share of their corporate bonds held by bond mutual funds subsequently experience an increase in credit risk. Our model shows 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 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 support the model's predictions. A one-standard-deviation increase in the bond holding share of active bond funds increases a firm's next-period CDS premium by around 19 bps compared to its credit rating peers for firms rated BBB or below. This relationship becomes stronger in statistical and economic significance 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 substantially ahead of a firm's debt maturity, confirming the importance of the refinancing channel at work in the model, and distinguishing our findings from "reaching for yield" by bond funds. We provide further evidence against reverse causality via subsample analyses which shows that our results are stronger in turbulent market periods, which are less associated with reaching for yield. Finally, we exploit acquisitions of funds into larger families as an exogenous shock to funds' flow motivations to further allay endogeneity concerns.

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, Hui, Yu Xu, and Jun Yang, 2019, Systematic risk, debt maturity, and the term structure of credit spreads. Unpublished working paper, Massachusetts Institute of Technology.

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.

Diamond, Douglas W., 1991, Debt maturity structure and liquidity risk, *Quarterly Journal of Economics* 106, 709-737.

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.

Gopalan, Radhakrishnan, Fenghua Song, and Vijay Yerramilli, 2014, Debt maturity structure and credit quality, *Journal of Financial and Quantitative Analysis* 49, 817-842.

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, 2019, Yield spreads and the corporate bond rollover channel, *Review of Finance*, forthcoming.

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.

Titman, Sheridan, 1992, Interest rate swaps and corporate financing choices, *Journal of Finance* 47, 1503-1516.

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

Valenzuela, Patricio, 2016, Rollover risk and credit spreads: Evidence from international corporate bonds, *Review of Finance* 20, 631-661.

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

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

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

$$\underbrace{\Pr(V = \bar{V} | s = 0) \cdot 1}_{\text{No default at } t=2} + \underbrace{\Pr(V = 0 | s = 0) \cdot 0}_{\text{Default at } t=2} - p + \kappa E(\Pr(\tau = G | a = 1, V) | s = 0), \tag{A.3}$$

which, upon substituting in the price, becomes

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

$$E(\Pr(\tau = G | a = 1, V) | s = 0) - E(\Pr(\tau = G | a = 1, V) | s = \bar{V})\}. \tag{A.4}$$

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:

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

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

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:

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

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

$$E(\Pr(\tau = G|a = 1, V)|s = 0) = \frac{\gamma_V(1-\gamma_\tau)}{1+\gamma_\tau-2\gamma_V\gamma_\tau}\frac{2\gamma_\tau}{1+\gamma_\tau}, \tag{A.20}$$

$$E(\Pr(\tau = G|a = 0, V)|s = 0) = \left(1 - \frac{\gamma_V(1-\gamma_\tau)}{1+\gamma_\tau-2\gamma_V\gamma_\tau}\right)\frac{2\gamma_\tau}{1+\gamma_\tau}. \tag{A.21}$$

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.4) 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.21), 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. $\square$

Proof of Proposition 4. First, note that:

$$p_f^* - p^* = \kappa\{E(\Pr(\tau = G|a = 1, V)|s = \bar{V}) - E(\Pr(\tau = G|a = 0, V)|s = \bar{V})\}. \qquad \text{(A.22)}$$

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

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

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

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:

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

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:

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

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, Credit Risk, and Cash Flow Prospects

In Panel A of this table we report the baseline firm-month level panel regression results of CDS premium on fund holding share. In columns (1) and (2), we include market-level controls and credit rating fixed effect, while in columns (3) and (4), we include credit-rating-by-month fixed effect. In columns (1) and (3), we use the holding share of all funds, while in columns (2) and (4), we use the holding share of active funds only. In Panel B, we interact fund holding share with two indicator variables, namely a dummy for credit rating of A or above, and another with credit rating of BBB or below. In Panel C, we report the panel regression results with an interaction term between fund holding share and 1-year stock return. In Panel B, we further report F-statistic testing the hypothesis that the two coefficients are equal. Controls are 1-year realized volatility, skewness, and kurtosis, recovery rate, firm size, leverage, ROE, and dividend payout per share, and in the cases of columns (1) and (2), 1-month S&P 500 return, 3-month T-Bill rate, term spread, and VIX. 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.

Panel A. Baseline regressions

	Dependent variable: 5-year CDS spread (bps)			
	(1) All funds	(2) Active only	(3) All funds	(4) Active only
Fund holding share	0.507***	0.651***	0.503***	0.642***
	(3.33)	(4.05)	(3.48)	(4.06)
Controls	YES	YES	YES	YES
Credit rating FE	YES	YES	NO	NO
Credit-rating-by-month FE	NO	NO	YES	YES
Adjusted R-squared	0.579	0.581	0.663	0.664
No. of obs.	33,436	33,436	33,262	33,262

Panel B. Credit rating interactions

	Dependent variable: 5-year CDS spread (bps)			
	(1) All funds	(2) Active only	(3) All funds	(4) Active only
Fund holding share ×	0.109	-0.026	0.029	-0.068
I(A or above) (%)(1)	(0.72)	(-0.16)	(0.19)	(-0.41)
Fund holding share ×	0.627***	0.830***	0.649***	0.836***
I(BBB or below) (%)(2)	(3.48)	(4.30)	(3.60)	(4.33)
F-statistic: (1) = (2)	6.58**	13.25***	7.08***	12.99***
Controls	YES	YES	YES	YES
Credit rating FE	YES	YES	NO	NO
Credit-rating-by-month FE	NO	NO	YES	YES
Adjusted R-squared	0.579	0.581	0.663	0.664
No. of obs.	33,436	33,436	33,262	33,262

Panel C. 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 (%)	0.638***	0.850***	0.627***	0.807***
	(3.55)	(4.47)	(3.72)	(4.38)
Fund holding share ×	-0.938***	-1.357***	-0.877***	-1.106***
1-year stock return (%)	(-3.07)	(-4.26)	(-3.19)	(-3.83)
1-year stock return (%)	-0.476***	-0.380***	-0.720***	-0.687***
	(-3.11)	(-2.75)	(-5.10)	(-5.41)
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	0.584	0.663	0.665
No. of obs.	33,436	33,436	33,262	33,262

Table 3. Fund Characteristics, Fund Holdings, and Credit Risk

In this table, we re-run the baseline regressions in column (4) of Table 2 Panel A, as well as the credit rating interactions in column (4) of Table 2 Panel B using active funds' holding shares, albeit 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 (4) of Table 2 Panel A, with credit-rating-by-month dummies. In Panel A, we report the regressions of CDS spread on high- and low-group active funds' holding shares. We further report F-statistic testing the hypothesis that the coefficients of high- and low-group holding shares are equal. In Panel B, we interact high- and low-group active funds' holding shares with credit rating-based dummies as in Table 2 Panel B. We further report the F-statistic testing the equality of high- and low-groups' coefficients, separately for those rated A or above vs. BBB or below. *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. High- vs. low-group baseline regressions

	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 (%)(1)	0.453***	1.177***	0.447***	0.519***
	(2.62)	(4.42)	(2.79)	(3.00)
Low-group holding share (%)(2)	0.906***	0.436**	1.262***	1.040***
	(4.46)	(2.31)	(3.96)	(3.84)
F-statistic: (1) = (2)	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

Panel B. High- vs. low-group regressions: Credit rating interactions

	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 ×	-0.271	0.156	-0.184	-0.014
I(A or above) (%)(1)	(-1.49)	(0.43)	(-0.97)	(-0.07)
Low-group holding share ×	0.233	-0.165	0.375	-0.255
I(A or above) (%)(2)	(0.88)	(-0.94)	(1.21)	(-0.87)
High-group holding share ×	0.673***	1.407***	0.634***	0.682***
I(BBB or below) (%)(3)	(3.12)	(4.50)	(3.21)	(3.15)
Low-group holding share ×	1.066***	0.615**	1.459***	1.317***
I(BBB or below) (%)(4)	(4.41)	(2.58)	(3.92)	(4.08)
F-statistic: (1) = (2)	3.29*	0.74	2.81*	0.47
F-statistic: (3) = (4)	2.81*	4.17**	4.80**	3.35*
Controls	YES	YES	YES	YES
Credit-rating-by-month FE	YES	YES	YES	YES
Adjusted R-squared	0.664	0.665	0.666	0.665
No. of obs.	33,262	33,262	33,262	33,262

Table 4. 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 Panels A and B, albeit with an interaction term between fund holding share (or its interaction with credit rating-based dummies) 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 (3) and (4) in Table 2 Panel A, whose coefficient estimates we do not report. In Panel B, we report the F-statistics testing (i) the equality of coefficients between fund holding share's interaction with A or above vs. BBB or below dummies, which is equivalent to testing the equality of coefficients when a firm does not have a bond nearing maturity, and (ii) the equality of coefficients between the sum of fund holding share's interaction with the A or above dummy and its respective interaction with the near-maturity dummy vs. the sum of fund holding share's interaction with the BBB or below dummy and its respective interaction with the near-maturity dummy, which is a test of coefficient equality between high vs. low credit rating firms around a firm's bond maturity. *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. Baseline regressions: Interaction with near-maturity dummy

	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*** (3.16)	0.577*** (3.69)	0.431*** (2.96)	0.543*** (3.45)
Fund holding share × Near-maturity dummy	0.536** (2.25)	0.752** (2.39)	0.446** (2.26)	0.618** (2.44)
Near-maturity dummy	-19.180** (-2.50)	-21.502*** (-2.82)	-15.491** (-2.22)	-17.345*** (-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

Panel B. Credit rating interactions: Interaction with near-maturity dummy

	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 × *I*(A or above) (%)[(1)]	0.054 (0.35)	-0.034 (-0.21)	0.027 (0.17)	-0.081 (-0.48)
Fund holding share × *I*(BBB or below) (%)[(2)]	0.582*** (3.27)	0.757*** (4.00)	0.560*** (3.14)	0.725*** (3.83)
Fund holding share × *I*(A or above) × Near-maturity dummy (%)[(3)]	-0.189 (-0.69)	-0.223 (-0.59)	0.000 (0.00)	0.069 (0.21)
Fund holding share × *I*(BBB or below) × Near-maturity dummy (%)[(4)]	0.743*** (2.96)	0.922*** (2.87)	0.561*** (2.65)	0.721*** (2.72)
Near-maturity dummy	-19.180** (-2.50)	-21.502*** (-2.82)	-15.491** (-2.22)	-17.345*** (-2.69)
F-statistic: (1) = (2)	5.30**	10.32***	5.33**	10.60***
F-statistic: (1)+(3) = (2)+(4)	14.80***	16.79***	10.70***	12.87***
Controls	YES	YES	YES	YES
Credit-rating-by-month FE	YES	YES	YES	YES
Adjusted R-squared	0.664	0.666	0.664	0.665
No. of obs.	33,262	33,262	33,262	33,262

Table 5. Fund Holdings and Credit Risk: Do Market Conditions Matter?

In this table, we re-estimate column (4) in Table 2 Panels A and B, 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 (4) in Table 2 Panel A, 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. In Panel B, we further report F-statistic testing the hypothesis that the two coefficients 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.

Panel A. Baseline regressions

	Dependent variable: 5-year CDS spread (bps)					
	(1)	(2)	(3)	(4)	(5)	(6)
	High default spread	Low default spread	Coeff. diff. test (*t*-stat)	High VIX	Low VIX	Coeff. diff. test (*t*-stat)
Active fund holding share (%)	0.867*** (3.83)	0.373** (2.22)	0.494** (2.01)	0.847*** (3.66)	0.385** (2.22)	0.462* (1.75)
Controls	YES	YES		YES	YES	
Credit-rating-by-month FE	YES	YES		YES	YES	
Adjusted R-squared	0.666	0.622		0.670	0.606	
No. of obs.	17,100	16,162		16,635	16,627	

Panel B. Interactions with credit rating dummies: A or above vs. BBB or below

	Dependent variable: 5-year CDS spread (bps)					
	(1)	(2)	(3)	(4)	(5)	(6)
	High default spread	Low default spread	Coeff. diff. test (*t*-stat)	High VIX	Low VIX	Coeff. diff. test (*t*-stat)
Active fund holding share × *I*(A or above) (%)[(1)]	-0.171 (-0.69)	0.022 (0.14)	-0.193 (-0.80)	-0.174 (-0.73)	0.030 (0.18)	-0.204 (-0.89)
Active fund holding share × *I*(BBB or below) (%)[(2)]	1.135*** (4.18)	0.474** (2.29)	0.661** (2.21)	1.109*** (3.98)	0.489** (2.27)	0.621* (1.92)
F-statistic: (1) = (2)	13.47***	3.32*		13.01***	3.20*	
Controls	YES	YES		YES	YES	
Credit-rating-by-month FE	YES	YES		YES	YES	
Adjusted R-squared	0.668	0.623		0.672	0.607	
No. of obs.	17,100	16,162		16,635	16,627	

Table 6. Fund Acquisitions and Credit Risk

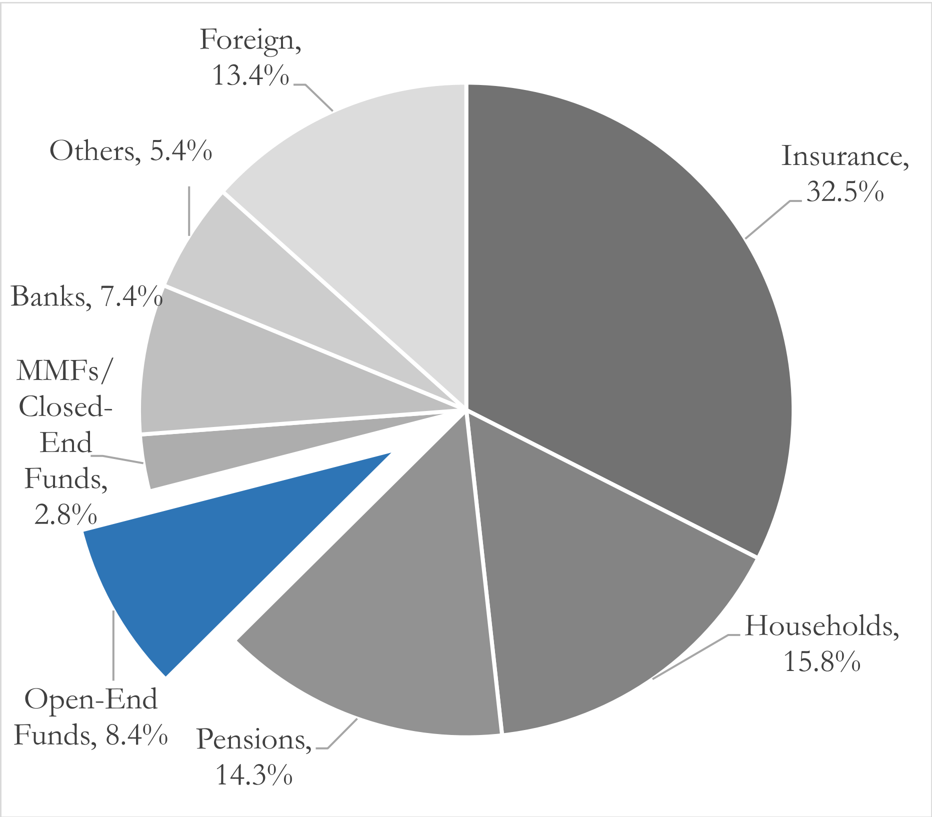
In this table we estimate the effect of fund acquisitions on credit risk. We identify all instances of fund acquisitions using the "Delist Reason Flag" in the CRSP Mutual Fund database. We then focus on fund acquisitions where (i) an active fund was acquired by another fund belonging to a different family 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. 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 subsequent month. In columns (3) and (4), we engage in a placebo test, whereby a placebo "acquisition" dummy takes the value of one with a three month lag, i.e., when an acquisition occurs in four months' time. We then re-estimate columns (4) of Table 2 Panels A and B for our subsample, with active fund holding share variable(s) interacted with fund acquisition dummy. All controls are identical to column (4) of Table 2 Panel A, 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)			
	Main test: acquisition month		Placebo test: 3 months before acquisition	
	(1)	(2)	(3)	(4)
Active fund holding share (%)	1.336***		1.304***	
	(6.04)		(5.88)	
Active fund holding share × Fund acquisition dummy	-0.600***		0.277	
	(-2.73)		(0.83)	
Fund acquisition dummy	8.879	9.069	-7.831	-6.876
	(1.26)	(1.20)	(-1.20)	(-1.09)
Active fund holding share × *I*(A or above)		0.794***		0.763***
		(3.36)		(3.23)
Active fund holding share × *I*(BBB or below)		1.587***		1.559***
		(5.44)		(5.34)
Active fund holding share × *I*(A or above) × Fund acquisition dummy [(1)]		-0.490*		0.211
		(-1.92)		(0.73)
Active fund holding share × *I*(BBB or below) × Fund acquisition dummy [(1)]		-0.612***		0.358
		(-2.75)		(0.98)
Controls	YES	YES	YES	YES
Credit-rating-by-month FE	YES	YES	YES	YES
Adjusted R-squared	0.669	0.672	0.669	0.671
No. of obs.	3,309	3,309	3,309	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

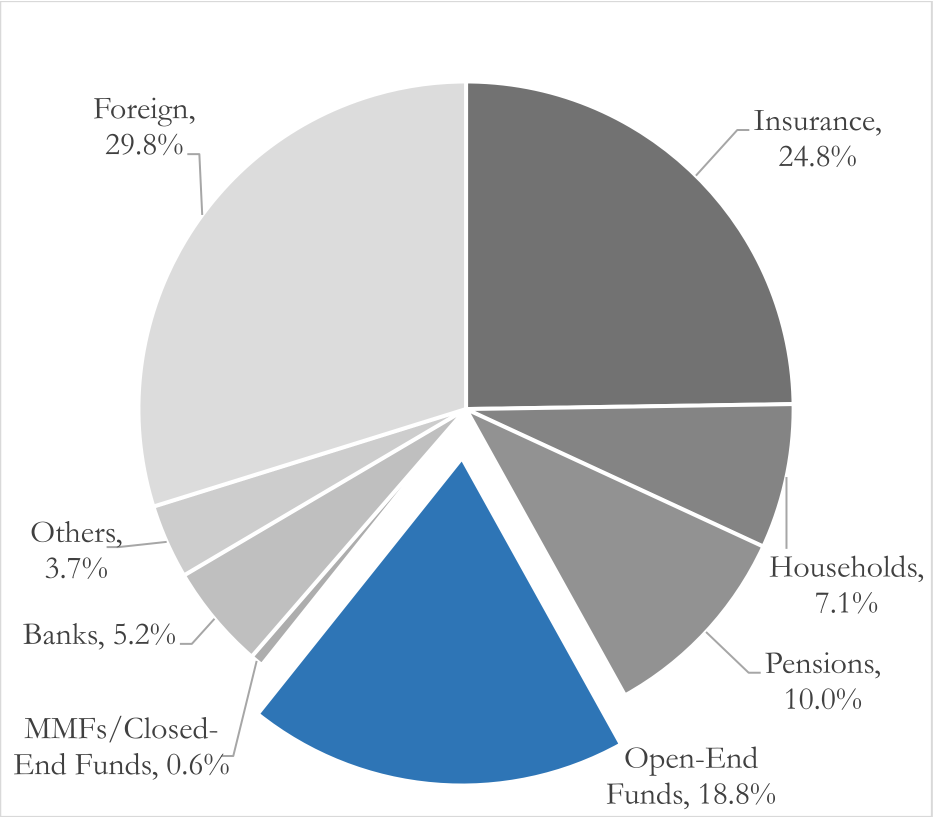


Table A.1. Fund Holding and Credit Risk: Full Estimation Results

In this table we report the full firm-month level panel regression results reported in Panel A of Table 2. For the definition of each variable used in the analysis, refer to Appendix C. 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) All funds	(4) Active only
Fund holding share (%)	0.507*** (3.33)	0.651*** (4.05)	0.503*** (3.48)	0.642*** (4.06)
1-year stock return (%)	-0.851*** (-6.52)	-0.859*** (-6.61)	-1.068*** (-9.15)	-1.073*** (-9.19)
Historical volatility (%)	4.660*** (9.03)	4.615*** (8.95)	6.133*** (12.83)	6.086*** (12.74)
Historical skewness	3.362 (1.29)	3.468 (1.34)	7.757*** (3.08)	7.848*** (3.12)
Historical kurtosis	-0.083 (-0.21)	-0.057 (-0.14)	-0.811** (-2.05)	-0.794** (-2.01)
Recovery rate	-14.450*** (-5.51)	-14.438*** (-5.51)	-14.328*** (-4.89)	-14.348*** (-4.90)
Log assets	-0.017 (-0.01)	0.446 (0.15)	-2.620 (-0.99)	-2.263 (-0.87)
Leverage (%)	1.476*** (7.06)	1.465*** (7.04)	1.359*** (7.34)	1.352*** (7.33)
ROE (%)	-0.398 (-1.47)	-0.385 (-1.43)	-0.149 (-0.70)	-0.139 (-0.65)
Dividend payout per share ($\times 100$)	-8.743 (-1.47)	-8.334 (-1.41)	3.731 (0.74)	4.040 (0.81)
1-month S&P 500 return (%)	0.721*** (3.76)	0.725*** (3.79)		
3-month T-Bill rate (%)	-11.440*** (-2.97)	-12.685*** (-3.47)		
Term spread (%)	-14.454** (-2.58)	-15.606*** (-2.88)		
VIX	-0.067 (-0.09)	-0.095 (-0.13)		
Credit rating FE	YES	YES	NO	NO
Credit-rating-by-month FE	NO	NO	YES	YES
Adjusted R-squared	0.579	0.580	0.662	0.663
No. of obs.	33,436	33,436	33,262	33,262

Table A.2. Robustness Check: Change-on-Change Regression Specification

In this table we re-estimate the results reported in columns (3) and (4) of Table 2 Panels A and B, albeit with both the dependent, explanatory and the control variables all in change rather than in level forms. Controls are identical to those 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: Δ 5-year CDS spread (bps)			
	(1) All funds	(2) Active only	(3) All funds	(4) Active only
Δ Fund holding share (%)	0.085	0.102*		
	(1.53)	(1.68)		
Δ Fund holding share × *I*(A or above) (%)[(1)]			-0.102	-0.099
			(-1.42)	(-1.15)
Δ Fund holding share × *I*(BBB or below) (%)[(2)]			0.133**	0.148**
			(2.13)	(2.25)
F-statistic: (1) = (2)			7.85***	7.11***
Δ Controls	YES	YES	YES	YES
Credit-rating-by-month FE	NO	NO	YES	YES
Adjusted R-squared	0.205	0.205	0.205	0.205
No. of obs.	31,985	31,985	31,985	31,985

Table A.3. 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 Table 2 Panels A and C 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 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.

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.4. 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. Baseline regressions

	Dependent variable: 5-year CDS spread (bps)					
	(1)	(2)	(3)	(4)	(5)	(6)
	High T-Bill rate	Low T-Bill rate	Coeff. diff. test (*t*-stat)	High term spread	Low term spread	Coeff. diff. test (*t*-stat)
Active fund holding share (%)	0.671***	0.522**	0.150	0.772***	0.507***	0.265
	(3.66)	(2.38)	(0.59)	(3.60)	(2.96)	(1.20)
Controls	YES	YES		YES	YES	
Credit-rating-by-month FE	YES	YES		YES	YES	
Adjusted R-squared	0.653	0.676		0.665	0.652	
No. of obs.	15,414	17,848		16,863	16,399	

Panel B. Interactions with credit rating dummies: A or above vs. BBB or below

	Dependent variable: 5-year CDS spread (bps)					
	(1)	(2)	(3)	(4)	(5)	(6)
	High T-Bill rate	Low T-Bill rate	Coeff. diff. test (*t*-stat)	High term spread	Low term spread	Coeff. diff. test (*t*-stat)
Active fund holding share × *I*(A or above) (%)[(1)]	-0.097	-0.076	-0.021	-0.048	-0.089	0.041
	(-0.45)	(-0.32)	(-0.07)	(-0.20)	(-0.54)	(0.19)
Active fund holding share × *I*(BBB or below) (%)[(2)]	0.894***	0.675**	0.220	0.970***	0.688***	0.283
	(3.95)	(2.58)	(0.72)	(3.81)	(3.19)	(1.04)
F-statistic: (1) = (2)	13.47***	3.32*		13.01***	3.20*	
Controls	YES	YES		YES	YES	
Credit-rating-by-month FE	YES	YES		YES	YES	
Adjusted R-squared	0.655	0.677		0.666	0.653	
No. of obs.	15,414	17,848		16,863	16,399	

Table A.5. 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 of the 6-month period preceding the acquisition month. All controls are identical to Table 7, and we similarly engage in a placebo test in columns (3) and (4). *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)			
	Main test: acquisition month		Placebo test: 3 months before acquisition	
	(1)	(2)	(3)	(4)
Active fund holding share (%)	1.151***		1.068***	
	(5.32)		(4.88)	
Active fund holding share × Fund acquisition dummy	-0.669**		0.584*	
	(-2.42)		(1.85)	
Fund acquisition dummy	14.207*	12.548	-12.351**	-12.006**
	(1.77)	(1.56)	(-2.57)	(-2.02)
Active fund holding share × *I*(A or above)		0.793***		0.708**
		(2.84)		(2.56)
Active fund holding share × *I*(BBB or below)		1.297***		1.228***
		(4.71)		(4.46)
Active fund holding share × *I*(A or above) × Fund acquisition dummy (1)		-0.418*		0.562**
		(-1.69)		(2.01)
Active fund holding share × *I*(BBB or below) × Fund acquisition dummy (1)		-0.708**		0.658*
		(-2.26)		(1.75)
Controls	YES	YES	YES	YES
Credit-rating-by-month FE	YES	YES	YES	YES
Adjusted R-squared	0.684	0.685	0.684	0.684
No. of obs.	1,726	1,726	1,726	1,726