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Zusammenfassung

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Contrary to the findings reported in some of the extant literature, our study indicates that over the past few years a change in investors' behavior patterns means that investment decisions are made at short notice, and that shares are redeemed in a discriminatory manner when funds perform poorly. By using a data assembled from 1672 retail funds in Germany over the period March 2008 to April 2010, we are able to show that in general, both the prior fund performance and prior net redemptions have a statistically significant influence on fund outflows. Moreover, there are indications that in recent crises situations that have resulted in the withdrawal of shares investors react fast to market signals. Our findings will also highlight areas in which policy-makers, regulatory authorities and the fund industry should establish a strong regulatory framework to prevent liquidity shortages of retail funds.

JEL-Klassifikation: G01, G23, G14, G28, D53
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Kredit und Kapital,
Manuskripteinreichung

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I. Introduction

This paper intends to expand on the current literature on flows of German retail funds by examining some aspects of shareholder behavior during the financial market crisis from 2008 to 2010. Our study focuses primarily on the relationship between fund performance and the redemption of shares by investors. Furthermore, we examine whether investor behavior is linked to fund category when shares are being redeemed as a result of disturbances in the financial markets, and whether significant outflows from funds can induce other investors to also redeem their shares *(domino effect)*.

Ippolito (1992), Sirri and Tufano (1998) and Del Guerico and Tkac (2002) have already proven the general correlation between prior fund performance and net flows, whereas Cashman et al. (2006) have examined investors perseverance in light of outflows from poorly performing funds. Their findings suggest that investors traditionally responded immediately to well performing funds by making additional investments, while at the same time displaying reluctance to redeem shares from poorly performing funds.

Our analysis, however, suggests the opposite, namely, that investors today are quick to react to market signals, and will withdraw their investments early in times of crises. We can demonstrate that investor behavior no longer conforms to the perseverance hypothesis of Cashman et al. (2006), but now turns to different market signals in order to try to anticipate the withdrawal tendencies of other investors, which can result in panic redemption of shares. The question arises as to why comparable studies no longer yield comparable results. We would suggest that increasing reliance on the internet for the dissemination of information, and the decreasing associated costs, even private investors could respond rapidly to any information that might indicate strategically complementary dependencies. This, in turn, results in greater market fluctuation, where markets are increasingly driven by demand and supply scenarios, and less controlled by commercial investors.

Although an increasing number of retail clients invest in shares for the purposes of wealth building and retirement security, the relevant markets have received little research attention so far, particularly in relation to liquidity risks and investors' mitigation behavior. In February 2011, the retail fund market in Germany was valued at about € 342.3 trillion. Of these, *equity funds* made up 33.74%, *fixed income funds* 16.26%, *balanced funds* 6.89% and *money market funds* 2.56% of total the market volume. Open *real estate funds* accounted for a further 25.48% (for further details see Capital market statistics of Deutsche Bundesbank [2011]).

A number of publications focus their considerations on specific fund segments, which enables their authors to avoid additional problems posed by potential correlations occurring between the different fund categories and successive aggregate fund flows emerging as a result of self-fulfilling investors pessimism during times of crisis. Warther (1995), for instance, concentrated specifically on the study of aggregate fund flows, while Edelen and Warner (1999) focused their attentions on the effects of prior performance on the returns of mutual funds. Sebastian and Tyrell (2006) established that a run on the shares of any individual fund should not always be seen as a negative; on the contrary, it can have a sanitizing result in that it punishes ineffectual management of retail funds. Within this context, the authors highlight the issue of moral hazard arising in connection with buoyant markets, and take a more critical stand towards regulatory intervention proposed, for example, by Diamond and Dybvig (1983). By contrast, contemporaneous research, defines the relationship between net flows and fund performance differently.[1] While in the past papers have tended to look for a positive linear connection, more recent research assumes a non-linear relationship between net flows and prior performance (Chevalier and Ellison [1995] or Gruber [1996]). Kane, Santini and Aber (1991) and Patel, Zeckhauser and Hendricks (1991), for example, maintain a positive correlation between performance and net flows. The analytical work on investors' behavior in connection with the redemption of fund shares has led to ambiguous results in the earlier literature. Hendricks, Patel and Zeckhauser (1993), for example, found that investors with shares in even the most poorly performing funds generally behaved consistently in not immediately withdrawing their shares. Carhart (1997) has suggested that the withdrawal costs of shares have an important influence on fund returns. Brown and Götzmann (1995) have also observed a correlation between high punitive withdrawal fees, and investor

[1] Net flows equal the difference between inflows and outflows of specific funds.

reluctance to redeem their shares even when invested in poorly performing funds, but are unable to offer a reason for this.

In addition, we have also identified a change in the perseverance of investors with shares in well performing funds. Although it has in the past suggested that funds with higher taxes and costs also returned a proportionally better performance to recover their administration costs (Ippolito 1992), this has already been refuted by subsequent studies, such as Elton et al. (1993) and Ivkovic and Weisbenner (2006).

Our paper will begin by examining the question whether the perseverance hypothesis as put forward by Cashman et al still applies to the twenty-first-century investor, or whether their investors' behavior can be shown conclusively to have changed to a pattern that is more responsive to the likely knock-on effects of market fluctuations and their consequences. Our findings agree with the observations put forward by both Edelen (1999) and Coval and Stafford (2006), who have shown that fund managers on occasion have to be subjected engage in to cost-intensive and unprofitable trades in order to adapt their portfolios to changing market situations. Particularly in the event of unexpected outflows, when asset managers are forced to liquidate assets in 'fire-sale-conditions', profits begin to decrease. Because fund managers carry out the majority of cash generating trades on the day after the withdrawal of fund shares, the net asset value (NAV) of a fund will not completely transfer the real costs to the withdrawing investors. On the contrary, the costs of premature liquidation of assets devolve to the more cautious investors who remain in the fund. This may lead to a strategically complementary dependence, because the higher the number of investors withdrawing from a fund, the lower the expectations for future returns, thus increasing the likelihood of more investors withdrawing from the fund, causing a liquidity shortage. It is worth noting that the mutual dependency that is created between the ailing fund and the remaining investors. The more assets are liquidated, the higher the devolved costs become, increasing the potential losses due to higher liquidation costs for the remaining investors. Particularly, when market conditions are strained is the likelihood greater that investors reject the adjusted market price, making it more costly to sell illiquid assets than under normal circumstances in the financial markets. To illustrate this further our empirical analysis will compare the differences of outflows in conjunction with fund categories and prior performance. In doing so, we aim to contribute towards an improved understanding of investors' behavior in crisis situations.

While on the whole the scientific literature so far has focused on the US markets, our study will be concentrated on examining investor behavior in the German fund markets.[2] The study is made more interesting in that the 2007/2008 crisis represents the first occasion on which the German fund industry was confronted with significant aggregate outflows from funds (see Capital market statistics of Deutsche Bundesbank [2011]). Despite the uniqueness of this phenomenon, or perhaps because of it, it has not been the subject of academic study so far, although Bannier, Fecht and Tyrell (2006) and Ber et al. (2011) have published some papers examining aspects of the German fund market. Considering the fundamental influence of crises on the economic power of individual countries, it is important to understand the consequences of such fluctuations. For this reason, our investigation into investors' behavior and their decision-making processes is based upon data gathered from a number of German retail fund.

Our paper will proceed by giving an outline description of the date used for this study in Section 2. In Section 3 we introduce some descriptive statistics on the evolution of net flows in specific fund markets, while Section 4 presents the findings of our analyses in support of our hypotheses. Our paper concludes with a summary of our conclusions, together with our recommendations, based upon our findings, of how the industry might guard against similar sudden fund fluctuations in the future.

II. Data

The data assembled for these analyses consist of 35,895 monthly observations from 1,672 German retail funds, as reported to the *Deutsche Bundesbank* by the German asset management companies between March 2008 and April 2010. German asset management companies report the related fund categories, net asset values, and monthly flows of funds to Deutsche Bundesbank. These comprise of 695 *equity funds*, 367 *fixed income funds*, 540 *balanced funds*, 58 *money market funds*, 11 *mortgage funds* and 17 *convertible funds*. We have eliminated from our sample all those funds, which have closed or merged with other retail funds during our observation period. We have also excluded all those funds from our sample that reported a net asset value of less than € 1,000,000.

One objective of our study is to test the dependencies between monthly net redemptions of fund shares and prior performance of funds, whereby the monthly net redemptions of fund *j* with NAV (Net Asset Value) at month *i* are calculated with the equation

[2] Tkac (2004) gives a general overview on American fund market and discuss regulatory methods and consequences for the fund industry.

$$net\ redemptions_{ij} = \frac{inflows_{ij} - outflows_{ij}}{NAV_{i-1,j}}.$$

The monthly performance of fund *j* with NAV (Net Asset Value) at month *i* is calculated as follows:

$$performance_{ij} = 1 - \left(\frac{NAV_{i,j} - net\ redemptions_{ij}}{NAV_{i-1,j} - net\ redemptions_{i-1,j}}\right)$$

As stated earlier, our main focus is on establishing whether monthly net redemptions of fund shares relate to prior performance of funds. Within this context, we intend to establish whether consistent fund performance affects the redemption behavior of investors. In order to measure the consistency of fund performance, and net redemptions we have set the standardized performance indicator *'perfind'* over the respective observation period *n=1,…,n* recursively to assess the prior performance with the beginning of our observation period set *'perfind'* at 100 to represent fund performance up to observation period to create benchmark against which to calculate fluctuations 2007/2008:

$$\begin{aligned}
&perfind_0 = 100\\
&perfind_1 = perfind_0 + (performance_{1j} * perfind_0)\\
&\vdots \qquad\qquad\qquad\qquad\qquad\qquad \vdots\\
&perfind_{n-1} = perfind_{n-2} + (performance_{n-1,j} * perfind_{0,n-2})\\
&perfind_n = perfind_{n-1} + (performance_{nj} * perfind_0).
\end{aligned}$$

The standardized net redemption indicator *'nmaind'* over the respective observation period $n = 1, \dots, n$ is also assessed recursively to identify the prior net redemptions:

$$\begin{aligned}
&nmaind_0 = 100\\
&namind_1 = nmaind_0 + (net\ redemptions_{1j} * nmaind_0)\\
&\vdots \qquad\qquad\qquad\qquad\qquad\qquad \vdots\\
&namind_{n-1} = nmaind_{n-2} + (net\ redemptions_{n-1,j} * nmaind_{n-2})\\
&namind_n = nmaind_{n-1} + (net\ redemptions_{nj} * nmaind_{n-1}).
\end{aligned}$$

Furthermore, we have conducted several statistic assessments of the structure and dynamics of fund flows from 2008 to 2010 with a primary focus on net redemptions during the financial crisis in 2007/2008. The next section will also show the calculations to test for correlations between the various independent variables described in Table 3, and the net redemption of fund shares, using several ordinary least square regressions.

III. Descriptive Statistics

During the financial market turmoil of 2007/2008, the German fund industry was experiencing its most extreme outflows from retail funds in more than three decades (BVI Jahrbücher [1999–2010]). Not surprisingly, our sample, which includes 6 different categories of retail funds, shows an unprecedented number of redemptions of fund shares between September and November 2008. The crisis reached a preliminary height with the collapse of Lehman Brothers in September 2008, and a peak net outflow of 3.77% in October 2008. After this, the fund industry recovered sufficiently to record renewed investor confidence in the funds market during 2009.

[Insert Figure 1 about here]

As well as showing the average monthly fund flows, Table 1 shows the monthly percentage of funds characterized by two-month net outflows thus outflows are higher than inflows over a two-month period. We have selected the two-month horizon of net redemptions in order to avoid the possibility of the inflows and outflows from two consecutive months balancing each other out. Despite the surprisingly high percentage of funds reporting two-month net outflows over the entire observation period, a peak of this phenomenon is discernible in September 2008, coinciding with the peak of the financial crisis. This is followed by the lowest number of funds reporting two-month net outflows, which falls below the 40% mark between May and September 2009. The relatively high proportion of funds reporting two-month net outflows over the entire observation period can, however, be explained by cross-sectional fund flows.

[Insert Table 1 about here]

A more detailed view on the various fund categories covered by our sample suggests that the manner in which investors might react in crisis circumstances may be fund-specific, i.e. that investors in the same type of fund will also be likely to display similar behavior or decision-making patterns. Table 2 demonstrates *money market funds*, *fixed income funds* and funds invested in convertible bonds *(convertible funds)* are faced with the highest net redemption of fund shares that with respect to their median of outflows. Furthermore, the highest percentage of funds reporting two-month net outflows also fall into the same fund categories. From the viewpoint of industry it is important to know whether funds are liquid enough to cover redemptions of fund shares by investors because otherwise fund managers have to sell assets of funds that face extraordinarily outflows

under tensioned market circumstances. Brunnermeier (2010), and Adrian and Shin (2010) have already established the fundamental risk to market liquidity that such *'fire sales'* represent. For that reason, we approximate the 99th percentiles of two-month net redemptions calculated based on estimated extreme value distributions. Table 2 shows only slight differences of approximated 99th percentiles between *equity funds*, *mortgage and convertible funds* and *fixed income funds*.[3] This calculation indicates that the funds experiencing the highest risk of redemption from 2008 to 2010 were the *money market funds*. By contrast, *balanced funds*, i.e. funds whose portfolios are made up of both equities and fixed income securities, evidence much less risk of redemption risk than the categories of funds discussed above. The relatively low redemption risk observed in the case of *balanced funds* can be explained through the lower losses this fund category reported during financial market crisis episodes.

As stated previously, the great majority of funds recorded massive losses during the 2008 crisis because of the collapse of the global asset markets. Estimated 99th percentiles of funds` losses reported in Table 2 are significantly higher at *equity funds* than those of *fixed income funds*, which might be due to more volatile equity markets.

To illustrate the correlation between the redemption of fund shares and extraordinarily high losses under crisis circumstances we have also calculated the susceptibility of investors to poor performance of funds. This has been achieved by comparing the ratio between 99th percentile of losses and 99th percentile of two-month net redemptions. In doing so, we have made a distinction between *outperforming funds* and *underperforming funds*. By definition, *outperforming funds* report a higher net asset value (NAV) at the end of each observed month due to a positive performance accrual from the beginning of the observation period in March 2008 while *underperforming funds* demonstrate a decreasing net asset value (NAV) at the end of each observed month due to a negative performance accrual. Table 2 shows that the underlying susceptibilities of *outperforming funds* are clearly greater than the susceptibilities of *underperforming funds* in general, whereas *money market funds* and *fixed income funds* provide the highest values of our sensitivity assessment. At the same time, the sensitivity assessment suggests that shareholders in *equity funds* and

[3] Approaches emanating from Extreme-Value-Theory allow the reliable prediction of the likelihood of rare but also plausible events since they model the 'fat tails' of empirical distributions with sufficient accuracy. In such a way, they can also assess the daily net redemptions of funds and the fund performance from empirical data even in times of a crisis (Reiss R.–D. and Thomas M. [2000], Longin [2000], Embrechts, Klüppelberg, Mikosch [1997]). For the estimation of parameters we rely on a genetic algorithm that delivers reliable and valid results for our purposes.

balanced funds display the least susceptibility. This suggests that investors in *money market funds* and *fixed income funds* respond more dramatically than investors with *equity funds* or *balanced funds*. This observation is likely to be based in the fact that, historically, *fixed income funds* and *money market funds* were promoted by the fund industry as the more appropriate investments for risk-adverse investors.

In summary, our descriptive statistics do provide some evidence that based upon fund flows, *balanced funds* can be declared the 'winners' for the duration of the observation period, and reflects the relatively low risk exposure associated with this fund category. By contrast, *money market funds* are faced with surprisingly sharp increases in redemptions during a period of increasing yields in the money market instruments.

[Insert Table 2 about here]

IV. Analytics and Results

In order to test our hypothesis that poor fund performance is punished by substantial redemptions of fund shares due to shrinking investor confidence in the fund industry, and that those outflows subsequently lead the *domino effect* that is created by these withdrawals, we have examined a number of regression models. We have used these regressions to test our hypothesis that investors do show a distinguishable redemption behavior throughout our sample period, and that a correlation exists between investor reaction and the category of fund invested in. For a more detailed view, we have tested a number of performance indicators, measures of prior redemption of fund shares and financial market indicators as control variables for their relevance to the independent variable *'evtnma2m'*. This variable reflects the percentiles of two-month net redemptions of fund shares that we estimate by appropriate extreme value distributions. We have selected this approximation model to enable us to focus our investigations on extreme outflows only, because of the asymmetric distribution of fund withdrawals during crisis periods. For that reason Cashman et al. (2006), for instance, examine whether different quantiles of prior performance show distinguishable relations with net outflows from funds.

A. Proof of Hypothesis 1: There is a correlation between fund outflows and the corresponding fund category

As stated before, one objective of our study is to confirm our hypothesis that a correlation exists between net fund outflows, and their corresponding fund category. Therefore, we have used fund classifications as a factored

predictor-variable with fixed effects to our panel regression. Table 4 shows that apart from *convertible funds* and *underperforming mortgage funds*, the fund classification variable illustrates a significant negative correlation with the dependent variable for all fund categories but to a different extent, whereas the classifier for *equity funds* is the basis of our factored variable. *Money market funds* and *convertible funds*, however, show markedly lower coefficients than those in the other fund categories. This observation corresponds to the findings displayed in Table 2, which shows that *money market funds* and *convertible funds* experienced the highest rate of two-month share redemptions. In addition, the results indicate that investors do distinguish between *outperforming funds* and *underperforming funds* because the fund categories enter our regression with higher coefficients for *outperforming funds* than those for *underperforming funds*. In this context it should be noted that the higher intercept of *outperforming funds* in comparison to *underperforming funds* reflect the distinguishable net flows of these two subsamples. Thus, these findings are also consistent with the sensitivity measures illustrated in Table 2. Taking into account that in Table 2 the related fund categories show significant performance differences over the observation period, these differences between *outperforming funds* and *underperforming funds* also highlight that the prior performance of a fund is one of the driving forces for the redemption of fund shares by investors.

B. Proof of Hypothesis 2: Fund outflows relate to prior performance and prior redemption of fund shares

In the case of the performance variables *'evtperf2m'* and *'evtperf',* we also rely on the estimation of percentiles of the empirical performance distributions by the means of extreme-value-distributions. For better orientation, we emphasize at this point that the higher the percentiles of the respective two-month net redemptions the more investors appear to redeem fund shares. Table 4 reports positive and statistically significant coefficients for the performance variables *'evtperf2m'*, *'evtperf'* and *'log10perf'* that reflect the corresponding percentiles of the performance over the prior two months, percentiles of the prior monthly performance and our standardized prior performance indicator, respectively. From this we can conclude that the best performing funds are those which show higher inflows. By contrast, our flow indicator *'log10nma'* exhibits a positive effect on the two-month net redemptions since it achieves a negative and statistically significant coefficient. The calculations prove that increased outflows from funds do induce further redemptions of shares by investors.

To summarize this far, it can be said that both performance variables and flow variables display a significant influence on the two-month net flows of fund shares. Particularly the examined fixed effects regressions also suggest that the redemption of fund shares by investors in any one period usually has an impact on the flows of funds in the period following. The different intercepts observed in *outperforming funds* and *underperforming funds* support these findings further. Since the indicators for the persistence of prior net redemptions result in negative and statistically significant coefficients, the regression models indicate that a significant number of investors redeem their shares because they have become aware of other investors having done so. As consumers typically do not receive any information on investment flows of funds in detail, we would suggest that this type of investor behavior must be the result of negative media reports circulating about the fund industry at the time.

In addition, we have applied financial market indicators as control variables to examine if net flows of funds reflect movements of the financial markets. Among the control variables, our indicators on the performance in global stock markets *('msci')* and stock market uncertainty *('vola')* prices generate positive and statistically significant coefficients, suggesting that the returns in the global stock markets can induce further flows of funds. By contrast, however, Table 4 displays a negative and statistically significant correlation between the dependent variable and the indicator on global bond market prices *'gbi'*. In that instance, both the *'libor'* rate and our variable *'gold'* show only a weak influence on the flows of funds.

[Insert Table 4 about here]

As a robustness test, we have calculated the variance inflation factors listed in Table 5 to ensure that there are no correlations between our depending variables (for further information on Variance Inflation Factors see Belsley et al. [1980]).

[Insert Table 5 about here]

Although thus far our regression models have been unable to prove conclusively that poor performing funds are punished by redemptions of fund shares, we can state that both the consistency of prior performance of funds, and the fund categories can exert influence on the two-month net redemptions. The reason that we find only weak support for our hypothesis may be a result of our so far relatively rough distinction between *outperforming* and *underperforming funds*.

To clarify we have performed further tests involving three single ordinary least squares regressions to establish the relationship between *equity funds*, *fixed income funds* and *money market funds* in the context of net redemptions of fund shares.

The results reported in Table 5 illustrate that most of our independent variables significantly relate to the percentiles of two-month net redemptions. The corresponding standardized beta coefficients indicate a strong positive and statistically significant influence on net redemptions by the prior performance of funds *('evtperf2m'* and *'evtperf')* for all subsamples. Furthermore, the standardized beta coefficients indicate a strong correlation between our logarithmic net redemption indicator *('log10nma')* and the percentiles of two-month net redemptions for all different fund categories since it enters the regressions with negative and statistically significant coefficients. This then would suggest conclusively that funds with high prior outflows or funds that report poor performance also experience significant further redemptions of fund shares by their investors. Moreover, we can characterize our control variables by relatively low standard beta coefficients. Only the indicator of the global stock markets (*'msci')* and the indicator of the global bond markets (*'gbi')* show a statistical influence on the two-month net redemptions in the case of *equity funds*.

The results from these linear regressions on *equity funds*, *fixed income funds* and *money market funds* are consistent with our hypothesis that the prior performance of funds is strongly related to the two-month net redemptions. Our observations of investors' behavior in such a short term refutes the conclusion put forward in Sirri and Tufano (1992), that consumers abstain from redeeming fund shares when faced with poor performing funds. Regardless of whether net redemptions are caused by sales activities of the asset management companies or whether they are based on the investors´ reaction to information about prior performance of funds, it seems likely that investors are no longer inclined to take the long-term view with regard to poorly performing funds. Quite the opposite; investors now appear more pro-active about gathering information relating to funds performance, and increasingly ready to discard shares of those funds that show evidence of falling below their level of expectation. In this context, it is worth remembering that the dissemination of fund information via the electronic media has reduced the cost of accessing that information, while at the same time facilitating greater customer awareness of market movements (see for example Bogan [2008]).

[Insert Table 6 about here]

In order to test the observed correlation between prior performance of funds and the net redemptions of fund shares, we also intend to examine the ordinary least squares regressions for each quintile of the two-month fund performance. In addition, using the same regression models, we also intend to examine the significance of the relevant fund category on two-month net redemptions. At this point, one should keep in mind that the highest quintiles of this performance measurement represent well performing funds.

Table 7 illustrates that our variables indicating fund performance *('evtperf2m', 'evtperf', 'log10perf')* do indicate a positive and statistically significant relationship with the different quantiles of the two-month net flows of funds. The monthly performance attributions as well as the two-month performance attribution appear to show less influence on the two-month net flows in the higher quantiles of two-month net flows. This indicates that well performing funds are attracting more investments than poor performing funds. Conversely, the results also imply that investors punish poor performing funds by redeeming their fund shares, thereby lending support to our hypothesis. Particularly, we can argue that the standardized performance indicator *('log10perf'),* which reflects the persistence of fund performance, shows increasing influence on the high quantiles of two-month net flows. This observation is consistent with the standardized indicator of net flows *('log10nma')*, which displays the persistence of net flows during our observation period, but in the opposite direction. Thus, it seems likely that a persistence of net outflows induces further outflows from funds while the persistence of net inflows is highly correlated to further inflows.

Among our control variables the indicator of the global stock markets *('msci'),* the volatility of global stock markets *('vola')* reflecting the uncertainty of participants in the stock markets and the indicator of the global bond markets *('gbi')* show a statistically significant influence on the two-month net flows of funds. Interestingly, Table 7 reports an increasing influence of these variables within the high quantiles of two-month net flows. This seems to indicate that funds report increasing outflows during periods of high market fluctuations. We would suggest that the opposite sign of the coefficients attained for the indicator of the global stock markets *('msci')* compared with the coefficients provided for the indicator of the global bond markets *('gbi')* echoes the negative correlation between stock and bond markets. In addition, we note that the *gold* prices and *libor rates* show only a weak influence on the two-month net flows of funds.

The results given in Table 7 suggest the observed correlations between our independent variables and the two-month net flows of funds to be consistent with the results provided in Table 6 and Table 4 gained by examining regressions for different sub-samples, such as the different fund categories or *outperforming funds* and *underperforming funds*. The results across different quantiles of the two-month net outflows show similar consistencies. Thus, we can conclude at this stage of our studies that the persistency of fund flows, the persistency of fund performance, as well as the performance of a fund in the short term, can all be expressed in relation to the two-month net flows of funds, particularly in the case of outflows from funds. Therefore, our results are consistent with the findings by Cashman et al. (2006) such that they observe high outflows both of good and poor performing funds, where a similar shape of curve of fund inflows has been observed, particularly in relation to poorly performing funds. On the understanding that consumers under strained market conditions in light of a declining fund industry generally reduce inflows of new money, we can explain our results more easily by the behavior of investors in more panicked conditions.

[Insert Table 7 about here]

V. Conclusion

During the financial crisis of 2007/2008, *money market funds*, *fixed income funds* and funds invested in convertible bonds *(convertible funds)* have been faced with the highest net redemptions of fund shares by investors ever witnessed. As the results of our investigations have shown, there exists strong evidence that investors behave in a selective manner when they decide whether to redeem their shares from funds.

In general, we find that the prior performance of funds had a negative and statistically significant influence on the net redemption of fund shares by investors over our observation period from March 2008 to April 2010. However, our results do not confirm the findings of previous publications such as Ippolito (1992) or Sirri and Tufano [1998]) that consumers are investing disproportionately more in funds that have been shown to perform very well during the previous reporting period, while failing to retreat from poorly performing funds at the same rate. This contradiction might be due to the high frequency of unfortunate events that led to substantial losses by the banking and fund industry during the financial crisis of 2008. Furthermore, lower information costs for investors resulting from the rapidly growing availability of information via electronic media further

enables investors to monitor markets themselves, and adjust their portfolios accordingly. Another change of investor behavior is evidenced in the increased number of investors that will abandon poorly performing funds as soon as those enter into a dip after a previous period of high performance. This research has identified the relatively recent emergence of pro-active investors who prefer to ensure the short-term profitability of their portfolios in favor of a prolonged exposure to risk as a fund's long-term performance is shifting from good to bad. The role that institutional investors play relating to this observation will be the subject of future research.

Our regression models do provide support for our hypothesis that investor attitudes are reflected in the categories of funds selected. Our measures of redeeming sensitivity, which relies on estimates of extreme value distributions, also indicate that a correlation does exist between investor behavior and fund categories.

Furthermore, our regression models provide some empirical evidence that the redemption of fund shares by investors in prior periods generally influences the more recent flows of funds. Therefore, our findings provide strong support for our proposal that redemptions of fund shares by a significant number of investors will result in a *domino effect* of further shares being redeemed during the following reporting period.

This results in the remaining investors having to accept further losses due to *fire sales*, which, in turn, will have substantial impact on the overall fund performance, and lead to further redemptions of fund shares (some basic studies on this issue have been completed by Edelen [1999] and Massa and Phallippou [2005]). Such amplifying effects might be quite similar to the effects of the self-accelerating spiral of liquidity risk within the global banking system under crisis circumstances described by Brunnermeier (2009).

To conclude our study, we would suggest that the fund industry should establish a strong self-regulatory framework to ensure that fund managers have a clearer idea of the different dimensions of liquidity risk such as redemption risk and market liquidity risk. It is worth noting that generating liquidity under strained market conditions in order to cover the liquidity needs incurred by the increasing number of redemptions of fund shares causes negative externalities for those consumers that remain invested in such tumbling funds, since they have to accept further losses caused by the additional unexpected liquidity costs. It may therefore be necessary to consider the introduction of a redemption fee, which would, take the performance losses caused by the necessity of fund managers to cover liquidity needs in the event of high redemption ratios into account. An

alternative would be the introduction of longer notice periods before investments can be switched. In order to offer further contributions to this particular discussion, we intend to examine the exact scale of such externalities in the next phase of our research work.

However, accepting that consumers punish poor performances of fund managers by significant redemptions of fund shares, fund managers should be obliged to hold a sufficient part of liquid assets at any time to cover such redemptions of fund shares. In order to avoid significant negative externalities for patient consumers such liquidity risks should be better regulated and proved by regulatory authorities especially with regard to funds that report poorer performance than a respective peer group.

Appendices

Table 1
Two-month net redemptions grouped by month of observation period

Our sample contains 35,895 monthly observations from 1,672 funds from March 2008 to April 2010. Among the 1,672 funds appear 695 equity funds, 367 fixed income funds, 540 balanced funds, 58 money market funds, 11 mortgage funds and 17 convertible funds. Balanced funds are invested in equities and fixed income securities. Per definition, convertible funds are funds that invest in convertible bonds. The monthly net redemptions equal the difference of inflows into funds and outflows from funds. The two-month net redemptions equal the sum of net redemption in two consecutive months. We calculate the percentage of funds with outflows is as the ratio of the number of funds with negative two-month net redemptions (outflows) to the total number of funds.

Month	Averaged two-month net redemptions	Percentage of funds with outflows	Month	Averaged two-month net redemptions	Percentage of funds with outflows
01.04.2008	2.78%	45.17%	01.04.2009	0.56%	43.32%
01.05.2008	2.53%	46.65%	01.05.2009	1.53%	38.19%
01.06.2008	2.14%	50.08%	01.06.2009	1.81%	35.99%
01.07.2008	1.38%	48.13%	01.07.2009	1.89%	37.25%
01.08.2008	0.43%	54.45%	01.08.2009	2.11%	35.17%
01.09.2008	-0.91%	63.85%	01.09.2009	2.79%	35.29%
01.10.2008	-3.77%	59.97%	01.10.2009	2.09%	38.95%
01.11.2008	-2.47%	45.39%	01.11.2009	2.10%	39.79%
01.12.2008	3.49%	42.34%	01.12.2009	0.97%	42.05%
01.01.2009	3.85%	46.61%	01.01.2010	0.72%	43.79%
01.02.2009	0.12%	45.49%	01.02.2010	1.76%	41.28%
01.03.2009	0.23%	46.66%	01.03.2010	1.33%	43.12%

Figure 1
Percentage of averaged two-month net redemptions from 2008 to 2010

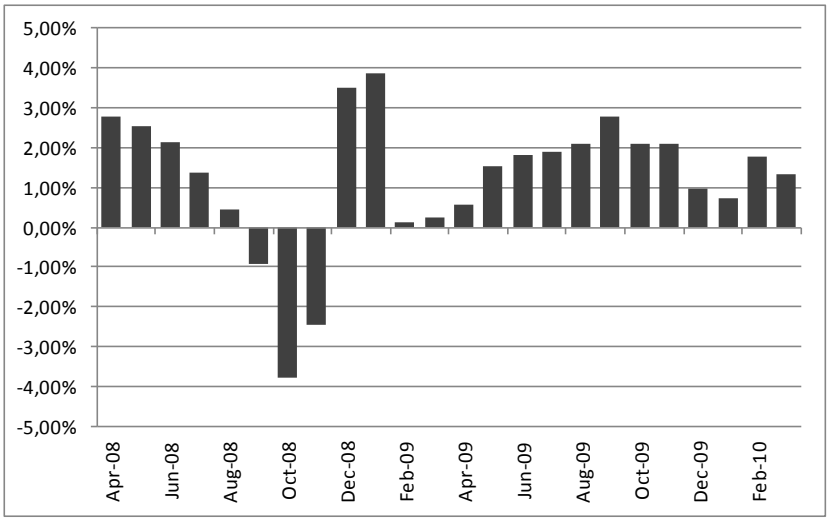

Table 2
Two-month net redemptions grouped by categories of funds

We calculate the percentage of funds with outflows as the ratio of the number of funds with negative two-month net redemptions (outflows) to the total number of observations. (n = number of observations, average and median are calculated over the entire period in question from 2008 to 2010). Sensitivity equals the ratio between 99th percentiles of losses and 99th percentiles of two-month net redemptions. 99th percentiles are calculated based on approximated extreme value distributions (GEV or GPD).[4]

	Equity Funds	Money Market Funds	Mortgage Funds
n	14,768 / 7,677	1,427 / 983	284 / 103
% observations with outflows	51.98%	68.89%	36.27%
Average / median of outflows	-0.11% / 0.90%	-5.82% / -4.27%	-1.49% / 0.11%
99th percentile net redemptions	34.98%	31.04%	31.81%
99th percentile losses	53.02%	29.79%	43.22%
Sensitivity (entire sample)	0.66	0.90	0.74
Sensitivity (outperforming funds)	1.16	1.49	1.65
Sensitivity (underperforming funds)	0.64	0.86	0.74
	Balanced Funds	Fixed Income Funds	Convertible Funds
n	10,536 / 4,318	7,990 / 4,719	394 / 251
% observations with outflows	40.98%	59.06%	63.71%
Average / median of outflows	3.62% / 0.00%	0.45% / -0.93%	-2.24% / -2.12%
99th percentile net redemptions	18.55%	31.04%	31.81%
99th percentile losses	29.79%	34.16%	43.22%
Sensitivity (entire sample)	0.62	0.91	0.74
Sensitivity (outperforming funds)	0.78	1.17	1.65
Sensitivity (underperforming funds)	0.62	0.85	0.74

[4] GEV (Generalized Extreme Value Distribution), GPD (Generalized Pareto Distribution)

Table 3
Dependent and independent variables

Variable	Definition	Calculation formula/Source
evtnma2m (Dependent variable)	Percentiles of two month net redemption of fund shares approximated by fitting extreme value distributions[5]	$nma2m_{ij} = \left(\frac{inflows_{ij} - outflows_{ij} + inflows_{i-1,j} - outflows_{i-1,j}}{NAV_{i-2,j}}\right)$ $evtnma2m = percentile_{GEV,GPD}(nma2m_{ij})$
perf_ind	Standardized performance indicator (calculated recursively)	$perfind_0 = 100$ $perfind_1 = perfind_0 + (performance_{1j} * perfind_0)$ $\vdots \quad \vdots \quad \vdots$ $perfind_n = perfind_{n-1} + (performance_{nj} * perfind_0)$
nma_ind	Standardized net redemptions indicator (calculated recursively)	$nmaind_0 = 100$ $namind_1 = nmaind_0 + (net\ redemptions_{1j} * nmaind_0)$ $\vdots \quad \vdots \quad \vdots$ $namind_n = nmaind_{n-1} + (net\ redemptions_{nj} * nmaind_{n-1})$
log10perf	Logarithm to base 10 of standardized performance indicator	$log10perf = log10(\text{perf\_ind})$
log10nma	Logarithm to base 10 of standardized performance indicator	$log10nma = log10(nma\_ind)$
evtperf	Percentiles of monthly performance approximated by fitting extreme value distributions	$perf_{ij} = 1 - \left(\frac{NAV_{i,j} - net\ redemptions_{ij}}{NAV_{i-1,j} - net\ redemptions_{i-1,j}}\right)$ $evtperf = percentile_{GEV,GPD}(performance_{ij})$
evtperf2m	Percentiles of two months performance attribution	$per2m_{ij} = 1 - \left(\frac{NAV_{i,j} - net\ redemptions_{ij} - net\ redemptions_{i-1,j}}{NAV_{i-2,j} - net\ redemptions_{i-2,j}}\right)$ $evtperf2m = percentile_{GEV,GPD}(per2m_{ij})$
msci	Monthly percentage change of MSCI World	extracted from Bloomberg[6]
vola	Monthly volatility of MSCI World	extracted from Bloomberg
gbi	Monthly percentage change of JPM Global Bond Index	extracted from Bloomberg
gold	Monthly percentage change of gold price	extracted from Bloomberg
libor	Monthly libor rate	extracted from Bloomberg

[5] Approaches emanating from Extreme-Value-Theory allow the reliable prediction of the likelihood of rare, but also plausible events since they model the 'fat tails' of empirical distributions with sufficient accuracy. (Reiss R.–D. and Thomas M. [2000], Embrechts [2000], Embrechts, Klüppelberg, Mikosch [1997]). For the estimation of parameters we relied on a genetic algorithm which delivered reliable and valid results for our purposes.
[6] Bloomberg PLC is one of the leading providers of financial market information.

Table 4
Panel regression with fixed effects

This table shows the results of a panel regression with fixed effects. The percentiles of two-month net redemptions of fund shares are the dependent variable. The factor variable for the fund categories relates to equity funds as the base level. The sample covers the two-month net redemptions of 33,739 observations and 1,648 funds respectively over the period March 2008 to April 2010. In the event of outperforming funds, the sample covers the two-month net redemptions for 13,663 observations and 1,047 funds. In the case of underperforming funds, the sample covers the two-month net redemptions for 20,076 observations and 1,110 funds. By definition, *outperforming funds* report a higher net asset value (NAV) at the end of each observed month due to a positive performance accrual from the beginning of the observation period in March 2008 while *underperforming funds* demonstrate a decreasing net asset value (NAV) at the end of each observed month due to a negative performance accrual. Significance levels are marked with *** (P>t) <=0.01, ** (P>t) <=0.02 and * (P>t) <=0.05.

	Fixed (time) effects regression			Fixed (within) effects regression		
	All funds	Outperf. Funds	Underperf. Funds	All funds	Outperf. Funds	Underperf. Funds
	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)
evtperf2m	0.18*** (0.006)	0.174*** (0.010)	0.154*** (0.008)	0.503*** (0.048)	0.433*** (0.062)	0.316*** (0.064)
evtperf	0.47*** (0.006)	0.540*** (0.010)	0.407*** (0.007)	0.506*** (0.050)	0.488*** (0.061)	0.491*** (0.065)
log10perf	0.51*** (0.011)	0.583*** (0.021)	0.465*** (0.016)	0.065*** (0.011)	0.048** (0.020)	-0.015 (0.025)
log10nma	-0.61*** (0.013)	-0.691*** (0.021)	-0.605*** (0.017)	-0.105*** (0.012)	-0.132*** (0.020)	-0.164*** (0.023)
msci	0.74*** (0.024)	0.471*** (0.040)	0.828*** (0.030)	1.078*** (0.337)	0.838*** (0.278)	1.904*** (0.254)
vola	1.69*** (0.085)	1.099*** (0.147)	1.913*** (0.101)	2.136*** (0.636)	1.902*** (0.680)	0.969 (0.545)
gbi	-1.24*** (0.053)	-0.835*** (0.090)	-1.352*** (0.064)	-1.150 (0.737)	-4.093*** (0.698)	-3.832*** (0.530)
gold	0.05*** (0.019)	0.064* (0.032)	0.026 (0.022)	0.446 (0.341)	-0.211 (0.273)	1.026*** (0.196)
libor	-0.01*** (0.001)	-0.024*** (0.002)	-0.002* (0.001)	0.007 (0.008)	-0.008 (0.006)	0.003*** (0.006)
money market funds	-	-	-	-0.031*** (0.009)	-0.106 (0.040)	-0.047*** (0.015)
mortgage funds	-	-	-	-0.086*** (0.020)	-0.058*** (0.009)	-0.057 (0.032)
balanced funds	-	-	-	-0.034*** (0.005)	-0.052*** (0.011)	-0.029*** (0.008)
fixed income funds	-	-	-	-0.030*** (0.005)	-0.006*** (0.035)	-0.019*** (0.008)
convertible funds	-	-	-	-0.014 (0.016)	-0.006 (0.035)	0.008 (0.025)
Intercept	0.46*** (0.016)	0.396*** (0.033)	0.605*** (0.023)	0.074* (0.033)	0.299*** (0.039)	0.467*** (0.045)
R-squared (within between overall)	0.4738 0.5945 0.4948	0.5392 0.4610 0.5012	0.4204 0.4902 0.4256	0.4164 0.8812 0.5287	0.4540 0.7062 0.5282	0.3359 0.6769 0.3955

Table 5
Variance Inflation Factors (VIF) of independent variables applied to ordinary least squares (OLS) regressions

This table reports the Variance Inflation Factors (VIF) that we have calculated in order to test the dependent variables on collinearities. The Variance Inflation Factors have an intuitive interpretation. Variance Inflation Factors less than 5 indicates that the independent variable shows only weak multicollinearity (for further information on Variance Inflation Factors see Belsley et al. [1980]).

Variable	VIF	1/VIF
evtperf2m	3.56	0.2807
evtperf	3.52	0.2839
log10perf	5.69	0.1757
log10nma	5.54	0.1804
msci	2.87	0.3480
vola	2.28	0.4382
gbi	1.70	0.5891
gold	1.26	0.7960
libor	1.61	0.6194
Money market funds	1.08	0.9251
Mortgage funds	1.02	0.9837
Balanced funds	1.36	0.7339
Fixed income funds	1.30	0.7720
Convertible funds	1.02	0.9803
Mean VIF	2.37	

Table 6
Ordinary least squares (OLS) regressions for different fund categories

This table shows the results of an ordinary least square (OLS) regression of independent variables listed in Table 3 on percentiles of two-month net redemptions of fund shares. In addition to coefficients and standard errors, the table displays the standardized beta coefficients. The sample covers the two-month net redemptions for 13,848 observations of equity funds, 7,726 observations of fixed income funds, and 1,373 observations of money market funds over the period March 2008 to April 2010. Significance levels are marked with *** (P>t) <=0.01, ** (P>t) <=0.02 and * (P>t) <=0.05.

	Equity Funds		Fixed Income Funds		Money Market Funds	
	Coef. (Std. Err.)	Beta	Coef. (Std. Err.)	Beta	Coef. (Std. Err.)	Beta
evtperf2m	0.1966*** (0.0098)	0.2223	0.1888*** (0.0122)	0.1785	0.1434*** (0.0278)	0.1388
evtperf	0.3965*** (0.0098)	0.4510	0.6867*** (0.0122)	0.6358	0.7698*** (0.0282)	0.7264
log10perf	0.0766*** (0.0096)	0.0913	0.2812*** (0.0160)	0.3409	0.1174*** (0.0254)	0.1324
log10nma	-0.2754*** (0.0113)	-0.2704	-0.3621*** (0.0166)	-0.4317	-0.1460*** (0.0249)	-0.1674
msci	1.0029*** (0.0475)	0.2317	0.0459 (0.0406)	0.0103	-0.1133 (0.1035)	-0.0237
vola	1.3619*** (0.1572)	0.0810	0.9129*** (0.1460)	0.0521	0.8191* (0.3728)	0.0432
gbi	-1.8474*** (0.1004)	-0.1503	-0.3335*** (0.0909)	-0.0265	-0.6228** (0.2473)	-0.0427
gold	0.1128*** (0.0349)	0.0224	-0.0688* (0.0329)	-0.0132	-0.1489 (0.0838)	-0.0261
libor	-0.0112*** (0.0014)	-0.0644	-0.0025* (0.0012)	-0.0144	-0.0020 (0.0034)	-0.0105
cds	-0.0005*** (0.0001)	-0.0442	-0.0001 (0.0001)	-0.0115	-0.0004 (0.0002	-0.0299
Intercept	0.7143*** (0.0168)		0.2620*** (0.0152)		0.1731*** (0.0335)	
Adj R-squared	0.4358		0.7440		0.7556	

Table 7

Simultaneous quantile regressions on the two-month net flows from funds

This table displays the results of simultaneous quantile regressions of our independent variables listed in Table 3 on the percentiles of two-month net redemptions of fund shares. We choose the 20%, 40%, 60% and 80% quantiles and use 10 (bootstrapped) standard error estimations. The sample covers the two-month net redemptions of the entire sample over the period from March 2008 to April 2010. Significance levels are marked with *** (P>t) <=0.01, ** (P>t) <=0.02 and * (P>t) <=0.05

	20% Quantile Coef. (SE)	40% Quantile Coef. (Std. Err.)	60% Quantile Coef. (Std. Err.)	80% Quantile Coef. (Std. Err.)
evtperf2m	0.289*** (0.020)	0.279*** (0.011)	0.228*** (0.012)	0.147*** (0.010)
evtperf	0.566*** (0.019)	0.611*** (0.011)	0.572*** (0.010)	0.365*** (0.009)
log10perf	0.090*** (0.008)	0.096*** (0.006)	0.117*** (0.006)	0.125*** (0.006)
log10nma	-0.160*** (0.010)	-0.173*** (0.007)	-0.241*** (0.008)	-0.267*** (0.007)
msci	0.581*** (0.017)	0.617*** (0.017)	0.954*** (0.020)	0.776*** (0.023)
vola	-0.168 (0.101	0.425*** (0.062)	1.255*** (0.065)	1.763*** (0.069)
gbi	-0.766*** (0.059)	-0.904*** (0.036)	-1.547*** (0.055)	-1.401*** (0.072)
gold	0.000 (0.022)	-0.002 (0.007)	0.027* (0.012)	0.055*** (0.013)
libor	-0.012*** (0.001)	-0.008*** (0.001)	-0.004*** (0.001)	0.000 (0.001)
Intercept	0.166*** (0.007)	0.222*** (0.010)	0.417*** (0.012)	0.709*** (0.012)
R-squared	0.4901	0.4261	0.3124	0.2542

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