# The Behavior of Intoxicated Investors

# The role of institutional investors in propagating the financial crisis of 2007-2008*


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**Abstract:** 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 institutional investors. Using a novel data of investors' bond holdings, we test predictions of the theory of dynamic asset liquidation in the context of the crisis: (i) investors who face liquidation problems at the onset of the crisis will not sell the (now illiquid) securitized bonds and instead sell other assets that have lower permanent price impacts of trading; and (ii) investors with large enough future liquidity shocks hold on to 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. Post-crisis, these funds did not sell securitized bonds on average and instead sold corporate bonds to meet their demands for liquidity. Shorter-horizon mutual funds liquidated greater portions of their corporate bond holdings and in particular lower-rated bonds. Furthermore, corporate bond yields widened more for those bonds whose mutual fund holders' portfolios were more heavily exposed to securitized bonds, and particularly more so for lower-rated bonds. Selling pressure on corporate bonds came primarily from mutual fund investors with high exposure; in contrast, insurance companies sold little regardless of their exposure. These findings suggest that performance-sensitive and short horizon mutual fund played a role in transmitting the crisis from primarily AAA-rated securitized bonds to lower-rated corporate bonds.



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# Introduction

There is a widespread concern that the overhang of impaired, hard-to-value assets on banks' balance sheets has prolonged the current credit crisis and the ensuing economic downturn. Much less discussed is the question of whether non-bank fixed-income investors, in particular bond mutual funds and insurance companies that hold the majority of corporate debt securities, have had exposure to the same illiquid or "toxic"[1] assets. If so, have these institutional investors played a role in the transmission of financial shocks from the securitization market to other sectors? Have their portfolio choices exacerbated the financial crisis's impact on the real economy? Would their behavior have been altered under different regulatory policies? These are the questions we aim to examine in this paper.

What started as a series of negative news about the deteriorating health of subprime mortgage markets in late 2006 developed into a full-fledged crisis in August 2007, when "liquidity abruptly dried up for many firms and securities markets".[2] Securitized bonds – mortgage-backed securities (MBS), asset-backed securities (ABS), collateralized-debt-obligations (CDO) and so forth – displayed sharp drops in their resale values. As the ability of many financial institutions (e.g., investment banks, hedge funds, and off-balance SIVs of commercial banks) to fund their balance sheets depended on liquid secondary markets for these securitized bonds, this set off a catastrophic chain of events that eventually led to the sale of Bear Stearns, the bankruptcy of Lehman Brothers, and government bailouts of many remaining financial institutions in 2008.[3]

Since a large sum of taxpayer money has been spent to rescue the banks, it is easy to see why there is a public outcry about the apparent ineffectiveness of the capital injection in letting the credit flow again to the real economy. However, such ineffectiveness should have been foreseen from and can be directly related to the shift from the traditional lend-and-hold model of banking to the originate-and-distribute model where banks held only a fraction of the loans they originated. At the same time, bond financing became a more common source of external financing for (especially large) corporations.[4] In both cases, institutional investors such as mutual bond funds and insurance companies increasingly supplied the majority of capital as creditors. In fact, some argue that these investors' strong demand for relatively safe debt instruments fueled the credit

[1] 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.
[2] See Getter et al. (2007).
[3] See Gorton (2008), Gorton (2009), Gorton and Metrick (2009), and Brunnermeir (2009) for informative readings.
[4] For large representative firms, about two thirds of their total debt is attributable to outstanding bonds and less than one third to bank loans (Massa, Yasuda and Zhang, 2009).

expansion and securitization boom in the U.S. in 2003-2006.[5] 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.

We focus on two potential transmission mechanisms in which institutional investors may play a central role. The first mechanism is based on the effect of liquidity shocks in securitized bond markets on "open-end" institutional investors. Institutional investors (e.g., mutual funds) that grant withdrawal rights to clients are subject to runs, much like traditional banks (e.g., Bernardo and Welch, 2005). While this makes it costly for these investors to hold illiquid assets, the belief that the secondary markets for securitized bonds would remain liquid might explain why they might have chosen to have exposure to securitized bonds prior to the onset of the crisis.[6] Indeed, by one private estimate, these institutional investors' collective exposure exceeds even that of banks.[7] Once these markets froze, these investors, if left with significant exposure to the now illiquid asset class, had to decide how to rebalance their portfolios. Possibilities of massive withdrawals (in the event of investor panic or flight to quality) may prompt them to liquidate some of their assets. In particular, they may be reluctant to sell the illiquid, "toxic" assets and book losses at fire sale prices (thereby exacerbating the investor flight) and instead sell other, less illiquid assets, such as corporate bonds. We examine whether their trade decisions thus trigger a transmission of the crisis from the securitization market to other, seemingly unrelated asset classes such as corporate bonds.

Another potential mechanism is through the effect of downgrades and devaluations of securitized bonds on insurance companies. In contrast to mutual funds, insurance companies (and pension funds) may be more suited to hold illiquid assets with long investment horizons, since their contracts with their customers have long lock-ups, penalties for early withdrawals, and predictable payout schedules. Thus, in the event of temporary deviations of prices from fundamentals, they are presumably less pressured to sell than mutual funds. However, these institutional investors are subject to capital regulations, which makes it expensive for them to hold lower-rated bonds. At origination these securitized bonds were disproportionately AAA-

[5] See Holmstrom (2009), Caballero et al. (2009), and Nini (2009).
[6] Shleifer and Vishny (2009), Gorton and Metrick (2009) and others describe an eco-system 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.

rated, as we show below. Many of them were eventually downgraded, sometimes severely, in the course of the worsening crisis. We expect this regulatory constraint to affect the portfolio decisions of insurance companies with exposure to the securitized bonds after downgrades.

Moreover, at the same time, the new FASB accounting rule (FAS 157) for fair-value accounting or mark-to-market accounting might have started affecting portfolio decisions of publicly-traded insurance companies starting in the fall of 2007, when the rule came into effect.[8] Thus, we expect this regulatory constraint to affect public and private insurance companies differently. For both downgrades and devaluations, whether they liquidate, what they liquidate, and whether their portfolio decisions amplify the crisis are largely unexplored, empirical questions that we believe deserve examination.

For both classes of institutional investors, transmission operates through the joint management of both securitized bonds and corporate bonds by the same managers.[9] In cases 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. The key question is which assets the investor would choose to sell. Scholes (2000) suggests that an investor holding both liquid and illiquid assets in his portfolio would sell first the most liquid assets. This predicts sales of high-rated corporate bonds first and then lower-rated ones.

However, this behavior is myopic in the sense that it does not account for the inter-temporal implications of selling the liquid assets first. Indeed, if the market conditions deteriorate further and the investor faces redemption calls in the future, having sold liquid assets first leaves the portfolio more exposed to future negative shocks. Recent developments in the theory of dynamic asset liquidation in a multi-period setting identify specific conditions under which a contagion occurs as functions of investor- and bond characteristics. The main predictions are that (i) investors who face liquidation problems at the onset of the crisis will not sell the (now illiquid) securitized bonds and instead sell other assets that have lower permanent price impact of trading;

[8] Here the question is more complex, because, unlike banks, insurance companies are potentially subject to two sets of accounting standards --- GAAP, which they use to file with SEC (if they are public), and SAP (statutory accounting principles), set by NAIC (National Association of Insurance Commissioners), which they use to file with their state regulators. Importantly, SAP has not adopted a FAS 157-equivalent rule for insurance company holdings as of the fall of 2009, and insurance companies had been using amortized cost as opposed to fair value accounting in filing their SAP statements.

[9] In case of mutual funds, both bond funds and blend funds manage large portfolios of fixed income securities (plus equity in case of blend funds), and fund managers shift in and out of different subcategories of bonds. In case of insurance companies, while they hold both equity and bonds, the portfolios are usually managed separately for fixed incomes and equity.

and (ii) investors with large enough future liquidity shocks hold on to liquid assets, and instead sell assets that have relatively high (temporary) price impact of trading. Given the different implications of the two models for the transmission of the crisis, we first investigate a series of hypotheses based on this dynamic liquidation framework as well as a more naïve Scholes conjecture, which predicts that investors faced with liquidation needs choose to liquidate the most liquid assets first.

Unlike many previous 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,[10] we instead concentrate on the economic incentives of third-party buyers of these assets. To the best of our knowledge there is paucity of evidence on this side of the equation. Some argue that these investment managers' hunger for high-rated bonds with competitive yields pushed the credit bubble, rather than banks pulling them in. Thus, we think it is important to understand determinants of their behavior and particularly the impact of their actions on the crisis.

We use a novel data of quarterly portfolio holdings of securitized bonds and corporate bonds by institutional investors from 1998 to 2008. While no public data or systematic studies exist to the best of our knowledge, these investors are thought to hold significant amounts of securitized debt as part of their debt portfolios. Indeed, our results confirm that they have accumulated significant exposure. Moreover, these are the very same institutional investors who buy and hold the overwhelming majority of corporate bonds. This suggests that studying the determinants of their actions, both in the pre-crisis period where they made initial purchase decisions, and in the crisis period where they faced decisions whether and when to dispose of these securitized bonds (or alternatively corporate bonds), could shed light on the causes and effects of the credit crisis that we are in today. Importantly, there are meaningful variations across these institutional investors in terms of their managerial incentives, their affiliations with participants in the securitized bond markets, and their institutional arrangements with end investors (e.g., fund investors and insurance account holders).

We collect information on mutual funds at the individual fund level, and on insurance companies at the company level. While the current version of the paper focuses on the early period of the crisis (2007 Q3 to 2008 Q1) and on mutual funds, we expect to expand the analysis to include the later period of the crisis and more detailed analyses of insurance companies in the next version of the paper. The empirical analyses are conducted both at the investor level and at

[10] See Mian and Sufi (2008, 2009), Keys et al. (2009), among others.

the *individual bond* level – that is, we examine investors' portfolio choices as functions of their attributes (e.g., horizon, performance sensitivity of pay, affiliation with banks and big financial groups), and we also examine the performance and trading volumes of individual corporate bonds as functions of their current bondholders' attributes (such as their exposure to now-illiquid, securitized bonds). For the latter analysis, we control for the issuer firm-fixed effects, and thus are able to isolate the within-issuer variations in selling pressures across bonds.

Theory suggests that institutional investors with short horizon will not invest in undervalued assets that are not expected to recover in value soon. However, if the assets are already held – for example because the practice of "rating at the edge" understated the perceived riskiness of these assets – 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 first examine whether and why institutional investors hold securitized bonds in the first place. Institutional investors' holdings of securitized bonds increased fourfold during the sample period to nearly $2 trillion in 2007, which was disproportionately AAA-rated. In contrast, only 10% of their $3 trillion (as of 2007) corporate bond holdings are AAA-rated, and the pool of AAA-rated corporate bonds grew much more slowly during the sample period. Overall, their holdings of AAA-rated bonds increased sharply as percentage of total during the sample period, and this is primarily driven by the issuance of securitized bonds. We find that, among mutual funds, those funds with higher sensitivity of pay to performance held higher portions of their portfolios in securitized bonds.

We argue that, under a shared belief that securitized bond markets remain liquid, mutual funds with shorter horizon were incentivized to load up on these assets. This interpretation is consistent with recent empirical evidence on hedge fund behavior at the top of the bubble (e.g., Brunnermeier and Nagel, 2004) as well as anecdotal evidence 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. We also find that funds that are affiliated with banks held more securitized bonds, which can be due to either their informational advantage, implicit guarantees from banks, or potential conflicts of interest.

Second, having established that institutional investors had indeed significant exposure to the securitization market prior to the crisis, we focus on the investors' liquidation problem as the

crisis impairs liquidity and resale values of their holdings. 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. We therefore examine the net sales of assets around the onset of the crisis. We observe a strong negative relationship between the net percentage changes in portfolio holdings and the liquidity of the asset. Between June 2007 and March 2008, the average mutual fund reduces the holdings of corporate bonds in its portfolio by 16% (about 6 percentage points in absolute terms). This increases the percentage representation in the portfolio of the securitized bonds by 10% (about 2 percentage points). Over the same period, the average insurance company reduces the holdings of corporate bonds in its portfolio by 1.3% (0.73 percentage points in absolute terms), increasing the holdings of securitized bonds by 1.5% (0.51 percentage points).

When the subprime-mortgage crisis hit the market in August 2007 and the securitized bond market became illiquid, mutual funds sold both lower-rated and relatively liquid 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 hold on to securitized bonds. Again, this may be a signal of better (actual or perceived) information as well as less fear to hold on to these assets as these funds may count on implicit guarantees from the groups they are affiliated with in case of future liquidity needs.

Third, further examining the sales of corporate bonds by mutual funds around the onset of the crisis, we find that the average investor tends to sell the sub-investment grade bonds more than investment grade bonds. The change in holdings of the investors around the crisis also depends on the investor horizon. One standard deviation shorter horizon translates to an 8% higher sale of corporate bonds in general and in a 27% higher sale of lower-rated corporate bonds. These findings are consistent with the main premise of the dynamic liquidation model.

Finally, analyzing 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 yields widened more 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 around the crisis. Furthermore, in line with the findings on portfolio rebalancing by investors, 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. Our bond-level analyses lend support to the view 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 (mostly AAA-rated) securitized bond market to the lower-rated corporate bond market via the joint ownership of both securities by mutual funds.

In sum, performance-sensitive and short-horizon mutual fund investors loaded up on securitized bonds (which were highly rated and yielded higher than treasury bonds) during the boom years. When faced with liquidity shocks at the onset of the crisis, these funds sold lower-rated corporate bonds, thereby transmitting the crisis from primarily AAA-rated securitized bonds to lower-rated corporate bonds. In the clearest evidence of the channel, the effects manifested in greater spread increases for individual corporate bonds that are held by investors with heavy exposure to securitized bonds (controlling for unobserved issuer characteristics with firm fixed effects).

Our primary goal is to study the role of institutional debt investors (e.g., bond funds and insurance companies) in propagating financial market instability. We aim to study how the crisis episode in which one asset class (securitized bonds) experiences an extreme market turmoil accompanied by very low liquidity affects the portfolio decisions of institutional investors holding this class of assets as well as others. We are among the first to theoretically argue and provide evidence for the transmission of the crisis via these investors' joint ownership. We also provide a first detailed empirical analysis of professional investor behavior in the securitized bond market. Our novel dataset allows us to link individual corporate bond performances around the onset of the crisis to their bondholders' exposure to securitized bonds.

In conducting our analysis, we draw on the results of Brown et al. (2009), which study a multi-period liquidation problem for investors with liquidity constraints. We discuss how our hypotheses are related to their analysis as well as the original conjecture made by Scholes in Scholes (2000) in Section 2. We also draw on the literature on limits of arbitrage (e.g., Shleifer and Vishny, 1997; Coval and Stafford, 2007) and use investment horizon as our key measure of the investors' anticipated liquidity needs in the second period.

Our results have also important policy implications. For example, we show 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. In contrast, long-horizon mutual funds and insurance companies contributed less to the sales of corporate bonds. This implies that regulations 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 the hedge funds have been able to withstand the withdrawal pressure better.

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. Sections 5 presents the analyses of the transmission mechanism via 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

We build our empirical hypotheses regarding the mutual funds' liquidation problems on a theoretical work by Brown et al. (2009),[11] which in turns builds on the Scholes conjecture.

The Scholes conjecture states that investors facing an immediate liquidation problem in a one-period setting sell off the most liquid assets to exactly meet the immediate 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 at the beginning of the period. This implies a positive correlation between the drop in the value of securitized bonds and the increase in yields of high quality corporate bonds. That is, it posits a direct transmission of a shock from securitized bonds to the high quality bond segment.

The Brown et al. (2009) model points out that there is 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 model also highlights the importance of differentiating between permanent and temporary impact of trading on prices: "When the expected need for liquidity is large, the investor holds on to assets with a low temporary impact of trading and sells relatively illiquid assets" (Brown et al., 2009). Therefore, an investor with short-term horizon (in the sense of Shleifer and Vishny, 1997) may not necessarily sell the most liquid assets in the first period. In fact, if "there is a high probability of a large future liquidity need, the optimal solution involves

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

retaining assets that have a small temporary impact of trading. In the face of potential future adversity, there is a high option-value to the temporary component of liquidity. The permanent component of liquidity does not share this feature, so that investors will prefer to sell assets with a low ratio of permanent to temporary price impact in the early stages of a crisis, and to hold on to assets with a high ratio of permanent to temporary price impact to protect themselves against an aggravation of the crisis" (Brown et al., 2009).

These key features of the model lead to three predictions that are relevant in the context of mutual funds with exposure to securitized bonds and facing potential withdrawal requests.

First, investors will not sell assets with high permanent price impact, which arises independent of trading rates and is related to information asymmetry about the value of the asset. This is quite relevant, since the information sensitivity of securitized bonds jumped dramatically at the onset of the crisis, switching from seemingly information-insensitive debt that required little research to information sensitive debt with structural, informational, and institutional complexity that few holders were equipped to evaluate. This suggests that investors facing liquidation problems will not prioritize sales of securitized bonds and instead sell other assets with lesser permanent price impact of trading, such as corporate bonds.

***Hypothesis 1:*** *Securitized bonds will not be sold at the onset of the crisis.*

Second, the larger the expected liquidity needs in the future (second) period, the more investors liquidate in the first period in a precautionary manner. This implies that the more vulnerable the investors are to the future liquidation problem, the more they liquidate in the first period.

Third, the investors may or may not sell the most liquid assets first, depending on their expectation of liquidity needs in the future (second) period. If they expect shocks to be sufficiently large and recur in the future, they may find it optimal to hold on to assets with a low temporal price impact from trading – i.e., more heavily traded, easy-to-dispose assets – and instead sell assets with higher temporal impact of trading on prices. We measure temporal price impact of bonds using both bond ratings and actual trade-based metrics. The intuition is that, ceteris paribus, the lower the rating, the higher the price impact of trading is expected to be.

To test these predictions, we need to measure the future liquidity needs of investors. We employ the investment horizon of the investors as our empirical measure. 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, a hypothesis that corresponds to the second prediction of the model is thus that, the shorter the horizon, the larger the potential liquidity shock in the second period, and thus the more they liquidate in the first period. A hypothesis corresponding to the third prediction of the model is that, the shorter the horizon, the more they liquidate assets with relatively high temporal impact of trading in the first period, and hold on to more liquid assets as a protection.

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

***Hypothesis 3:*** *The investment horizon of mutual funds is positively associated with the temporal liquidity of the assets they sell.*

Summing the three hypotheses together, we predict that securitized bonds with high permanent price impact of trading will not be sold at the onset of the crisis. At the same time, sub-investment grade bonds will be prioritized for selling, especially by short-horizon mutual fund investors.

We then test the implications of the models for the transmission mechanism. While the simple static Scholes conjecture – selling the most liquid assets in the first period– suggests a transmission of the crisis from the securitization market to the high quality bonds, the dynamic liquidation model we focus on posits a direct transmission of a shock from securitized bonds to the lower-rated bond segment. Furthermore, the magnitude of the transmission should be a function of the stock of securitized bonds that the investors accumulated before the crisis. We therefore argue that, the larger the exposure of investors holding a particular asset *and* the higher the temporary price impact of trading, the more they are sold in the first period, and the more negatively the price of the asset is impacted. We examine this hypothesis by constructing aggregate investor exposure measures, yield changes, and trading volumes at the individual asset (i.e., corporate bond) level.

***Hypothesis 4a:*** *For a given security, mutual fund investors' portfolio exposure to (once liquid, now illiquid) securitized bonds is positively associated with yield changes (negatively associated with asset price changes) and positively associated with trading volumes.*

***Hypothesis 4b:*** *For a given security, mutual fund investors' portfolio exposure to securitized bonds is more positively associated with yield changes and with trading volumes, the lower rated the bond is.*

# 3. Data

## *3.1 Data Sources*

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-baked 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 1998 to 2008. We focus on U.S. institutional investors in the EMAXX database, and their holdings of corporate bonds and structured products (about 1,800 institutional investors every quarter, holding in aggregate a total face value of about $80 billion 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 Insurers Commissioners (NAIC, for insurance companies) and the Security and Exchange Commission (SEC, for mutual funds), and on voluntary disclosure by the major pension funds. 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/her ability to stay invested in a long run is perceived to be low. This may be due to uncertainty about its redemption calls. Investors facing withdrawal calls have to liquidate their positions (e.g., Edelen, 1999). Thus, the more volatile the fund flows, the shorter the average investment horizon of such a fund will be. We therefore use as our first proxy of horizon the volatility of flows. The higher the flow volatility, the lower the horizon should be.

Another determinant of the horizon is the sensitivity of flows to performance (e.g., Shleifer and Vishny, 1997). The more sensitive the fund flows are to performance, the more uncertain the

horizon will be. A risk-averse[12] investor will rationally account for the fact that the horizon will depend on his performance. We therefore use as our second proxy of horizon the flow-performance sensitivity. The higher the flow-performance sensitivity, the lower the horizon should be.

We can alternatively measure investment horizon by focusing on the actual trades by the investors. Standard literature (e.g., 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 (Yin, 2005). Conversely, short-horizon investors are more likely to be matched with portfolio managers with high turnover. We therefore use portfolio turnover as our third proxy of investment horizon. The higher the turnover of the portfolio, the shorter the investment horizon of the investor should be.

The flow-performance sensitivity is defined as follows (Huang et al., 2007).[13] Using monthly total net asset values from CRSP Mutual Funds, we define the monthly net flow into the mutual fund 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. This is a measure of the net flow of "new money" into the mutual fund, divided by the fund's net asset value in the previous month. Every month, we also assign a performance to the fund. We start by computing the fund's alpha from an eight-factor model[14] for the fund's returns, estimated on a rolling window of length equal to 36 months. We then sort alphas into percentiles, and the fund's performance is equal to the percentile rank, i.e. a performance equal to 0.99 indicates that the fund has an alpha above 99% of all funds in our data in that month. Finally, for each fund and

[12] In the case of professional money managers, "risk aversion" may be generated by institutional constraints (e.g., VAR or Value-at-Risk) imposed by the group they belong to, as well as by regulatory capital requirements (Basel II for banks, NAICS for insurance companies, SEC for mutual funds). See Herring and Schuermann (2003) for detailed descriptions of these factors.

[13] 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.

[14] See the Appendix for the details on the model specifications. For factor models used to explain fixed-income returns, see, for example, Litterman and Scheinkman (1991), Knez et al. (1994), Colin-Dufresne et al. (2001), and Chen et al. (2008). We find that our results are not sensitive to alternative model specifications. Gutierrez et al. (2010) also reports that performance measures of bond funds are not sensitive to alternative model specifications.

month *t*, we estimate the following regression over a rolling window of length equal to 12 months:

$$Flow_s = \alpha_t + \beta_t Performance_s + \varepsilon_s, \quad s = t-12,\ldots,t$$

The fund's flow-performance sensitivity in month *t* is the estimate $\hat{\beta}_t$.

We also construct some proxies for information. The first measure, *Affiliated to commercial banks,* captures affiliation with financial conglomerates that also own the banks that participate in the securitized debt markets and perform due diligence on the instruments. This could mean that these investors have informational advantage over unaffiliated investors. Alternatively, they may be less risk averse than unaffiliated investors to hold these securitized bonds because they receive implicit buyback guarantees from their affiliate banks in the event of market turmoil. Additionally, there may have been pressure on these affiliated funds to hold securitized bonds if agents at the participating banks in the securitization process had poor incentives and were mainly motivated to maximize fees. Thus, this measure is not necessarily a pure information measure. The second information 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 descriptive statistics in Table I. Panels A and B report the securitized bond and corporate bond holdings by mutual funds (Panel A) and insurance companies (Panel B). It is striking that securitized bonds held by the sample institutional investors (Panel A-1 and B-1) are overwhelmingly AAA-rated, with just a handful of non-AAA, investment grade tranches, and virtually no junk-rated tranches. In contrast, the vast majority of corporate bonds held by institutional investors (Panel A-2 and B-2) are investment grade but lower than AAA-rated. This finding about corporate bond holdings is not surprising, as the number of AAA-rated corporate issuers steadily dwindled over the years, from more than 60 in the 1980's to just 6 as of the end of 2008. It has been argued that institutional investors had great appetite for the securitized bonds because the securitization methodology enabled creation of informationally insensitive, highly rated debt in vast quantities. The summary statistics reported here corroborate this view.

Also, comparing Panel A-2 and B-2, we also find that mutual funds hold higher percentage of their 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 percentage of the total portfolio. For both classes of institutional investors, their holdings of AAA-rated bonds grew sharply, both as percentage of their total portfolios and also in absolute value during the sample period (1998-2008). For mutual funds, it grew from about 3% of total to 12%; for insurance companies, it grew from about 6% to 16%. In both cases, the growth came disproportionately from the growth in securitized bond holdings. The high percentage of AAA-rated securitized bonds held by insurance companies is significant, as we now know that many of them eventually were downgraded, some of them drastically. We will examine the impact of downgrades on their holding decisions below.

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 D-1 and D-3 report breakdown of all securitized bonds; Panel D-2 and D-4 report breakdown for 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. ABS, which is any asset-backed securities other than those backed by mortgages, can be backed by a wide variety of assets, including credit card debt, student loans, auto loans, etc. Finally, agency-backed debt 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 NOB = 21788) for Tables II, IV and V is a fund-quarter, whereas the unit of observations (with NOB = 8148) for Tables III, VI, VII, and VIII is a corporate bond. For example, the first three rows in Panel E-1, *Turnover ratio*, *Flow-performance sensitivity*, and *Flow volatility*, report the sample statistics (across fund-quarters) for the three proxies of investment horizons for our sample mutual funds. There is a great amount of variability in these measures – e.g., flow-performance sensitivity can vary from virtually zero sensitivity to the coefficient value of 1.6, i.e., a one percentage change in alpha percentile ranking results in 1.6% more flows to the fund.

The fifth variable from the top in Panel E-1, *Affiliated to Commercial Bank*, indicates that about one quarter of sample funds are affiliated with banks. The thirteenth variable, *Hold equity*

(Y/N), indicates that about two thirds of our sample mutual funds are pure bond funds that do not hold any equity, while the remaining one third 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 variables defined at the fund level, variables in Penal E-2 are defined at the level of 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, $\Delta YS$, measure the change in yield spreads of corporate spreads between the pre-crisis 2007 Q2 and the post-crisis 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 yields of some bonds hardly change while others shoot up sharply.

The seventh variable, *Holders' Exposure (to Securitized Bonds)* is a key variable of 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 indicates that investors' exposure varies widely from none to very high level (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. We 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 and present the results in Section 6. Other variables are standard bond characteristics used in the literature; for definitions of other variables in the table, see the Appendix.

## 4. Horizon and Demand

What determines the overall levels of holdings of securitized debt by institutional bond investors in general, and in particular, mutual funds? 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 seems to have understated their risk relative to corporate bonds,[15] while the

[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

promised yield made these instruments attractive especially for the investors for whom a higher performance would have been more valuable – i.e., the investors with shorter horizon. 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 papers.[16]

We therefore expect that, *among mutual funds*, the fund managers whose pay was more sensitive to performance, as well as the one with higher turnover or higher volatility of flows held more of the securitized debt. This prediction may be counterintuitive at first, as the standard literature on limits of arbitrage would suggest that the investors who hold more illiquid assets are the ones with longer horizon. However, the results are consistent with a world where participants may well be aware of a liquidity bubble and yet decide to ride the wave rather than betting against it until the music stops,[17] especially when their pay is tied to (short-term) performance. A high sensitivity to performance induces the investor to load up on potentially more risky assets. Indeed, in a winner-takes-all context, the loss accruing from a conservative behavior may more than offset any gain ensuing from a lower loss if the market changes. This is consistent with recent empirical evidence on hedge fund behavior at the top of the bubble (e.g., Brunnermeier and Nagel, 2004).

Also note that we do not expect mutual funds to hold less 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 higher percentage of their portfolios in securitized bonds than mutual funds.

In doing this analysis we have to separately control for the potential information effect –i.e., institutional investors that are affiliated with banks or large financial conglomerates may hold higher portions of their portfolios in securitized bonds because they have superior information about the true quality of these bonds. Alternatively, funds affiliated with banks may be less risk

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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)

[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, shortly before the onset of the crisis)

averse than unaffiliated investors to hold these securitized bonds because they receive implicit buyback guarantees from their affiliate banks in the event of market turmoil.

Specifically we estimate the effects of mutual funds' investment horizon on their portfolio holdings by estimating the following model:

$$H_{it} = \alpha + \beta\, Horizon_{it} + \gamma' x_{it} + \varepsilon_{it} \quad , \quad (1)$$

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.[18] *Horizon* is our proxy for the investment horizon of the fund – *Turnover ratio*, *Flow-performance sensitivity*, or *Flow volatility*. *Affiliated to commercial bank* and *log(Family Size)* capture the information effect and are part of *X*, which also include a set of standard fund characteristics (the fund's flow in the previous quarter (*Past Flow*), the fund's return in the previous quarter (*Fund return*), 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 1), 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 1998Q1-2008Q1.

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, while in Panel B, the dependent variable is the fraction of the fund's portfolio represented by corporate bonds. In columns (1)-(5) the model is estimated using the Fama-MacBeth, while in columns (6)-(10), it is estimated as a pooled OLS.

The results show a strong negative correlation between the horizon length of the investor and the percentage of the portfolio invested in securitized bonds. The effect is not only statistically significant, but also economically relevant. Holding other variables constant and evaluated at the sample mean, a fund at the top decile of *Flow-performance sensitivity* holds 26% of its portfolio in securitized bonds, while at fund at the bottom decile holds only 22% (similar effects obtain for *Flow volatility* and *Turnover Ratio*).

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

It is interesting to note that the fund affiliation also plays a significant role. In particular, funds that are affiliated to 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 effectively subsidizing these funds' holdings in the event of market turmoil. The recent anecdotal evidence about Citigroup' infusion of cash in its own money market funds to keep them afloat is consistent with this latter interpretation.[19]

Several of the other control variables are significant. For example, funds with higher expense ratios hold more in corporate bonds and less in securitized bonds. One possible interpretation is that individual corporate bonds are considered more information sensitive than securitized bonds because its default risk contains more idiosyncratic risk about the firm. Consequently, funds with more active investment strategies (and higher expenses) gravitate towards corporate bonds, whereas funds with lower expenses choose to hold securitized bonds. 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).

In sum, results from Table II show that the shorter-horizon mutual funds loaded more heavily on securitized bonds than those with longer-horizon prior to the crisis.

# 5. Selling Behavior around the Crisis and the Investor Horizon

## *5.1 What gets sold around the crisis?*

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

As described in the Introduction, the crisis unfolded starting in August 2007. Since our observations are quarterly, we examine changes between (i) second quarter of 2007 ending in

[19] While this is not our central question, we examine the post-crisis fund performance and find that bank-affiliated funds underperform as a result of their portfolio decisions that 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 for the post-crisis period, and we stress the need to be cautious in making a definitive conclusion on this question.

June and the third quarter of 2007 ending in September, and also between (ii) second quarter of 2007 ending in June and the fourth quarter of 2007 ending in December. Untabulated univariate statistics show that on average securitized bonds are not sold and that most of the sales are concentrated in corporate bonds. The average mutual fund reduces the holdings of corporate bonds in its portfolio by 16%. This increases the percentage representation in the portfolio of the securitized bonds by about 10%. This is consistent with Hypothesis 1 of the dynamic liquidation problem a-la Brown et al. (2009), namely, securities with high permanent price impact of trading (securitized bonds) are not prioritized in the initial period of the crisis.

To investigate determinants of corporate bond sales more systematically, 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. They 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*), covenant protection index (*CovIndex*),[20], and 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. Inclusion of issuer fixed-effects implies that we control for any unobserved firm characteristics that may affect 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 is, and the larger *InvRating* is. The other two proxies are directly related to how thinly traded the

[20] The construction of the covenant index follows Billet *et al.* (2007).

bond is. They are constructed by using data on actual transactions from TRACE. The first is *InvTrades*, the natural logarithm of the inverse the number of trades from TRACE. For each bond, we consider the mean number of trades per day, between the period January 2007-June 2007. The more illiquid, the larger this variable is. The second is the bond's Amihud illiquidity ratio.[21] The Amihud ratio is defined as the average daily $1000 \times \sqrt{|\Delta P| / \$V}$ , where $\Delta P$ 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 is. We compute the average ratio over the period January 2007-June 2007.

The results are reported in Table III. 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 here are mixed and 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, while it may also be consistent with the dynamic liquidation hypotheses a-la Brown et al. (2009). Namely, their model predicts that the investors may or may not sell more liquid assets first, depending on their expectation of future liquidity shocks.

In contrast, the negative relationship of sales with ratings is consistent with the dynamic liquidation hypothesis and is not consistent with the Scholes conjecture. To further differentiate between the two hypotheses, we proceed to focus on the investment horizon of the mutual fund investors in the next Section.

### *5.2 Selling and Investment Horizon around 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 and also whether they sell low quality bonds more. The Scholes conjecture posits that investors, regardless of their horizon, would always sell the most liquid assets– high quality corporate bonds – to exactly meet their liquidity needs, while the dynamic liquidation hypothesis posits that investors with short investment horizon liquidate more

[21] Amihud (2002).

in the first period (Hypothesis 2), and skew towards liquidating assets with high temporal price impact (Hypothesis 3). 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:

$$\Delta H_i = \alpha + \beta\, Horizon_i + \gamma' x_i + \varepsilon_i, \tag{3}$$

where $\Delta H$ 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*, *Flow-performance sensitivity*, or *Flow volatility* – while *x* is a set of fund characteristics including the standard control variables from Equation (1), as well as the fraction of securitized bonds in the fund's portfolio. Both *Horizon* and *x* are expressed in their values as of June 2007. The *t*-statistics are based on White heteroskedasticity-robust standard errors. The sample includes all the mutual funds belonging to the merged Lipper eMAXX-CDA/Spectrum data set, over the period 2007Q2-2007Q4.

The results are reported in Table IV. In columns (1)-(5), the dependent variable is the fraction of the fund's portfolio represented by securitized bonds, while in columns (6)-(10), the dependent variable is the fraction of the fund's portfolio represented by corporate bonds. The results show a strong negative (positive) correlation between the horizon length of the investor and the net change the portfolio representation of securitized bonds (corporate bonds). That is, the shorter the horizon, the more the investor reduces his stake in corporate bonds. This increases the stake in securitized bonds. The effect is not only statistically significant, but also economically relevant. One standard deviation increase in the Flow-performance sensitivity (Turnover ratio, Flow volatility) is related to a 6% (2%. 4%) higher reduction in corporate bond holdings.

Also in this case, fund affiliation plays a significant role. Funds that are affiliated to commercial banks or are part of big financial groups tend to sell more corporate bonds and hold on to securitized bonds. Again, this may be a signal of better (actual or perceived) information about the value of the securitized bonds as well as less fear to hold on to these assets as these funds may count on implicit guarantees from the group they are affiliated with in case of future liquidity needs.

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 sub-investment grade corporate bonds (Hypothesis 3). We repeat the specification presented in Equation (3) and

simply replace the dependent variable with $\Delta C$, the changes in portfolio representations of (i) investment-grade corporate bonds and (ii) sub-investment grade corporate bonds.

The results are reported in Table V. In the odd-numbered columns, the dependent variable $\Delta C$ 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 sub-investment grade bonds. The estimates are broadly supportive of the dynamic liquidation hypothesis in that the propensity to liquidate is more sensitive to investment horizon 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. The effect is economically very clear. One standard deviation increase in Flow-performance sensitivity (Turnover ratio, Flow volatility) translates to a 27% (30%, 17%) higher sale of sub-investment grade bonds, 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 that R-squared is two to five times larger for the sub-investment grade bonds (even-numbered columns) than for investment grade bonds (odd-numbered columns). Other control variable results are qualitatively similar to those in Table IV.

The results in Table II, IV and V together show that (i) short-horizon mutual funds loaded up on securitized bonds and ended up with higher exposure to them by the onset of the crisis, and that (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 results are consistent with predictions of the dynamic liquidation model, where vulnerable investors optimize over multiple periods and as a result may (i) choose to liquidate excessively in the initial period and (ii) hold on to relatively liquid assets when faced with sufficiently large expected future shocks. They also choose not to liquidate the securitized bonds. This is consistent with investors avoiding sales of assets with high permanent price impact of trading.

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

The previous sections show that as the crisis hits the market institutional investors with a short investment horizon hold on to their (now) most illiquid assets – the securitized bonds – and sell

the others. In particular, they prioritize the sale of sub-investment grade bonds. We also find that these short-horizon mutual funds have loaded up on securitized bonds prior to the crisis and have significant exposure. In this section we 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 focus on changes in corporate bond yields (prices) and trading volumes (Hypothesis 4a). We further test whether the effects are larger the lower the bond rating is (Hypothesis 4b).

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

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

where each observation corresponds to a corporate bond with data in the FINRA TRACE data set. The dependent variable $\Delta YS_i$ is the change in corporate bond *i*'s yield spread around 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. Data on Treasury bond yields are retrieved from the Federal Reserve Statistical Release.

One of the key implications of the dynamic liquidation model is that, for a sufficiently large expected future liquidity shock, investors optimizing over multiple periods may choose to liquidate in excess of what they immediately need in the initial period. We empirically gauge this magnitude of potential future shocks by constructing first an exposure of a portfolio to securitized bonds at individual mutual fund level, and then weight-averaging this exposure across all funds holding a particular corporate bond *i*, thus creating an exposure measure at the individual bond level ($HoldersExposure_i$). The larger the exposure of bond *i*'s mutual fund investors, the higher the potential future shock facing mutual fund investors of bond *i* and thus the more bond *i* is expected to be sold today.

How about insurance company investors? We expect the mechanism governing their portfolio decisions to be distinct. First, they are not subject to runs like mutual funds, with longer lock-up periods and heftier early withdrawal penalties. This makes them less subject to selling pressure in the initial period of the crisis. Second, they are subject to rating-based capital regulation. Downgrades of securitized bonds would thus predict sales by insurance companies; in the second half of 2007, which we focus on this part of the 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 analogous *HoldersExposure* measure for insurance companies and include this variable in one of the specifications.

The dynamic liquidation model also 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 and hold on to the assets with low temporary price impacts (as a hedge against future shocks). We thus interact the exposure measure ($HoldersExposure_i$) with $InvRating_i$ (as defined before) and includes this interaction term as well $InvRating_i$ itself in the model. The lower the rating, the higher the $InvRating_i$ is, and 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. Inclusion of issuer fixed effects implies that we are able to isolate the within-issuer variations in selling pressures across bonds as functions of bond-specific exposure measures.

We report the results in Table VI. In columns (1)-(4) $\Delta YS$ 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 (4a). In terms of economic significance, 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 from Table I that on average corporate bond yields increased by approximately 100bps in the first quarter of the crisis, and about 200 bps in the first two quarters of the crisis. Thus these are large but reasonable magnitudes.

The third coefficient, the interaction term of *HoldersExposure* and *InvRating*, is also positive and significant. So 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 (4b) 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 (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 rating itself on the yield change by including *InvRating* itself in the model (second row). This coefficient is positive and significant, which 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 results suggest 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 results presented here are in line with the intuition provided in Figure 1, as well as with our previous findings. They show that the increases in bond yield spreads around the 2007 crisis are pronounced among the low-rated bonds held by mutual funds with heavy exposure to securitized bonds. 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 of 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. We will examine how their behavior is affected by large-scale downgrades in the later period below.

While the positive relationship between investors' exposure to securitized bonds and 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 observed individual bond sales by mutual funds as functions of their exposure. We now study whether mutual funds' relative trading impact increased around the crisis and whether this increase is related to the fraction of securitized bonds they held. We therefore estimate:

$$\Delta Tr_i = \alpha + \beta\, HoldersExposure_i + \gamma\, InvRating_i + \delta\left(HoldersExposure_i \times InvRating_i\right) + \varphi' x_i + \varepsilon_i, \quad (5)$$

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*. The dynamic liquidation model predicts that the selling pressure from mutual funds on a bond is higher the more they are exposed to securitized bonds *and* the lower the bond rating is. The other variables are as defined in the previous specification.

The results are reported in Table VII. 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 % of the total trading volume for the bond in the initial months of the crisis. One standard deviation increase in *HoldersExposure* is associated with a 50% higher increase in mutual funds' selling pressure for a high yield bond (rating BBB- or below) than for an AAA-rated bond.

Finally, as a robustness check, we re-estimate specification (5) using as dependent variable *logVol*, defined as: $\log Vol = \log(1 + \$Vol)$ where *$Vol* is the bond's average daily trading volume, expressed in thousands of dollars. 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 VIII. 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 validates our use of bond rating as a measure of temporary price impact of trading. Importantly, the third coefficient, the interaction between the first two, is positive and significant. This implies that, even though lower-rated bonds in general traded less in the initial months of the crisis, among those that are held by investors with exposure to securitized bonds, the higher exposure and lower the bond rating, the more they were traded. This is consistent with Hypothesis (4b), that is, when they face large uncertainty about recurring future liquidity shocks (as measured by exposure to securitized bonds), investors preferred to sell lower-rated corporate bonds and hold on to higher-rated corporate bonds, as a hedge against future forced liquidations.

This table thus provides the final missing link between securitized bond holdings, investor sales and corporate bond yields: 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

same initial months of the crisis. Overall, these results suggest that funds significantly increase their price pressure on low quality bonds during the crisis and that this impact is negatively related to the length of their investment horizon.

## Conclusion

We study a transmission mechanism that explains the contagion of the crisis from the securitized bond market to the corporate bond market. We argue that one possible avenue of transmission operates through the common ownership of both classes of assets by institutional bond investors. While a joint ownership alone does not necessitate a contagion, recent developments in the theory of dynamic asset liquidation in a multi-period setting identify specific conditions under which contagion occur for certain investor- and bond types. The main prediction of this model is that investors with large enough future liquidity shocks hold on to the most liquid assets, and instead sell assets that have relatively high (temporary) price impact of trading. We investigate a series of hypotheses based on this dynamic liquidation model as well as a more naïve Scholes conjecture, which predicts that investors face with liquidation needs choose to liquidate the most liquid assets first.

The results confirm the predictions of the multi-period dynamic liquidation model of investors facing liquidity constraints. First, we argue and show that prior to the onset of the crisis mutual fund investors are eager participants in the securitized bond market, especially in the top-rating category. Together institutional investors held nearly $2 trillion in securitized bonds, which were predominantly AAA-rated. In contrast, they held approximately $3 trillion in corporate bonds, of which only 10% were AAA-rated. Among mutual funds, the shorter-horizon mutual funds held higher portions of their portfolios in securitized bonds than long-horizon mutual funds. We argue that 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 needs for more intensive credit research.

The world changed in August 2007, when securitized bonds abruptly became illiquid and their resale values plunged. Among the institutional investors with significant exposure to securitized bonds, we first focus on mutual funds, which are subject to investor runs and thus may liquidate assets in the initial months of the crisis, either to meet current withdrawal requests or in anticipation of future withdrawal requests. The dynamic liquidation model predicts that investors facing liquidation problems uniformly avoid selling assets with high permanent price impact of

trading, which is characterized by high degree of information asymmetry. Consistent with this prediction, we find that investors on average do not sell the now impaired and hard-to-value securitized bonds, and instead reduce holdings of corporate bonds.

Further examining the sales of corporate bonds by mutual funds around the onset of the crisis, we find that the average investor tends to sell the sub-investment grade bonds more than investment grade bonds. The change in holdings of the investors around the crisis also depends on the investor horizon. One standard deviation shorter horizon translates to an 8% higher sale of corporate bonds in general and in a 27% higher sale of low quality corporate bonds.

Finally, analyzing the transmission of shocks from the securitization market to the corporate bond market via corporate bondholders' exposure to securitized bonds, we find that the higher the fraction of securitized bonds held in the portfolio, the more the investor sells corporate bonds and especially low quality corporate bonds. These results show a direct channel of transmission of the crisis from securitized bonds to the corporate bond market. We also document a direct price effect. Examining changes in individual corporate bond spreads around the onset of the crisis, we show that bond yields widened more for those bonds whose holders' portfolios were more heavily exposed to securitized bonds. Moreover, this effect is higher for sub-investment grade corporate bonds: for a high-yield bond, a one standard deviation increase in the fraction of securitized bonds in the portfolio of its holders translates into a 28 bps increase in the yield spread over the first six months of the crisis. These findings indicate that institutional investors 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. We further plan to implement our ongoing study of the impact of rating-based capital regulation and fair-value accounting rule changes on the behavior of insurance companies in the next phase of this project.

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**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 around the crisis. *H* is defined as the percentage of corporate bonds (resp. securitized bonds) in the mutual fund's portfolio, minus the average percentage holdings of corporate bonds (resp. 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: we cross three maturity terciles and three rating terciles, obtaining nine sectors. $\Delta H$ 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, minus the average percentage of investment grade (resp. sub-investment grade) corporate bonds among the funds in the same sector. $\Delta C$ is the change in *C* between June 2007 and December 2007.

**Turnover ratio** Turnover ratio of the mutual fund's portfolio, retrieved from the CRSP Survivor-Bias-Free Mutual Fund Database. It is 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. It is defined as follows (Huang, Kelsey and Yan, 2007). 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. Every month, the fund's alpha is estimated, as the intercept from an eight-factor model for the fund's return, as specified in Table XI, and estimated on a rolling window of length equal to 36 months. Next the alphas are sorted into percentiles, and the fund's performance is equal to the percentile rank, i.e. a performance equal to 0.99 indicates that the fund has an alpha above 99% of all funds in the data set in a given month. Finally, the following regression is estimated, over a rolling window of length equal to 12 months:

$$Flow_s = \alpha_t + \beta_t Performance_s + \varepsilon_s, \quad s = t-12,\ldots,t$$

The fund's flow-performance sensitivity in month *t* is the estimate $\hat{\beta}_t$.

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

**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 to commercial bank** Indicator variable equal to one if the mutual fund belongs to a fund family that is affiliated to a commercial bank. Data on banks participating in syndicated loans is retrieved from the LPC Dealscan data set. These data are matched to fund affiliation data using the same methodology as Massa and Rehman (2008).

**Past flow** Investment flow into the mutual fund (defined above) over the previous quarter.

**Fund return** Quarterly return of the mutual fund, based on compounded monthly returns from the CRSP Survivor-Bias-Free Mutual Fund Database.

**Family equity holdings** Equity holdings by the mutual fund's family, as a fraction of its 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. The fee is calculated using ratios based on the line items reported in the Annual Report Statement of Operations.

**Exp. Ratio** Fund's expense ratio, obtained from the CRSP Survivor-Bias-Free Mutual Fund Database. It is the expense ratio of the most recently completed fiscal year, defined as the total investment that the shareholders pay for the fund's operating expenses (which include 12b1 fees, see below).

**Actual 12b1** Ratio of total assets of the fund attributed to marketing and distribution costs, as reported in the Annual Report Statement of Operations. Obtained from the CRSP Survivor-Bias-Free Mutual Fund Database.

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

**Hold 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. The equity holdings are obtained from the CDA/Spectrum data set.

**II. Bond characteristics**

**logSale (Jul-Oct 2007/Jul-Dec 2007)** Natural logarithm of the net sales (in thousands of dollars) of the bond by institutional investors in the Lipper eMAXX data set, over the periods July to October 2007 or July to December 2007.

**ΔYS (Jul-Oct 2007/Jul-Dec 2007)** Change in the bond's yield spread over the periods July to October 2007 or July to December 2007. The yield spread is defined as the spread between the bond's yield to maturity and the yield to maturity of a government bond of comparable maturity. Data on bond yields to maturity is obtained from the Financial Industry Regulating Authority (FINRA)'s Trade Reporting and Compliance Engine (TRACE) data set.

**ΔTr (Jul-Oct 2007/Jul-Dec 2007)** Net sales of the bond on part of mutual funds, as a fraction of the bond's total trading volume, over the periods July to October 2007 or July to December 2007. It is defined as:

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

Net sales of the bond by mutual funds are obtained as the changes in mutual funds' holdings from the Lipper eMAXX data set. The bond's total trading volume is obtained from the Financial Industry Regulating Authority (FINRA)'s Trade Reporting and Compliance Engine (TRACE) data set.

**Holders' Exposure** Average holdings of securitized bonds as a fraction of the portfolio of the average mutual fund holding the bond. Mutual fund holdings of securitized bonds and corporate bonds are retrieved from the Lipper eMAXX data set; mutual fund holdings of equity are retrieved from the CDA/Spectrum data set. For each bond, we compute the fraction of securitized bonds in the portfolio of each mutual fund that holds the bond. We

then make a weighted average across mutual funds, with weights proportional to the size of the funds' holdings of the bond.

**Insurance Holders' Exposure** Average holdings of securitized bonds as a fraction of the portfolio of the average insurance company holding the bond. Insurance companies' holdings of securitized bonds and corporate bonds are retrieved from the Lipper eMAXX data set; insurance companies' holdings of equity are retrieved from the 13f Institutional Equity holdings data set. For each bond, we compute the fraction of securitized bonds in the portfolio of each insurance company that holds the bond. We then make a weighted average across insurance companies, with weights proportional to the size of the company's holdings of 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. It is 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). Data on bond ratings are obtained from the Mergent Fixed Income database.

**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. Data on covenants are retrieved from the Mergent Fixed Income database. Starting from the 15 covenant categories described in Billet *et al.* (2007), 15 corresponding covenant indicator variables are created for each bond in the sample. The sum of the covenant indicators is then divided by 15, to create an index that ranges 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. Data on maturity dates are retrieved from the Mergent Fixed Income database.

**Amihud** Amihud's (2002) illiquidity proxy. It is defined as:

$$1000 \times \sqrt{\frac{|\Delta P|}{\$V}}$$

where $\Delta P$ is the bond's return (percentage change in the daily average price), and $\$V$ is the bond's daily dollar trading volume. Data on bond prices and trading volumes are obtained from the Financial Industry Regulating Authority (FINRA)'s Trade Reporting and Compliance Engine (TRACE) data set.

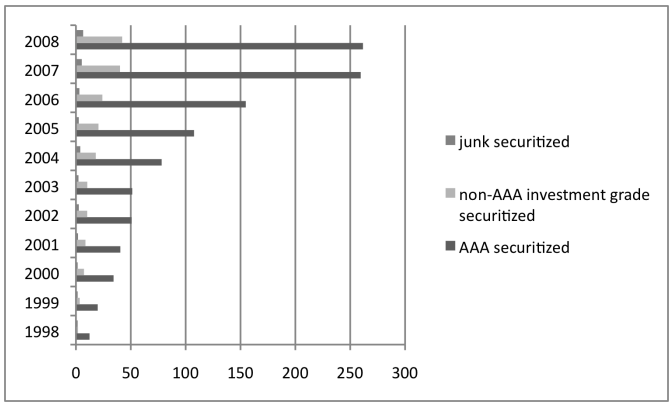
**InvTrades** The natural logarithm of the inverse of the number of trades on the bond, as reported from the Financial Industry Regulating Authority (FINRA)'s Trade Reporting and Compliance Engine (TRACE) data set.

**Table I Summary Statistics**

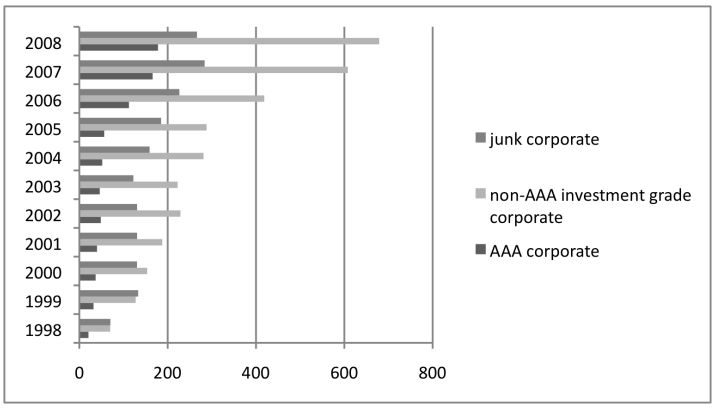
The table reports the summary statistics. Panels A and B report the securitized bond and corporate bond holdings by mutual funds (Panel A) and insurance companies (Panel B). Panel C reports AAA-rated bond holdings by % of the total portfolio. Panels D reports the breakdown of securitized bond holdings 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 assets holdings of mutual funds**

**A-1: Securitized Bonds ($bn)**

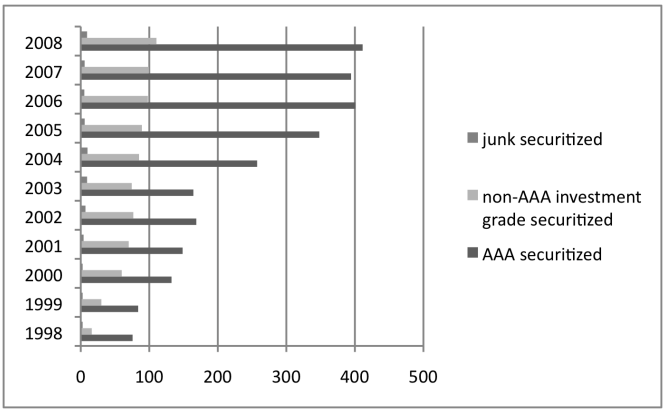



**A-2: Corporate Bonds ($bn)**

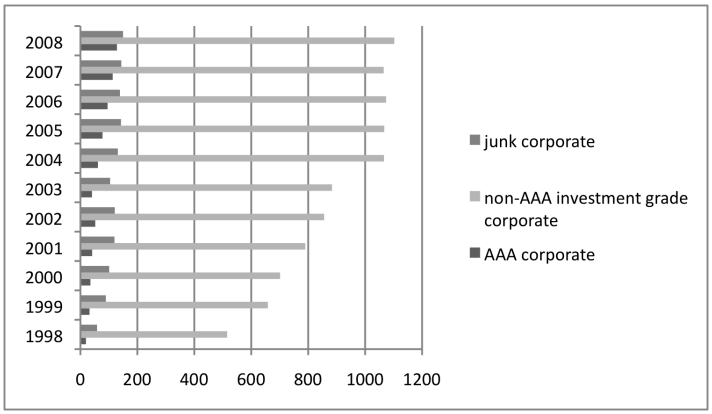



**B. Corporate bond and securitized assets holdings of insurance companies**

**B-1: Securitized Bonds ($bn)**

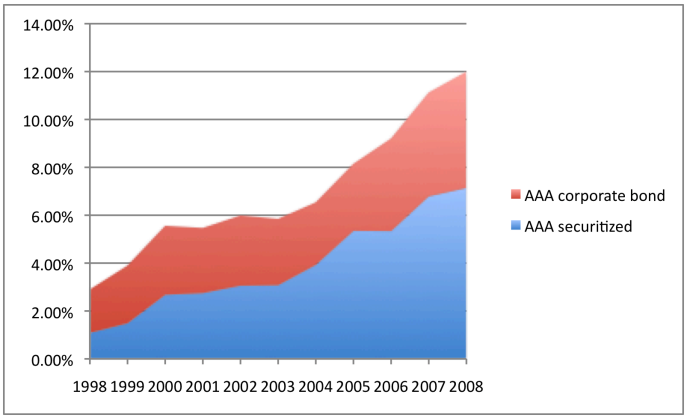



**B-2: Corporate Bonds ($bn)**

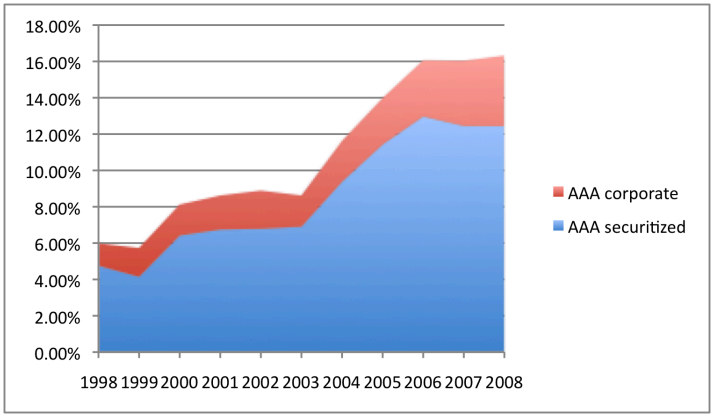



**C: AAA-rated bonds as % of total**

**C-1: Mutual fund portfolio**

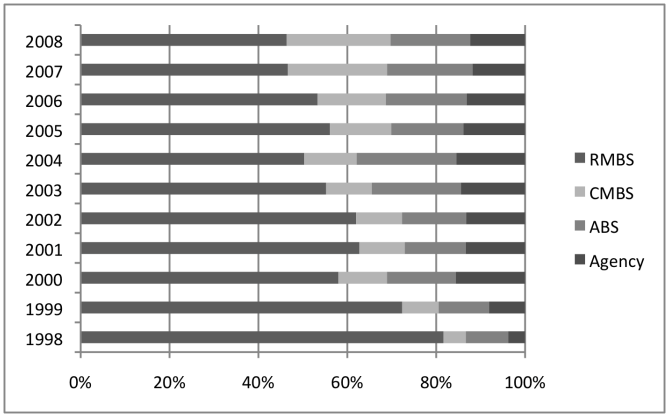



**C-2: Insurance company portfolio**

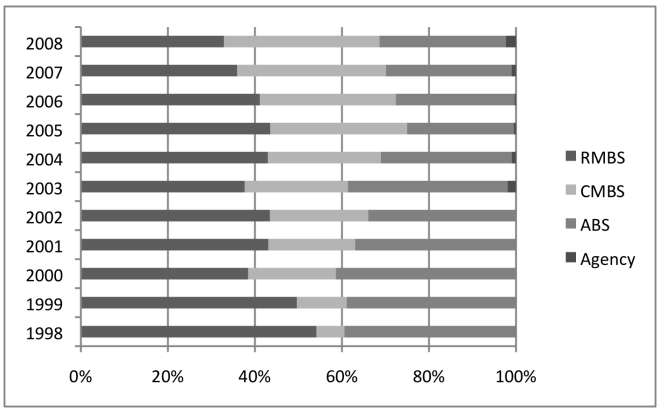


**D. Securitized bond holdings, by underlying asset type and ratings**

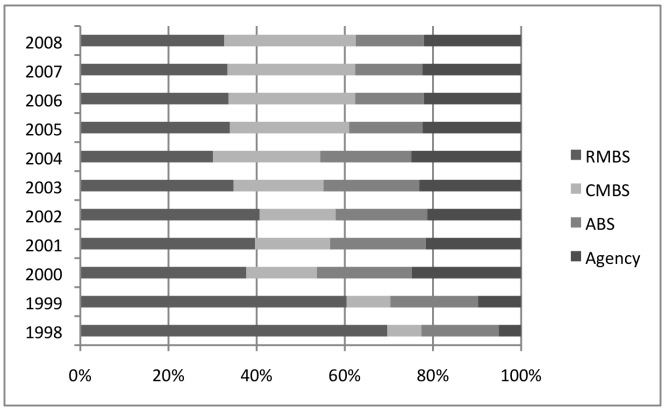
**D-1: Mutual fund portfolio – all ratings**



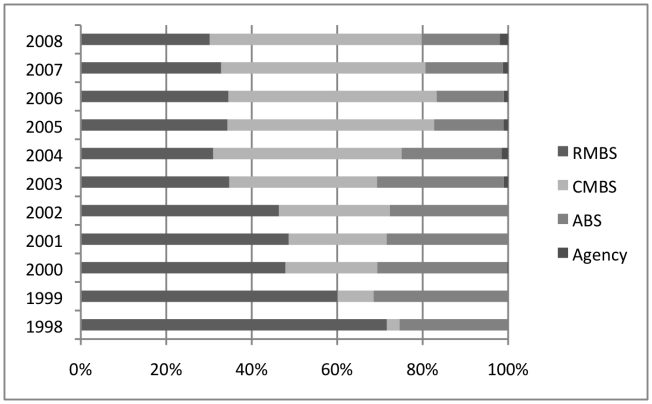

**D-2: Mutual fund portfolio – AAA-rated only**




**D-3: Insurance company portfolio – all ratings**




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



**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, IV, and V** | | | | | | |
| **Turnover ratio** | 0.0123 | 0.0078 | 0.0153 | 0.0007 | 0.3454 | 21788 |
| **Flow-performance sensitivity** | 0.2014 | 0.0792 | 0.3129 | 0.0016 | 1.6070 | 21788 |
| **Flow volatility** | 0.1075 | 0.0622 | 0.1317 | 0.0054 | 0.6972 | 21788 |
| **Log(Family Size)** | 3.0899 | 3.0928 | 1.9120 | 0.0259 | 7.6027 | 21788 |
| **Affiliated to commercial bank** | 0.2603 | 0.0000 | 0.4388 | 0.0000 | 1.0000 | 21788 |
| **Past flow** | 0.1397 | -0.3590 | 0.1897 | -0.5974 | 1.4985 | 21788 |
| **Fund return** | 0.3730 | 0.3721 | 0.0207 | 0.1589 | 0.4313 | 21788 |
| **Family equity holdings** | 0.3744 | 0.2747 | 0.3018 | 0.0005 | 0.9142 | 21788 |
| **Mgmt fee** | 0.5234 | 0.5340 | 0.2108 | 0.0010 | 0.9690 | 21788 |
| **Exp. ratio** | 0.0109 | 0.0096 | 0.0068 | 0.0000 | 0.1877 | 21788 |
| **Actual 12b1** | 0.0048 | 0.0025 | 0.0036 | 0.0000 | 0.0103 | 21788 |
| **Average maturity of holdings** | 4.6356 | 4.6857 | 0.6975 | 2.2275 | 5.7566 | 21788 |
| **Hold equity (N/Y) [1 = NO]** | 0.6850 | 1.0000 | 0.4645 | 0.0000 | 1.0000 | 21788 |
| **Fund's equity holdings return** | 0.0164 | 0.0000 | 0.0979 | -0.1875 | 0.3253 | 21788 |
| **E-2: Variables used in Tables III, VI, VII, and VIII** | | | | | | |
| **logSale (Jul-Oct 2007)** | 3.3864 | 0.0000 | 4.3138 | 0.0000 | 13.541 | 8148 |
| **logSale (Jul-Dec 2007)** | 4.2004 | 0.0000 | 4.7330 | 0.0000 | 13.893 | 8148 |
| **ΔYS (Jul-Oct 2007)** | 0.9798 | 0.6014 | 1.2425 | 0.0241 | 13.191 | 8148 |
| **ΔYS (Jul-Dec 2007)** | 1.9952 | 1.2933 | 2.4273 | 0.2951 | 25.469 | 8148 |
| **ΔTr (Jul-Oct 2007)** | 0.0018 | 0.0000 | 0.0269 | -0.0133 | 0.8258 | 8148 |
| **ΔTr (Jul-Dec 2007)** | 0.0049 | 0.0000 | 0.0401 | -0.0090 | 0.8717 | 8148 |
| **Holders' Exposure (to Securitized Bonds)** | 0.0787 | 0.0000 | 0.1413 | 0.0000 | 0.9050 | 8148 |
| **InvRating** | -2.6118 | -3.0910 | 1.0897 | -3.3322 | 0.0000 | 8148 |
| **Yield spread in 2007Q2** | 1.1460 | 1.0834 | 2.1705 | 0.1830 | 9.4245 | 8148 |
| **No Rating (Y/N)** | 0.1444 | 0.0000 | 0.3515 | 0.0000 | 1.0000 | 8148 |
| **Bond face value** | 10.692 | 11.290 | 2.3416 | 5.7746 | 15.425 | 8148 |
| **Covenants (Y/N)** | 0.4243 | 0.0000 | 0.4943 | 0.0000 | 1.0000 | 8148 |
| **CovIndex** | 0.1429 | 0.0000 | 0.1941 | 0.0000 | 0.6667 | 8148 |
| **log(Months to maturity)** | 4.1050 | 4.2485 | 1.1545 | 0.0000 | 6.9903 | 8148 |
| **Insurance Holders' Exposure** | 0.1881 | 0.1964 | 0.1807 | 0.0000 | 0.9716 | 8148 |
| **Amihud** | 0.4956 | 0.4969 | 0.3043 | 0.0091 | 1.2050 | 8148 |
| **InvTrades** | -0.9774 | -0.8544 | 0.5011 | -4.0012 | -0.2231 | 8148 |

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

The table reports the estimates of a model:

$$H_{it} = \alpha + \beta Horizon_{it} + \gamma' x_{it} + \varepsilon_{it}, \quad (1)$$

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). *Horizon* is the mutual fund's horizon, proxied for by *Turnover ratio*, *Flow-performance sensitivity*, or *Flow volatility*. *x* is a set of standard control variables. In both panels, in columns (1)-(5) the model is estimated using the Fama-MacBeth procedure. The standard errors are Newey-West, with lag length parameter equal to 1. In columns (6)-(10), 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 1998Q1-2008Q1. 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** | 1.2581*** | | | 0.9975*** | | |
| | *5.14* | | | *2.58* | | |
| **Flow-performance sensitivity** | | 0.0727*** | | | 0.0697*** | |
| | | *4.00* | | | *3.92* | |
| **Flow volatility** | | | 0.0274*** | | | 0.0199** |
| | | | *3.12* | | | *1.97* |
| **Log(Family Size)** | -0.0015 | 0.0002 | 0.0001 | 0.0001 | 0.0011 | 0.0011 |
| | *-0.94* | *0.11* | *0.04* | *0.02* | *0.44* | *0.43* |
| **Affiliated to commercial bank** | 0.0173*** | 0.0151*** | 0.0148*** | 0.0182 | 0.0158 | 0.0166 |
| | *3.11* | *2.89* | *2.95* | *1.59* | *1.44* | *1.50* |
| **Past flow** | -0.0033 | -0.0153*** | -0.0537*** | 0.0000 | 0.0001 | -0.0396* |
| | *-1.42* | *-2.75* | *-3.26* | *0.07* | *0.12* | *-1.94* |
| **Fund return** | -0.5287 | -0.4436 | -0.4774 | -0.2386*** | -0.2044** | -0.1807** |
| | *-1.07* | *-0.96* | *-1.04* | *-2.70* | *-2.30* | *-2.07* |
| **Family equity holdings** | -0.0199*** | -0.0162** | -0.0180*** | -0.0280** | -0.0243** | -0.0263** |
| | *-3.09* | *-2.26* | *-2.64* | *-2.29* | *-1.98* | *-2.15* |
| **Mgmt fee** | 0.0027 | 0.0036 | 0.0038 | -0.0003 | -0.0005 | -0.0005 |
| | *1.11* | *1.24* | *1.39* | *-0.27* | *-0.44* | *-0.41* |
| **Exp. ratio** | -2.8822*** | -2.5196*** | -2.7139*** | -0.0004 | -0.0003 | -0.0004 |
| | *-8.33* | *-8.02* | *-8.30* | *-0.92* | *-0.63* | *-0.86* |
| **Actual 12b1** | -0.1642 | 0.0000 | 0.0000 | -0.0002*** | -0.0002** | -0.0002** |
| | *-1.01* | *0.25* | *0.41* | *-2.59* | *-2.49* | *-2.39* |
| **Average maturity of holdings** | 0.0007*** | 0.0009*** | 0.0008*** | 0.0012*** | 0.0013*** | 0.0013*** |
| | *2.08* | *2.74* | *2.50* | *5.05* | *6.14* | *5.97* |
| **Hold equity (N/Y) [1 = NO]** | 0.1169*** | 0.1188*** | 0.1194*** | 0.1338*** | 0.1358*** | 0.1378*** |
| | *20.03* | *17.18* | *19.66* | *12.88* | *13.46* | *13.82* |
| **Fund's equity holdings return** | 0.0059 | 0.0155 | 0.0088 | -0.0321*** | -0.0293*** | -0.0310*** |
| | *0.20* | *0.53* | *0.29* | *-3.45* | *-3.09* | *-3.35* |
| **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.** | 21788 | 21788 | 21788 | 21788 | 21788 | 21788 |
| **(Average) $R^2$** | 0.129 | 0.117 | 0.114 | 0.097 | 0.090 | 0.087 |

**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** | -1.7436*** | | | -1.3993*** | | |
| | *-5.59* | | | *-2.87* | | |
| **Flow-performance sensitivity** | | -0.0613** | | | -0.0569** | |
| | | *-2.43* | | | *-2.48* | |
| **Flow volatility** | | | -0.0181 | | | -0.0158 |
| | | | *-1.33* | | | *-1.14* |
| **Log(Family Size)** | 0.0010 | -0.0017 | -0.0016 | 0.0000 | -0.0017 | -0.0018 |
| | *0.52* | *-1.03* | *-0.90* | *0.00* | *-0.48* | *-0.50* |
| **Affiliated to commercial bank** | -0.0262*** | -0.0268*** | -0.0246*** | -0.0251* | -0.0249* | -0.0244* |
| | *-3.77* | *-3.83* | *-3.88* | *-1.69* | *-1.76* | *-1.72* |
| **Past flow** | 0.0067 | 0.0148* | 0.0416 | 0.0002 | 0.0001 | 0.0315 |
| | *1.26* | *1.77* | *1.54* | *0.42* | *0.29* | *1.14* |
| **Fund return** | 0.5435 | 0.3501 | 0.4656 | 0.2635* | 0.1793 | 0.1873 |
| | *0.60* | *0.42* | *0.56* | *1.78* | *1.24* | *1.28* |
| **Family equity holdings** | -0.0420*** | -0.0437*** | -0.0407*** | -0.0335 | -0.0344* | -0.0317 |
| | *-5.40* | *-5.72* | *-5.25* | *-1.58* | *-1.68* | *-1.54* |
| **Mgmt fee** | -0.0014 | -0.0013 | -0.0035 | -0.0034 | -0.0030 | -0.0031 |
| | *-0.32* | *-0.30* | *-0.97* | *-1.33* | *-1.23* | *-1.23* |
| **Exp. ratio** | 5.8535*** | 5.2552*** | 5.4973*** | -0.0003 | -0.0004** | -0.0003 |
| | *8.85* | *8.71* | *8.41* | *-1.47* | *-2.14* | *-1.58* |
| **Actual 12b1** | 0.0414 | 0.0000 | -0.0001 | 0.0003** | 0.0003** | 0.0003** |
| | *1.01* | *-0.64* | *-1.07* | *2.28* | *2.32* | *2.18* |
| **Average maturity of holdings** | -0.0013*** | -0.0016*** | -0.0016*** | -0.0020*** | -0.0023*** | -0.0023*** |
| | *-2.76* | *-3.20* | *-3.14* | *-6.24* | *-7.64* | *-7.68* |
| **Hold equity (N/Y) [1 = NO]** | 0.0702*** | 0.0673*** | 0.0665*** | 0.0181 | 0.0170 | 0.0139 |
| | *4.30* | *4.35* | *4.21* | *1.01* | *0.97* | *0.79* |
| **Fund's equity holdings return** | -0.0830 | -0.0878 | -0.0847 | 0.0413** | 0.0385*** | 0.0405** |
| | *-1.22* | *-1.21* | *-1.25* | *2.55* | *2.32* | *2.48* |
| **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.** | 21788 | 21788 | 21788 | 21788 | 21788 | 21788 |
| **(Average) $R^2$** | 0.090 | 0.082 | 0.080 | 0.043 | 0.040 | 0.039 |

**Table III Sales of Corporate Bonds by Institutional Investors Around the Crisis**

The table 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 dependente 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.

| | (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 (Y/N)** | -3.1242** | 0.0897 | 0.0967 | -3.2439** |
| | *-2.01* | *0.95* | *1.02* | *-2.15* |
| **Bond is not held by institutional investors (Y/N)** | 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 (Y/N)** | 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 |
| **$R^2$** | 0.906 | 0.884 | 0.907 | 0.908 |

**Table IV Changes in Mutual Fund Holdings of Securitized Bonds and Corporate Bonds Between 2007Q2 and 2007Q4**

The table reports the estimates of a model:

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

The dependent variable $\Delta H$ is the change, between 2007Q2 and 2007Q4, in the fraction of the fund's portfolio represented by securitized Bonds (columns (1)-(3)) or corporate bonds (columns (4)-(6)), in excess of the average for the fund's class (based on the average rating and maturity of the securities in the fund's portfolio), both defined in the Appendix. *Horizon* is the mutual fund's horizon, proxied for by *Turnover ratio*, *Flow-performance sensitivity*, or *Flow volatility*. *x* is a set of standard mutual fund characteristics. Both *Horizon* and *x* are expressed in their values as of June 2007. The t-statistics are based on White heteroskedasticity-robust standard errors. The sample includes all the mutual funds belonging to the merged Lipper eMAXX-CDA/Spectrum data set, over the period 1998Q1-2008Q1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

| | **Holdings of Securitized Bonds** | | | **Holdings of Corporate Bonds** | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Turnover ratio** | 0.7570** | | | -0.6522 | | |
| | *1.97* | | | *-1.37* | | |
| **Flow-performance sensitivity** | | 0.0312** | | | -0.0475*** | |
| | | *2.49* | | | *-3.47* | |
| **Flow volatility** | | | 0.0459* | | | -0.0575** |
| | | | *1.87* | | | *-2.36* |
| **Securitized holdings – 2007Q2** | -0.0755*** | -0.1957*** | -0.1993*** | | | |
| | *-3.93* | *-6.50* | *-6.56* | | | |
| **Corp. bond holdings – 2007Q2** | | | | -0.0267 | -0.1170*** | -0.1247*** |
| | | | | *-1.43* | *-4.66* | *-4.84* |
| **Affiliated to commercial bank** | 0.0065*** | 0.0307*** | 0.0019 | -0.0045* | 0.0255** | 0.0025 |
| | *3.22* | *2.58* | *0.82* | *-1.80* | *-2.05* | *0.93* |
| **log(Family size)** | 0.0183* | 0.0019 | 0.0302** | -0.0099 | -0.0022 | -0.0239* |
| | *1.92* | *0.81* | *2.53* | *-0.87* | *0.82* | *-1.93* |
| **Past flow** | 0.0000 | -0.0000 | -0.0918* | 0.0001 | 0.0002 | 0.1151** |
| | *0.02* | *-0.00* | *-1.87* | *0.32* | *0.59* | *2.36* |
| **Fund return** | -0.0134 | 0.2370 | 0.3356 | 0.1810 | -0.0801 | -0.1944 |
| | *-0.03* | *0.35* | *0.49* | *0.28* | *-0.10* | *-0.25* |
| **Family equity holdings** | 0.0011 | 0.0425** | 0.0426** | 0.0203 | -0.0303* | -0.0295* |
| | *0.08* | *2.49* | *2.50* | *1.44* | *-1.79* | *-1.75* |
| **Mgmt fee** | 0.0013* | 0.0005 | 0.0005 | -0.0041*** | -0.0037*** | -0.0040*** |
| | *1.76* | *0.47* | *0.43* | *-3.88* | *-3.00* | *-3.04* |
| **Exp. ratio** | -1.3824 | -3.4059** | -3.8713*** | 2.8635** | 4.5382*** | 5.2471*** |
| | *-1.13* | *-2.27* | *-2.65* | *2.19* | *3.03* | *3.58* |
| **Actual 12b1** | 0.0004*** | 0.0004*** | 0.0004*** | -0.0004*** | -0.0004*** | -0.0005*** |
| | *3.41* | *2.88* | *3.04* | *-3.16* | *-2.77* | *-3.13* |
| **Average maturity of holdings** | -0.0001 | 0.0014*** | 0.0014*** | 0.0001 | -0.0011*** | -0.0012*** |
| | *-0.24* | *4.26* | *4.33* | *0.62* | *-3.50* | *-3.60* |
| **Hold equity (N/Y) [1 = NO]** | -0.0019 | 0.0338 | 0.0329 | 0.0092 | 0.0021 | 0.0046 |
| | *-0.14* | *1.51* | *1.46* | *0.59* | *0.10* | *0.22* |
| **Fund's equity holdings return** | -0.1038 | -0.2612 | -0.2902* | 0.0928 | 0.1113 | 0.1264 |
| | *-0.78* | *-1.61* | *-1.75* | *0.74* | *0.77* | *0.87* |
| **Standard error** | White | White | White | White | White | White |
| **N. Obs.** | 622 | 619 | 705 | 622 | 619 | 705 |
| **$R^2$** | 0.112 | 0.148 | 0.148 | 0.047 | 0.083 | 0.079 |

**Table V Changes in Mutual Fund Holdings of Corporate Bonds Between 2007Q2 and 2007Q4, By Rating Category**

The table 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 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 sub-investment grade bonds. *Horizon* is the mutual fund's horizon, proxied for by *Turnover ratio*, *Flow-performance sensitivity*, or *Flow volatility*. *x* is a set of standard control variables. Both *Horizon* and *x* are expressed in their values as of June 2007. *F*-stat *p*-values for statistical significance of the two *Horizon* coefficients (for high and low-rated 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 1998Q1-2008Q1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

| **Rating** | **High** | **Low** | **High** | **Low** | **High** | **Low** |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Turnover ratio** | -0.8509*** | -1.1138** | | | | |
| | *-3.44* | *-2.50* | | | | |
| **Flow-performance sensitivity** | | | -0.0355** | -0.0729*** | | |
| | | | *-2.11* | *-3.23* | | |
| **Flow volatility** | | | | | -0.0403** | -0.1167*** |
| | | | | | *-2.09* | *-3.19* |
| **Affiliated to commercial bank** | -0.0609** | -0.3236*** | -0.0030 | -0.0396*** | -0.0964*** | -0.3263*** |
| | *-2.41* | *-11.07* | *-0.31* | *-2.76* | *-5.22* | *-11.96* |
| **log(Family size)** | -0.0029 | -0.0327** | 0.0060** | 0.0013 | 0.0021 | -0.0297** |
| | *-0.32* | *-2.25* | *2.54* | *0.37* | *0.25* | *-2.12* |
| **Securitized holdings in 2007Q2** | 0.0056** | 0.0018 | -0.0760*** | -0.3128*** | 0.0033* | 0.0019 |
| | *2.38* | *0.50* | *-3.08* | *-11.24* | *1.73* | *0.52* |
| **Past flow** | 0.0002** | 0.0001 | 0.0003*** | 0.0003*** | 0.0808** | 0.2335*** |
| | *2.33* | *1.15* | *4.10* | *2.94* | *2.10* | *3.20* |
| **Fund return** | 0.5787 | 0.3212 | 0.6485 | 0.5233 | 0.1223 | 0.3255 |
| | *0.72* | *0.28* | *0.81* | *0.49* | *0.26* | *0.30* |
| **Family equity holdings** | -0.0072 | -0.0513 | -0.0013 | -0.0517** | 0.0059 | -0.0499* |
| | *-0.49* | *-1.96* | *-0.09* | *-1.98* | *0.47* | *-1.95* |
| **Mgmt fee** | 0.0033*** | -0.0075*** | 0.0031*** | -0.0066*** | 0.0029*** | -0.0070*** |
| | *3.55* | *-5.82* | *2.96* | *-6.42* | *2.73* | *-6.52* |
| **Exp. ratio** | -1.9056* | 0.5341 | -1.2586 | -0.2611 | -0.4291 | 0.7912 |
| | *-1.68* | *0.30* | *-1.01* | *-0.15* | *-0.33* | *0.46* |
| **Actual 12b1** | -0.0001 | -0.0002 | -0.0000 | -0.0002 | 0.0000 | -0.0003 |
| | *-0.47* | *-1.35* | *-0.26* | *-1.18* | *0.21* | *-1.55* |
| **Hold equity (N/Y) [1 = NO]** | -0.0170 | 0.0246 | -0.0197 | 0.0173 | -0.0269*** | 0.0185 |
| | *-1.27* | *1.13* | *-1.42* | *0.81* | *-3.01* | *0.88* |
| **Fund's equity holdings return** | -0.0933 | 0.1482 | -0.1064 | 0.1053 | -0.0943 | 0.1483 |
| | *-1.00* | *0.96* | *-1.17* | *0.70* | *-1.34* | *0.97* |
| ***F*-stat (*p*-value)** | 1.01 (0.3145) | | 4.12** (0.0429) | | 4.40** (0.0363) | |
| **Standard error** | White | White | White | White | White | White |
| **N. Obs.** | 622 | 622 | 619 | 619 | 705 | 705 |
| **$R^2$** | 0.062 | 0.313 | 0.073 | 0.330 | 0.154 | 0.332 |

## Table VI Changes in Corporate Bonds' Yield Spreads Around the Crisis

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

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

where each observation corresponds to a corporate bond with data in the FINRA TRACE data set. The dependent variable $\Delta YS$ is the change in the bond's yield spread around the crisis. The yield spread is 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 retrieved from the Federal Reserve Statistical Release. In columns (1)-(4) $\Delta YS$ is defined as the change in the bond's yield spread over the period from the last week of June through to 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 to the last week of 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.

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

$$\Delta YS_i = \alpha + \beta\, ShortExposedHolders_i + \gamma\, InvRating + \delta\left(ShortExposedHolders_i \times InvRating_i\right) + \varphi' x_i + \varepsilon_i \quad (5)$$

where each observation corresponds to a corporate bond with data in the FINRA TRACE data set. The dependent variable $\Delta YS$ is defined as in Panel A. In columns (1)-(3) $\Delta YS$ is defined as the change in the bond's yield spread over the period from the last week of June through to the last week of October 2007, while in columns (4)-(6) it is the change in the bond's yield spread over the period from the last week of June through to the last week of December 2007. *ShortExposedHolders* 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 three proxies for mutual fund horizon: turnover ratio, flow-performance sensitivity, and flow volatility. We obtain one indicator *ShortExposedHolders* for each proxy: *High-Turnover holders*, *High-Flow sensitivity holders*, and *High-Volatility holders*. *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 for this panel.

In both panels and 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.

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 (Y/N)** | -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 (Y/N)** | 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 (Y/N)** | 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.** | 8148 | 8148 | 8148 | 8148 | 8148 | 8148 | 8148 | 8148 |
| **$R^2$** | 0.645 | 0.698 | 0.699 | 0.700 | 0.744 | 0.746 | 0.746 | 0.746 |

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) | (5) | (6) |
| **High-Turnover holders** | 0.2926 | | | 0.7624*** | | |
| | *1.15* | | | *2.75* | | |
| **High-Flow Sensitivity holders** | | 0.3703* | | | 0.5901** | |
| | | *1.74* | | | *2.25* | |
| **High-Flow volatility holders** | | | 0.4439* | | | 0.4700** |
| | | | *1.86* | | | *1.99* |
| **InvRating** | 0.7940* | 0.7869** | 0.7663** | 2.0166*** | 1.9884*** | 1.8093*** |
| | *1.91* | *2.09* | *2.40* | *3.57* | *3.52* | *3.55* |
| **High-Turnover holders X InvRating** | 0.0938 | | | 0.2162** | | |
| | *1.13* | | | *2.54* | | |
| **High-Flow sensitivity holders X InvRating** | | 0.1325* | | | 0.1671** | |
| | | *1.86* | | | *2.09* | |
| **High-Flow volatility holders X InvRating** | | | 0.1659** | | | 0.1476** |
| | | | *2.15* | | | *2.09* |
| **Insurance Holders' Exposure** | 0.1726 | -0.0757 | -0.3403 | -0.7867 | -0.6205 | -0.5088 |
| | *0.31* | *-0.15* | *-0.64* | *-1.51* | *-1.18* | *-1.10* |
| **Insurance Holders' Exposure X InvRating** | 0.0236 | -0.0552 | -0.1529 | -0.2618 | -0.1988 | -0.1640 |
| | *0.13* | *-0.35* | *-0.94* | *-1.47* | *-1.11* | *-1.06* |
| **Issuer fixed effects** | Yes | Yes | Yes | Yes | Yes | Yes |
| **Other Control Variables** | Yes | Yes | Yes | Yes | Yes | Yes |
| **Offering year fixed effects** | Yes | Yes | Yes | Yes | Yes | Yes |
| **Standard error cluster** | Issuer | Issuer | Issuer | Issuer | Issuer | Issuer |
| **N. Obs.** | 8147 | 8136 | 8136 | 7348 | 7335 | 7204 |
| **$R^2$** | 0.662 | 0.645 | 0.594 | 0.769 | 0.7684 | 0.762 |

**Table VII Corporate Bond Trading Pressure by Mutual Funds Around the Crisis**

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

$$\Delta Tr_i = \alpha + \beta\, HoldersExposure_i + \gamma\, InvRating_i + \delta\left(HoldersExposure_i \times InvRating_i\right) + \varphi' x_i + \varepsilon_i, \quad (7)$$

where each observation corresponds to a corporate bond with data in the FINRA TRACE data set. The dependent variable $\Delta Tr_i$ is the selling pressure of mutual funds on the bond, defined as the total net sales by mutual funds divided by the total trading volume on the bond, over the crisis period. In columns (1)-(4) $\Delta Tr_i$ is defined over the period from July through to October 2007, while in columns (5)-(8) it is defined over the period from July through to the 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.

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

$$\Delta Tr_i = \alpha + \beta\, ShortExposedHolders_i + \gamma\, InvRating + \delta\left(ShortExposedHolders_i \times InvRating_i\right) + \varphi' x_i + \varepsilon_i \quad (8)$$

where each observation corresponds to a corporate bond with data in the FINRA TRACE data set. The dependent variable $\Delta Tr$ is defined as in Panel A. In columns (1)-(3) $\Delta Tr$ is defined over the period from the last week of June through to the last week of October 2007, while in columns (4)-(6) it is over the period from the last week of June through to the last week of December 2007. The explanatory variables are defined as follows. *ShortExposedHolders* 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 three proxies for mutual fund horizon: turnover ratio, flow-performance sensitivity, and flow volatility. We obtain one indicator *ShortExposedHolders* for each proxy: *High-Turnover holders*, *High-Flow sensitivity holders*, and *High-Volatility holders*. *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 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.

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 (to Securitized Bonds)** | 0.0012 | 0.0052 | 0.0063 | 0.0046 | -0.0123* | -0.0101 | -0.0061 | -0.0180* |
| | *0.33* | *1.11* | *1.32* | *0.70* | *-1.79* | *-1.47* | *-1.03* | *-1.72* |
| **InvRating** | 0.0018 | 0.0026 | 0.0026 | 0.0029 | 0.0036 | 0.0037 | 0.0026 | 0.0036 |
| | *0.52* | *0.68* | *0.66* | *0.75* | *0.72* | *0.73* | *0.51* | *0.72* |
| **Holders' Exposure X InvRating** | 0.0029* | 0.0039** | 0.0035** | 0.0040** | 0.0034** | 0.0042** | 0.0034* | 0.0044** |
| | *1.85* | *2.13* | *2.04* | *2.22* | *2.04* | *2.41* | *1.81* | *2.49* |
| **2007Q2 log-volume** | -0.0005 | -0.0006 | -0.0002 | -0.0008 | -0.0017 | -0.0017 | -0.0007 | -0.0022* |
| | *-1.03* | *-1.02* | *-0.66* | *-1.14* | *-1.47* | *-1.48* | *-0.65* | *-1.89* |
| **No Rating (Y/N)** | -0.0069 | -0.0095 | -0.0092 | -0.0105 | -0.0121 | -0.0120 | -0.0082 | -0.0118 |
| | *-0.60* | *-0.77* | *-0.75* | *-0.85* | *-0.75* | *-0.75* | *-0.51* | *-0.74* |
| **Bond is not held by mutual funds (Y/N)** | -0.0040*** | -0.0027** | -0.0027** | -0.0027** | -0.0167* | -0.0167* | -0.0169 | -0.0166 |
| | *-3.68* | *-2.04* | *-2.05* | *-2.04* | *-1.68* | *-1.66* | *-1.63* | *-1.64* |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Bond face value** | 0.0003 | 0.0002 | 0.0002 | 0.0001 | 0.0003 | 0.0003 | 0.0004 | 0.0001 |
| | *1.43* | *1.07* | *1.08* | *0.81* | *0.44* | *0.46* | *0.65* | *0.27* |
| **Covenants (Y/N)** | 0.0009 | 0.0018 | 0.0018 | 0.0016 | 0.0020 | 0.0022 | 0.0019 | 0.0012 |
| | *0.61* | *0.90* | *0.92* | *0.80* | *0.78* | *0.87* | *0.76* | *0.50* |
| **CovIndex** | 0.0001 | -0.0025 | -0.0027 | -0.0025 | 0.0004 | -0.0005 | 0.0007 | 0.0011 |
| | *0.03* | *-0.55* | *-0.61* | *-0.55* | *0.08* | *-0.08* | *0.13* | *0.21* |
| **log(Months to maturity)** | -0.0011 | -0.0011 | -0.0013 | -0.0011* | -0.0014 | -0.0014 | -0.0020* | -0.0014 |
| | *-1.54* | *-1.67* | *-1.58* | *-1.67* | *-1.50* | *-1.52* | *-1.88* | *-1.51* |
| **Insurance Holders' Exposure** | | -0.0009 | -0.0010 | -0.0007 | | -0.0024 | -0.0024 | -0.0019 |
| | | *-0.16* | *-0.19* | *-0.13* | | *-0.39* | *-0.38* | *-0.30* |
| **Insurance Holders' Exposure X InvRating** | | -0.0010 | -0.0010 | -0.0009 | | -0.0012 | -0.0011 | -0.0010 |
| | | *-0.95* | *-0.96* | *-0.90* | | *-0.85* | *-0.83* | *-0.71* |
| **Amihud** | | | 0.0030 | | | | 0.0091*** | |
| | | | *0.93* | | | | *2.58* | |
| **Holders' Exposure X Amihud** | | | -0.0059 | | | | -0.0182 | |
| | | | *-0.76* | | | | *-1.10* | |
| **InvTrades** | | | | -0.0009 | | | | -0.0020 |
| | | | | *-1.01* | | | | *-1.33* |
| **Holders' Exposure X InvTrades** | | | | -0.0012 | | | | -0.0089 |
| | | | | *-0.26* | | | | *-1.17* |
| **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.** | 8148 | 8148 | 8148 | 8148 | 8148 | 8148 | 8148 | 8148 |
| **$R^2$** | 0.529 | 0.531 | 0.531 | 0.532 | 0.339 | 0.339 | 0.340 | 0.339 |

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) | (5) | (6) |
| **High-Turnover holders** | 0.0015** | | | 0.0039*** | | |
| | *2.13* | | | *3.35* | | |
| **High-Flow Sensitivity holders** | | 0.0015** | | | 0.0039*** | |
| | | *2.18* | | | *3.61* | |
| **High-Flow volatility holders** | | | 0.0012** | | | 0.0023** |
| | | | *2.31* | | | *2.41* |
| **InvRating** | 0.0008 | 0.0007 | 0.0012 | 0.0011 | 0.0009 | 0.0008 |
| | *0.61* | *0.53* | *1.16* | *0.51* | *0.43* | *0.41* |
| **High-Turnover holders X InvRating** | 0.0004* | | | 0.0008** | | |
| | *1.88* | | | *2.23* | | |
| **High-Flow sensitivity holders X InvRating** | | 0.0004** | | | 0.0010*** | |
| | | *2.00* | | | *2.86* | |
| **High-Flow volatility holders X InvRating** | | | 0.0012** | | | 0.0023** |
| | | | *2.31* | | | *2.41* |
| **Insurance Holders' Exposure** | -0.0011 | -0.0011 | -0.0003 | -0.0023 | -0.0027* | -0.0002 |
| | *-1.29* | *-1.24* | *-0.45* | *-1.48* | *-1.79* | *-0.14* |
| **Insurance Holders' Exposure X InvRating** | -0.0003 | -0.0002 | -0.0001 | -0.0008 | -0.0010** | -0.0002 |
| | *-0.91* | *-0.89* | *-0.59* | *-1.57* | *-1.97* | *-0.40* |
| **Issuer fixed effects** | Yes | Yes | Yes | Yes | Yes | Yes |
| **Other Control Variables** | Yes | Yes | Yes | Yes | Yes | Yes |
| **Offering year fixed effects** | Yes | Yes | Yes | Yes | Yes | Yes |
| **Standard error cluster** | Issuer | Issuer | Issuer | Issuer | Issuer | Issuer |
| **N. Obs.** | 8147 | 8136 | 8136 | 7348 | 7335 | 7204 |
| **$R^2$** | 0.528 | 0.528 | 0.617 | 0.623 | 0.623 | 0.595 |

**Table VIII Corporate Bond Trading Volume Around the Crisis**

The table reports the estimates of a model:

$$\log Vol_i = \alpha + \beta\, HoldersExposure_i + \gamma\, InvRating_i + \delta\left(HoldersExposure_i \times InvRating_i\right) + \varphi' x_i + \varepsilon_i \qquad (9)$$

where each observation corresponds to 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 thousands of dollars) over the crisis period. In columns (1)-(4) *logVol* is defined over the period from July through to October 2007, while in columns (5)-(8) it is defined over the period from July through to the 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 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.

| | **Trading Volume – Jul-Oct 2007** | | | | **Trading Volume – Jul-Dec s2007** | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Holders' Exposure (to Securitized Bonds)** | 0.7926** | 0.7921** | 1.2826*** | 0.4247 | 0.6143*** | 0.5704** | 1.0620*** | -0.0971 |
| | *2.47* | *2.19* | *3.37* | *0.96* | *2.78* | *2.06* | *3.49* | *-0.30* |
| **InvRating** | -1.5573*** | -1.5009*** | -1.4287*** | -1.4932*** | -0.6416*** | -0.6069*** | -0.5773*** | -0.6096*** |
| | *-4.51* | *-4.49* | *-4.51* | *-4.46* | *-3.08* | *-2.97* | *-2.93* | *-2.96* |
| **Holders' Exposure X InvRating** | 0.2352** | 0.2508** | 0.1479 | 0.2479** | 0.1753** | 0.1714* | 0.0344 | 0.1657* |
| | *2.29* | *2.03* | *1.18* | *2.04* | *2.38* | *1.76* | *0.38* | *1.77* |
| **2007Q2 log-volume** | 0.4481*** | 0.4365*** | 0.3922*** | 0.4366*** | 0.5238*** | 0.5117*** | 0.4758*** | 0.5186*** |
| | *10.87* | *10.94* | *10.20* | *11.37* | *18.15* | *17.90* | *16.77* | *19.17* |
| **No Rating (Y/N)** | 4.9266*** | 4.7616*** | 4.5829*** | 4.7404*** | 2.0847*** | 1.9852*** | 1.9017*** | 1.9970*** |
| | *4.58* | *4.58* | *4.60* | *4.55* | *3.20* | *3.11* | *3.07* | *3.10* |
| **Bond is not held by mutual funds (Y/N)** | -0.6043*** | -0.5813*** | -0.5907*** | -0.5782*** | -0.4986*** | -0.4716*** | -0.5139*** | -0.4700*** |
| | *-5.93* | *-5.83* | *-5.86* | *-5.78* | *-6.53* | *-6.26* | *-6.78* | *-6.33* |
| **Bond face value** | 0.2748*** | 0.2631*** | 0.2553*** | 0.2628*** | 0.1393*** | 0.1295*** | 0.1271*** | 0.1306*** |
| | *7.54* | *7.31* | *7.16* | *7.02* | *8.59* | *8.07* | *8.27* | *7.93* |
| **Covenants (Y/N)** | 0.1126 | 0.1326 | 0.0944 | 0.1192 | 0.1696* | 0.1762* | 0.1938** | 0.1675* |
| | *0.83* | *1.01* | *0.72* | *0.91* | *1.77* | *1.87* | *2.16* | *1.81* |
| **CovIndex** | 0.5587* | 0.4816* | 0.4407 | 0.4838* | 0.3774** | 0.3369* | 0.2801 | 0.3115* |
| | *1.91* | *1.70* | *1.55* | *1.70* | *2.02* | *1.81* | *1.56* | *1.69* |
| **log(Months to maturity)** | -0.0948*** | -0.0924*** | -0.0774*** | -0.0920*** | -0.1020*** | -0.0999*** | -0.0869*** | -0.0991*** |
| | *-4.44* | *-4.32* | *-3.00* | *-4.32* | *-8.15* | *-8.03* | *-6.00* | *-8.12* |
| **Insurance Holders' Exposure** | | 0.3251 | 0.3203 | 0.3253 | | 0.4095* | 0.4252** | 0.3647* |
| | | *1.02* | *1.04* | *1.01* | | *1.93* | *2.11* | *1.76* |
| **Insurance Holders' Exposure X InvRating** | | -0.0636 | -0.0677 | -0.0630 | | -0.0253 | -0.0080 | -0.0360 |
| | | *-0.57* | *-0.60* | *-0.56* | | *-0.39* | *-0.13* | *-0.57* |
| **Amihud** | | | -0.1481 | | | | -0.1097 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | *-0.84* | | | | *-1.06* | |
| **Holders' Exposure X Amihud** | | | -2.0471** | | | | -2.5791*** | |
| | | | *-2.28* | | | | *-4.36* | |
| **InvTrades** | | | | 0.0284 | | | | 0.0937 |
| | | | | *0.37* | | | | *1.70* |
| **Holders' Exposure X InvTrades** | | | | -0.3598 | | | | -0.6418*** |
| | | | | *-1.48* | | | | *-3.67* |
| **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.** | 8148 | 8148 | 8148 | 8148 | 8148 | 8148 | 8148 | 8148 |
| **$R^2$** | 0.803 | 0.806 | 0.806 | 0.806 | 0.880 | 0.881 | 0.883 | 0.881 |

**Table IX Relationship between mutual funds' and insurance companies' trades**

The table reports the estimates of a model:

$$MF_Netbuy_{it} = \alpha + \beta_1 INS_Netbuy_{it} \times (1 - Crisis_t) + \beta_2 INS_Netbuy_{it} \times Crisis_t + \gamma' x_{it-1} + \varepsilon_{it} \quad (10)$$

where each observation is a given corporate bond, in a given quarter. The dependent variable *MF_Netbuy* is the net purchases of the bond by all mutual funds (column (1)), or by mutual funds that have a large exposure to securitized bonds and a short horizon, i.e. the high-Turnover (column (2)), high-Flow sensitivity (column (3)), and high-Flow volatility (column (4)) funds, defined as in table X above, or by non-exposed mutual funds that have a long horizon (columns (5)-(7)), i.e. by all funds minus the highly exposed, short-horizon funds. *MF_Netbuy* is equal to net purchases of the bond by these categories of 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 variable equal to one for dates between 2007Q3 and 2008Q1. *x* is a vector of standard bond characteristics used throughout the paper, including bond issuer and quarter fixed effects. The last row of the table reports the F test statistic for the difference between the coefficients on *INS_Netbuy* X (1 – *Crisis*) and *INS_Netbuy* X *Crisis*. The sample includes all bonds in the FINRA TRACE data set with available data on bond characteristics from the Mergent FISD data set and bond holdings in the Lipper EMAXX data set, for the period 1998Q1-2008Q1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

| | **All funds** | **Short-horizon mutual funds** | | | **All other mutual funds** | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **INS_Netbuy X (1-Crisis)** | 0.1046*** | 0.0018*** | 0.0011*** | 0.0018*** | 0.1001*** | 0.1015*** | 0.0974*** |
| | *13.52* | *6.64* | *5.51* | *5.81* | *12.94* | *13.06* | *12.73* |
| **INS_Netbuy X Crisis** | 0.2793*** | 0.0070*** | 0.0050*** | 0.0092*** | 0.2218*** | 0.2225*** | 0.2324*** |
| | *11.59* | *6.97* | *6.43* | *6.94* | *9.60* | *9.55* | *10.28* |
| **InvRating** | -0.0270*** | 0.0002 | 0.0002* | 0.0002 | -0.0267*** | -0.0255*** | -0.0270*** |
| | *-4.27* | *0.98* | *1.68* | *0.64* | *-4.25* | *-4.09* | *-4.40* |
| **Log-volume** | -0.0026*** | -0.0001*** | -0.0001*** | -0.0001*** | -0.0025*** | -0.0025*** | -0.0025*** |
| | *-7.88* | *-9.34* | *-10.49* | *-8.85* | *-7.74* | *-7.78* | *-8.02* |
| **No Rating (Y/N)** | 0.0439** | -0.0008* | -0.0008** | -0.0010 | 0.0454** | 0.0418** | 0.0472*** |
| | *2.41* | *-1.67* | *-2.36* | *-1.56* | *2.50* | *2.32* | *2.67* |
| **Bond not held by mut. funds (Y/N)** | 0.0083 | 0.0000 | 0.0000 | 0.0002** | 0.0111** | 0.0111** | 0.0103** |
| | *1.63* | *0.26* | *-0.05* | *2.23* | *2.32* | *2.32* | *2.16* |
| **Bond face value** | 0.0033*** | -0.0001*** | -0.0001*** | -0.0001*** | 0.0031*** | 0.0030** | 0.0028** |
| | *2.79* | *-3.30* | *-4.29* | *-4.09* | *2.63* | *2.51* | *2.36* |
| **Covenants (Y/N)** | -0.0143 | 0.0013*** | 0.0032** | 0.0015** | -0.0188 | -0.0259 | -0.0194 |
| | *-0.73* | *3.04* | *2.23* | *2.22* | *-1.19* | *-1.36* | *-1.04* |
| **CovIndex** | 0.0031 | -0.0015*** | -0.0010*** | -0.0017*** | 0.0074 | 0.0070 | 0.0072 |
| | *0.36* | *-5.40* | *-4.49* | *-4.61* | *0.85* | *0.81* | *0.83* |
| **log(Months to maturity)** | 0.0019*** | 0.0002*** | 0.0001*** | 0.0002*** | 0.0015*** | 0.0016*** | 0.0015*** |
| | *4.16* | *10.06* | *8.22* | *6.62* | *3.51* | *3.64* | *3.39* |
| **Issuer and quarter f.e.** | Y | Y | Y | Y | Y | Y | Y |
| **Standard error cluster** | Bond | Bond | Bond | Bond | Bond | Bond | Bond |
| **N. Obs.** | 68561 | 68588 | 68568 | 68555 | 67387 | 67373 | 67377 |
| **$R^2$** | 0.286 | 0.124 | 0.115 | 0.126 | 0.289 | 0.291 | 0.288 |
| **INS_Netbuy X (1-Crisis) = = INS_Netbuy X Crisis** | 20.87*** | 29.58*** | 23.67*** | 25.61*** | 32.06*** | 24.40*** | 25.03*** |

**Table X Price impact of mutual funds' trades relative to insurance companies' trades**

The table reports the estimates of a model:

$$\Delta YS_{it} = \alpha + \beta_1 \, Absorb_{it} \times (1 - Crisis_t) + \beta_2 \, Absorb_{it} \times Crisis_t + \gamma' x_{it-1} + \varepsilon_{it} \qquad (11)$$

where each observation is a corporate bond-quarter pair. The dependent variable $\Delta YS$ is the quarterly change in the bond's yield spread. *Absorb* is a proxy for the ability of purchases by insurance companies to absorb sales by mutual funds and is defined as the purchases of the bond by insurance companies net of the sales of the bond by securitized bonds-exposed mutual funds with a short horizon. In column (1), it is defined as the net purchases of the bond by all insurance companies minus the net sales of the bond by exposed, high-Turnover funds (*Absorb I – High Turnover*); in column (2), it is defined similarly, except using high-flow volatility as the measure of short horizons (*Absorb I – High Flow Volatility*); in column (3), it is defined similarly, except using high-flow sensitivity to performance as the short-horizon measure (*Absorb I – High Flow Sensitivity*); in columns (4)-(6), it is analogously defined, except using overall sales by mutual funds rather than net sales (*Absorb II – High Turnover*, *Absorb II – High Flow volatility*, *Absorb II – High Flow Sensitivity*). All the *Absorb* proxies are divided by the total institutional holdings of the bond as of the previous quarter. *Crisis* is an indicator variable equal to one for dates between 2007Q3 and 2008Q1. *x* is a vector of standard bond characteristics used throughout the paper, including bond issuer and quarter fixed effects. For brevity, only the key coefficients are shown. The last row of the table reports the *F*-test statistic for the difference between the coefficients on *Absorb* X (1 – *Crisis*) and *Absorb* X *Crisis*. The sample includes all bonds in the FINRA TRACE data set with available data on bond characteristics from the Mergent FISD data set and bond holdings in the Lipper EMAXX data set, for the period 1998Q1-2008Q1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| **Absorb I-High Turnover X (1 - Crisis)** | -0.0394 | | | | | |
| | *-0.36* | | | | | |
| **Absorb I-High Turnover X Crisis** | -0.5031* | | | | | |
| | *-1.94* | | | | | |
| **Absorb I-High Flow volatility X (1 - Crisis)** | | -0.0167 | | | | |
| | | *-0.15* | | | | |
| **Absorb I-High Flow volatility X Crisis** | | -0.5627** | | | | |
| | | *-2.13* | | | | |
| **Absorb I-High Flow sensitivity X (1 - Crisis)** | | | -0.0128 | | | |
| | | | *-0.12* | | | |
| **Absorb I-High Flow sensitivity X Crisis** | | | -0.5484** | | | |
| | | | *-2.11* | | | |
| **Absorb II-High Turnover X (1 - Crisis)** | | | | -0.0158 | | |
| | | | | *-0.15* | | |
| **Absorb II-High Turnover X Crisis** | | | | -0.6582*** | | |
| | | | | *-2.80* | | |
| **Absorb II-High Flow volatility X (1 - Crisis)** | | | | | -0.0292 | |
| | | | | | *-0.27* | |
| **Absorb II-High Flow volatility X Crisis** | | | | | -0.5803** | |
| | | | | | *-2.35* | |
| **Absorb II-High Flow sensitivity X (1 - Crisis)** | | | | | | -0.0581 |
| | | | | | | *-0.55* |
| **Absorb II-High Flow sensitivity X Crisis** | | | | | | -0.5789** |
| | | | | | | *-2.36* |
| **Issuer and quarter f.e.** | Y | Y | Y | Y | Y | Y |
| **N. Obs.** | 66916 | 66910 | 66918 | 66902 | 66896 | 66898 |
| **$R^2$** | 0.232 | 0.231 | 0.232 | 0.232 | 0.232 | 0.232 |
| **F test** | 2.68* | 3.64* | 3.59* | 6.13** | 4.15** | 4.74** |

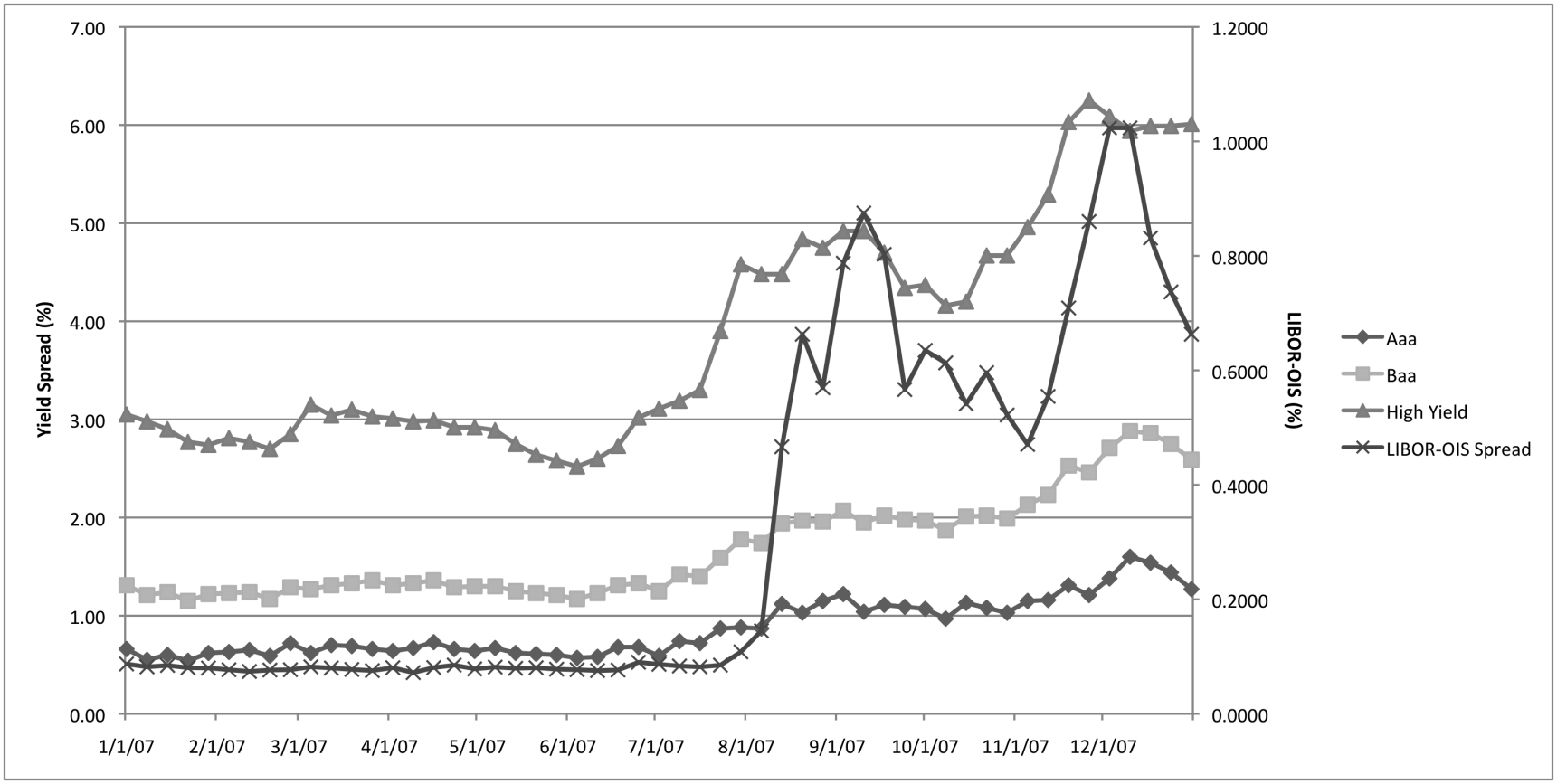



**Figure 1 Corporate Bond Yield Spreads and LIBOR-OIS spread**
The graph plots weekly average yield spreads on corporate bonds 2007, for Aaa, Baa, and High Yield corporate bonds, as well as the spread between the LIBOR rate and the Overnight Index swap rate (LIBOR-OIS Spread, secondary axis). The yield 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.

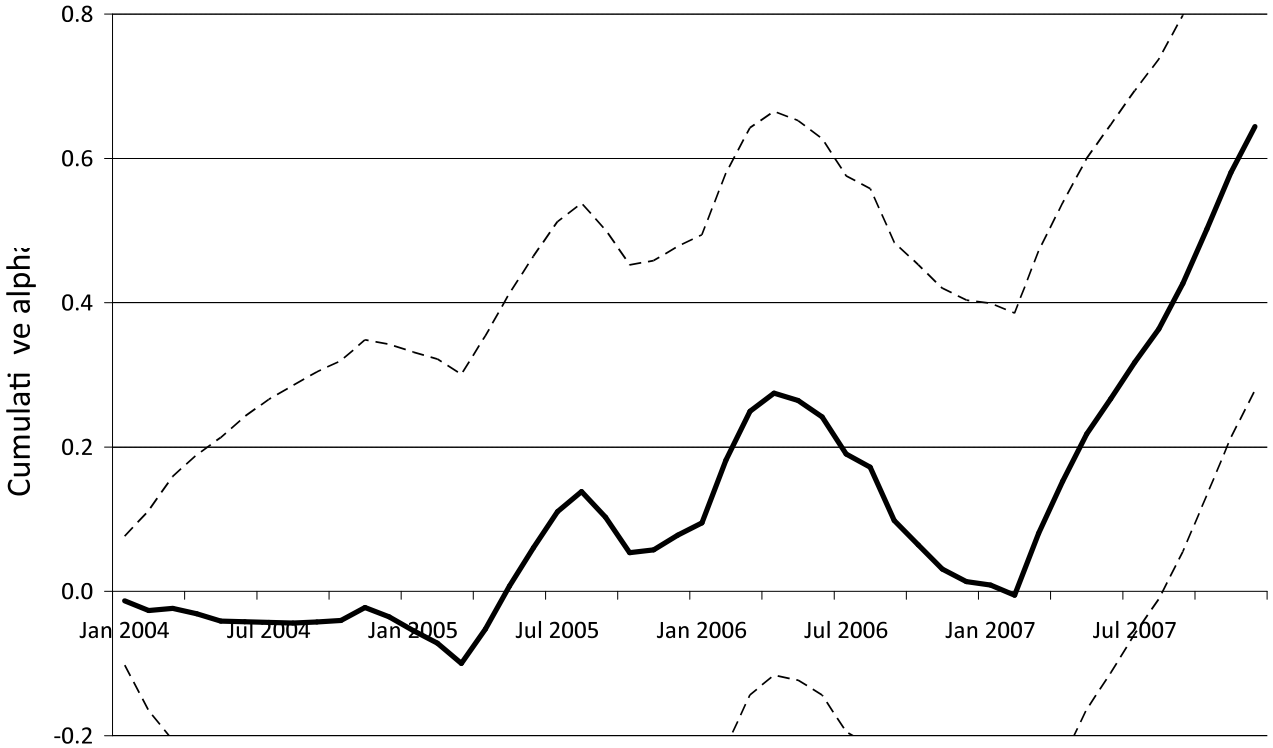



**Figure 2 Alpha of a Long-short Portfolio of Low-rated Corporate Bonds with and without Exposure**

The figure plots the cumulative eight-factor alpha 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 matching bonds without the exposure, over the period 2004-2007 in increments of six-month sub-periods. The solid line represents the cumulative alpha. The dashed lines represent the 95% confidence interval around the cumulative alpha.

We define "high exposure" as those bonds whose average mutual fund holder's exposure to securitized bonds is in the top 30%. We place these bonds in the short portfolio. The matching bonds are selected via propensity score matching, as follows. Every calendar month, a probit regression is estimated for the cross-section of corporate bonds, where the dependent variable is equal to 1 for a bond with high exposure, and 0 otherwise. The explanatory variables are a set of bond characteristics (presence and strength of covenants, convertibility, offering amount, spread to Treasury yield at the issuance date, time to maturity, rating, total amount held by mutual funds and by insurance companies). From this probit regression, predicted values are constructed for each bond. The matching bonds are those that have the largest predicted probabilities of having high exposure and yet in fact are not high in exposure, i.e., the dependent variable equals 0. The number of matching bonds is equal to the number of the shorted bonds in each calendar month.

The cumulative alpha is obtained as follows. For each calendar month between January 2004 and December 2007, a calendar-time eight factor model is estimated, on portfolio return data covering the prior 12 months. The eight factor model is:

$$R_t = \alpha + \beta_1 (R_{mt} - R_{ft}) + \beta_2 HML_t + \beta_3 SMB_t + \beta_4 UMD_t + \beta_5 (R_{bt} - R_{ft}) + \beta_6 TS_t + \beta_7 CS_t + \beta_8 RS_t + \varepsilon_t \quad (6)$$

where $R$ is the portfolio return, $R_m$ is the return on the market portfolio, $R_f$ is the risk-free return, *HML*, *SMB*, *UMD* are the returns on the book-to-market, size, and momentum factor mimicking portfolios, $R_b$ is the return on the bond market portfolio (Dow Jones bond index), and *TS*, *CS*, and *RS* are the returns on the term spread, curvature spread, and risk spread factors (defined in the Appendix). The intercept from this model is the month's alpha. At any given month, the cumulative alpha is the equal to running sum of the monthly alphas up to and including that month.

The standard errors are computed as follows. First, a monthly standard error is estimated, based on the volatility of the series of monthly alphas, using the Newey-West estimator with lag length equal to 11 periods, to account for the overlap between the estimation periods for the monthly alphas. The monthly standard error is then scaled up by the square root of the number of months (i.e. 12), to obtain the standard error on the cumulative alpha.