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THE BEHAVIOR OF INTOXICATED INVESTORS: THE ROLE OF INSTITUTIONAL INVESTORS IN PROPAGATING THE CRISIS OF 2007-2008

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The Behavior of Intoxicated Investors: The role of institutional investors in propagating the crisis of 2007-2008

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ABSTRACT

Using a novel data of institutional investors' bond holdings, we examine a transmission of the crisis of 2007-2008 from the securitized bond market to the corporate bond market via joint ownership of these bonds by investors. We posit that, ceteris paribus, corporate bonds held by investors with high exposure to securitized bonds and liquidity needs experience greater selling pressure and price declines (yield increases) at the onset of the crisis. We further test predictions of a model of dynamic asset liquidation: Investors with large enough future liquidity shocks retain liquid assets, and instead sell assets that have relatively high temporary price impacts of trading. Mutual funds with higher sensitivity of pay to performance held higher portions of their portfolios in securitized bonds prior to the crisis. After the onset of the crisis, these funds did not sell securitized bonds on average and instead sold corporate bonds to meet their liquidity needs. Sales rose and yield spreads widened more for those corporate bonds whose mutual fund holders' portfolios were more heavily exposed to securitized bonds, compared to same-issuer bonds held by unexposed funds. Shorter-horizon mutual funds liquidated greater portions of their corporate bond holdings and in particular lower-rated bonds. In contrast, insurance companies sold little regardless of their exposure as long as they were above the minimum capital ratio threshold. These findings suggest that short-horizon mutual funds with high exposure to securitized bonds played a role in transmitting the crisis from securitized bonds to corporate bonds.

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Introduction

By August 2007, the souring of the subprime mortgage market that had begun some months earlier turned from a bad taste in the mouth to a nearly heart-stopping assault on the financial body of the U.S. economy.[1] "Liquidity abruptly dried up for many firms and securities markets" (Getter et al. 2007, p. 9), as securitized bonds – mortgage-backed securities (MBS), asset-backed securities (ABS), collateralized debt obligations (CDO) and so forth – displayed sharp drops in their resale values and became "toxic."[2] While much attention has focused on how these assets "intoxicated" banks and left them staggering, much less attention has been paid to the possibility of "intoxicated investors," that is, nonbank, fixed-income investors, and, in particular, bond mutual funds and insurance companies, which hold the majority of corporate debt securities. Have they been heavily exposed to these toxic assets? Have their portfolio choices exacerbated the impact of the financial crisis on the real economy? How did regulatory policy affect their behavior? These are the questions we aim to explore in this paper.

The focus on these institutional investors seems well-warranted. By the time of the crisis, bond financing had become a more common source of external financing for (especially large) corporations.[3] Institutional investors, such as mutual bond funds and insurance companies increasingly supplied the majority of capital—either directly through bond financing, or indirectly through investing in securitized loans. In fact, some argue that these investors' strong demand for relatively safe debt instruments fueled the credit expansion and securitization boom in the U.S. in 2003-2006.[4] Thus, their financial conditions and constraints could become as important financial bottlenecks as those of traditional banks on the road to the economic recovery, at least for large firms. For this reason, to fully understand the crisis and the way it has been transmitted to the real economy, it is important to look at the role of institutional investors as holders of these assets. To the best of our knowledge, there is very scarce evidence on this side of the equation.[5]

The primary goal of our study is to examine the role of institutional debt investors (e.g., bond funds and insurance companies) in propagating financial market instability. More specifically, we aim to study how the crisis episode in which one asset class (securitized bonds) experiences

[1] See Gorton (2008), Gorton (2009), Gorton and Metrick (2009), and Brunnermeir (2009) for informative readings.
[2] There is no exact agreed-upon definition of what constitutes a "toxic" asset in the discussion of crisis. We use the definition "no-agency, securitized bonds" to capture a class of assets that have become impaired during the crisis.
[3] For large representative firms, about two-thirds of their total debt is attributable to corporate bonds and less than one-third to bank loans (Massa, Yasuda, and Zhang, 2009).
[4] See Holmstrom (2008), Caballero et al. (2008), and Nini (2009).
[5] For studies that examine whether skewed incentives of originators or sellers (e.g., banks, mortgage banks, and investment banks) contributed to the unsustainable boom and the subsequent collapse of the market for securitized bonds, see Mian and Sufi (2008, 2009), Keys et al. (2010), Griffin and Tang (2009), and Jiang et al. (2009), among others.

extreme market turmoil accompanied by very low liquidity affects the portfolio decisions of institutional investors holding this and other classes of assets. We are among the first to provide evidence for the transmission of the crisis via these investors' joint ownership. We also provide the first detailed empirical analysis of professional investor behavior in the securitized bond market. We exploit a novel dataset that links individual corporate bond performances around the onset of the crisis to their bondholders' exposure to securitized bonds.

We focus on a potential transmission mechanism based on the effect of liquidity shocks on "open-end" institutional investors investing in securitized bond markets. Institutional investors that grant withdrawal rights to clients (e.g., mutual funds) are subject to runs, much like traditional banks (see, e.g., Bernardo and Welch, 2005). The desire of these investors to hold liquid – and potentially high-return – assets joint with the widespread belief that the secondary markets for securitized bonds would remain liquid induced them to load up on these securitized bonds prior to the onset of the crisis.[6] Indeed, one private estimate puts these institutional investors' collective exposure higher than that of banks.[7] Once the crisis hit, these investors, left with significant exposure to the now more illiquid asset class, had to decide how to rebalance their portfolios. Mutual funds, facing the possibility of massive withdrawals following bad performance, would have to meet the redemption claims by liquidating some of their assets. Reluctant to sell the more illiquid, "toxic" assets and book losses at fire sale prices (thereby exacerbating the investor flight), they would instead sell other, more liquid assets, such as corporate bonds.

In contrast, another class of institutional investors (e.g., insurance companies and pension funds) — which face longer-term investors and are equipped with long lock-ups, penalties for early withdrawals, and predictable payout schedules — were less pressured to sell than mutual funds, especially in the event of temporary deviations of prices from fundamentals. However, for these institutional investors, capital regulations made it expensive to hold lower-rated bonds.

Thus, we expect that, while the investor horizon influences the reaction of mutual funds, regulatory capital constraints influence the portfolio decisions of insurance companies when/if downgrades occur.

[6] Shleifer and Vishny (2009), Gorton and Metrick (2009), and others describe an ecosystem of the so-called "shadow banking system" where broker-dealer banks actively supported liquidity of securitized bonds by acting as market makers and at the same time funded their balance sheets in the repo market using the same bonds as collateral.

[7] Blundell-Wignall (2007) quotes a private investment bank estimate where insurance companies and asset managers together are shown to have delta-adjusted exposure to 28.6% of existing CDOs, whereas hedge funds and banks split the remaining exposure at 46.5% and 24.9%, respectively.

This distinction offers us a unique event to test how different classes of institutional investors subject to different demand conditions and regulatory constraints would react to the crisis. More importantly, it offers us a unique opportunity to look at the transmission mechanism from the securitization market to other, seemingly unrelated, asset classes, such as corporate bonds. In the case of mutual funds, a drop in the resale value of one subclass of assets in the portfolio and the ensuing reduction in the value of the portfolio induces the investor to rebalance his portfolio, for example, to prepare for potential redemption requests. In contrast, insurance companies are expected not to respond unless the bonds are downgraded.

The key question is which assets the investor would choose to sell and who would put the selling pressure on assets more than others. We posit that, ceteris paribus, corporate bonds held by investors with high exposure to securitized bonds and liquidity needs experience greater selling pressure and price declines (yield increases) at the onset of the crisis. The idea that an investor who faces a liquidation problem and holds both liquid and illiquid assets in his portfolio would first sell the more liquid assets is intuitive and is suggested by Scholes (2000) and others. "A 'systemic shock' … is an event that causes [securitized] debt to become *informationally-sensitive*, that is, sensitive to adverse selection" and "cause[s] the (inefficient) collapse of trading in [such] debt." (Gorton 2009, p.10)[8] In response to this negative shock to their portfolios, investors with liquidity needs would choose to retain the securitized bonds and sell other, more liquid assets. As to which types of corporate bonds investors would choose to sell, we further test predictions of a model of dynamic asset liquidation: Investors with large enough potential future liquidity shocks retain "assets with a low temporary [price] impact of trading" (e.g., investment-grade bonds), and instead sell "relatively illiquid assets" (e.g., junk bonds). (Brown et al. 2009, p. 3)

We collect information on mutual funds at the individual fund level and on insurance companies at the company level. We use a novel dataset of quarterly portfolio holdings of securitized bonds and corporate bonds by institutional investors from 1998Q1 to 2008Q1. The empirical analysis is conducted both at the investor level and at the *individual corporate bond* level. That is, we examine (i) investors' portfolio choices as functions of their attributes (e.g., horizon, performance sensitivity of pay, and affiliation with banks and big financial groups), as

[8] Gorton and Metrick (2009) find that collateral values of securitized bonds (reflected in repo haircut rates) collapsed after the onset of the crisis across all collateral types, including even those that were not subprime-related. Gorton (2009) also discusses how "market participants are not prepared to cope with the sudden information requirements for understanding, valuing, and trading securities that are suddenly information-sensitive. … This makes them illiquid." (p. 37)

well as (ii) the yield spread changes and net sales of individual corporate bonds as functions of their current bondholders' attributes, such as their exposure to now-illiquid, securitized bonds.

We start by examining whether and why institutional investors hold securitized bonds in the first place. Indeed, theory suggests that institutional investors with short horizon will not invest in undervalued assets that are not expected to recover in value soon. However, institutional investors may have been attracted to hold securitized bonds prior to the crisis because these assets were perceived to be liquid, and because they exhibited relatively high ratings and relatively attractive yields. The practice of "rating at the edge" might also have understated the perceived riskiness of these assets.

We find that institutional investors' holdings of securitized bonds increased fourfold during the sample period, totaling nearly $2 trillion in 2007. About 80% of these (with known ratings) were AAA-rated. By comparison, only 10% of the institutional investors' holdings of corporate bond holdings (around $3 trillion as of 2007) were AAA-rated. Also, overall, the pool of AAA-rated corporate bonds grew much more slowly during the sample period. As a result, there was a sharp increase in their holdings of securitized bonds as a percentage of AAA-rated assets during the sample period. Among mutual funds, the funds with higher sensitivity of pay to performance held larger portions of their portfolios in securitized bonds.

These results are consistent with the idea that, when general confidence in the enduring liquidity of the securitized bond market was high, mutual funds with high pay-performance sensitivity were incentivized to load up on these assets. And indeed, anecdotal evidence suggests that highly rated securitized bonds were favored by institutional investors, which are constrained to invest mostly in highly rated assets and which wanted to "spice up" their performance for competitive reasons. The result is also consistent with empirical evidence on hedge fund behavior at the top of the bubble (e.g., Brunnermeier and Nagel 2004). Funds affiliated with banks also held more securitized bonds.

After establishing that institutional investors had significant exposure to the securitization market before the crisis, we focus on the investors' liquidation problem as the crisis impairs liquidity and the resale values of their holdings. We predict that as the crisis hits, mutual fund investors with prior holdings will choose not to sell these assets immediately, as fire sales and realized losses may trigger large outflows and further exacerbate their liquidity problem. At the same time, having significant exposure to these now highly illiquid assets may force them to liquidate other assets in order to meet current withdrawal requests or in anticipation of future withdrawal requests.

We consider both the traditional "static" Scholes approach and a more dynamic liquidation model. Given the different implications of the dynamic liquidation model from the more traditional framework for the transmission of the crisis, we first investigate the hypotheses common to both models and then proceed with those more specific to each particular model. Specifically, a common prediction of both the Scholes and the dynamic liquidation model is that investors faced with a liquidation problem will not sell the most illiquid assets in the initial period. And indeed, as theory predicts, we document a strong negative relationship between the net percentage changes in portfolio holdings and the liquidity of the assets. In the last quarter of 2007, the mutual funds reduced the holdings of corporate bonds in their portfolios by -15% (-6% of total holdings), while they reduced their holdings of securitized bonds by -9% (-1.9% of total holdings). During the same period, insurance companies are small net purchasers, increasing their holdings of corporate bonds and securitized bonds by just 1.9% and 0.3% of their total holdings, respectively.

When the subprime mortgage crisis hit the market in August 2007, mutual funds sold corporate bonds to meet their increased demand for liquidity. Shorter-horizon mutual funds liquidated greater portions of their corporate bond holdings. Affiliated funds also tended to sell more corporate bonds and retain securitized bonds. This may be a signal of better (actual or perceived) information as well as less fear about holding on to these toxic assets as these funds may count on implicit guarantees from the groups they are affiliated with in case of future liquidity needs. Among insurance companies, only the firms close to or below the risk-based capital threshold engaged in selling the toxic assets.

We then try to differentiate between the traditional Scholes-type model and the dynamic liquidation model by further examining the type of corporate bonds that were sold more around the onset of the crisis. We find that, in line with the dynamic liquidation hypothesis, the average investor tended to sell the junk bonds more than investment-grade bonds. The change in holdings of the investors after the onset of the crisis also depended on the investor horizon. One standard deviation shorter horizon translates to a 6% higher sale of junk bonds and to a significantly smaller impact on the sale of investment-grade bonds.

Next we turn to the transmission of the shocks from the securitization market to the corporate bond market via corporate bondholders' exposure to securitized bonds. We show that bond yield spreads widened more and net sales were larger for those bonds whose holders' portfolios were more heavily exposed to securitized bonds, and particularly more so for lower-rated bonds. An increase in the holdings of securitized bonds in the portfolio of the average investor from 0% to

50% translates to a 70 bps increase in the yield spread of a corporate bond after the onset of the crisis. In line with the dynamic liquidation hypothesis and the previous findings, the effect is sharper for lower-rated bonds. Selling pressure on these lower-rated corporate bonds came primarily from mutual fund investors with high exposure to securitized bonds, while insurance company investors contributed to a lesser degree to the trading volumes during the second half of 2007.

It is important to stress that in our analysis of corporate bond yields (and trading volumes) we include bond issuer dummy variables (firm fixed effects). This is crucial for identification. Effectively, we compare the yield spread change of a bond held by exposed investors to another bond *issued by the same firm* but held by non-exposed investors, holding constant any issuer-specific characteristics (both observable traits, such as credit ratings, as well as unobservable, idiosyncratic traits). This drastically reduces the endogeneity concerns that inclusion of a bond in exposed investors' portfolios could be correlated with some unobserved characteristics about the issuing firm.

Our findings support the view that the sharp increase in yield spreads of lower-rated bonds at the start of the crisis is at least partly due to the contagion of the shock from (mostly AAA-rated) securitized bond market to the lower-rated corporate bond market via the joint ownership of both securities by mutual funds. Figure 1 illustrates this point.

Overall our results show that performance-sensitive and short-horizon mutual fund investors loaded up on securitized bonds (which were highly rated and yielded higher returns than Treasury bonds) during the boom years. When faced with liquidity shocks at the onset of the crisis, these funds sold corporate bonds, thereby transmitting the crisis from securitized bonds to corporate bonds.[9] In the clearest evidence of the channel, the effects were manifested in greater spread increases for individual corporate bonds that are held by investors with heavy exposure to securitized bonds, compared to same-issuer bonds held by unexposed investors. Figure 2 illustrates this point.

Our results have important policy implications. In particular, they suggest that the initial transmission of the crisis from the securitization market to the corporate bond market is primarily caused by actions of short-horizon mutual funds, whereas long-horizon mutual funds and insurance companies contributed less to the sales of corporate bonds. This implies that regulations

[9] Longstaff (2010) finds that declines in subprime-related asset values forecast widening of corporate bond spreads with a lag after the onset of the crisis, especially in 2007. The result is consistent with a liquidity channel of contagion. Our results suggest that portfolio holdings of institutional investors provide one such channel.

intended to delay panic-induced withdrawals – e.g., lock-up clauses – may prevent the transmission of the crisis. This is in line with anecdotal evidence suggesting that hedge funds have been better able to withstand the withdrawal pressure. Our results also highlight the vulnerability of companies that depend on mutual funds as primary bond investors.[10]

The remainder of the paper is organized as follows. Section 2 discusses the hypotheses. Section 3 describes the construction of the sample, our key variables, and sample summary statistics. Section 4 presents the analysis of investors' demand for securitized bonds prior to the crisis. Section 5 presents the analyses of mutual funds' portfolio decisions around the onset of the crisis in the summer of 2007. Section 6 presents the bond-level analysis of the effects of investors' exposure to securitized bonds on corporate bonds' yields and trading volumes. Section 7 concludes.

2. Hypotheses

The idea that an investor who faces a liquidation problem and holding both liquid and illiquid assets in his portfolio would first sell the more liquid assets is intuitive and is suggested by Scholes (2000) and others. We posit that, given the negative shock to the securitization market at the onset of the crisis, and the severity of the adverse selection problem in the secondary market for securitized bonds, investors with liquidity needs would choose to retain them and sell other, more liquid assets.

Hypothesis 1: *Securitized bonds will not be prioritized for sales at the onset of the crisis.*

Second, the larger the expected liquidity needs in the future, the more investors will liquidate today in a precautionary manner. This implies that the more vulnerable the investors are to the future liquidation problem, the more they will liquidate in the first period. To test this prediction, we need to measure the future liquidity needs of the investors. We draw on the literature on limits of arbitrage (e.g., Shleifer and Vishny, 1997; Coval and Stafford, 2007) and use the investment horizon as our key measure of the investors' anticipated liquidity needs. We argue that this is a good measure for mutual funds, since short-horizon mutual funds are likely to receive larger withdrawal requests as a result of their exposure to (now illiquid) securitized bonds. In this context, the second hypothesis is thus that, the shorter the horizon, the larger the potential liquidity shock, and thus the more they liquidate.

[10] Massa, Yasuda, and Zhang (2009) find that corporations whose local bond investors are primarily mutual funds depend less on bond financing and have lower leverage, compared to firms whose local bond investors are primarily insurance companies.

Hypothesis 2: *The investment horizon of the investors is negatively associated with the magnitudes of their liquidation decision.*

Third, and most importantly, we posit that, ceteris paribus, corporate bonds held by investors with high exposure to securitized bonds and liquidity needs experience greater selling pressure and price declines (yield increases) at the onset of the crisis. The magnitude of the transmission should be a function of the stock of securitized bonds that the investors accumulated before the crisis. Mutual funds seek to maintain relatively stable risk and style characteristics to satisfy their objectives. The "shock" to the securitized bond market has left the funds with "toxic" holdings that are riskier and less liquid than they had anticipated. To cut back the heightened portfolio risk level, the funds with (now illiquid) securitized bond holdings would choose to liquidate corporate bonds. We therefore argue that, the larger the exposure of investors holding corporate bonds, the more they are sold, and the more negatively the prices of the bonds are impacted. We examine this hypothesis by constructing holders' exposure measures, yield spread changes, and trading volumes at the individual asset (i.e., corporate bond) level.

Hypothesis 3: *For a given corporate bond, mutual fund investors' portfolio exposure to securitized bonds is positively associated with yield spread changes (negatively associated with asset price changes) and positively associated with trading volumes.*

As to which types of corporate bonds investors would choose to sell, we build our secondary hypotheses on a model of dynamic asset liquidation by Brown et al. (2009),[11] which, in turn, builds on the Scholes conjecture. The Scholes conjecture states that investors who face an immediate liquidation problem in a one-period setting sell off the most liquid assets to exactly meet the liquidity need. In such a myopic setting, investors do not consider the liquidity needs in the future (second) period. Scholes himself points out that, as a result, the investor's portfolio becomes much more illiquid than it was at the beginning of the period. This implies a positive correlation between the drop in the value of securitized bonds and the increase in the yields of highly-rated corporate bonds. That is, it posits a direct transmission of a shock from securitized bonds to the highly-rated bond segment.

The Brown et al. (2009) model points out a trade-off between selling the more liquid assets first (and thus limiting the immediate loss) and holding on to liquid assets (and thereby protecting against a future liquidity shock) when investors face a multi-period liquidation problem. The main implication of the model is that, investors with large enough potential future liquidity

[11] Also see Carlin et al. (2007).

shocks retain liquid assets (e.g., investment-grade bonds), and instead sell assets that have relatively high temporary price impacts of trading (e.g., junk bonds). This leads to a sub-hypothesis that accompanies Hypothesis 2, as follows:

Hypothesis 2b: *The investment horizon of mutual funds is positively associated with the temporary liquidity of the assets they sell.*[12]

The model also highlights the importance of differentiating between permanent and temporary impacts of trading on prices. In particular, the model predicts that investors will not sell assets with a high permanent price impact when faced with a liquidation problem. The permanent (as opposed to temporary) price impact is defined in terms of the information asymmetry about the value of the asset. This concept became very relevant during the crisis as the information sensitivity of securitized bonds jumped dramatically at the onset of the crisis, switching from seemingly information-insensitive (simple and transparent) debt that required little research to information sensitive debt with structural, informational, and institutional complexity that few holders were equipped to evaluate. Thus, the model's prediction with respect to securitized bonds is in line with Hypothesis 1.

The model also suggests a specific transmission of the shock from securitized bonds to the lower-rated corporate bonds. The larger the exposure of investors holding a particular asset *and* the higher the temporary price impact of trading, the more they will be sold in the first period, and the more negatively the price of the asset will be impacted. This leads to a sub-hypothesis that accompanies Hypothesis 3, as follows:

Hypothesis 3b: *For a given corporate bond, the impact of mutual fund investors' exposure to securitized bonds on yield changes and bond sales is larger, the lower rated the bond is.*

Note that this sub-hypothesis is not exclusive to the Brown et al. (2009)'s model. It is also supported by our general idea of contagion, namely, that the shock to the securitized bond market prompted re-balancing by exposed mutual funds to revert to their target risk levels, thus triggering a transmission to lower-rated corporate bonds.[13]

3. Data

3.1 Data Sources

[12] We will measure the temporary price impact of bonds using both bond ratings and actual trade-based metrics. In Table VII we show that lower-rated bonds indeed trade in significantly smaller numbers.

[13] For related studies that examine the role of international investors in spreading crises through re-balancing of their cross-country asset holdings, see, e.g., Boyer et al. (2006) and the papers cited therein.

We construct our sample by merging a number of different data sources: the Lipper EMAXX institutional bond holdings database, Thomson Financial's 13f Institutional Holdings, CDA/Spectrum, the CRSP Mutual Funds dataset, and the Mergent FISD Corporate Bond Dataset.

The Lipper EMAXX database contains details of corporate bond and securitized bond (mortgage- or asset-backed securities, collateralized debt, mortgage, or loan obligations, and their variants) holdings for nearly 20,000 U.S. and European insurance companies, U.S., Canadian, and European mutual funds, and leading U.S. public pension funds. It provides information on quarterly ownership of more than 50,000 fixed-income issuers with over $7 trillion in total par amount from 1998Q1 to 2008Q1. We focus on U.S. institutional investors in the EMAXX database, and their holdings of corporate bonds and structured products (about 15,000 institutional investors every quarter, holding in aggregate a total face value of about $300M per institution on average in any given quarter). For these institutions, Lipper EMAXX reports the holdings based on regulatory disclosure to the National Association of Insurance Commissioners (NAIC, for insurance companies) and the Securities and Exchange Commission (SEC, for mutual funds), and on voluntary disclosure by the major pension funds.[14] Thomson Financial's 13f dataset contains information on the equity positions of investment companies holding U.S. equities.

3.2 Empirical Proxies

To conduct our analyses, we need empirical proxies for investment horizons. An investor has a short investment horizon if his ability to stay invested in the long run is perceived to be low. One reason for a short horizon may be an investor's uncertainty about the potential for redemption calls, which would require him to liquidate his position (e.g., Edelen 1999); that is, the more volatile the fund flows, the shorter the average investment horizon of such a fund will be. Therefore our first proxy of horizon is the volatility of flows, where the higher the flow volatility, the lower the horizon should be.

An alternative way to measure the investment horizon is by focusing on the actual trades by the investors. The standard literature (e.g., Q. Chen et al., 2007, Gaspar et al., 2006) suggests that investors who turn over their portfolios more often have a shorter investment horizon. This may be due to the need to face redemptions as well as tax considerations. Long-term investors dislike high turnover portfolios as this can result in undesirable short-term taxable capital gains (Jin

[14] Importantly, EMAXX provides par amount holdings, which enables us to measure quantity changes (as opposed to market value changes) in investors' holdings of various bonds.

2006). Conversely, short-horizon investors are more likely to be matched with portfolio managers with high turnover. Therefore, portfolio turnover is our second proxy of investment horizon, where the higher the turnover of the portfolio, the shorter the investment horizon of the investor should be. We measure flow volatility as the standard deviation of the fund's flow, over the previous 12 months. We use as the fund's turnover ratio the CRSP Mutual Funds turnover ratio.

We also construct proxies for investor relationships. Relationships could affect investors' portfolio decisions through either pure information effects or additional incentive effects. The first relationship variable, *Affiliated with commercial banks,* captures the affiliation with financial conglomerates that also own the banks that participate in the securitized debt markets and perform due diligence on the instruments. This implies that these investors have an informational advantage over unaffiliated investors. This variable may also capture the fact that affiliated investors are less risk averse than unaffiliated investors as they receive implicit buyback guarantees from their affiliate banks in case of market turmoil. It may also capture any pressure the funds receive from originating affiliate banks to buy their securitized bonds, especially if the banks, unable to sell the bonds to third parties, used their affiliate funds as dumping grounds. The second relationship variable captures affiliation with large asset management groups (*Log*(*Family size*)). In contrast to the first measure, this is a pure information measure.

3.3 Descriptive Statistics

We report summary statistics in Table I. Panel A reports the securitized bond and corporate bond holdings by mutual funds and insurance companies. Institutional investors' holdings of securitized bonds increased fourfold during the sample period, totaling nearly $2 trillion in 2007. While asset holdings grew steadily for both classes of institutional investors over most of the pre-crisis period, mutual funds' holdings of securitized bonds in the 2004-2007 period grew particularly rapidly, doubling in just 3 years; in contrast, insurance companies' holdings grew more gradually. There is also a large contraction in the mutual funds' holdings of corporate bonds in the last quarter of 2007.

Panel B reports the securitized bond and corporate bond holdings of mutual funds by ratings. It is striking that nearly 80% of securitized bonds (with known ratings) held by the sample mutual funds are AAA-rated, with just a handful of non-AAA, investment-grade tranches, and virtually no junk-rated tranches (statistics for insurance companies are similar). In contrast, the majority of corporate bonds held by mutual funds are investment-grade but lower than AAA-rated. This is not surprising, as the number of AAA-rated corporate issuers steadily dwindled over the years,

from more than 60 in the 1980s to just 6 as of the end of 2008. As we argued above, institutional investors had great appetite for securitized bonds because the securitization methodology enabled the creation of informationally insensitive, highly rated debt in vast quantities. The summary statistics reported here corroborate this view. Mutual funds also hold a higher percentage of their corporate bond portfolios in junk-rated bonds than insurance companies. This is consistent with the fact that risk-based capital regulation makes it expensive for insurance companies to hold low-rated bonds (see, for example, Herring and Schuermann, 2003).

Panel C reports AAA-rated bond holdings as a percentage of the total portfolio. For both classes of institutional investors, holdings of AAA-rated bonds grew sharply, both as percentage of their total portfolios and in absolute value, during the sample period. For mutual funds, it grew from about 3% of the total to 12%, and for insurance companies it grew from about 6% to 16%. In both cases, the growth came disproportionately from the growth in securitized bond holdings.

Panel D presents securitized bond holdings by collateral type (residential mortgage-backed securities (RMBS), commercial mortgage-backed securities (CMBS), other asset-backed securities (ABS), and government agency-backed securities (Agency)). Panels D-1 and D-3 show all securitized bonds, and Panels D-2 and D-4 show AAA-rated bonds only. In general, RMBS is the most common collateral type throughout the sample period, though the portfolios become more diversified among the four collateral types over time. CMBS appears to be more popular among the insurance companies than among mutual funds. The opposite is true for ABS, which can be backed by a wide variety of assets, including credit card debt, student loans, auto loans, etc. Finally, Agency is not a dominant fraction of portfolios; i.e., investors primarily invested in privately issued securitized bonds.

Panel E reports the summary statistics for the main variables used in the analysis. Note that the unit of observations (with N.Obs = 16252) for Tables II and IV is a fund-quarter, whereas the unit of observations (with N.Obs = 8148) for Tables III (Panel A) and V-VII is a corporate bond. For example, *Turnover ratio* and *Flow volatility* in Panel E-1 report the sample statistics (across fund-quarters) for the two proxies of investment horizons for our sample of mutual funds. There is a great amount of variability in these measures; e.g., flow volatility ranges from 0.0031 to 0.3987.

Another variable in Panel E-1, *Affiliated with Commercial Bank*, indicates that about one-quarter of the sample funds are affiliated with banks. The variable *No equity* (which equals 1 if the fund does *not* hold equity), indicates that about four-fifths of our sample mutual funds are pure bond funds that do hold no equity, while the remaining one-fifth are blend funds with some

holdings of equity. Other variables are standard mutual fund characteristics used in the literature: for definitions of other variables in the table, see the Appendix.

In contrast to Panel E-1 in which the variables are defined at the fund level, the variables in Panel E-2 are defined at the level of the individual corporate bonds that are held by our sample funds. For example, the first two variables, *LogSale (Jul-Oct 2007)* and *LogSale (Jul-Dec 2007)*, measure the log of net sales of a given corporate bond by the sample mutual funds. The next two variables, ΔYS, measure the change in yield spreads of corporate spreads between the pre-crisis 2007 Q2 and the crisis (periods of) 2007 Q3 and 2007 Q4, respectively. On average, bond yield spreads increase by approximately 1% in the first 3 months of the crisis, and nearly 2% in the first 6 months, as indicated by the mean of these variables. The average masks the great variability, however, in that the yields of some bonds hardly change, while others shoot up sharply.

The variable *Holders' Exposure (to Securitized Bonds)* is of significant interest. It measures how much an average mutual fund investor holding corporate bond *i* is exposed to securitized bonds that become illiquid and impaired at the onset of the crisis. The sample statistics indicate that investors' exposure varies widely from none to very high (over 90%). We similarly measure and report the exposure of the average insurance firm investor holding corporate bond *i* to securitized bonds. It appears that the average exposure is higher for insurance company investors than for mutual funds, but the variance is not larger. In Section 6, we will examine whether the exposure of existing investors to securitized bonds explains some of the increases in corporate bond yields at the onset of the crisis. Other variables are standard bond characteristics used in the literature. The definitions of the other variables are provided in the Appendix.

4. Investor Demand for Securitized Bonds Before the Crisis

What determines the overall levels of holdings of securitized debt by institutional bond investors in general and mutual funds in particular? As we argued, one of the main features of these securitized debt tranches (especially AAA-rated tranches) was the fact that they offered slightly more attractive yields than Treasury bonds of similar ratings and maturity. Indeed, the prevailing rating system understated their risk relative to corporate bonds,[15] while the promised yield made

[15] "'Rating at the edge' might also have contributed to favorable ratings of structured products versus corporate bonds; while a AAA-rated bond represents a band of risk ranging from a near-zero default risk to a risk that just makes it into the AAA-rated group, banks worked closely with the rating agencies to ensure that AAA tranches were always sliced in such a way that they just crossed the dividing line to reach the AAA rating." (Brunnermeir 2009, p.81) For studies that

these instruments attractive especially for investors for whom a higher performance would have been more valuable, e.g., the investors with short horizons, and those with high flow-performance sensitivity. And there appeared to be little illiquidity penalty associated with holding these securities prior to the crisis, in light of the fact that investment banks frequently used them as collateral in accessing the repo market, and banks kept them in their off-balance sheet SIVs, which were financed using short-term asset-backed commercial paper.[16]

We therefore expect that, *among mutual funds*, the funds with shorter horizons and funds with higher flow-performance sensitivity would hold more securitized debt. The former prediction may be counterintuitive in a simplified, limits-of-arbitrage story, as the investors who hold more illiquid assets should be the ones with longer horizons. However, participants may not have anticipated that securitized bonds would become highly illiquid and might have found these bonds attractive since they exhibited relatively high credit ratings and relatively high yields. Alternatively, participants, even if aware of a liquidity bubble, may have decided to ride the wave rather than betting against it,[17] loading up on potentially riskier assets (e.g., Brunnermeier and Nagel 2004).[18]

We estimate the effects of mutual funds' flow-performance sensitivity and investment horizon on their portfolio holdings by estimating the following model:

$$H_{it} = \alpha + \beta\, Flow\text{-}Performance\ Sensitivity\ (\text{alternatively}\ Horizon)_{it} + \gamma' x_{it} + \varepsilon_{it} \quad (1),$$

where each observation represents the portfolio composition of a given mutual fund in a given quarter. The dependent variable *H* is alternatively the fraction of the fund's portfolio invested in either securitized bonds or corporate bonds.[19] We define the variable *Flow-performance sensitivity* based on Huang et al. (2007) and discuss its construction in the Appendix. *Horizon* is one of the two proxies for the investment horizon of the fund – *Flow volatility* or *Turnover ratio*. *X* is a set of fund characteristics (*Affiliated with commercial bank*, *Log(Family Size)*, the fund's flow in the previous quarter (*Past Flow*), the fund's return in the previous quarter (*Fund return*),

examine how various tranches of securitized debt (e.g., CDOs) were priced, see, e.g., Coval, Jurek, and Stafford (2008) and Longstaff and Myers (2009).

[16] See Gorton and Metrick (2009).

[17] "When the music stops, in terms of liquidity, things will be complicated. But as long as the music is playing, you've got to get up and dance. We're still dancing." (Chuck Prince, former CEO of Citigroup, quoted on July 10, 2007, in *Financial Times* shortly before the onset of the crisis)

[18] Also note that we do not expect mutual funds to hold more securitized bonds than insurance companies, since the mechanism governing insurance companies' decisions to hold securitized bonds is expected to be distinct from that governing mutual fund decisions, as we posit above. Thus, we examine the effect of pay-performance sensitivity, flow volatility, etc., on holdings using only the mutual fund sample. Indeed, as shown in Table I, insurance companies in the aggregate held a higher percentage of their portfolios in securitized bonds than did mutual funds.

[19] They are not mere complements of each other, because there is a third component, namely, equity.

the equity holdings of the fund's family (*Family equity holdings*), management fees (*Mgmt fee*), *Expense ratio*, *Actual 12b1*, *Average maturity* (of the fund's fixed income holdings), an indicator variable for whether the fund holds equity or not, and the return on the fund's equity holdings (*Equity return*)).

We estimate the model using both Fama-MacBeth cross-sectional regression (with Newey-West standard errors with lag length parameter equal to 4), and a pooled OLS with quarter fixed effects and standard errors clustered around each fund (Petersen 2009). The sample includes all the mutual funds belonging to the merged Lipper eMAXX-CDA/Spectrum data set over the period 1998Q1-2007Q2.[20][21]

The results are reported in Table II. In Panel A, the dependent variable is the fraction of the fund's portfolio represented by securitized bonds. In Panel B, the dependent variable is the fraction of the fund's portfolio represented by corporate bonds. In columns (1)-(3) the model is estimated using the Fama-MacBeth; in columns (4)-(6), it is estimated as a pooled OLS.

The results show a strong correlation between the investors' horizons and their investments in securitized bonds. The effect is not only statistically significant, but also economically relevant. All else equal, a fund in the top decile of *Turnover* (Flow volatility) holds 49% (40%) of its portfolio in securitized bonds, while a fund in the bottom decile holds only 36% (37%). Funds with high flow-performance sensitivity also hold significantly higher portions of their portfolios in securitized bonds.

The fund affiliation also plays a significant role. Funds that are affiliated with commercial banks display a higher percentage of securitized bond ownership. This finding is consistent with both (i) inside/higher quality information received by the funds thanks to their affiliation and (ii) implicit guarantees by their affiliate banks that effectively subsidize these funds' holdings in the event of market turmoil. The anecdotal evidence about Citigroup's infusion of cash into its own money market funds to keep them afloat is consistent with this latter interpretation.[22]

[20] The merged dataset consists of both pure bond funds (about 80% of the sample) and blend funds, which hold some equity (about 20%). In unreported analysis, we re-estimate the models reported in Tables II and IV using only pure bond funds and find that the results are qualitatively unchanged.

[21] While many observers of the crisis point to August 2007 as the first month in which financial contagion or systemic risk surfaced (as reflected, e.g., in the sharp rise in the LIBOR-OIS spread, shown in Figure 1), subprime market indicators (e.g., ABX) exhibited localized disruptions as early as 2007Q1. Thus, as a robustness check, we also re-run the model using data up to 2006Q4 rather than 2007Q2 and find that results are qualitatively unchanged.

[22] Tangentially, we examine fund performance following the onset of the crisis and find that bank-affiliated funds underperform because their portfolios are heavy in securitized bond holdings. This result is consistent with the view that affiliated mutual funds exercised less scrutiny when increasing their holdings of securitized bonds; however, the sample period is quite short after the onset of the crisis, and we stress the need for caution in drawing definitive conclusions from this evidence.

Among the control variables, it is interesting to note that funds with higher expense ratios hold more in corporate bonds and less in securitized bonds. One possible interpretation is that a corporate bond is considered more information-sensitive than a securitized bond because its default risk contains more idiosyncratic risk about the firm. Therefore, funds with more active investment strategies (and higher expenses) gravitate towards corporate bonds, whereas funds with lower expenses choose to hold securitized bonds. The equity focus of fund families is negatively associated with portfolio weights of both corporate bonds and securitized bonds. This may be because prominent pure bond funds tend to be part of fund families that are focused on fixed-income securities (e.g., PIMCO).

Overall, these results show that the performance sensitive and shorter-horizon mutual funds loaded heavily on securitized bonds prior to the crisis. We now turn to examining their behavior after the onset of the crisis.

5. Selling Behavior after the Onset of the Crisis

5.1 Who sells and what gets sold after the onset of the crisis?

We now consider the first prediction regarding the mutual funds' liquidation problem: They will not sell the most illiquid assets first. We test this prediction by focusing on the sales of securitized bonds and corporate bonds around the time of the onset of the crisis and relate them to the liquidity of the asset.

As described in the Introduction, the crisis started in August 2007. Since our observations are quarterly, we examine changes between (i) the second quarter of 2007 ending in June and the third quarter of 2007 ending in September, and also between (ii) the second quarter of 2007 ending in June and the fourth quarter of 2007 ending in December. Unreported statistics show that, on average, securitized bonds were not sold and that most of the sales took place in corporate bonds. The mutual funds reduced the holdings of corporate bonds in their portfolios by $253B (-15%) in the last quarter of 2007, while they reduced their holdings of securitized bonds by $82B (-9%). This is consistent with Hypothesis 1, namely, that securitized bonds were not prioritized for sale in the initial period of the crisis. During the same period, insurance companies are small net purchasers, increasing their holdings of corporate bonds by $60B (3%) and securitized bonds by $10B (1%). The contrast between mutual funds and insurance companies are also consistent with Hypothesis 2, namely, that short-horizon investors liquidated greater portions of their portfolios.

Next we examine whether the net sales of corporate bonds and securitized bonds are related to the contemporaneous fund flows.[23] Unlike hedge funds and investment banks that were highly leveraged and were forced to de-leverage when the values of securitized bonds that they posted as collateral plunged, mutual funds are generally un-levered. Thus, the posited propagation of shocks from securitized bonds to corporate bonds via the joint ownership of the assets (and liquidity-motivated trades) by mutual funds has to come from either contemporaneous or future expected fund flows.[24] Given our data constraints, we examine this question using contemporaneous flows only.[25] We predict that funds with the most negative flows are the main sellers of corporate bonds, and that their sales of corporate bonds dominate their trades of securitized bonds.

The results are reported in Table III, Panel A. We use just the pure bond funds that held both corporate bonds and securitized bonds in their portfolios prior to the crisis and use their portfolio changes in the last two quarters of 2007 as the dependent variable. In columns (1)-(4) the dependent variable is the percentage net purchases of corporate bonds (odd-numbered columns) and securitized bonds (even-numbered). In columns (5)-(8) the dependent variable is the *Log-$ Sales* and columns are organized analogously. The cross section of sample funds are then sorted by their contemporaneous fund flows into four bins. In columns (1)-(2) and (5)-(6), the net position changes are regressed on just the four category dummies; in columns (3)-(4) and (7)-(8), the model also includes additional fund characteristics, such as *Affiliated with bank* and *Log*(*Family size*). As expected, there is a monotonic relationship between the fund flows and net sales: funds with the most negative flows have significantly more negative net position changes, and vice versa. Importantly, funds that experience the most negative flows significantly reduce corporate bond holdings but retain securitized bonds, consistent with them needing to meet liquidity needs and deciding to sell more liquid part of portfolios. The *F*-stat for the hypothesis that the funds with the most negative flows sold significantly more corporate funds than securitized bonds is significant at the 5% level in three out of the four specifications. Interestingly, funds affiliated with banks also reduce corporate bond holdings significantly but retain

[23] We thank Ken French for suggesting this exercise.

[24] As discussed in Section 2, funds could decide to sell corporate bonds for allocation reasons even in the absence of contemporaneous outflows. Mutual funds seek to maintain relatively stable risk and style characteristics to satisfy their objectives. The "shock" to the securitized bond market has left the funds with "toxic" holdings that are riskier and less liquid than they had anticipated. To reduce the risk level, so as to avoid future outflows, the funds with securitized bond holdings would liquidate (particularly low-grade) corporate bonds.

[25] Ideally, we would also like to run experiments where we would observe the impact on *not* re-balancing funds' portfolios in response to the crisis shock on their *future* outflows. However, this is not observable for two reasons. First, in equilibrium rational fund managers would avoid such outcome by re-balancing their portfolios. Second, we are limited by our data, which last only until the first quarter of 2008.

securitized bonds. Overall, these preliminary results support the idea that the liquidity-motivated trades by funds most desperate to raise cash contributed to the propagation of shocks from securitized bonds to corporate bonds.

To further investigate the determinants of corporate bond sales at the bond level, for a cross-sectional sample of corporate bonds we estimate multivariate regressions of the following form:

$$\log Sale_i = \alpha + \beta\, Quality + \delta \log Hold_i + \gamma' x_i + \varepsilon_i, \qquad (2)$$

where $LogSale_i$ is the log-net sales (in thousands of dollars) of corporate bond *i* by institutional investors between July 2007 and December 2007, $LogHold_i$ denotes the log-dollar holding of corporate bond *i* by institutional investors as of June 2007, and *x* is a vector of standard bond characteristics, which are: the logarithm of the amount outstanding (*Bond face value*), the logarithm of the number of months to maturity (*Log(Months to maturity)*), an indicator variable for whether the bond has covenants (*Covenants*), a covenant protection index (*CovIndex*),[26] an indicator variable equal to 1 when the bond does not have a rating, 0 otherwise, an indicator variable equal to 1 when the bond is not held by institutional investors in our data set as of June 2007, as well as bond issuer and issuance year fixed effects. Including issuer fixed-effects implies that we control for any unobserved firm characteristics that may affect the sales of all bonds issued by a given issuer.

Quality denotes one of three proxies for the quality of the bond, which we include one at a time (in specifications (1) –(3)), as well as all three (in specification (4)). The first proxy is the *InvRating*, defined as:

$$\log\left(\frac{1}{1+Rating}\right),$$

where *Rating* is a numerical variable measuring the bond's rating, ranging from 0 (no rating) to 24 (AAA rating or above); the lower the rating, the higher the temporary price impact of trading, and the larger *InvRating*. The other two proxies are directly related to how thinly traded the bond is. They are constructed by using data on actual transactions from TRACE. The first is *InvTrades*, the natural logarithm of the inverse of the number of trades from TRACE. For each bond, we consider the mean number of trades per day between January 2007-June 2007; the more illiquid, the larger this variable. The second is the bond's Amihud illiquidity ratio.[27] The Amihud ratio is

[26] The construction of the covenant index follows Billet et al. (2007).
[27] Amihud (2002).

defined as the average daily $1000 \times \sqrt{|\Delta P|/\$V}$, where ΔP is the daily percentage change in price ("return") and *$V* is the bond's dollar volume of trade. This most directly measures the price impact of daily trading, as normalized by trade volume; again, the more illiquid the bond, the larger this variable. We compute the average ratio over the period January 2007-June 2007.

The results are reported in Table III, Panel B. They show that the sales by institutional investors are concentrated on bonds with lower ratings, as well as on the more liquid bonds. One standard deviation increase (decrease) in the bond's *InvRating* (Amihud ratio, *InvTrades*) is associated with a 22% (5%, 3%) higher selling pressure.

These findings are (at least partly) consistent with both the Scholes conjecture and the dynamic liquidation hypotheses. The positive relationship of sales with liquidity is consistent with the Scholes conjecture as well as with the dynamic liquidation hypotheses á la Brown et al. (2009). In contrast, the negative relationship of sales with ratings is consistent with the dynamic liquidation hypothesis and is inconsistent with the Scholes conjecture.

5.2 Selling and Investment Horizon after the onset of the crisis

We now link sales to the horizon of the investors and test whether investors with shorter horizon liquidate more in the initial phase of the crisis (Hypothesis 2) and also whether they sell lower-rated bonds more (Hypothesis 2b). We therefore relate the changes in holdings of mutual fund investors around the onset of the crisis to their investment horizon. For Hypothesis 2, we estimate for a sample of mutual funds:

$$\Delta H_i = \alpha + \beta\, Horizon_i + \gamma' x_i + \varepsilon_i, \qquad (3)$$

where ΔH is the change, between 2007Q2 and 2007Q4, in the fraction of the fund's portfolio represented by either securitized bonds or corporate bonds. *Horizon* is our proxy for the fund horizon – *Turnover ratio* or *Flow volatility*[28] – while *x* is a set of fund characteristics including the control variables from Equation (1), as well as the fraction of securitized (or corporate) bonds in the fund's portfolio as of 2007Q2. Both *Horizon* and *x* are expressed in values as of June 2007 in column (1)-(4). As described earlier, there were some signs of disruptions in the subprime-

[28] Our results reported in Tables IV-VI are robust to using the flow performance sensitivity as a third proxy of horizon. We are however concerned with two potential issues. First, the extreme performance may be more likely for equity than bonds, and more likely for lower grade corporate bonds than AAA-rated securitized bonds. Second, the sensitivity could also capture how well fund manager incentives are aligned with fund investors. These concerns make clean interpretations of results using the sensitivity proxy difficult. Thus we rely instead on the turnover and flow volatility proxies for our inferences. The results are available from the authors upon request.

mortgage markets as early as 2007Q1; hence it is possible that funds that held more securitized bonds experienced disruptions in their performance and flows in the first two quarters of 2007. Thus, to ensure that our measures of fund investment horizon are not driven by these early episodes of the crisis, we repeat our analysis using horizon measures as of December 2006, instead of June 2007, and report the results in columns (5)-(8).[29]

The results are reported in Table IV, Panel A. In columns (1)-(2), the dependent variable is the fraction of the fund's portfolio represented by securitized bonds, while in columns (3)-(4), the dependent variable is the fraction of the fund's portfolio represented by corporate bonds. The results show a significantly negative (positive) correlation between the horizon length of the investor and the net change in the representation of securitized bonds (corporate bonds) in the portfolio; that is, the shorter the horizon, the more the institutional investor reduces his stake in corporate bonds. In terms of magnitude, one standard deviation increase in the *Turnover ratio* (*Flow volatility*) is related to a 6% (2%) higher reduction in corporate bond holdings. Funds that are affiliated with commercial banks or are part of big financial groups tend to sell more corporate bonds and to retain securitized bonds.

We further examine whether the short-horizon investors sell low quality bonds more by examining their sales of corporate bonds separately for investment-grade and subinvestment-grade corporate bonds (Hypothesis 3). We repeat the specification presented in Equation (3) and simply replace the dependent variable with ΔC, the changes in portfolio representations of (i) investment-grade corporate bonds and (ii) sub-investment grade corporate bonds.

The results are reported in Table IV, Panel B. In the odd-numbered columns, the dependent variable ΔC is the fund's excess sales of investment grade bonds, as a fraction of the value of the fund's portfolio as of June 2007. In the even-numbered columns, the dependent variable is the fund's sales of junk bonds. The estimates are broadly supportive of the dynamic liquidation hypothesis in that the propensity to liquidate is more sensitive to the investment horizons of the investors for low-rated bonds. The impact of investor horizon on the sales of corporate bonds is concentrated among the below-investment-grade bonds. A one standard deviation increase in *Turnover ratio* (*Flow volatility*) tends to increase the sale of junk bonds by 6% (6%), whereas it has a significantly smaller impact on the sales of investment grade bonds (*F-stat p*-values for the statistical significance of the two coefficients are provided at the bottom of the table). Note also

[29] We thank Kent Daniel for suggesting this exercise. In unreported analysis, we also re-estimate the models reported in Tables V-VI (Panel B) and VIII using horizon measures as of December 2006 and find that the results are qualitatively unchanged.

that R-squared is three to five times larger for the junk bonds (even-numbered columns) than for investment-grade bonds (odd-numbered columns).

Overall, the results in Tables II and IV show that (i) short-horizon mutual funds loaded up on securitized bonds and ended up with a higher exposure to them by the onset of the crisis, and (ii) when the crisis hit in August 2007 and securitized bonds became illiquid, they liquidated more than longer-horizon investors in the first months of the crisis, and, in particular, they reduced their holdings of lower-rated corporate bonds. The result on lower-rated corporate bonds being sold more is consistent with the predictions of the dynamic liquidation model, where vulnerable investors optimize over multiple periods and as a result may retain relatively liquid assets when faced with sufficiently large expected future shocks. Alternatively, investors with exposure to securitized bonds may have perceived securitized bonds to have become permanently riskier, and wished to reduce the elevated risk of their portfolios by selling riskier corporate bonds.

As reported earlier, we find that the insurance companies overall were small net purchasers of both asset classes at the onset of the crisis. The only exception is a small subset of insurance companies whose risk-based capital ratios (RBC ratio) were below the threshold level of 2 as of 2007Q2 — these insurance companies sold securitized bonds.[30] Given that downgrades did ***not*** occur for most of these bonds until after our sample period, this behavior is consistent with the view that insurance companies' portfolio decisions are based on capital regulation constraints.

6. Effects of Investors' Exposure to Securitized Bonds on Corporate Bonds

The previous sections show that, as the crisis hits the market, institutional investors with a short investment horizon retain their (now) most illiquid assets – the securitized bonds – and sell the others. In particular, they prioritize the sale of junk bonds. We now examine whether corporate bonds that are held by investors with heavy exposure to securitized bonds experience negative shocks at the onset of the crisis. We start by focusing on changes in corporate bond yield spreads (prices) and trading volumes (Hypothesis 3). We then test whether the size of the impact is related to the bond rating (Hypothesis 3b). Finally, we examine whether insurance companies act as strategic liquidity providers to offset the sales by short-horizon mutual funds.

6.1 Effects on Corporate Bond Yields

For a cross-sectional sample of corporate bonds, we estimate the following model:

[30] The NAIC states that insurance companies with an RBC ratio below 2 are subject to supervision by state regulators.

$$\Delta YS_i = \alpha + \beta HoldersExposure_i + \gamma InvRating_i + \delta(HoldersExposure_i \times InvRating_i) + \varphi' x_i + \mu_j + \varepsilon_i \quad (4),$$

where each observation corresponds to a corporate bond with data in the FINRA TRACE data set. The dependent variable ΔYS_i is the change in corporate bond *i*'s yield spread around the time of the onset of the crisis. The yield spread is the difference between the bond's yield in the secondary market, as reported by TRACE, and the yield of a Treasury bond of comparable maturity.[31] Data on Treasury bond yields are from the Federal Reserve Statistical Release.

We empirically gauge the magnitude of potential future shocks by creating an exposure measure at the individual bond level ($HoldersExposure_i$). This measure is constructed by first calculating the exposure of the portfolio of each institutional investor to the securitized bonds at the individual mutual fund level, and then weight-averaging this exposure across all the funds holding a particular corporate bond *i*.[32] The larger the exposure of the mutual fund investors holding bond *i*, the more bond *i* is expected to be sold today.

What about insurance company investors? We expect the mechanism governing their portfolio decisions to be distinct. As we argued, they are not subject to runs like mutual funds, because they have longer lock-up periods and heftier early withdrawal penalties. This makes them less subject to selling pressure in the initial period of the crisis. At the same time, they are subject to rating-based capital regulation. Downgrades of securitized bonds would thus predict sales by insurance companies. However, in the second half of 2007 — the focus of our analysis — there were only a very small number of downgrades of securitized bonds. Thus, we do not expect insurance companies to liquidate as much as mutual funds during this period. To verify this prediction, we also construct an analogous *HoldersExposure* measure for insurance companies and include this variable in one of the specifications.

The dynamic liquidation model predicts that, for a sufficiently large expected future liquidity shock, investors optimizing over multiple periods may choose to liquidate assets that have relatively high temporary price impacts in the initial period (e.g., junk bonds) and to retain assets with low temporary price impacts (e.g., investment-grade bonds) to hedge against future shocks. We thus interact the exposure measure ($HoldersExposure_i$) with $InvRating_i$ (as defined before) and include this interaction term as well as $InvRating_i$ itself in the model. The lower the rating,

[31] For related literature on determinants of credit spreads and fixed-income returns, see Litterman and Scheinkman (1991), Knez et al. (1994), Colin-Dufresne et al. (2001), Chen et al. (2008), and Gutierrez et al. (2010).

[32] In the results reported in Tables V-VII, the exposure measures are as of June 2007. In unreported analyses, we re-estimate the models in Tables V-VII with exposure measures as of December 2006 and find that the results are qualitatively unchanged.

the higher the $InvRating_i$ is, and the more the bond is expected to be sold as a function of the bondholders' exposure to securitized bonds.

We also include a standard set of bond characteristics *x*, which includes the level of the yield spread of bond *i* as of June 2007, the bond's liquidity measures (*Amihud ratio* or *InvTrades*, as defined before), an interaction term between *HoldersExposure* and bond liquidity, as well as issuer and issuance year fixed effects. In all specifications, the standard errors are clustered around bond issuers.

There may be concerns that the inclusion of a given corporate bond in a portfolio of high-exposure investors is endogenous. The inclusion of a bond issuer dummy μ_j (firm fixed effect) allows us to mitigate these concerns. Effectively, the use of a firm fixed-effect model enables us to compare the yield spread change of a bond held by exposed investors to another bond *issued by the same firm* (firm *j*) but held by non-exposed investors, holding any issuer-specific characteristics (both observable traits, such as credit ratings, as well as unobservable, idiosyncratic traits) constant.

Further, since we construct the dependent variable, yield spread, as the yield of the bond in excess of the Treasury bond of the same term structure, we are also able to control for any term spread difference that might be present between the exposed and non-exposed bonds of a given issuer. That is, we are able to isolate the variations in spread changes and selling pressures across bonds (holding issuer risk and term structure constant) as functions of bond-specific exposure measures.

We report the results in Table V. In columns (1)-(4) ΔYS is defined as the change in the bond's yield spread over the period from the last week of June through the last week of October 2007, while in columns (5)-(8) it is the change in the bond's yield spread over the period from the last week of June through the last week of December 2007. The sample includes all bonds in the FINRA TRACE data set with available data on bond characteristics from the Mergent FISD data.

The first coefficient, *HoldersExposure*, is positive and significant, which means that the higher the exposure of the investors holding bond *i*, the more the yield spread goes up in the months after the onset of the crisis. Comparing the coefficients on *HoldersExposure* between the left- and the right-hand side panel, we also note that they are two to three times larger in the right-hand side panel, which is consistent with the worsening effect of investors' exposure on yields over time. The results are consistent with Hypothesis (3). An increase in *HoldersExposure* from 0% to 50% is associated with a 70 bps higher increase in the yield spread in the first two quarters

of the crisis. Recall (Table I) that corporate bond yield spreads increased by approximately 100bps on average in the first quarter of the crisis, and about 200 bps in the first two quarters of the crisis. This suggests that our findings are large but reasonable.

The third coefficient, the interaction term of *HoldersExposure* and *InvRating*, is also positive and significant. This implies that the lower the rating of the bond, the more its yield increased as a function of its holders' exposure to securitized bonds. The result is consistent with Hypothesis (3b) and suggests that the sharp increase in yield spreads of lower-rated bonds at the start of the crisis, as depicted in Figure 1, is at least partly due to the contagion of the shock from the (mostly AAA-rated) securitized bond market to the lower-rated corporate bond market via the joint ownership of both securities by mutual funds.

We separately control for the effect of a rating itself on the yield spread change by including *InvRating* itself in the model (second row). The positive and significant coefficient suggests that the lower the rating of the bond, the more the bond yield increased during this period independent of the investors' exposure to securitized bonds. This may be due to overall increased fear of risk or investor panic that is unrelated to the transmission mechanism we examine here. The interaction term between *HoldersExposure* and the bond's overall liquidity measures (Amihud ratio, *InvTrades*), on the other hand, is generally insignificant.

We also augment specification (4) by adding the fraction of securitized bonds held by the insurance companies and the corresponding interaction term with the ratings. Neither coefficient is significant (though positive). This is in line with our expectations, since insurance companies are not expected to be under pressure in the initial period of the crisis when bond ratings are still largely intact.

Overall, these results show that there is an incremental effect that comes from the transmission channel that we identify over and above the general unconditional increase in corporate bond yields during this period. The increase in bond yield spreads around the 2007 crisis is most pronounced among the low-rated bonds held by mutual funds with heavy exposure to securitized bonds.

As a robustness check, in Panel B, we estimate an alternative model specification:

$$\Delta YS_i = \alpha + \beta ShortExposed_i + \gamma InvRating_i + \delta(ShortExposed_i \times InvRating_i) + \varphi' x_i + \mu_j + \varepsilon_i \quad (5),$$

where $ShortExposed_i$ is an indicator equal to 1 if bond i's short-horizon mutual fund holder's exposure to securitized bonds is above the sample median. The idea is to isolate the effect on short-horizon investors' exposure (to securitized bonds) on yield spread changes, rather than the

average holder's exposure. We use two proxies of investor horizon, and examine the model using both the change in yield spread between July and October 2007 (columns (1)-(2)), as well as between July and December 2007 (columns (3)-(4)). Positive coefficients on $ShortExposed_i$ itself as well as positive coefficients on its interaction term with $InvRating_i$ indicate that presence of high exposure for these investors with liquidity needs is associated with greater yield spread changes, and this is especially so for lower-rated bonds.

In Figure 2, we provide an illustration of the econometric results presented in Table V. We plot the cumulative monthly return on a portfolio that is short on corporate bonds whose mutual fund holders have "high exposure" to securitized bonds, and long on a set of issuer- and duration-matched bonds without the exposure. We place a "high exposure" bond in the short portfolio if and only if it has a matching bond without a high exposure satisfying the following criteria: (i) the matching bond is issued by the same issuer firm; and (ii) the time to maturity of the matching bond is between 50% and 150% of the time to maturity of the shorted bond. These matched bonds are then placed in the long portfolio. We then construct the return of a portfolio based on the difference between long portfolio's monthly return minus the short portfolio's monthly return.

The cumulative return on the long-short portfolio hovers around zero from 2004 to 2006, but rises sharply in 2007. Given that the return on this portfolio is, by construction, independent of changes in firm-specific risk, we can interpret this sharp rise as due to selling pressure on the exposed bonds by their investors.[33] While this plot is for illustrative purposes only, the issuer fixed effect models presented in Tables V-VII allow us to draw inferences about the statistical significance of this effect.

6.2 Effects on Corporate Bond Trades

While the positive relationship between investors' exposure to securitized bonds and an increase in the yield is consistent with selling pressure being exerted on the bond by mutual funds in need of liquidation, we have so far not directly studied whether individual bond sales by mutual funds are a direct function of their exposure. Therefore, we now focus on whether mutual funds' relative trading impact increased after the onset of the crisis and whether this increase is related to the fraction of securitized bonds they held. We estimate

$$\Delta Tr_i = \alpha + \beta HoldersExposure_i + \gamma InvRating_i + \delta(HoldersExposure_i \times InvRating_i) + \varphi' x_i + \mu_j + \varepsilon_i \quad , (6)$$

[33] There may be concerns that the term spread differences between the exposed bond and the matched bond may drive some of these results. In the results reported here, the exposed bonds have on average slightly longer duration (about 8.75 years) than the matched bonds (8.13 years) by the same issuers. To address these concerns, we repeated the exercise with a restricted sample where the matched bonds had longer duration than the exposed bonds, and the results were qualitatively unchanged.

where the dependent variable is defined as:

$$\Delta Tr_i = \frac{\text{Net sales of the mutual funds}}{\text{Total volume of trading from TRACE}}$$

for corporate bond *i*, over the periods July-October 2007 and July-December 2007. This variable proxies the weight of the mutual funds' sales out of all the trades for bond *i*. We hypothesize that the selling pressure from mutual funds on a bond is higher the more the funds are exposed to securitized bonds *and* the lower the bond rating is. The other variables are defined as in the previous specification.

The results are reported in Table VI. The interaction term coefficient is positive and significant. Thus, the lower the rating of bond *i and* the higher the exposure of its investors to securitized bonds, the higher the mutual funds sales as a percentage of the total trading volume for the bond in the initial months of the crisis. A one standard deviation increase in *HoldersExposure* is associated with a 26% higher increase in mutual funds' selling pressure for a junk bond (rated BBB- or below) than for a AAA-rated bond.

In Panel B, we estimate an alternative model specification based on the following:

$$\Delta Tr_i = \alpha + \beta ShortExposed_i + \gamma InvRating_i + \delta(ShortExposed_i \times InvRating_i) + \varphi' x_i + \mu_j + \varepsilon_i \quad (7).$$

This specification is analogous to Equation (5) in Table V, Panel B.

We find a positive relationship between trading volume and both *ShortExposed* itself as well as its interaction with *InvRating.* This indicates that the presence of high exposure for the investors with liquidity needs is associated with more selling pressure, and especially for lower-rated bonds.

Finally, as a robustness check, we re-estimate specification (6) using as a dependent variable *LogVol*, defined as: *LogVol* = log(1 + *Vol*) where *Vol* is the bond's average daily trading volume, expressed in thousands of trades. This variable proxies for the overall trade in the market. *HoldersExposure* and *InvRating* are defined as above, and *x* is a set of standard control variables, including the average weekly log-trading volume as of June 2007, as well as issuer and issuance year fixed effects.

The results are reported in Table VII. The first row coefficient, *HoldersExposure*, is positive and significant, implying that the higher the bondholders' exposure to securitized bonds, the higher the trading volume of corporate bond *i*. The second row coefficient, *InvRating*, is negative and significant, implying that unconditionally lower-rated bonds are traded less and thus more

illiquid. This finding validates our use of a bond's rating as a measure of a temporary price impact of trading. More importantly, the third coefficient, the interaction between the first two, is positive and significant. This implies that, even though lower-rated bonds traded less in the initial months of the crisis in general, among those held by investors with exposure to securitized bonds, higher exposure and lower bond rating were directly related to more trades. This is consistent with Hypothesis (3b). That is, when faced with large uncertainty about recurring future liquidity shocks (as measured by exposure to securitized bonds), investors chose to sell lower-rated corporate bonds and to retain higher-rated corporate bonds as a hedge against future forced liquidations.

This provides the final link between securitized bond holdings, investor sales, and corporate bond yields. It shows that the corporate bonds that experience increases in yields due to high exposure of their holders to securitized bonds are also the ones that display spikes in trading volumes and increases in representations of mutual fund trades among overall trades during the initial months of the crisis. Overall, these results suggest that funds significantly increase their price pressure on corporate bonds during the crisis and that this impact is positively related to their exposure to securitized bonds.

6.3 Are Insurance Companies Strategic Liquidity Providers?

In the previous sections, we find that insurance companies traded relatively little and in fact were small net purchases of both corporate bonds and securitized bonds at the onset of the crisis. Magnitudes of their trades are small compared to those of mutual funds, which suggest they did not fully offset the mutual funds' liquidity demand. Moreover, unlike mutual fund holders whose exposure to securitized bonds affected increases in bond yield spreads, insurance companies' exposure to securitized bonds had no significant impact on the yields of corporate bonds they held. Similarly, their exposure did not impact how much mutual funds holders contributed to the selling pressure on a given bond. At the same time, we find, in Table VII, that the effect of insurance companies' exposure on the overall trades of a bond was significantly positive in the period including the last quarter of 2007.

In this subsection we provide additional analysis on whether insurance companies acted as strategic liquidity providers to offset the sales of corporate bonds by mutual funds.[34] Our analysis

[34] We acknowledge that our analysis is limited by the fact that we do not observe holdings by other classes of investors, such as hedge funds, banks, governments, and foreign investors. Clearly, it is important to understand who besides insurance companies acted as liquidity providers in various asset class markets during this time of the crisis. For example, He, Khang, and Krishnamurthy (2010) argue that banks were liquidity providers in the securitized bond market.

consists of comparisons of insurance companies' behavior in pre-crisis and crisis periods, such as correlation of their trades with mutual funds' and price impact of their trades and mutual funds' trades on bond yield spreads.

First, we examine the extent to which mutual funds' net trades of individual corporate bonds are (positively or negatively) correlated with insurance companies' net trades of the same bonds. The model we estimate and report in Table VIII, Panel A is as follows:

$$MF\_Netbuy_{it} = \alpha + \beta_1 INS\_Netbuy_{it} \times (1 - Crisis_t) + \beta_2 INS\_Netbuy_{it} \times Crisis_t + \gamma' x_{it-1} + \varepsilon_{it} \quad (8),$$

where MF_Netbuy_{it} and INS_Netbuy_{it} are mutual funds' and insurance companies' net purchases of corporate bond *i* at *t*, respectively. Column (1) in Panel A reports the results for all the mutual funds, while columns (2)-(3) and (4)-(5) report the results for short-horizon funds and non-short-horizon funds, respectively. Positive and significant coefficients for β_1 and β_2 imply that insurance companies' trades and mutual funds' trades are positively correlated both in the pre-crisis and crisis periods. The large *F*-stat values for H_0: $\beta_1 = \beta_2$ show that the positive correlation between the trades became significantly stronger, not weaker, during the crisis months.

In Panel B, we compare for a cross-section sample of corporate bonds the correlation of mutual funds' trades with insurance companies' trades in the crisis periods for low-flow funds and high-flow funds, respectively. While they are both positively correlated, trades of low-flow funds are significantly less correlated with the insurance companies' trades, suggesting that their trades offset each other to a greater degree than trades of high-flow funds and those of insurance companies.

Next, we break down the institutional trades into mutual fund trades and insurance company trades to see if there was a structural break in the relationship between the trades and the bond yields at the onset of the crisis. The results are reported in Table IX. This analysis provides several interesting findings. First, we document in column (2) that mutual funds are larger net sellers of corporate bonds in the crisis period than in the pre-crisis period. In contrast, insurance companies' net sales are significantly smaller as a percentage of their total holdings during the crisis period than in the pre-crisis period (column (1)). This suggests that, at least to a degree, insurance companies' trades mitigate the overall fluctuations in trades caused by mutual funds. In column (3), we show that the relation between the institutional investors' (i.e., mutual funds and insurance companies combined) net trades and bond yield spread changes was positive in the pre-crisis periods, whereas it turns negative, i.e., net sales are associated with yield increases, in the crisis periods. In column (4), we break down the institutional investors' net trades into mutual

funds' and insurance companies' trades, and show that this structural break in the relation between trades and yield changes is driven by mutual funds rather than insurance companies. Further, in column (5), we examine the net purchases by funds that experience more negative flows (below median). We find that their trades is significantly correlated with bond yield spread changes with a negative sign in the crisis-periods, and that the coefficient is significantly larger than for mutual funds overall (p-value = 0.0131).

Our interpretation of the results is as follows: Mutual funds were strategic liquidity providers for corporate bonds they held during the pre-crisis period, buying when yield for the bond was going up (when price was low). As the crisis hit, mutual funds became liquidity demanders, effectively selling when the price was low; this is especially true for funds with negative flows. In contrast, insurance companies never acted strategically. We think that this is perhaps because their flows are steady and they do not have much room to act strategically. Also, their capital regulation might have curtailed their economic incentives to hold (especially) lower-rated corporate bonds.

Overall, these findings suggest that insurance companies did not act as strategic liquidity providers at the onset of the crisis and that at best there is only weak evidence that their trades partially offset the net sales of corporate bonds by mutual funds.

Conclusion

We study a transmission mechanism that explains the contagion of the crisis from the securitized bond market to the corporate bond market. We posit that, ceteris paribus, corporate bonds held by "intoxicated" investors with high exposure to securitized bonds and liquidity needs experience greater selling pressure and price declines (yield increases) at the onset of the crisis. We further test predictions of the theory of dynamic asset liquidation: Investors with large enough future liquidity shocks retain the most liquid assets, and instead sell assets that have a relatively high (temporary) price impact of trading.

The results confirm our predictions about the transmission mechanism and the determinants of investors' portfolio decisions. We show that, prior to the onset of the crisis, mutual fund investors were eager participants in the securitized bond market, especially in the top-rating category. This was "rational" in the pre-crisis world when these securitized bonds were considered to be safe, liquid and informationally insensitive, relative to corporate bonds with higher idiosyncratic risk and, therefore, a need for more intensive credit research. Consistent with the view that investors were hungry for relatively attractive yields in the low-interest environment,

funds with high flow-performance sensitivity held higher portions of their portfolios in securitized bonds. Funds that are affiliated with commercial banks also held higher portions of their portfolios in securitized bonds.

When securitized bonds abruptly became illiquid and their resale values plunged, the institutional investors with significant exposure to securitized bonds – i.e., mutual funds with short investment horizons and insurance firms with regulatory capital constraints – faced a portfolio rebalancing problem. The mutual funds did not rush to sell the now impaired and hard-to-value securitized bonds en masse, and instead sharply reduced holdings of corporate bonds, while the insurance companies sold neither class of assets (except those with a below-threshold level of risk-based capital, which reduced holdings of securitized bonds). The mutual funds' portfolio decisions induced a transmission of shocks from the securitization market to the corporate bond market. Most importantly, sales rose and yield spreads widened more for bonds held by exposed mutual fund investors, compared to same-issuer bonds held by unexposed investors. Our findings show that short-horizon investors with high exposure to securitized bonds have played a significant role in spreading the crisis from the securitized bond market to the seemingly unrelated corporate bond market. The incentives and contract features significantly affect the behavior of institutional investors, as indicated by the impact of investment horizon, as well as institutional differences between mutual funds and insurance companies on their behavior.

References

Amihud, Yakov, 2002, Illiquidity and Stock Returns: Cross-section and Time-series Effects, *Journal of Financial Markets* 5, 31-56.

Bernardo A.E., and I. Welch, 2004, Liquidity and Financial Market Runs, *Quarterly Journal of Economics*, 135-157

Billett, M., T. D. King, and D. Mauer, 2007, Growth Opportunities and the Choice of Leverage, Debt Maturity, and Covenants, *Journal of Finance* 62, 697-730.

Blundell-Wignall, A., Structured Products: Implications for Financial Markets, OECD, 2007.

Boyer, B., T. Kumagai, and K. Yuan, 2006, How Do Crises Spread? Evidence from Accessible and Inaccessible Stock Indices, *Journal of Finance* 61, 957-1003.

Brown, D., B. Carlin, and M. Lobo, 2009, On the Scholes Liquidation Problem, Working Paper.

Brunnermeier, M., 2009, Deciphering the Liquidity and Credit Crunch 2007-2008. *Journal of Economic Perspectives* 23, 77-100.

Brunnermeier, M., and S. Nagel, 2004, Hedge Funds and the Technology Bubble, Journal of Finance 59, 2013-2040.

Caballero, R., E. Farhi, and P. Gourinchas, 2008, An Equilibrium Model of 'Model Imbalances' and Low Interest Rates, *American Economic Review* 98, 358-393.

Carlin, B.I., M.S. Lobo, and S. Viswanathan, 2007, Episodic Liquidity Crises: Cooperative and Predatory Trading. *Journal of Finance* 62, 2235-2274.

Chen, Q., I. Goldstein, and W. Jiang, 2007, Payoff Complementarities and Financial Fragility: Evidence from Mutual Fund Outflows, Working Paper, University of Pennsylvania.

Chen, X., J. Harford, and K. Li, 2007, Monitoring: Which Institutions Matter? *Journal of Financial Economics* 86, 279-305.

Chen, Y., W. Ferson, and H. Peters, 2008, Measuring the Timing Ability of Fixed Income Mutual Funds, Working paper, University of Southern California.

Colin-Dufresne, P., R. Goldstein, and J. S. Martin, 2001. The Determinants of Credit Spread Changes. Journal of Finance 56, 2177—2207.

Coval, J., J. Jurek, and E. Stafford, 2008, Economic Catastrophe Bonds, *American Economic Review* 99, 628–66.

Coval, J.D, and E. Stafford, 2007, Asset Fire Sales (and Purchases) in Equity Markets, *Journal of Financial Economics* 86, 479-512.

Edelen, R., 1999, Investor Flows and the Performance of Open-Ended Mutual Funds, *Journal of Financial Economics* 53, 439-466.

Gaspar J.-M., M. Massa, and P. Matos, 2006, Favouritism in Mutual Fund Families? Evidence on Strategic Cross-Fund Subsidization, *Journal of Finance* 61, 73-104.

Getter, D., M. Jickling, M. Labonte, and E. Murphy, 2007, Financial Crisis? The Liquidity Crunch of August 2007, CRS Report for Congress.

Gorton, G., 2008, The Panic of 2007, Working Paper.

Gorton, G., 2009, Slapped in the Face by the Invisible Hand: Banking and the Panic of 2007, Working Paper.

Gorton, G., and A. Metrick, 2009, Securitized Banking and Run on Repo, Working Paper.

Griffin, J. and D. Y. Tang, 2009, Did Subjectivity Play a Role in CDO Credit Ratings?, Working Paper, University of Texas at Austin.

Gutierrez, R., W. Maxwell, and D. Xu, 2010, On Economies of Scale and Persistence in Corporate-Bond Mutual Funds, Working paper, University of Oregon.

He, Z., I. Khang, and A. Krishnamurthy, 2010, Balance Sheet Adjustments during the 2008 Crisis, Working paper.

Herring, R., and T. Schuermann, 2003, Capital Regulation for Position Risk in Banks, Securities Firms and Insurance Companies, Working Paper.

Holmstrom, B., 2008, "Discussion of 'The Panic of 2007,' by Gary Gorton," in *Maintaining Stability in a Changing Financial System*, Proceedings of the 2008 Jackson Hole Conference, Federal Reserve Bank of Kansas City, 2008.

Huang J.C., K.D. Wei, and H. Yan, 2007, Volatility of Performance and Mutual Fund Flows, Working Paper, University of Texas at Austin.

Jiang, W., A. Nelson, and E. Vytlacil, 2009, Liar's Loan? Effects of Origination Channel and Information Falsification on Mortgage Delinquency, Working Paper, Columbia University.

Jin, L., 2006, Capital Gain Tax Overhang and Price Pressure, Journal of Finance 61, 1399-1430.

Keys, B. J., T. K. Mukherjee, A. Seru, and V. Vig. 2010. Did Securitization Lead to Lax Screening? Evidence from Subprime Loans, *Quarterly Journal of Economics* 125, 307-362.

Knez, P., R. Litterman, and J. Scheinkman, 1994. Explorations Into Factors Explaining Money Market Returns. *Journal of Finance* 49, 1861-1882.

Litterman, R. and J. Scheinkman, 1991. Common Factors Affecting Bond Returns. *Journal of Fixed Income*, 54-61.

Longstaff, F., 2010, The Subprime Credit Crisis and Contagion in Financial Markets, *Journal of Financial Economics* 97, 436-450.

Longstaff, F., and B. Myers, 2009, How Does the Market Value Toxic Assets?, Working paper.

Massa, M., A. Yasuda, and L. Zhang, 2009, Supply Uncertainty of the Bond Investor Base and the Leverage of the Firm, Working Paper.

Mian, A. and A. Sufi, 2008, The Consequences of Mortgage Credit Expansion: Evidence from the U.S. Mortgage Default Crisis, Working Paper.

Mian, A. and A. Sufi, 2009, House Prices, Home Equity-based Borrowing, and the U.S. Household Leverage Crisis, Working Paper.

Nini, G., 2009. How Non-banks Increased the Supply of Bank Loans: Evidence from Institutional Term Loans, Working Paper.

Petersen, M., 2009, Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches, *Review of Financial Studies* 22, 435-480.

Shleifer, A. and R. Vishny, 1997, The limits to arbitrage, *Journal of Finance* 52, 35-55.

Shleifer, A. and R. Vishny, 2009, Unstable Banking, Working Paper.

Scholes, M., 2000, Crisis and Risk Management. *American Economic Review* 90, 17-21.

Appendix: Variable Definitions

I. Mutual Fund Characteristics

$H, \Delta H, \Delta C$ Holdings of corporate bonds and securitized bonds in the mutual fund's portfolio, and changes thereof after the onset of the crisis. *H* is defined as the percentage of corporate bonds (respectively securitized bonds) in the mutual fund's portfolio, in excess of the average percentage holdings of corporate bonds (respectively securitized bonds) among the funds in the same sector as the fund. We define sectors based on the maturity and rating of the securities held in the funds' portfolios by crossing three maturity terciles and three rating terciles, obtaining nine sectors. ΔH is the change in *H* between June 2007 and December 2007. *C* is the percentage of investment grade (resp. sub-investment grade) corporate bonds in the mutual fund's portfolio, defined analogously. ΔC is the change in *C* between June 2007 and December 2007.

Flow volatility Standard deviation of the mutual fund's monthly flows, computed over a rolling window of length 12 months.

Turnover ratio Turnover ratio of the mutual fund's portfolio, defined as the minimum (of aggregated sales or aggregated purchases of securities) divided by the average 12-month total net assets of the fund.

Flow-performance sensitivity Sensitivity of the investment flow into the mutual fund to the fund's past performance. Define the net flow into the mutual fund in a given month as:

$$Flow_t = \frac{TNA_t - (1 + R_t) \times TNA_{t-1}}{TNA_{t-1}}$$

where *TNA* is the fund's total net asset value, and *R* is the fund's return. We sort funds into 3x3 = 9 styles, based on maturity and ratings of bonds held. Every month, the fund's style-adjusted return is calculated as the fund's return minus the average style return. We measure the fund *i*'s percentile rank of its cumulative style-adjusted return in January to June of a given year ($Performance(Jan\text{-}June)_{it}$) and the cumulative flow into the fund in July to December of the same year ($Flow(July\text{-}Dec)_{it}$), so as to avoid the overlap in measurement periods. Finally, the following regression is estimated separately for each fund *i* over the period 1998-2006:

$$Flow\,(Jul\text{-}Dec)_{it} = a_i + b_i Perf\,ormance(Jan\text{-}June)_{it} + \varepsilon_{it},$$

The fund *i*'s flow-performance sensitivity is the estimate $\hat{b}_i$.

Log(Family size) Natural logarithm of the total net assets under management of the fund's mutual fund family, expressed in thousands of dollars.

Affiliated with commercial bank Indicator variable equal to one if the mutual fund belongs to a fund family that is affiliated with a commercial bank (following Massa and Rehman (2008)).

Past flow Investment flow into the mutual fund over the previous quarter.

Fund return Quarterly return of the mutual fund.

Family equity holdings Equity holdings by the fund's fund family as a fraction of total holdings.

Mgmt fee Management fees of the mutual fund, as a fraction of its average net assets, obtained from the CRSP Survivor-Bias-Free Mutual Fund Database.

Expense Ratio Fund's expense ratio in the most recent fiscal year, defined as the total investment that the shareholders pay for the fund's operating expenses (including12b1 fees).

Actual 12b1 Ratio of total assets of the fund attributed to marketing and distribution costs, as reported in the Annual Report Statement of Operations.

Average maturity of the holdings Natural logarithm of the average maturity of the fixed income holdings of the mutual fund, expressed in quarters.

No equity (N/Y) Indicator variable equal to one if the fund does not hold any equity, zero otherwise.

Fund's equity holdings return Quarterly return on the equity holdings of the mutual fund.

II. Bond characteristics

LogSale (Jul-Oct 2007/Jul-Dec 2007) Natural logarithm of the net sales (in $K) of the bond by institutional investors over the periods July to October 2007 or July to December 2007.

Δ***YS (Jul-Oct 2007/Jul-Dec 2007)*** Change in the bond's yield spread (defined as the spread between the bond's yield and the yield of a government bond of comparable maturity) over the periods July to October 2007 or July to December 2007.

Δ***Tr (Jul-Oct 2007/Jul-Dec 2007)*** Net sales of the bond by mutual funds as a fraction of the bond's total trading volume, over the specified periods (July-Oct 2007/July-Dec 2007).

Holders' Exposure Holdings of securitized bonds as a fraction of the portfolio of the average mutual fund holding the bond. For each bond, we compute the fraction of securitized bonds in the portfolio of each mutual fund that holds the bond. We then weight average across mutual funds, with weights proportional to the par amount held by each fund.

Insurance Holders' Exposure Average holdings of securitized bonds as a fraction of the portfolio of the average insurance company holding the bond.

No rating (Y/N) Indicator variable equal to one if the bond does not have a rating, zero otherwise.

InvRating An inverse measure of the quality of the bond's rating, as defined in the text.

Bond face value Natural logarithm of the total amount outstanding of the bond at the issuance date, expressed in thousands of dollars.

Covenants (Y/N) Indicator variable equal to one if there are covenants attached to the bond, and zero otherwise. Data on covenants are obtained from the Mergent Fixed Income database.

CovIndex Billet et al. (2007) index of covenant protection ranging from zero (no covenant protection) to one (complete covenant protection).

Log(Months to maturity) Natural logarithm of the bond's time to maturity, expressed in months.

Amihud Amihud's (2002) illiquidity proxy, as defined in the text.

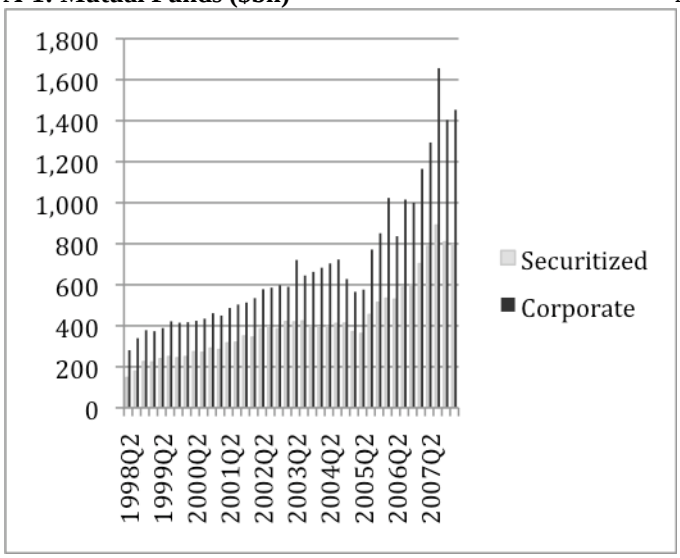
InvTrades The natural logarithm of the inverse of the number of trades on the bond, as reported from FINRA's TRACE data set.

Table I Summary Statistics

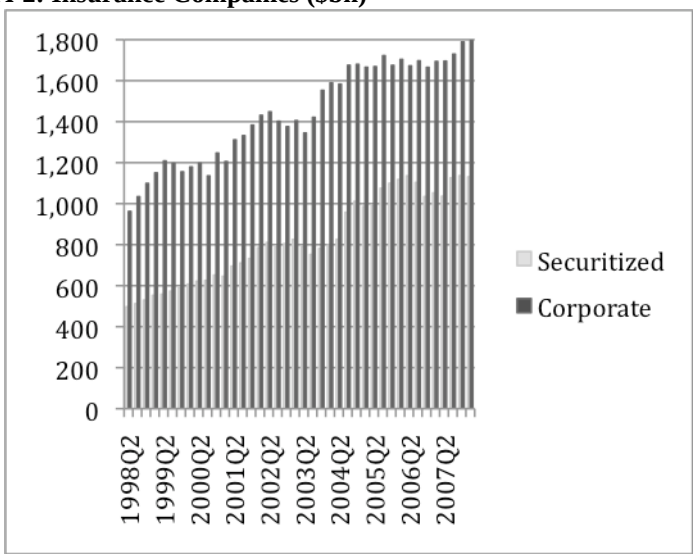
The table reports the summary statistics. Panel A reports the securitized bond and corporate bond holdings by mutual funds and insurance companies. Panel B reports the corporate bond and securitized bond holdings of mutual funds by ratings (for bonds with known ratings only). Panel C reports AAA-rated bond holdings as % of the total portfolio. Panels D reports the breakdown of securitized bond holdings by collateral type (residential mortgage-backed securities (RMBS), commercial mortgage-backed securities (CMBS), other asset-backed securities (ABS), and government agency-backed securities (Agency). Panel E reports the summary statistics for the main variables used in the analysis.

A. Corporate bond and securitized bond holdings of mutual funds and insurance companies

A-1: Mutual Funds ($bn)

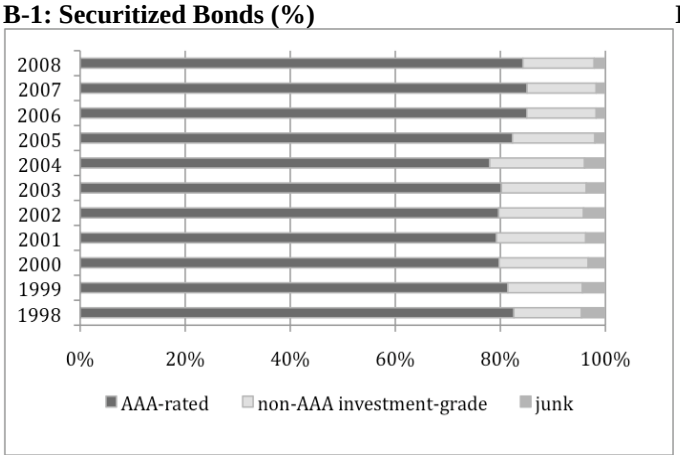


A-2: Insurance Companies ($bn)

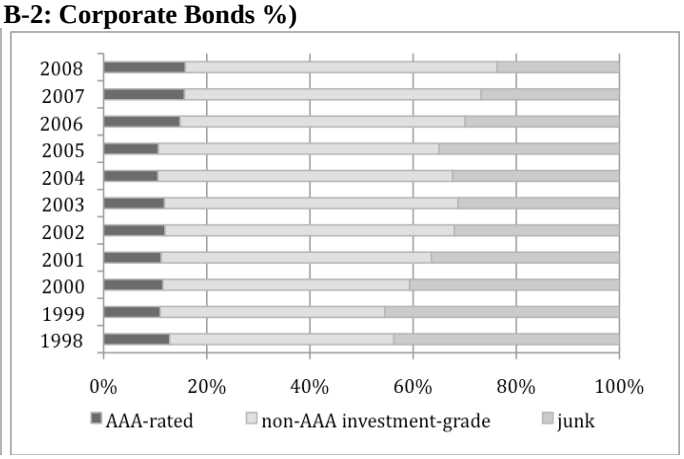


B. Corporate bond and securitized bond holdings of mutual funds, by ratings

B-1: Securitized Bonds (%)

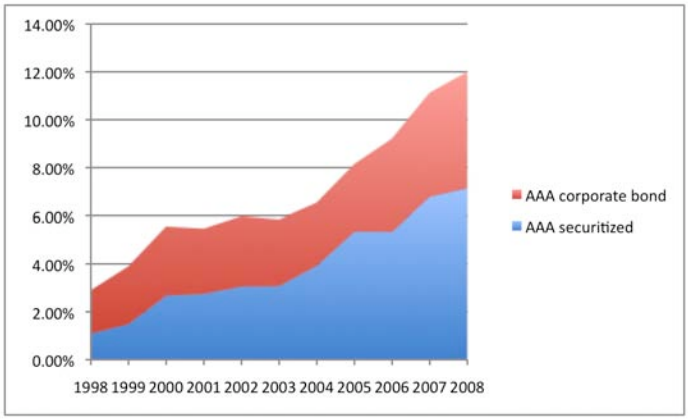


B-2: Corporate Bonds %)



C: AAA-rated bonds as % of total

C-1: Mutual fund portfolio



C-2: Insurance company portfolio

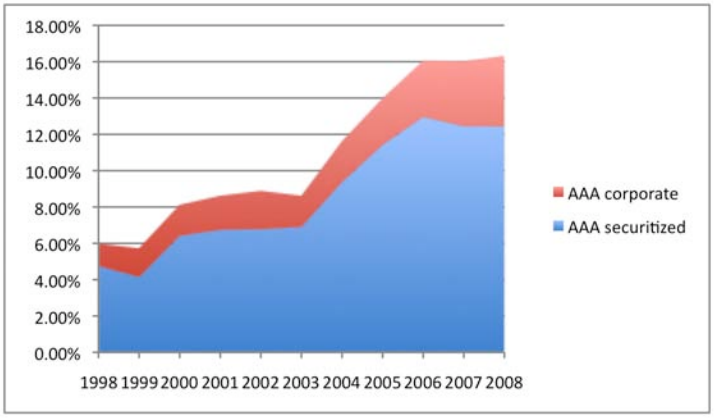
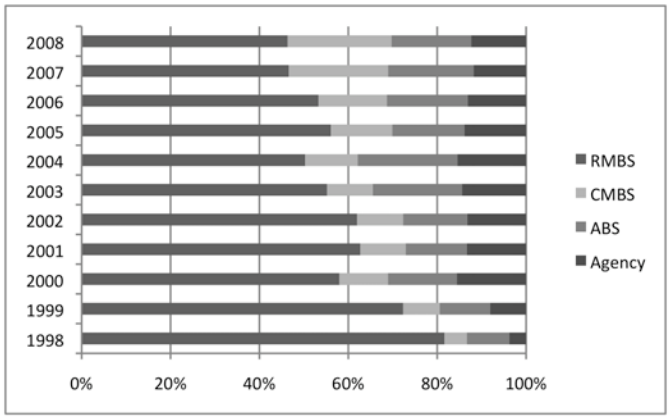


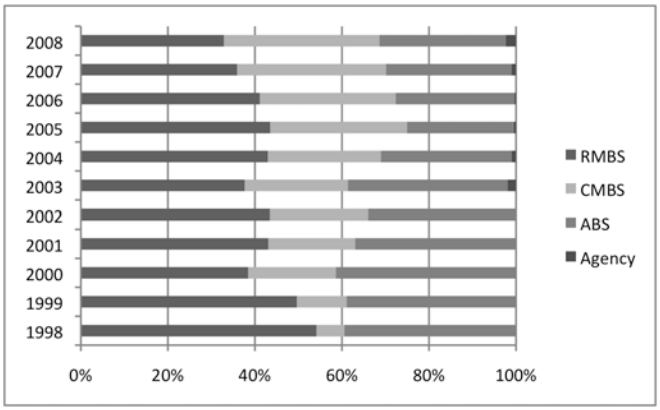
Table I Summary Statistics – cont'd

D. Securitized bond holdings, by underlying asset type and ratings

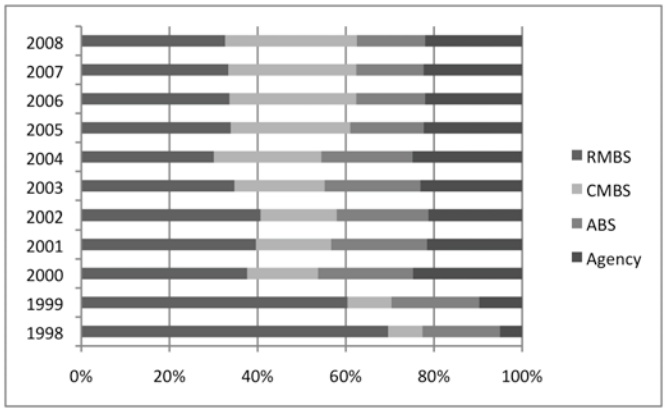
D-1: Mutual fund portfolio – all ratings



D-2: Mutual fund portfolio – AAA-rated only



D-3: Insurance company portfolio – all ratings



D-4: Insurance company portfolio – AAA-rated only

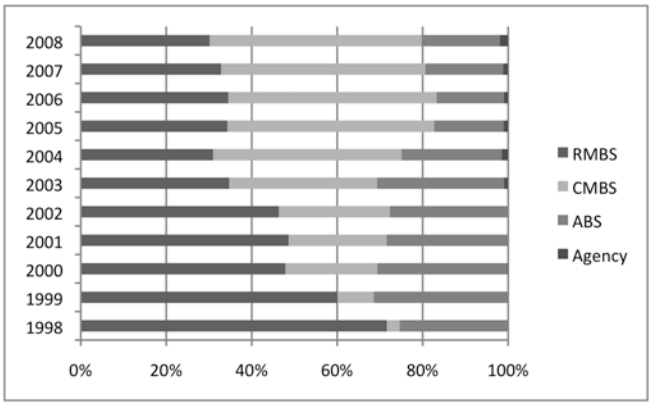


Table I Summary Statistics – cont'd

E. Variables Used in the Analysis

	Mean	Median	St. Dev.	Min	Max	N. Obs
	(1)	(2)	(3)	(4)	(5)	(6)
E-1: Variables used in Tables II and IV						
Excess fractional holdings of corporate bonds	0.0346	0.0000	0.2809	-0.8644	0.9861	16252
Excess fractional holdings of securitized assets	0.0154	0.0000	0.2216	-0.6464	0.8956	16252
Turnover ratio (as fraction of TNA)	0.0135	0.0088	0.0137	0.0000	0.0980	16252
Flow-performance sensitivity	0.2407	0.0874	0.4779	0.0000	8.5579	15835
Flow volatility (over 12 monthly flows)	0.0549	0.0303	0.0658	0.0031	0.3987	15400
Log(Family Size) (Size in $M)	3.0722	3.0809	1.8474	0.0000	7.2332	16252
Affiliated with commercial bank [1=YES]	0.2877	0.0000	0.4527	0.0000	1.0000	16252
Past flow	0.0202	-0.0009	0.1187	-0.2176	1.9452	16252
Fund return	0.0136	0.0114	0.0432	-0.3982	0.7702	16252
Family fractional equity holdings	0.1582	0.0000	0.2720	0.0000	0.9837	16252
Mgmt fee (%)	0.4956	0.5030	0.2465	0.0000	2.2210	16252
Exp. Ratio	0.0105	0.0093	0.0066	0.0000	0.1877	16252
Actual 12b1	0.0025	0.0000	0.0036	0.0000	0.0103	16252
Average maturity of holdings (months)	42.004	36.797	20.769	0.0007	196.00	16252
No equity [1 = NO]	0.8166	1.0000	0.3869	0.0000	1.0000	16252
Fund's equity holdings return	0.0114	0.0000	0.1050	-0.8961	2.0006	16252
E-2: Variables used in Tables III and V-VII						
LogSale (Jul-Oct 2007) (Sale in $K)	3.3864	0.0000	4.3138	0.0000	13.541	8148
LogSale (Jul-Dec 2007) (Sale in $K)	4.2004	0.0000	4.7330	0.0000	13.893	8148
ΔYS (Jul-Oct 2007) (%)	0.8151	0.5376	1.2439	0.0495	13.191	7348
ΔYS (Jul-Dec 2007) (%)	1.9650	1.2949	2.0580	0.3239	19.965	8148
ΔTr (Jul-Oct 2007)	0.0291	0.0000	0.2370	-0.0962	0.5646	8666
ΔTr (Jul-Dec 2007)	0.0353	0.0000	0.0846	0.0000	0.4997	8728
Holders' Exposure (between 0 and 1)	0.0944	0.0000	0.1472	0.0000	0.9050	9598
High-Turnover holders [1=YES]	0.3113	0.0000	0.4631	0.0000	1.0000	8728
High-Flow volatility holders [1=YES]	0.3291	0.0000	0.4699	0.0000	1.0000	8728
InvRating	-2.6509	-3.0445	1.0272	-3.3322	0.0000	9598
Yield spread in 2007Q2 (%)	1.3392	1.1010	1.4089	0.3530	9.4245	9598
No Rating [1 = NO]	0.1267	0.0000	0.3327	0.0000	1.0000	9598
Bond face value (Log($K))	11.275	12.067	2.0613	7.0553	15.425	9598
Covenants [1=YES]	0.4974	0.0000	0.5000	0.0000	1.0000	9598
CovIndex (between 0 and 1)	0.1673	0.0000	0.2004	0.0000	0.6667	9598
Log(Months to maturity)	4.1110	4.2627	1.1467	0.0000	6.9903	9598
Insurance Co.'s Exposure (between 0 and 1)	0.2182	0.2761	0.1751	0.0000	0.9716	9598
Bond is not held by mutual funds [1 = NO]	0.4359	0.0000	0.4959	0.0000	1.0000	9598
Amihud's Illiquidity proxy	0.4466	0.4095	0.2848	0.0433	1.5162	9598
InvTrades	-0.9774	-0.8544	0.5011	-4.0012	-0.2231	9598

Table II The Effects of Fund Types on the Propensity to Hold Securitized Bonds

The table reports the estimates of a model:

$$H_{it} = \alpha + \beta\, Flow - Performance\ Sensitivity\ (\text{alternatively } Horizon)_{it} + \gamma' x_{it} + \varepsilon_{it}, \quad (1)$$

where each observation represents the portfolio composition of a given mutual fund in a given quarter. The dependent variable *H* is the excess percentage ownership of the fund's portfolio represented by securitized bonds (Panel A) or corporate bonds (Panel B). *Sensitivity* is the mutual fund's flow-performance sensitivity. *Horizon* is the mutual fund's horizon, proxied for by *Turnover ratio* or *Flow volatility*. *x* is a set of standard control variables. In both panels, in columns (1)-(3) the model is estimated using the Fama-MacBeth procedure. The standard errors are Newey-West, with lag length parameter equal to 4. In columns (4)-(6), the model is estimated as a pooled OLS with quarter fixed effects, and standard errors clustered around each fund. The sample includes all the mutual funds belonging to the merged Lipper eMAXX-CDA/Spectrum data set, over the period 1998Q1-2007Q2. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

A. Holdings of Securitized Bonds

	Fama-MacBeth			**Pooled OLS**		
	(1)	(2)	(3)	(4)	(5)	(6)
Turnover ratio	1.3535***			1.2427***		
	4.84			*3.40*		
Flow volatility		0.1841***			0.1442**	
		4.78			*2.57*	
Flow-perf. sensitivity			0.0235***			0.0288**
			4.59			*2.58*
Log(Family Size)	-0.0015	-0.0002	0.0002	-0.0018	-0.0006	-0.0004
	-0.74	*-0.09*	*0.13*	*-0.56*	*-0.17*	*-0.11*
Affiliated with comm. bank	0.0198**	0.0181**	0.0216***	0.0205	0.0202	0.0228*
	2.57	*2.69*	*2.93*	*1.58*	*1.53*	*1.73*
Past flow	0.0001	-0.1230**	-0.0008	-0.0002***	-0.0016	-0.0001***
	0.01	*-2.15*	*-0.08*	*-3.53*	*-0.66*	*-3.23*
Fund return	-0.3157	-0.2957	-0.3113	-0.1361***	-0.1334***	-0.1420***
	-1.66	*-1.55*	*-1.65*	*-3.18*	*-3.01*	*-3.28*
Family equity holdings	-0.0185**	-0.0189*	-0.0230**	-0.0226	-0.0255*	-0.0270*
	-2.12	*-1.93*	*-2.62*	*-1.64*	*-1.80*	*-1.93*
Mgmt fee	-0.0330***	-0.0367***	-0.0395***	-0.0441**	-0.0450**	-0.0503**
	-4.37	*-4.84*	*-5.17*	*-2.26*	*-2.25*	*-2.56*
Exp. ratio	-1.8571	-1.6070	-1.6725	-2.4794***	-2.2712***	-2.2142***
	-1.62	*-1.45*	*-1.54*	*-3.39*	*-3.21*	*-3.10*
Actual 12b1	-2.7116	-3.0727	-2.9732	-1.5528	-2.0592	-1.9096
	-1.29	*-1.58*	*-1.56*	*-0.99*	*-1.31*	*-1.23*
Av. maturity of holdings	0.0005	0.0007	0.0006	0.0010***	0.0012***	0.0011***
	1.25	*1.57*	*1.46*	*3.38*	*3.91*	*3.93*
No equity	0.1173***	0.1234***	0.1240***	0.1252***	0.1340***	0.1322***
	21.35	*25.32*	*23.68*	*10.62*	*11.12*	*11.23*
Fund's equity hold. return	0.0062	0.0003	0.0138	-0.0261**	-0.0244**	-0.0233**
	0.20	*0.01*	*0.43*	*-2.37*	*-2.10*	*-2.03*
Quarter fixed effects	No	No	No	Yes	Yes	Yes
Standard error	Newey-West	Newey-West	Newey-West	Clustered by fund	Clustered by fund	Clustered by fund
N. Obs.	16252	15400	15835	16252	15400	15835
(Average) R^2	0.14	0.13	0.14	0.11	0.11	0.11

Table II The Effects of Fund Types on the Propensity to Hold Securitized Bonds – cont'd

B. Holdings of Corporate Bonds

	Fama-MacBeth			Pooled OLS		
	(1)	(2)	(3)	(4)	(5)	(6)
Turnover ratio	-1.8692***			-1.9044***		
	-5.41			*-4.12*		
Flow volatility		-0.1113**			-0.0399	
		-2.04			*-0.52*	
Flow-perf. Sensitivity			-0.0232***			-0.0272**
			-3.28			*-1.98*
Log(Family Size)	-0.0001	-0.0012	-0.0022	0.0010	-0.0002	-0.0011
	-0.02	*-0.46*	*-0.85*	*0.24*	*-0.05*	*-0.25*
Affiliated with comm. bank	-0.0290***	-0.0309***	-0.0325***	-0.0274	-0.0305*	-0.0311*
	-3.11	*-3.22*	*-3.72*	*-1.64*	*-1.80*	*-1.84*
Past flow	0.0214	0.1425	0.0218*	0.0003***	0.0022	0.0003***
	1.63	*1.64*	*1.70*	*5.10*	*0.99*	*4.66*
Fund return	0.3316	0.2993	0.3112	0.1771***	0.1798***	0.1823***
	1.04	*0.92*	*0.97*	*2.67*	*2.60*	*2.72*
Family equity holdings	-0.0381***	-0.0359**	-0.0329***	-0.0345	-0.0286	-0.0283
	-3.37	*-2.61*	*-3.18*	*-1.44*	*-1.18*	*-1.17*
Mgmt fee	0.0219*	0.0182*	0.0300**	0.0557*	0.0535*	0.0642**
	1.85	*1.78*	*2.20*	*1.94*	*1.83*	*2.25*
Exp. ratio	6.8974***	7.0888***	6.7267***	5.1192***	4.8543***	4.7298***
	4.62	*5.30*	*4.76*	*3.06*	*2.81*	*2.89*
Actual 12b1	-0.9586	-1.3660	-0.6165	0.8405	1.1335	1.4445
	-0.47	*-0.84*	*-0.34*	*0.31*	*0.41*	*0.54*
Av. maturity of holdings	-0.0010*	-0.0012**	-0.0012**	-0.0018***	-0.0020***	-0.0020***
	-1.92	*-2.09*	*-2.11*	*-4.48*	*-4.99*	*-5.02*
No equity	0.0993***	0.0932***	0.0907***	0.0575***	0.0465**	0.0486**
	3.33	*3.20*	*3.01*	*2.76*	*2.19*	*2.30*
Fund's equity hold. return	-0.0221	-0.0051	-0.0330	0.0391*	0.0408*	0.0391*
	-0.33	*-0.07*	*-0.50*	*1.93*	*1.95*	*1.90*
Quarter fixed effects	No	No	No	Yes	Yes	Yes
Standard error	Newey-West	Newey-West	Newey-West	Clustered by fund	Clustered by fund	Clustered by fund
N. Obs.	16252	15400	15835	16252	15400	15835
(Average) R^2	0.09	0.09	0.09	0.06	0.05	0.05

Table III Mutual Fund Flows and Bond Sales after the Onset of the Crisis

In Panel A, we examine pure bond funds that held both corporate bonds and securitized bonds in their portfolios prior to the crisis and use their portfolio changes in the last two quarters of 2007 as the dependent variable. In columns (1)-(4) the dependent variable is the percentage net purchases of corporate bonds (odd-numbered columns) and securitized bonds (even-numbered). In columns (5)-(8) the dependent variable is the negative of Log-$ Sales and columns are organized analogously. The cross section of sample funds are then sorted by their contemporaneous fund flows into four bins (*VeryLowFlow*, *LowFlow*, *HighFlow*, and *VeryHighFlow*). In columns (1)-(2) and (5)-(6), the net position changes are regressed on just the four category dummies; in columns (3)-(4) and (7)-(8), the model also includes additional fund characteristics. The row labelled *F*-stat reports the *F*-test statistics for the hypothesis that the paired coefficients (corporate bonds vs. securitized bonds) on the most negative flow group (*VeryLowFlow)* are equal. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

Panel B reports the estimates of a model:

$$\log Sale_i = \alpha + \beta Quality + \delta \log Hold_i + \gamma' x_i + \varepsilon_i, \quad (2)$$

where each observation corresponds to a corporate bond with data in the FINRA TRACE data set. The dependent variable is *LogSale*, the log-net sales (in thousands of dollars) of the bond by institutional investors between July 2007 and December 2007. *LogHold* denotes the log-dollar holding of the bond by institutional investors as of June 2007, and *x* is a vector of standard bond characteristics, including issuer and offering year fixed effects. *Quality* denotes one of three proxies for the quality of the bond: *InvRating* (the natural logarithm of the inverse of 1 + the numerical value of the bond's S&P rating, which ranges from 0 (no rating) to 24 (AAA rating or higher)), the bond's *Amihud* illiquidity ratio, and *InvTrades* (the natural logarithm of the inverse of the average number of daily trades of the bond over the period January-June 2007). In all specifications, the standard errors are clustered around bond issuers. The sample includes all bonds in the FINRA TRACE data set with available data on bond characteristics from the Mergent FISD data set. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

A. Fund Flows and Bond Sales (Fund-level analysis)

	Percentage net purchases				**- Log-$ sales**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VeryLowFlow	-0.0461**	-0.0126	-0.1123***	-0.0021	-5.7897***	0.8212	-5.3678***	0.1051
	-2.3	*-0.4*	*-3.33*	*-0.05*	*3.66*	*0.58*	*-3.37*	*0.08*
LowFlow	0.0061	0.0278	-0.0642**	0.0337	-3.7617**	-0.6552	-3.4436**	1.3056
	0.4	*1.32*	*-2.07*	*1.07*	*2.3*	*-0.45*	*-2.11*	*0.94*
HighFlow	0.0623***	0.0333	-0.0068	0.0383	-1.6623	-2.1962	-1.5584	3.1233**
	3.39	*1.16*	*-0.22*	*1.06*	*0.98*	*-1.43*	*-0.92*	*2.14*
VeryHighFlow	0.1097***	0.0733***	0.0312	0.0720**	1.698	-3.2612**	1.8597	3.6471***
	5.29	*2.69*	*0.95*	*2.16*	*-0.99*	*-2.21*	*1.09*	*2.63*
Secur. h. 2007Q2				-0.1322**				-10.6865***
				-2.16				*-6.12*
Corp. h. 2007Q2			0.0673**				-4.7014***	
			2.04				*-2.63*	
Affil. comm. bank			-0.0590***	-0.0432*			-1.1890*	-0.2330
			-2.84	*-1.76*			*-1.86*	*-0.24*
Log(Family size)			0.0030	0.0100*			0.0989	0.1407
			0.86	*1.77*			*0.52*	*0.79*
Fam. equity hold.			-0.1079***	-0.0076			-5.7627***	-0.4294
			-3.65	*-0.19*			*-3.70*	*-0.23*
Av. mat. of holdings			0.0009***	0.0004			-0.0066	0.0711***
			2.66	*0.64*			*-0.28*	*3.42*
***F*-stat (p-value)**	1.06 (0.3035)		4.82** (0.0281)		6.58** (0.0103)		22.60*** (0.0000)	
St. error	White	White	White	White	White	White	White	White
N. Obs.	550	550	550	550	550	550	550	550
(Pseudo-)R^2	0.09	0.02	0.13	0.04	0.02	0.01	0.03	0.02

B. Determinants of Corporate Bond Sales (Bond-level analysis)

	(1)	(2)	(3)	(4)
InvRating	1.0496**			1.0712**
	2.14			*2.25*
Amihud		-0.9552***		-0.7488***
		-4.54		*-3.56*
InvTrades			-0.4114***	-0.2938***
			-5.26	*-3.72*
No Rating [1 = NO]	-3.1242**	0.0897	0.0967	-3.2439**
	-2.01	*0.95*	*1.02*	*-2.15*
Bond is not held by institutional investors [1 = NO]	4.8895***	4.6887***	4.7389***	4.6379***
	25.10	*24.01*	*25.04*	*24.34*
LogHold (2007Q2)	1.0148***	0.9738***	0.9840***	0.9647***
	33.00	*31.90*	*32.83*	*31.98*
Bond face value	0.1919***	0.1640***	0.1756***	0.1492***
	5.99	*4.76*	*5.27*	*4.29*
Covenants [1 = YES]	1.1209***	1.0253***	1.0170***	1.0459***
	4.61	*4.33*	*4.37*	*4.36*
CovIndex	-0.1055	0.0722	0.0346	-0.1165
	-0.25	*0.20*	*0.09*	*-0.27*
Log(Months to maturity)	-0.3952***	-0.3226***	-0.3886***	-0.3348***
	-9.23	*-8.39*	*-9.58*	*-8.78*
Issuer fixed effects	Yes	Yes	Yes	Yes
Offering year fixed effects	Yes	Yes	Yes	Yes
Standard error cluster	Issuer	Issuer	Issuer	Issuer
N. Obs.	8148	8148	8148	8148
R^2	0.91	0.88	0.91	0.91

Table IV Changes in Mutual Fund Holdings of Securitized and Corporate Bonds At the Onset of the Crisis

Panel A reports the estimates of a model:

$$\Delta H_i = \alpha + \beta Horizon_i + \gamma' x_i + \varepsilon_i, \qquad (3)$$

The dependent variable ΔH is the change, between 2007Q2 and 2007Q4, in the fraction of the fund's portfolio represented by securitized bonds (columns (1)-(2) and (5)-(6)) or corporate bonds (columns (3)-(4) and (7)-(8)) in excess of the fund class average. *Horizon* is the mutual fund's horizon, proxied for by *Turnover ratio* (odd-numbered columns) or *Flow volatility* (even-numbered columns). *x* is a set of standard mutual fund characteristics, expressed in their values as of June 2007. *Horizon* is expressed in its value as of June 2007 (columns (1)-(4)) or as of December 2006 (columns (5)-(8)).

Panel B reports the estimates of a model:

$$\Delta C_i = \alpha + \beta Horizon_i + \gamma' x_i + \varepsilon_i$$

In the odd-numbered columns, the dependent variable *ΔC* is the fund's excess sales (defined analogously to ΔH above) of investment-grade bonds (*High*). In the even-numbered columns, the dependent variable is the fund's excess sales of junk bonds (*Low*). *Horizon* is the mutual fund's horizon, proxied for by *Turnover ratio* (columns (1)-(2) and (5)-(6)) or *Flow volatility* (columns (3)-(4) and (5)-(6)). *x* is a set of standard control variables as in Panel A. *F*-test statistics and *p*-values for the difference between the *Horizon* coefficients for investment-grade and junk bonds are provided in the row labelled "*F*-stat (*p*-value)". The sample includes all the mutual funds belonging to the merged Lipper eMAXX-CDA/Spectrum data set, over the period 2007Q2-2007Q4. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

Table IV Changes in Mutual Fund Holdings of Securitized and Corporate Bonds At the Onset of the Crisis – cont'd

Panel A. Changes in Holdings of Corporate Bonds and Securitized Bonds

	Fund horizon as of June 2007				Fund horizon as of December 2006			
	Securitized Bonds		Corporate Bonds		Securitized Bonds		Corporate Bonds	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Turnover ratio	1.1354**		-1.2015***		0.9809**		-1.0638**	
	2.41		*-2.61*		*2.09*		*-2.22*	
Flow volatility		0.0194***		-0.0978**		0.1439		-0.3411*
		10.13		*-2.04*		*0.94*		*-1.81*
Secur. h. 2007Q2	-0.0703***	-0.1334***			-0.0696***	-0.0807***		
	-3.73	*-5.35*			*-3.48*	*-3.57*		
Corp. h. 2007Q2			-0.0536***	-0.1091***			-0.0498***	-0.0520**
			-3.05	*-4.18*			*-2.60*	*-2.24*
Affil. comm. bank	0.0176*	0.0308***	-0.0048	-0.0310**	0.0197**	0.0237**	-0.0060	-0.0214
	1.79	*2.66*	*-0.41*	*-2.32*	*1.97*	*2.03*	*-0.52*	*-1.59*
Log(Family size)	0.0047**	0.0033	-0.0014	0.0014	0.0043*	0.0048**	-0.0015	-0.0032
	2.15	*1.37*	*-0.56*	*0.47*	*1.95*	*2.03*	*-0.58*	*-1.12*
Past flow	0.0349***	-0.0241***	-0.0382***	0.2812*	-0.0487	0.0456	0.0469	0.0007
	8.73	*-4.96*	*-10.09*	*1.78*	*-0.51*	*0.56*	*0.60*	*0.01*
Fund return	-0.4048*	-0.4537*	0.4436*	0.2713	-0.4752**	-0.5170**	0.4964*	0.4302
	-1.76	*-1.81*	*1.66*	*0.87*	*-2.03*	*-2.04*	*1.81*	*1.46*
Fam. equity hold.	0.0141	0.0427***	0.0063	-0.0338**	0.0145	0.0270*	0.0081	-0.0108
	1.11	*2.98*	*0.46*	*-1.98*	*1.12*	*1.88*	*0.58*	*-0.65*
Mgmt fee	0.0008	0.0000	-0.0049***	-0.0039***	0.0007	0.0006	-0.0047***	-0.0042***
	1.12	*-0.03*	*-5.24*	*-3.05*	*0.90*	*0.73*	*-4.97*	*-3.44*
Exp. ratio	-0.9977	-2.4503**	1.5340	4.1035***	-0.4825	-1.5858	1.1322	2.8026**
	-0.85	*-2.00*	*1.16*	*2.70*	*-0.42*	*-1.38*	*0.84*	*2.00*
Actual 12b1	0.0002*	0.0003**	-0.0002	-0.0003*	0.0002	0.0002*	-0.0001	-0.0002
	1.91	*2.06*	*-1.43*	*-1.90*	*1.36*	*1.90*	*-0.95*	*-1.41*
Av. maturity of holdings	0.0002	0.0010***	0.0000	-0.0010***	0.0002	0.0004	0.0000	-0.0002
	0.78	*3.44*	*0.06*	*-3.00*	*0.82*	*1.34*	*0.07*	*-0.69*
No equity	-0.0104	0.0012	0.0259*	0.0257	-0.0168	-0.0174	0.0307**	0.0339**
	-0.79	*0.08*	*1.93*	*1.43*	*-1.30*	*-1.19*	*2.22*	*2.04*
Fund's equity ret.	-0.0870	-0.0788	0.0490	-0.0154	-0.0567	0.0318	0.0182	-0.0528
	-0.85	*-0.70*	*0.37*	*-0.11*	*-0.56*	*0.30*	*0.14*	*-0.38*
Standard error	White	White	White	White	White	White	White	White
N. Obs.	517	577	517	577	494	511	494	511
R^2	0.10	0.11	0.08	0.08	0.08	0.08	0.06	0.05

Panel B. Sales of Corporate Bonds, by Ratings

	Fund horizon as of June 2007				Fund horizon as of December 2006			
Rating	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Turnover ratio	-1.2922***	-1.0967***			-0.8574***	-0.7205***		
	-3.33	*-4.16*			*-3.15*	*-3.59*		
Flow volatility			-0.2475***	-0.0790*			-0.1533**	-0.0464
			-3.16	*-1.70*			*-2.03*	*-1.39*
[Control variables suppressed]								
***F*-stat (*p*-value)**	0.21 (0.6500)		3.96** (0.0467)		0.24 (0.6276)		2.93* (0.0869)	
Standard error	White	White	White	White	White	White	White	White
N. Obs.	508	501	568	567	493	494	550	552
R^2	0.25	0.09	0.24	0.05	0.25	0.07	0.23	0.04

Table V Changes in Corporate Bonds' Yield Spreads After the Onset of the Crisis

Panel A of this table reports the estimates of a model:

$$\Delta YS_i = \alpha + \beta HoldersExposure_i + \gamma InvRating_i + \delta(HoldersExposure_i \times InvRating_i) + \varphi' x_i + \mu_j + \varepsilon_i \quad , (4)$$

where each observation is a corporate bond with data in the FINRA TRACE data set. The dependent variable ΔYS is the change in the bond's yield spread, defined as the difference between the bond's yield on the secondary market, as reported by TRACE, and the yield on a Treasury bond of comparable maturity. Data on Treasury bond yields are from the Federal Reserve Statistical Release. In columns (1)-(4) ΔYS is defined as the change in the bond's yield spread over the period from June to October 2007, while in columns (5)-(8) it is the change in the bond's yield spread over the period from June to December 2007. The explanatory variables are: *HoldersExposure* (the average fraction of securitized bonds in the portfolio of the mutual funds that hold the bond), *InvRating* (the natural logarithm of the inverse of 1 + the numerical value of the bond's S&P rating, which ranges from 0 (no rating) to 24 (AAA rating or higher)), the interaction term between these two variables, and a standard set of bond characteristics *x*, issuer fixed effects for issuer *j* (μ_j) and offering year fixed effects.

Panel B of this table reports the estimates of a model:

$$\Delta YS_i = \alpha + \beta ShortExposed_i + \gamma InvRating_i + \delta(ShortExposed_i \times InvRating_i) + \varphi' x_i + \mu_j + \varepsilon_i \quad (5)$$

where each observation is a corporate bond *i*. The dependent variable ΔYS is defined as in Panel A. *ShortExposed* is an indicator equal to 1 if bond *i*'s short-horizon mutual fund holders' exposure to securitized bonds is above the sample median. We use two proxies for mutual fund horizon: turnover ratio and flow volatility and obtain one indicator *ShortExposed* for each proxy. *InvRating* is defined as in Panel A. We further include the interaction term between these two variables, along with a standard set of bond characteristics *x*, including issuer and offering year fixed effects. For brevity, only the key coefficients are shown. In both panels and in all specifications, the standard errors are clustered around bond issuers. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

Panel A: The Baseline Model

	Change in Yield Spread – Jul-Oct 2007				**Change in Yield Spread – Jul-Dec 2007**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Holders' Exposure (to Securitized Bonds)	0.7885**	0.6659*	0.5762	0.3936	1.2900*	1.4210**	1.4042*	1.2581*
	2.02	*1.80*	*1.45*	*1.01*	*1.87*	*2.04*	*1.92*	*1.74*
InvRating	0.8066*	0.9079**	0.8497**	0.8048**	1.8664**	1.6608**	1.6482**	1.6086**
	1.84	*2.47*	*2.28*	*2.14*	*2.96*	*2.61*	*2.54*	*2.47*
Holders' Exposure X InvRating	0.2911**	0.2576**	0.2988**	0.2568**	0.4836**	0.5349**	0.5438**	0.5311**
	2.48	*2.16*	*2.53*	*2.18*	*2.26*	*2.43*	*2.51*	*2.43*
Yield spread in 2007Q2	-0.1909**	-0.2689***	-0.2717***	-0.2731***	-0.4174***	-0.4134***	-0.4147***	-0.4157***
	-2.48	*-2.89*	*-2.98*	*-2.99*	*-6.70*	*-6.40*	*-6.34*	*-6.37*
No Rating [1 = NO]	-2.6943*	-3.0231***	-2.8370**	-2.6829**	-6.0739***	-5.4002***	-5.3617***	-5.2271**
	-1.92	*-2.60*	*-2.41*	*-2.24*	*-3.05*	*-2.70*	*-2.63*	*-2.55*
Bond is not held by mutual funds [1 = NO]	0.0720	0.1387*	0.1188	0.1086	-0.1198	-0.1244	-0.1311	-0.1434
	0.79	*1.95*	*1.57*	*1.56*	*-0.95*	*-0.99*	*-1.11*	*-1.16*
Bond face value	-0.0012	-0.0082	0.0028	0.0120	-0.0372	-0.0333	-0.0302	-0.0225
	-0.07	*-0.60*	*0.19*	*0.79*	*-1.53*	*-1.44*	*-1.01*	*-0.95*
Covenants [1 = YES]	0.1651	0.0267	0.0311	0.0358	-0.1065	-0.0979	-0.0958	-0.0900
	1.37	*0.34*	*0.39*	*0.46*	*-0.73*	*-0.70*	*-0.68*	*-0.65*
CovIndex	-0.2727	-0.1518	-0.1218	-0.1090	0.1924	0.1865	0.1925	0.2066
	-0.87	*-0.73*	*-0.59*	*-0.52*	*0.49*	*0.48*	*0.50*	*0.53*

Log(Months to maturity)	-0.1016***	-0.1039***	-0.1154***	-0.1048***	-0.2147***	-0.2215***	-0.2251***	-0.2220***
	-3.20	*-2.94*	*-3.09*	*-2.85*	*-3.17*	*-3.25*	*-3.14*	*-3.22*
Insurance Holders' Exposure		0.2657	0.2632	0.2573		-0.2643	-0.2645	-0.2641
		0.75	*0.74*	*0.72*		*-0.52*	*-0.51*	*-0.52*
Insurance Holders' Exposure X InvRating		0.0374	0.0286	0.0266		-0.0635	-0.0628	-0.0676
		0.33	*0.25*	*0.23*		*-0.37*	*-0.37*	*-0.40*
Amihud			0.1525				0.0468	
			0.94				*0.14*	
Holders' Exposure X Amihud			0.6232				0.1272	
			1.35				*0.21*	
InvTrades				0.1873***				0.1088
				2.91				*0.98*
Holders' Exposure X InvTrades				-0.2203				-0.1274
				-1.22				*-0.44*
Issuer fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Offering year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard error cluster	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer
N. Obs.	7348	7348	7348	7348	8148	8148	8148	8148
R^2	0.65	0.70	0.70	0.70	0.74	0.75	0.75	0.75

Panel B: Short-horizon Investors with Exposure to Securitized Bonds

	Change in Yield Spread – Jul-Oct 2007		**Change in Yield Spread – Jul-Dec 2007**	
	(1)	(2)	(3)	(4)
ShortExposed (Turnover)	0.3324*		0.7222***	
	1.71		*2.71*	
ShortExposed (Flow Volatility)		0.2429		0.4700**
		1.26		*1.99*
InvRating	0.9439***	0.9231***	1.8800***	1.8093***
	2.79	*2.74*	*3.67*	*3.55*
ShortExposed (turnover) X InvRating	0.1181*		0.2083**	
	1.87		*2.54*	
ShortExposed (flow vol.) X InvRating		0.1228**		0.1476**
		2.01		*2.09*
Issuer fixed effects	Yes	Yes	Yes	Yes
Other Control Variables	Yes	Yes	Yes	Yes
Offering year fixed effects	Yes	Yes	Yes	Yes
Standard error cluster	Issuer	Issuer	Issuer	Issuer
N. Obs.	7302	7302	8136	8136
R^2	0.66	0.66	0.76	0.76

Table VI Corporate Bond Selling Pressure by Mutual Funds

Panel A reports the estimates of a model:

$$\Delta Tr_i = \alpha + \beta HoldersExposure_i + \gamma InvRating_i + \delta(HoldersExposure_i \times InvRating_i) + \varphi' x_i + \mu_j + \varepsilon_i \quad , (6)$$

where each observation is a corporate bond with data in the FINRA TRACE data set. The dependent variable ΔTr_i is defined as the total net sales of bond *i* by mutual funds divided by the total trading volume on the bond, over the crisis period. In columns (1)-(4) ΔTr_i is defined over the period from July to October 2007, while in columns (5)-(8) it is defined over the period from July to December 2007. The explanatory variables are: *HoldersExposure* (the average fraction of securitized bonds in the portfolio of the mutual funds that hold the bond), *InvRating* (the natural logarithm of the inverse of 1 + the numerical value of the bond's S&P rating, which ranges from 0 (no rating) to 24 (AAA rating or higher)), the interaction term between these two variables, and a standard set of bond characteristics *x*, issuer fixed effects for issuer *j* (μ_j), and offering year fixed effects.

Panel B reports the estimates of a model:

$$\Delta Tr_i = \alpha + \beta ShortExposed_i + \gamma InvRating_i + \delta(ShortExposed_i \times InvRating_i) + \varphi' x_i + \mu_j + \varepsilon_i \quad (7)$$

where each observation is a corporate bond. The dependent variable ΔTr is defined as in Panel A. *ShortExposed* is an indicator equal to 1 if the bond is held by short-horizon mutual funds with exposure to securitized bonds above the median. We use two proxies for mutual fund horizon: turnover ratio and flow volatility and obtain one indicator *ShortExposed* for each proxy. *InvRating* is defined as in Panel A. We further include the interaction term between these two variables, along with a standard set of bond characteristics *x* (the same set of variables as in Panel A), including issuer and offering year fixed effects. For brevity, only the key coefficients are shown. In both panels and in all specifications, the standard errors are clustered around bond issuers. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

Panel A: Baseline model

	Trading Pressure of Mutual Funds – Jul-Oct 2007				**Trading Pressure of Mutual Funds – Jul-Dec 2007**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Holders' Exposure	0.1040***	0.0928**	0.1230***	0.1119**	0.0312	0.0412	0.0506	0.0552
	2.75	*2.41*	*3.09*	*2.38*	*0.99*	*1.20*	*1.55*	*1.46*
InvRating	0.0096	0.0103	0.0121	0.0120	0.0102	0.0105	0.0127	0.0093
	0.37	*0.40*	*0.47*	*0.47*	*0.55*	*0.57*	*0.69*	*0.51*
Holders' Exposure X InvRating	0.0377***	0.0340***	0.0331***	0.0381***	0.0238**	0.0273**	0.0189*	0.0251**
	3.10	*2.75*	*2.66*	*3.09*	*2.37*	*2.44*	*1.82*	*2.49*
2007Q2 Log-volume	0.0008*	0.0007*	0.0006	0.0002	0.0014**	0.0013**	0.0012**	0.0014*
	1.75	*1.65*	*1.63*	*0.45*	*2.13*	*2.08*	*2.36*	*1.90*
No Rating [1 = NO]	-0.0310	-0.0339	-0.0386	-0.0389	-0.0352	-0.0351	-0.0430	-0.0325
	-0.37	*-0.41*	*-0.47*	*-0.47*	*-0.59*	*-0.60*	*-0.73*	*-0.55*
Bond is not held by mutual funds [1 = NO]	-0.0394***	-0.0386***	-0.0386***	-0.0389***	-0.0562***	-0.0559***	-0.0555***	-0.0566***
	-7.11	*-6.97*	*-7.00*	*-6.95*	*-12.01*	*-12.07*	*-11.81*	*-11.88*
Bond face value	-0.0002	-0.0004	-0.0007	-0.0005	0.0015**	0.0014**	0.0010*	0.0016**
	-0.28	*-0.56*	*-0.93*	*-0.72*	*2.44*	*2.22*	*1.66*	*2.39*
Covenants [1 = YES]	-0.0117	-0.0125	-0.0123	-0.0122	0.0079	0.0086	0.0073	0.0086
	-1.02	*-1.07*	*-1.07*	*-1.07*	*0.80*	*0.88*	*0.76*	*0.87*
CovIndex	0.0572*	0.0595*	0.0542*	0.0563*	0.0140	0.0104	0.0107	0.0150
	1.80	*1.83*	*1.70*	*1.76*	*0.54*	*0.41*	*0.42*	*0.58*

Log(Months to maturity)	-0.0013	-0.0013	-0.0006	-0.0013	-0.0052***	-0.0052***	-0.0044***	-0.0052***
	-1.44	*-1.44*	*-0.58*	*-1.39*	*-5.09*	*-5.11*	*-4.12*	*-5.09*
Insurance Holders' Exposure		0.0194				-0.0090		
		0.97				*-0.50*		
Insurance Holders' Exposure X InvRating		0.0040				-0.0048		
		0.62				*-0.75*		
Amihud			-0.0060*				-0.0059*	
			-1.71				*-1.85*	
Holders' Exposure X Amihud			-0.0916**				-0.0946**	
			-2.21				*-2.51*	
InvTrades				0.0058				0.0001
				1.22				*0.03*
Holders' Exposure X InvTrades				-0.0057				-0.0205
				-0.24				*-1.35*
Issuer fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Offering year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard error cluster	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer
N. Obs.	8666	8666	8666	8666	8728	8728	8728	8728
R^2	0.58	0.58	0.58	0.58	0.68	0.68	0.68	0.68

Panel B: Short-horizon Investors with Exposure to Securitized Bonds

	Mutual fund selling pressure – Jul-Oct 2007		**Mutual fund selling pressure – Jul-Dec 2007**	
	(1)	(2)	(3)	(4)
ShortExposed (Turnover)	0.0383***		0.0490***	
	2.86		*4.02*	
ShortExposed (Flow Volatility)		0.0375***		0.0436***
		2.82		*2.98*
InvRating	0.0200	0.0188	0.0197	0.0183
	0.77	*0.73*	*1.08*	*1.01*
ShortExposed (turnover) X InvRating	0.0096**		0.0073*	
	2.14		*1.84*	
ShortExposed (flow vol.) X InvRating		0.0079*		0.0067
		1.86		*1.52*
Issuer fixed effects	Yes	Yes	Yes	Yes
Other Control Variables	Yes	Yes	Yes	Yes
Offering year fixed effects	Yes	Yes	Yes	Yes
Standard error cluster	Issuer	Issuer	Issuer	Issuer
N. Obs.	8666	8666	8728	8728
R^2	0.58	0.58	0.69	0.68

Table VII Corporate Bond Trading Volume After the Onset of the Crisis

The table reports the estimates of a model:

$$LogVol_i = \alpha + \beta HoldersExposure_i + \gamma InvRating_i + \delta(HoldersExposure_i \times InvRating_i) + \varphi' x_i + \mu_j + \varepsilon_i$$

where each observation is a corporate bond with data in the FINRA TRACE data set. The dependent variable *LogVol* is the natural logarithm of the bond's average daily trading volume (expressed in number of trades) over the crisis period. In columns (1)-(4) *LogVol* is defined over the period from July to October 2007, while in columns (5)-(8) it is defined over the period from July to December 2007. The explanatory variables are: *HoldersExposure* (the average fraction of securitized Bonds in the portfolio of the mutual funds that hold the bond), *InvRating* (the natural logarithm of the inverse of 1 + the numerical value of the bond's S&P rating, which ranges from 0 (no rating) to 24 (AAA rating or higher)), the interaction term between these two variables, and a standard set of bond characteristics *x*, including issuer and offering year fixed effects. In all specifications, the standard errors are clustered around bond issuers. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

	Trading Volume – Jul-Oct 2007				**Trading Volume – Jul-Dec s2007**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Holders' Exposure (to Securitized Bonds)	0.8778***	0.9275***	1.3250***	0.5752	0.6254***	0.6348**	1.0685***	-0.0996
	2.73	*2.63*	*3.49*	*1.34*	*2.96*	*2.49*	*3.75*	*-0.33*
InvRating	-1.5356***	-1.5018***	-1.4736***	-1.4969***	-0.6168***	-0.5842***	-0.5456***	-0.5862***
	-4.38	*-4.37*	*-4.35*	*-4.36*	*-2.96*	*-2.88*	*-2.78*	*-2.92*
Holders' Exposure X InvRating	0.2382**	0.2686**	0.1395	0.2664**	0.1564**	0.1718*	0.0253	0.1594*
	2.28	*2.21*	*1.11*	*2.21*	*2.18*	*1.89*	*0.30*	*1.76*
2007Q2 Log-volume	0.4286***	0.4152***	0.4076***	0.4176***	0.5093***	0.4963***	0.4588***	0.5088***
	10.44	*10.50*	*11.02*	*11.08*	*18.22*	*18.03*	*17.28*	*19.98*
No Rating [1 = NO]	4.8706***	4.7862***	4.7075***	4.7739***	2.0144***	1.9284***	1.8119***	1.9423***
	4.46	*4.46*	*4.44*	*4.45*	*3.11*	*3.05*	*2.95*	*3.10*
Bond is not held by mutual funds [1 = NO]	-0.6231***	-0.5944***	-0.6176***	-0.5910***	-0.4955***	-0.4686***	-0.4976***	-0.4627***
	-6.10	*-5.89*	*-6.03*	*-5.83*	*-6.63*	*-6.37*	*-6.65*	*-6.37*
Bond face value	0.2756***	0.2649***	0.2636***	0.2653***	0.1389***	0.1289***	0.1260***	0.1317***
	7.62	*7.37*	*7.25*	*7.07*	*8.74*	*8.28*	*8.12*	*8.07*
Covenants [1 = YES]	0.0862	0.1031	0.1084	0.0931	0.1788*	0.1914**	0.1942**	0.1773*
	0.64	*0.78*	*0.83*	*0.70*	*1.90*	*2.08*	*2.18*	*1.94*
CovIndex	0.6117**	0.5301*	0.4661	0.5293*	0.4216**	0.3590*	0.2972	0.3563*
	2.07	*1.81*	*1.60*	*1.81*	*2.27*	*1.94*	*1.64*	*1.93*
Log(Months to maturity)	-0.0981***	-0.0958***	-0.0928***	-0.0954***	-0.1056***	-0.1035***	-0.0869***	-0.1028***
	-4.57	*-4.42*	*-3.88*	*-4.44*	*-8.47*	*-8.32*	*-5.97*	*-8.47*
Insurance Holders' Exposure		0.3089	0.3357	0.3042		0.3452*	0.3919**	0.3325*
		0.97	*1.07*	*0.95*		*1.77*	*2.09*	*1.65*
Insurance Holders' Exposure X InvRating		-0.0785	-0.0612	-0.0796		-0.0552	-0.0302	-0.0589
		-0.69	*-0.54*	*-0.70*		*-0.88*	*-0.50*	*-0.93*
Amihud			0.0632				-0.1411	
			0.33				*-1.50*	

Holders' Exposure X Amihud			-2.2277**				-2.4864***	
			-2.46				*-4.18*	
InvTrades				-0.0400				-0.1293**
				-0.50				*-2.50*
Holders' Exposure X InvTrades				0.3435				0.6824***
				1.41				*4.17*
Issuer fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Offering year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard error cluster	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer
N. Obs.	9598	9598	9598	9598	9573	9573	9573	9573
R^2	0.80	0.80	0.80	0.80	0.88	0.88	0.88	0.88

Table VIII Relationship between mutual funds' and insurance companies' trades

Panel A reports the estimates of a model:

$$MF\_Netbuy_{it} = \alpha + \beta_1 INS\_Netbuy_{it} \times (1 - Crisis_t) + \beta_2 INS\_Netbuy_{it} \times Crisis_t + \gamma' x_{it-1} + \varepsilon_{it} \quad (8)$$

where each observation is a corporate bond *i* in quarter *t*. The dependent variable *MF_Netbuy* is the net purchases of the bond by all mutual funds in column (1). In columns (2) and (3) they are the net purchases by short-horizon, exposed mutual funds (i.e., funds that have a short-horizon with exposure to securitized bonds above the median. We use two proxies for horizon – High Turnover (column (2)) and High Flow volatility (column (3)). In columns (4) and (5) they are the net purchases by all funds except the short-horizon, exposed funds. *MF_Netbuy* is calculated as the net purchases of bond *i* by the funds divided by the total institutional holdings of the bond (holdings of mutual funds plus holdings of insurance companies) as of the previous quarter. *INS_Netbuy* is the net purchases of the bond by insurance companies, again divided by the total institutional holdings of the bond. *Crisis* is an indicator equal to one for dates between 2007Q3 and 2008Q1. *x* is a vector of standard bond characteristics. The last row of the table reports the *F*-test statistic for H_0: $\beta_1 = \beta_2$. The sample is for the period 1998Q1-2008Q1.

Panel B reports the estimates of a model:

$$MF\_Netbuy_i = \alpha + \beta\, INS\_Netbuy_i + \gamma' x_i + \varepsilon_i$$

where *MF_Netbuy* is the net purchases of bond *i* by funds that experience below-median flows over the last six months of 2007 (*LowFlow* funds) in column (1) and *HighFlow* funds in column (2). *INS_Netbuy* is defined as above, and *x* is a set of standard bond characteristics, including offering year effects. In both panels, the symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

A. Correlations of mutual fund and insurance company trades, before and after the onset of the crisis

	All funds	**High Turnover**	**High Flow volatility**	**Non-High Turnover**	**Non-High Volatility**
	(1)	(2)	(3)	(4)	(5)
INS_Netbuy X (1-Crisis)	0.0892***	0.0010***	0.0016***	0.0862***	0.0835***
	11.18	*5.05*	*5.03*	*10.75*	*10.56*
INS_Netbuy X Crisis	0.2075***	0.0041***	0.0068***	0.1789***	0.1735***
	8.86	*5.03*	*5.29*	*7.69*	*7.81*
[Control variables suppressed]					
Bond and quarter fixed effect	Y	Y	Y	Y	Y
Standard error cluster	Bond	Bond	Bond	Bond	Bond
N. Obs.	68233	67744	67718	67077	67069
R^2	0.06	0.05	0.05	0.06	0.06
***F*-stat for H_0: $\beta_1 = \beta_2$**	23.00***	15.51***	14.01***	14.69***	14.39***

B. Trade Correlations and Flows after the Onset of the Crisis

	LowFlow funds	**HighFlow funds**
	(1)	(2)
INS_Netbuy	0.0008***	0.0017***
	2.76	*2.67*
[Control variables suppressed]		
Offering year fixed effect	Y	Y
Standard error	White	White
N. Obs.	9598	9539
R^2	0.02	0.02
***F*-stat for H_0: $\beta_{LowFlow} = \beta_{HighFlow}$**	5.75 (0.0165)	

Table IX The structural break in institutional trades and the correlation of the yield spread to trades

In columns (1)-(2), the table reports the estimates of a model:

$$Netbuy_{it} = \beta_1 (1 - Crisis_{it}) + \beta_2 \, Crisis_{it} + \varepsilon_{it}$$

where *Netbuy* is either *INS_Netbuy* (column (1)) or *MF_Netbuy* (column (2)). *INS_Netbuy* is the aggregate net purchases of bond *i* by all insurance companies, divided by the prior-quarter total holdings of insurance companies plus mutual funds. *MF_Netbuy* is analogously defined. *Crisis* is an indicator variable equal to one for dates between 2007Q3 and 2008Q1. The last row reports the *F*-test statistic for Ho: $\beta_1 = \beta_2$.

In column (3), the table reports the estimates of a model:

$$\Delta YS_{it} = \alpha + \beta_1 \, INST\_Netbuy_{it} \times (1 - Crisis_t) + \beta_2 \, INST\_Netbuy_{it} \times Crisis_t + \gamma' x_{it} + \varepsilon_{it}$$

where *INST_Netbuy* is the sum of *INS_Netbuy and MF_Netbuy, Crisis* is as defined above, and *x* is a of standard bond characteristics, including bond and quarter fixed effects. The last row reports the *F*-test statistic for Ho: $\beta_1 = \beta_2$.

In columns (4)-(5), the table reports the estimates of a model:

$$\Delta YS_{it} = \alpha + \beta_1 INS\_Netbuy_{it} \times (1 - Crisis_t) + \beta_2 \, INS\_Netbuy_{it} \times Crisis_t + + \beta_3 \, MF_{it} \times (1 - Crisis_t) + \beta_4 \, MF_{it} \times Crisis_t + \gamma' x_{it} + \varepsilon_{it}$$

where *Crisis*, *INS_Netbuy* are defined as above, and *MF* is either *MF_Netbuy* (column (4)), defined as above, or *LowFlow_Netbuy* (column (5)), defined as the net purchases of bond *i* by mutual funds that experience below-median flows in the quarter, divided by the prior-quarter total holdings of insurance companies plus mutual funds. *x* is a of standard bond characteristics, including individual bond and quarter fixed effects. The last row reports the *F*-test statistic for Ho: $\beta_3 = \beta_4$.

The sample is for the period 1998Q1-2008Q1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

Dependent Variable	**INS_Netbuy**	**MF_Netbuy**	ΔYS	ΔYS	ΔYS
	(1)	(2)	(3)	(4)	(5)
1 - Crisis	-0.0302***	-0.0233***			
	-109.75	*-66.95*			
Crisis	-0.0266***	-0.0436***			
	-54.88	*-53.83*			
INST_Netbuy X (1-Crisis)			0.1099		
			0.80		
INST_Netbuy X Crisis			-2.3966***		
			-9.86		
INS_Netbuy X (1-Crisis)				-0.1709	-0.1258
				-1.39	*-1.01*
INS_Netbuy X Crisis				-0.6031*	-0.6001*
				-1.83	*-1.78*
MF_Netbuy X (1-Crisis)				0.6210***	
				3.51	
MF_Netbuy X Crisis				-3.4781***	
				-12.11	
LowFlow_Netbuy X (1-Crisis)					-0.3964
					-1.01
LowFlow_Netbuy X Crisis					-5.1208***
					-5.73
[Control variables suppressed]					
Bond and quarter fixed effects	N	N	Y	Y	Y
Standard error cluster at	Bond	Bond	Bond	Bond	Bond
N. Obs.	63330	63757	63520	63137	62231
R^2	0.23	0.19	0.11	0.16	0.15
***F*-stat (*p*-value)**	6.19	719.11	84.19	153.36	22.48
	(0.0128)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

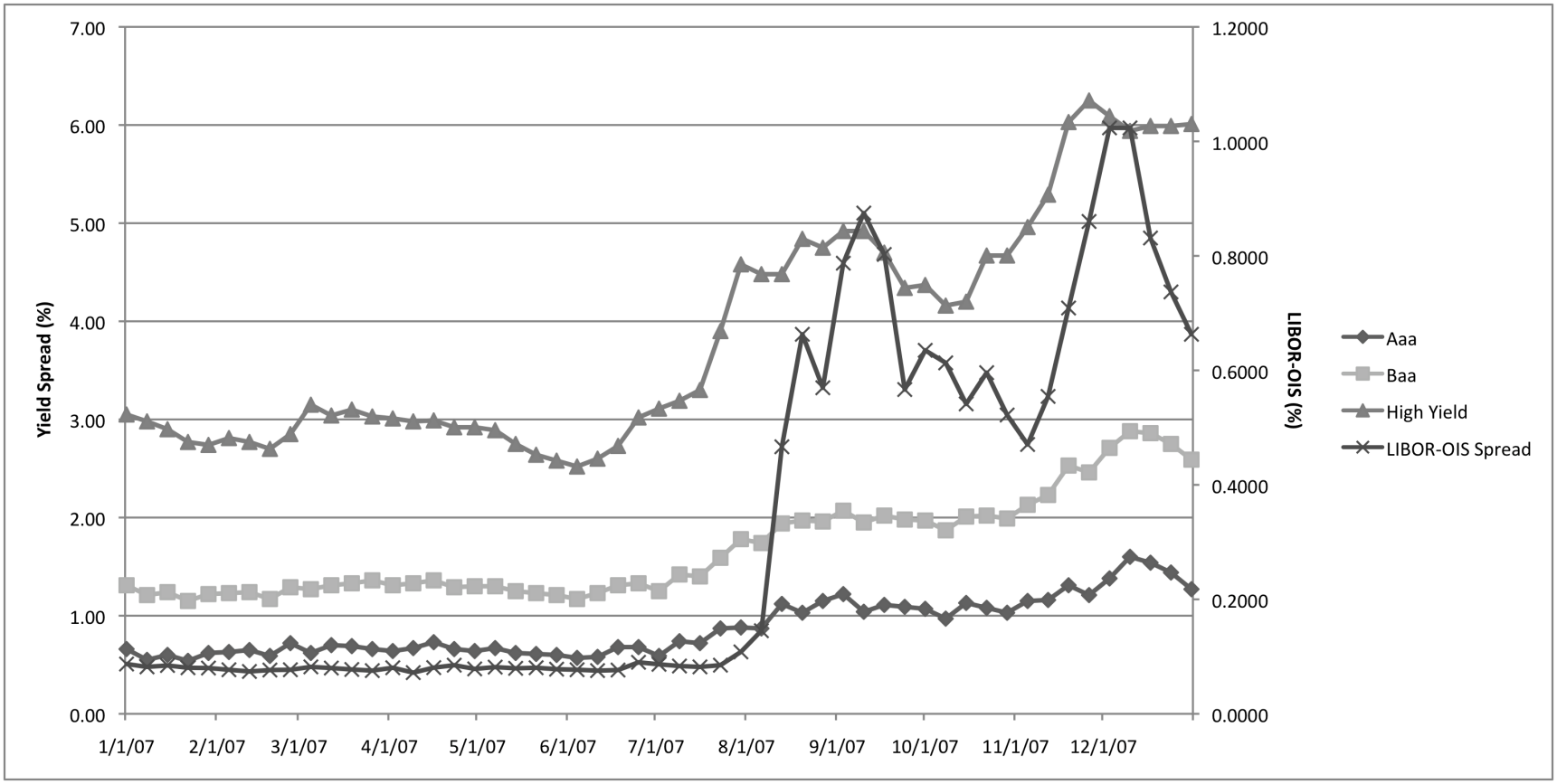


Figure 1 Corporate Bond Yield Spreads and LIBOR-OIS spread
The graph plots weekly average yield spreads on corporate bonds 2007, for Aaa, Baa, and High Yield corporate bonds, as well as the spread between the LIBOR rate and the Overnight Index swap rate (LIBOR-OIS Spread, secondary axis). The yield spread is defined as the difference between a bond's yield on the secondary market and the yield on a Treasury bond of comparable maturity. Data on Treasury yields are retrieved from the Federal Reserve Statistical Release.

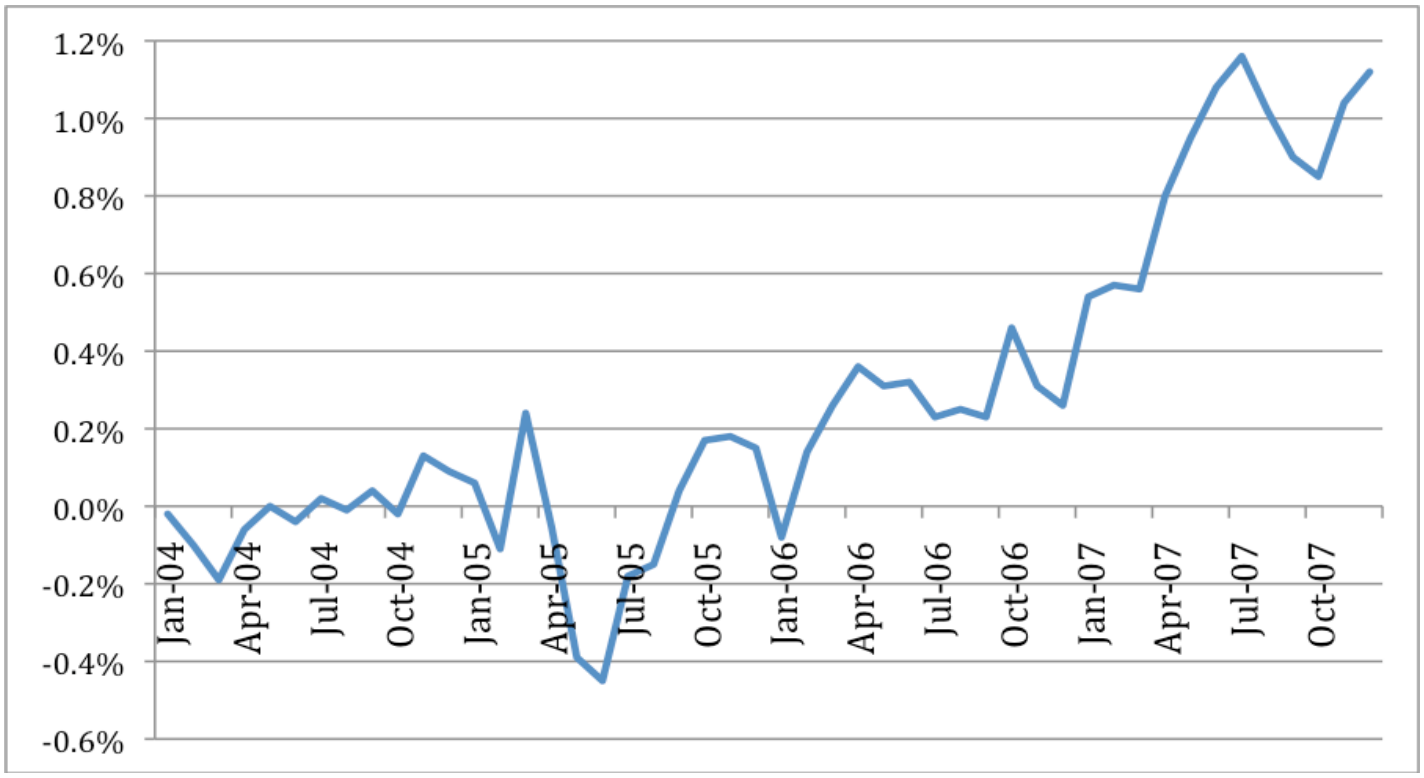


Figure 2 Cumulative return of a Long-short Portfolio of Low-rated Corporate Bonds with and without Exposure

The figure plots the cumulative monthly return on a portfolio that is *short* on the below-investment grade bonds whose mutual fund holders have high exposure to securitized bonds, and *long* on a set of issuer- and duration-matched bonds without the exposure, over the period 2004-2007.

We define "high exposure" as those corporate bonds whose average mutual fund holder's exposure to securitized bonds is in the top 30% in either of the previous two quarters. We place these bonds in the short portfolio if and only if it has a matching bond without a high exposure satisfying the following criteria: (i) the matching bond is issued by the same issuer firm; and (ii) the time to maturity of the matching bond is between 50% and 150% of the time to maturity of the shorted bond. We place these matching bonds in the long portfolio. The long-short portfolio's monthly return is then the long portfolio's monthly return (rebalanced to be equal-weighted each month) minus the short portfolio's monthly return (similarly rebalanced). Returns on individual corporate bonds are constructed from the secondary market prices, as reported by TRACE. In each period, bond returns are also winsorized at 1%.