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Cash holdings of German open-end equity funds: Does ownership matter?

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Non-technical summary

In the aftermath of the financial crisis, the discussion on the nature of runs on financial intermediaries has intensified, as have discussions on strategies to avoid runs. Holding liquidity can be one important element of a stabilization strategy. This paper explores the cash management conducted by German open-end equity funds for the period between 2005 and 2010. We analyse the cash response to mutual fund flows and capture effects related to ownership structures and asset liquidity. Thereby we complement earlier work which emphasizes the role of the investor base and portfolio liquidity conditions as determinants of mutual fund flows arising from strategic complementarities. We construct a unique data set by augmenting the German equity funds' balance sheet statistics (Deutsche Bundesbank) with information on their investor base and their portfolio liquidity. We distinguish funds whose shares are predominantly held by retail investors from funds with a stronger institutional orientation. The key finding of our panel-econometric study is that fund managers take ownership information and their liquidity status into account when making their cash decisions. More precisely, managers of permanently retail-oriented funds tend to move towards higher cash-to-asset ratios in response to inflows if the liquidity status of their equity portfolio is relatively poor. These funds raise their cash position significantly more intensely than funds with a stronger institutional linkage. We interpret this behavior within poorly liquid funds as an indication that managers are confident regarding institutional investments, while retail investments are seen as a more fragile source of finance. Likewise, within retail-oriented funds, the cash response of poorly liquid funds to inflows is found to exceed that of liquid ones. Given the presumed exposure of retail-oriented funds to the risk of strategic investor behavior at times of distress, the striking cash-building activity reflects the managers' interest in preventing a harmful spiral of outflows. In phases of market tensions this move by fund managers could reduce financial fragility in two ways: first, by lowering the shareholders' incentive to withdraw, and, second, by helping to avoid future fire sales through the ability to absorb future outflow shocks. Conditional on strong retail ownership and low portfolio liquidity, the estimation results support the view that fund managers raise their cash ratio in order to mitigate their exposure to these shocks on funding liquidity. This strengthens the view that cash holdings are perceived as a way to contain ownership-induced vulnerabilities in the form of self-reinforcing outflow cascades. Therefore fund managers' behavior appears to contribute to the self-stabilization of the financial system.

Nicht-technische Zusammenfassung

Im Gefolge der Finanzkrise sind die Eigenschaften von Runs auf Finanzintermediäre sowie entsprechende vorbeugende Strategien verstärkt diskutiert worden. Bei solchen Risikovorsorgestrategien kann der Liquiditätshaltung eine stabilisierende Rolle zukommen. Die vorliegende Studie untersucht die Liquiditätshaltung deutscher Aktien-Publikumsfonds im Zeitraum 2005 bis 2010. Im Kern betrachten wir, wie Fonds mit der Barmittelhaltung auf ihre Mittelflüsse unter Berücksichtigung von Effekten der Investorenstruktur und der Aktienliquidität reagieren. Damit stellt das vorliegende Papier einen Beitrag zu bestehenden empirischen Arbeiten dar, welche die Investorenbasis sowie die Portfolioliquidität der Fonds als Erklärungsfaktoren ihrer Mittelflüsse hervorheben. Als Grundlage für die vorliegende Untersuchung dient die Investmentfondsstatistik der Deutschen Bundesbank, die um Halterdaten und Portfolioliquiditätsdaten erweitert wurde. Wir unterscheiden zwischen Fonds, deren Anteile überwiegend von privaten (Retail-) Anlegern gehalten werden, und Fonds mit einer stärkeren institutionellen Orientierung. Unsere panelökonometrische Studie weist darauf hin, dass Fondsmanager sowohl ihre Investorenstruktur als auch ihren Liquiditätsstatus bei ihren Entscheidungen über die Höhe ihrer Barmittelhaltung berücksichtigen. Konkret bedeutet dies, dass Manager von dauerhaft retail-orientierten Fonds als Reaktion auf Mittelzuflüsse ihre Barmittelquote relativ zum Fondsvermögen erhöhen, wenn ihr Aktienportfolio eine vergleichsweise schwache Liquidität aufweist. Diese Fonds erhöhen ihre Cash-Position signifikant stärker als Fonds mit stärkerer institutioneller Bindung. Innerhalb der weniger liquiden Fonds liefert dieses Verhalten einen Hinweis darauf, dass Fondsmanager die Mittel privater (Retail-) Anleger als anfälliger einschätzen als institutionelle Investitionen. Ebenso zeigt sich, dass innerhalb der retail-orientierten Fonds die Cash-Reaktion der weniger liquiden Fonds die Reaktion der hochliquiden Fonds übersteigt. Vor dem Hintergrund des Risikos strategischen Investorenverhaltens, dem retail-orientierte Fonds in Phasen hoher Markverwerfungen ausgesetzt sind, spiegelt die auffällige Neigung zum Aufbau von Barmitteln das Interesse der Manager wider, eine Spirale von Mittelabflüssen zu unterbinden. In Phasen angespannter Märkte dürfte dies ihre finanzielle Verwundbarkeit in zweierlei Hinsicht reduzieren: Zum einen schmälert es den Anreiz der Anteilseigner zum Mittelabzug, zum anderen werden Absorptionskapazitäten geschaffen, welche durch Abflüsse erzwungene Aktienverkäufe am Markt vermeiden helfen. Die empirischen Schätzergebnisse legen nahe, dass Manager retail-orientierter Fonds mit weniger liquiden Portfolien ihre Barmittelquote zur Begrenzung dieser Finanzierungsrisiken erhöhen. Dies erhärtet die These, dass die Vorhaltung von

Barmitteln als ein Weg wahrgenommen wird, um die Anfälligkeit gegenüber sich selbst verstärkenden Abflusskaskaden gering zu halten. Das Verhalten der Fondsmanager dürfte damit zu einer Selbststabilisierung des Finanzsystems beitragen.

BUNDESBANK DISCUSSION PAPER NO 47/2013

Cash holdings of German open-end equity funds: Does ownership matter?[1]

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Abstract

In the light of the recent financial crisis, the discussion on the nature of runs and on the stabilizing role of liquidity holdings has intensified. This paper explores the cash management conducted by German open-end equity funds for the period between 2005 and 2010. Since ownership structures may have important consequences according to recent work, we distinguish funds whose shares are predominantly held by retail investors from funds with a stronger institutional orientation. Conditional on poor portfolio liquidity, we find that managers of permanently retail-oriented funds tend to move towards higher cash-to-asset positions. Cash-building intensities are found to be lower when illiquid funds are institutional-oriented or when the portfolio liquidity of retail-based funds is higher. The striking effort undertaken by poorly liquid funds with a lasting retail-orientation is likely to be linked to their exposure to the risk of strategic investor behavior at times of distress. We conclude that conditional on their liquidity status, these funds use cash as a device to provide for the ownership-related fragility of their funding base, thereby contributing to the self-stabilization of the financial system.

Keywords: cash holdings, equity funds, ownership, strategic complementarities, financial crisis

JEL-Classification: G01, G11, G23, G32

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1 Introduction

In search of the determinants of mutual fund investors' propensity to run, the role of the fund's liquidity position has been highlighted in recent work. The evidence found by Chen, Goldstein and Jiang (2010) suggests that, conditional on poor performance, liquidity patterns matter for shareholder's decision to withdraw.[2] On theoretical grounds, Liu and Mello (2011) have formalized the interplay of the flow decision of investors and optimal cash holdings of fund managers. When early redemptions imply that assets must be sold at a discount, their model suggests that fund managers choose cash holdings depending on the distribution of outflows and the risk of a run. In addition to the asset liquidity dimension, Chen et al. (2010) control for the shareholder base and find that liquidity patterns matter for withdrawals from small retail-oriented funds, but they do not matter when large institutional investors play a major role. They explain this result by unequal exposures to a run arising from strategic complementarities. This concept stands for self-reinforcing mechanisms that can lead to a fund closure, and, potentially, to a liquidity crisis.[3] It is based on the theoretical prediction that numerous small shareholders are more likely to withdraw from a distressed fund than few large shareholders: While small shareholders benefit from a first-mover advantage when outflows induce fire sales (at large discounts) at the expense of remaining shareholders, large shareholders tend to internalize the negative externalities of a first mover behavior – namely, the expected harm (backlash of costs of flow-induced fire sales on their own performance) which prompts shareholders to withdraw in anticipation of withdrawals by other shareholders.

While Liu and Mello (2011) suggest that a run is more likely when fund assets are highly illiquid and exogenous outflows are high, the view of Chen et al. (2010) on the origin of outflow spirals is complemented by the requirement of a retail-oriented investor base. Conversely, a spiral arising from strategic complementarities should not develop when a large investor dominates the fund. This paper adds to these views by analysing the determinants of a fund's precautionary cash allocations, using inflow

[2] Chen et al. (2010) classify equity mutual funds by applying different liquidity measures on each stock under management, which allows them to calculate portfolio averages. In a different, but related study on investor flows, Fecht and Wedow (2009) find that around the 2005-06 real estate fund crisis – when real estate assets are likely to be illiquid – tradable securities and cash reserves help to contain redemptions.

[3] These mechanisms constitute a core element of models on bank runs, currency attacks, and studies on bubbles and crashes. See Diamond and Dybvig (1983), Abreu and Brunnermeier (2003). In a related study, Iyer and Puri (2012) find that the bank-depositor relationship can mitigate bank runs and reduce financial fragility.

coefficients (gross inflows and net inflows) as a proxy, in the liquidity-ownership context.

To this end, we break down the sample of German open-end equity funds into institutional-oriented and retail-oriented funds. Second, we classify the funds in the sample by the liquidity status of their equity portfolio. Our ownership- and liquidity-related fund classifications are motivated by the theoretical prediction that numerous small shareholders are more likely to withdraw from a distressed fund than few large shareholders who tend to internalize negative externalities – namely the expected consequences of fire sale having a market impact which affects their own performance. We distinguish funds which are permanently dominated by retail shareholders from funds in which institutional investors hold the majority of fund shares, either temporarily or permanently. The nature of the shareholder base as a determinant of redemptions is a key motivation for adopting the fund manager's perspective in this paper. If investor flows are a function of ownership and liquidity patterns, we claim that the cash management of the fund is affected too. This takes us to the intuition of this paper: When the manager of a fund is aware of a large retail share in its investor base, and when he/she manages a portfolio of less liquid stocks, we expect him/her to offset this 'disadvantage' by allocating more inflows, if available, to cash reserves, than in other ownership constellations. Presuming that cash holdings act simultaneously as a shock absorber and as a shock preventer, cash-building decisions – which are likely to be made in anticipation of shareholder behavior – should help stabilize the fund's funding base.

In a dynamic panel estimation for the cash-to-assets ratio, we investigate whether fund managers increase their cash buffers in order to mitigate the risk of coordination failures caused by strategic complementarities that might induce a run. Our analysis of German open-end equity funds is based on the investment fund statistics as well as the security holdings statistic of the Deutsche Bundesbank. Moreover, we use Bloomberg bid-ask spreads on a security-by-security basis to construct a liquidity indicator at the portfolio level for each fund. We match this data with the time series for each fund. To construct a panel at the fund level which contains the liquidity indicator and ownership information, we match the data from the aforementioned three sources.

If our intuition is true, this has important implications: First, the cash position is not an exogenous regressor in the estimations for investor flows. Second, the same endogeneity problem emerges in the reversed regression, for example when cash

holdings are regressed on investor flows.[4] In this panel study we present estimations based on two different methodologies: within-group estimations with no control for endogeneity, and GMM estimations which control for the endogeneity of regressors and, more specifically, the predetermination of investor flows.

The key finding of our within-group estimations for the period 2005-2010 is: As a response to inflows, retail-oriented funds holding less liquid equity portfolios raise their cash-to-assets ratio more intensely than other funds. This outcome holds for gross inflows and net inflows alike. The GMM estimation approach confirms these results for the period from mid-2008 to end-2009. It supports the view that managers of retail-dominated funds with assets that have a rather unfavourable liquidity structure attempt to improve their overall liquidity status by building up cash buffers at times of distress.[5]

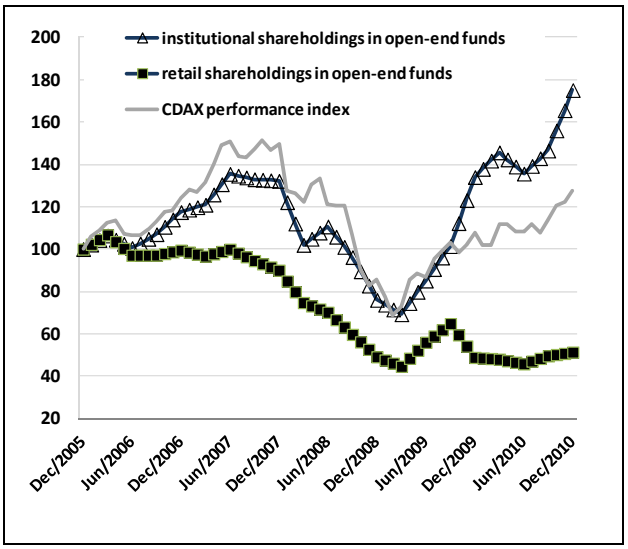
While the present paper focuses on self-stabilization through increased cash holdings (in response to inflows) to prevent future withdrawal shocks, we also look at estimates of realized shock absorption (measured by the cash response to outflows) which relate to transaction costs.[6] Our results show that once outflows exceed inflows, retail-oriented funds with poor asset liquidity do not use the buffer function of cash. In the case of gross outflows and the case of net redemptions, the insignificant response of the cash-to-assets ratio points to a subdued absorption of redemptions by cash buffers, meaning that cash buffers recede proportionally to total net assets. Such reluctance on the part of managers could be explained by the importance of cash holdings for this group of funds: At times of distress, it signals to investors that the fund will be able to meet potential redemptions. If fund managers expect their shareholders to worry about an outflow spiral triggered by shortfall in cash, managers might prefer a sale of some liquid part of their portfolio over an excessive meltdown of their cash position. Conversely, this tradeoff between impairing portfolio liquidity and absorbing net outflows (using cash buffers) is less prevalent for other funds. By the same token, a fund manager should be less worried about outflow spirals – and care less about their level of cash holdings to pre-empt a run – when his equity under management is liquid or when an institutional investor dominates his shareholder base. Aggregate data confirm a stable funding through this class of investors independent of cash holdings:

[4] Though the effectiveness of attempts to contain outflows is not at the core of this study, a positive linkage between cash holdings and subsequent net flows seems to hold for other than institutional-oriented funds in the period from 2005 to 2010, whereas under normal conditions, investors should focus on the fund performance rather than on its cash holdings. See Table 2.

[5] In this paper, 'cash' denotes the sum of bank deposits, and money market paper. The term 'cash building intensities' describes the responsiveness of cash holdings to inflows from investors.

[6] Regressions explaining withdrawals from German equity funds support the view that conditional on negative past performance, cash holdings contain subsequent withdrawals from illiquid funds with a permanent retail-orientation.

Figure 1: Shareholdings of open-end equity funds by investor group



December 2005 = 100.
Source: Deutsche Bundesbank, Thomson Reuters, the authors' calculations.

Even when managers build up cash buffers in small magnitudes, there is no indication that institutional investors shy away. Aggregate shareholdings tend to suggest that institutional investors have become more important in the equity fund industry.[7] In the sample period under review, average ownership of open-end equity funds showed a considerable shift away from retail shareholders: Whereas two thirds of all non-ETF fund assets were in the hands of retail investors in 2005, their weight had shrunk to little more than one third by the end of 2010.[8]

In the present study, we look at the cash management of German open-end equity funds excluding exchange traded funds. Under the current legislation[9], a fund is defined as an equity fund if at least 51% of its total net assets is held in equity. Asset valuations in this fund category were severely affected in the 2007-09 crisis period, while assets managed by other types of funds were less affected. Within equity funds, we investigate the behavior of funds open to the general public, which we term open-end funds. Unlike specialized funds, which are – by definition – mandated by institutional investors, open-end funds are committed to guarantee the liquidity of a fund share, for example, the ability to redeem it at any point in time. By nature, this characteristic makes open-end

[7] See Figure 1. Moreover, a comparison of the distributions of net fund flows as well as fund outflows by dominant investor group supports the view that institutional investors withdrew less and invested more on average.
[8] A comparison of end-2005 ownership data with the corresponding end-2010 data reveals that the number of funds predominantly held by institutional investors had risen from 199 (of which 44 exchange traded funds, ETFs) in 2005 to 298 (of which 93 ETFs) in 2010. At the same time, the number of funds in which retail investors constitute the majority shrank from 256 to 201.
[9] See the German Investment Fund Act (Investmentgesetz, 2003).

funds vulnerable to strategic complementarities and thus to withdrawals at times of distress. Between July 2007 and March 2009, these funds had to redeem shares amounting to € 4.8 billion[10]. Inevitably, this prompted their managers to worry about the implications of their investor base for redemptions.

Using a unique panel data set of equity funds' balance sheet and investor flow information combined with data on their shareholder base and on bid-ask spreads of their equities, this paper contributes to the literature by providing evidence of uneven cash management patterns: Retail-oriented funds are contrasted with funds whose shareholder base is – temporarily or permanently – dominated by institutional investors between 2005 and 2010. In an attempt to gauge fund managers' fears arising from strategic complementarities, we consider the cash response to inflows as pivotal along the lines of ownership and liquidity, because it permits us to explore the manager's interest in controling and mitigating withdrawals. While Chen et al. (2010) conclude that retail investors withdraw faster than institutionals from illiquid funds whose performance is poor, our results confirm the attempt of their managers to counteract this by raising cash buffers. That said we impose the condition that managers assume shareholders to be cash-sensitive, thus to expect consequences of a chosen cash level on their funding liquidity. Notably, the significantly higher responsiveness to inflows is closely linked to the fund's retail orientation and the liquidity status of its equities under management. We claim that when equity funds build up cash buffers more intensely in response to inflows, they signal to their investors that withdrawals will not produce negative externalities. This in turn reduces the likelihood of a run.

Conditional on poor liquidity, permanently retail-oriented funds are found to raise their cash position more than twice as intensely as other funds – a result which we interpret as a way to pre-empt future ownership-driven withdrawals.[11] The economic and statistical significance of differences in cash-building activities across investor groups is compatible with the view that fund managers build up cash buffers to contain their exposure to outflow risks. The degree of retail orientation apparently amplifies the cash allocation of fund managers. We interpret this as a measure of the strength at which

[10] At the same time, specialized funds attracted net inflows amounting to € 5.5 billion.

[11] Additionally, retail-oriented funds dampen the market impact of realized withdrawals more than others. See Table 4 and Table 5. This effect is, however, limited to liquid funds. We apply dynamic panel approaches (using the within-group estimator and the GMM system estimator) to a unique panel data set at the fund-level. This is based on the Bundesbank investment fund statistics, which we merge with quarterly data provided by the Bundesbank securities holdings statistics. This permits us to combine ownership information with monthly balance sheet and flow data, and to break down cash management by ownership classes. Given the restricted data availability of the latter, our econometric analysis is confined to the period from December 2005 to December 2010. Moreover, we exclude funds which were not active in the 2007-2009 crisis period.

equity fund managers fear a panic. Depending on their retail-orientation and liquidity status, fund managers perceive cash holdings as a way out of financial fragility, whereas other funds' cash-building activities are less intense. Although illiquid retail-oriented funds were still confronted with net redemptions in the review period, our regression results suggest that its cash holdings were managed in a way appropriate to mitigating this pressure.[12]

It should be mentioned, however, that this framework contrasts with a view from which the cash-to-assets ratio simply reflects the degree of monitoring intensity. A high cash position would then be purely a reflection of a lack in monitoring: This criticism refers to the monitoring activities of institutional capital providers – which are more intense than those of which retail investors are capable. Accordingly, at normal times with positive asset returns, such monitoring activities should force their investees to hold little cash and engage in liquidity transformation. Since the implied risk-taking is rewarded by a higher return, this prompts investors to stay invested despite greater financial fragility. To measure ownership effects on the cash management of open-end equity funds which are not driven by disparities in monitoring, we use the past fund return as a control variable for monitoring-related ownership effects on cash holdings and performance. Including this control variable, our empirical findings on cash responsiveness support the view that a fund's exposure to investors' strategic behavior – for example, the threat of a run which arises solely from expectations about other shareholders' propensity to withdraw – increases with its retail orientation. Moreover, and in line with the intuition of Chen et al. (2010), a differentiation by asset liquidity reveals that illiquid funds feel most exposed to this threat. We segment our panel along the lines of bid-ask spreads which are weighted with each equity's position in the fund's portfolio. We look at equity funds although typically, equities are rarely fully illiquid. Notwithstanding that, this paper argues that the cash management of equity funds is influenced by its liquidity rank. In our panel-econometric approach we separate funds with highly liquid equity portfolios from those with less liquid ones. The resulting liquidity-ownership matrix reveals that a high retail orientation reinforces illiquid funds' cash allocations. Conversely, managers of funds with a stronger institutional presence and managers of liquid retail-oriented funds allocate fewer inflows to their cash buffers. We conclude that cash serves as a device for offsetting the combined disadvantage resulting from poor liquidity and a retail orientation, thereby contributing to the self-stabilization of the financial system.

[12] In this study, funds are termed 'illiquid' when they manage equity portfolios in which the average value-weighted bid-ask spread (Bloomberg) exceeds the median in the period under review.

The remainder of the paper is structured as follows: Section 2 briefly reviews the related literature on cash determinants and the role of ownership. Data issues and the construction of the sample under review are described are described in section 3. Section 4 explains the ownership classification and the segmentation of funds by equity portfolio liquidity. Section 5 introduces the econometric approach. The empirical results are presented in section 6, and section 7 concludes.

2 Related literature

The present paper refers to two strands of the literature: First, we refer to the literature which examines the drivers of mutual funds' cash holdings. Second, we highlight strategic complementarities as an additional factor explaining their cash management: Based on the alleged prominent role that some groups of institutional investors have played in past crises, the effects of large versus small investors on funding liquidity have been extensively studied.[13] Among them, more recent papers investigate whether a self-fulfilling run is possible within mutual funds.[14] On theoretical grounds, Liu and Mello (2011) have formalized the interplay of the investors' flow decision – who maximize their payoff depending on fund cash holdings – and fund managers' cash holdings. When early redemptions imply that assets must be sold at a discount, their model suggests that fund managers choose cash holdings depending on the distribution of outflows and the risk of a run. The importance of the fund's cash position enters their model through the role of cash in the (threshold) redemption signal received by investors.

Using a global game model that Corsetti, Dasgupta, Morris and Shin (2004) constructed to analyze speculative attacks, Chen et al. (2010) traced back withdrawals from mutual funds to their investor base. Their study confirms that the composition of their investor base is closely linked to the threat of self-reinforcing destabilizing outflows. These authors claim that asset liquidity is pivotal. More specifically, the authors argue that withdrawals from illiquid funds incur costs through fire sales in poorly liquid assets, which are borne by the remaining shareholders. According to theory, this applies to small shareholders, who anticipate the negative effects of possible withdrawals by other shareholders. For small shareholders, this creates an incentive to pre-empt other shareholders by redeeming their shares as fast as possible. This destabilizes the fund,

[13] See, for example, Bannier (2005) or Corsetti, Dasgupta, Morris and Shin (2004) for the role of large versus small players in the global game literature.

[14] See Wermers (2012) for an empirical analysis of runs on US money market mutual funds. A related study is carried out by Qian and Tanyeri (2010) who investigate whether the anticipation of adverse events can trigger self-fulfilling runs in the mutual fund industry.

because outflows can be self-reinforcing. This threat explains why managers of illiquid funds have an incentive to pre-empt withdrawals. Following Chen et al. (2010), things are different when a considerable proportion of the fund's shares is held by a large investor. Their empirical results corroborate that institutional shareholders have a strong incentive not to withdraw from illiquid funds even when performance is bad:[15] The fear that fire sales induced by own withdrawals might damage their own performance prompts them to internalize the otherwise expected loss and stay in the fund. This helps the fund to be protected against a self-fulfilling liquidity shortage. The outcome of Chen et al. (2010) is notable because it sheds light on the fact that apart from performance, investor flows depend on ownership structures even at normal times.[16] Accordingly, shareholders who are affected by strategic complementarities do not hesitate to withdraw from distressed funds when they are sensitive to past returns and enjoy low switching costs.

With respect to the ownership linkage of strategic complementarities, a simple conclusion could be drawn: whereas managers of institutionally dominated funds are better off, those of retail-oriented funds should be all the more interested in mitigating the threat of self-reinforcing withdrawals, the less liquid are their assets under management. This leads to the intuition of this paper, since one way to bypass an expectation-driven funding problem is to raise the cash position of the fund. In this context, we refer to Fecht and Wedow (2009). In their analysis of German open-end real estate funds, cash holdings play an important role as a component of the liquidity ratio.[17] Their regression analysis for outflows shows that shareholders tend to disregard fund performance at times of panics, but worry about the liquidity risk arising from strategic complementarities. The authors stress that the liquidity status of the fund – including cash holdings – tends to suppress an endogenous spiral of outflows at times of

[15] With respect to the period 1995 to 2005, Chen, Goldstein and Jiang (2010) find that a strong retail-oriented investor base amplifies outflows from US mutual funds in the presence of illiquid portfolios and poor performance, while this effect is not significant for large institutional investors. Chen et al. conclude that retail shareholders are more prone to withdraw in the expectation that others will do the same, while funds dominated by institutional shareholders tend to refrain from such strategies: Since they typically hold a relative large share in the fund, they care less about what other shareholders do.

[16] For example, Fecht and Wedow (2009) discuss the role of fund performance and the liquidity ratio (including cash holdings) as determinants of fund outflows. They find that the significance of these factors is different between crisis periods and normal times.

[17] These authors define the liquidity ratio as the sum of cash holdings and tradable securities as a percentage of total net assets.

distress:[18] a substantial cash position signals to shareholders that the fund provides capacities to meet redemptions. This mitigates their fear that other shareholders could withdraw, which, in turn, contains their tendency to panic.

Nonetheless, the view of Chen et al. (2010) that large institutional investors reduce financial fragility has not gone unchallenged: Huang and Ratnovski (2011) present a theoretical paper on bank finance which concludes that institutional capital providers – who have better monitoring skills and a seniority position – might indeed run faster than others.[19] This should not be surprising at normal times, where fund managers should expect institutional investors to withdraw fast in case of bad performance. At periods of distress, however, the views of Chen et al. (2010) – who attribute a first-mover advantage to retail shareholders – contrast with the views of Huang and Ratnovski (2011) who presume a seniority advantage of wholesale financiers combined with a passive role of retail financiers. These contrasting views exhibit a surprising commonality, however: A large share held by retail investors makes an early, inefficient liquidation more likely: While in Huang and Ratnovski's case, it is the wholesale financier who runs, retail-oriented funds are more prone to outflows in case of Chen et al. (2010).

Against the background of this controversy, the present study asks whether fund managers use cash as an instrument in a way which is compatible with the threat emerging from retail-oriented funds in circumstances of distress and illiquidity, as highlighted by Chen et al. (2010). Supposing that the threat arising from strategic complementarities depends on the composition of the shareholder base and asset liquidity, we claim that managers who have good reasons to be afraid of withdrawals should be interested in building up their cash buffers. We therefore estimate the cash response to fund flows by ownership class and liquidity segment. By contrast, attempts to build up cash buffers would not be helpful if Ratnovski and Huang (2011) were right.

[18] Fecht and Wedow (2009) compare the crisis period of German real estate funds end-2005 to mid-2006 with the pre- and post-crisis periods. They argue that a large liquidity transformation of a financial intermediary (for example, when illiquid assets are financed by short-term liabilities) implies investor concerns that their capital return could be impaired by large scale withdrawals by other shareholders. Accordingly, if investors expect massive withdrawals by others, they have a strong incentive to withdraw their funds. The expectations of a fund experiencing a liquidity shortfall could then become self-fulfilling. Fecht and Wedow (2009) find that the liquidity ratio contains this effect and stabilizes the funding side.

[19] Referring to bank projects to be financed, Huang and Ratnovski (2011) distinguish retail depositors from institutional investors who hold senior claims. The authors argue that apart from the 'bright side' of wholesale funding (disciplining of the investee through monitoring), there is a 'dark side' too: The 'dark side' materializes when a 'noisy signal on the project quality' is publicly available: Because they have no incentive to conduct a costly monitoring, institutional investors may destabilize the funding of banks and trigger inefficient liquidations. However, neither the data on fund shareholdings nor the econometric analysis carried out in this paper confirm the view that equity fund managers have a distinct fear of – or provide for – a run on the part of institutional investors when assets under management are poorly liquid.

In order to analyse the role of cash holdings one must control for other factors which affect the relationship between the fund's investor base and its cash ratio, namely monitoring intensities, as well as other variables which explain the cash management of equity funds. Therefore we proceed by briefly reviewing the literature on optimal cash holdings.

On theoretical grounds, only a few papers have analysed the optimal choice problem of mutual fund cash holdings, for example, Constantinides (1986), Leland and Connor (1995), Yan (2007), and Nascimento and Powell (2010).[20] A common feature of the theoretical models presented in these papers is the dependence of the optimal cash ratio on the flow volatility, opportunity costs, and transaction costs. In normal market phases, there exists a trade-off between transaction costs (high cash level preferred) and opportunity costs (low cash level preferred), while flows are uncertain. On the one hand, the fund manager has a limited interest in building up cash reserves, because it deprives him/her of earning a return that could have been achieved on alternative uses.[21] On the other hand, in the absence of a cash buffer, flow variations – which typically are fairly pronounced within open-end funds – necessitate a frequent and thus costly rebalancing of the portfolio.[22]

Numerous studies have found these factors to be empirically relevant and being additional determinants of mutual fund cash holdings. Referring to the portfolio return, several studies have highlighted that apart from the approximation of opportunity costs, the return – say, the cash response to its lag – serves as an indicator of the presence of procyclical trading. Barberis and Shleifer (2003) even suggest that a negative response reflects a form of herd behavior. Moreover, Walter and Weber (2006) find a negative dependence of cash holdings on fund returns and interpret this as a sign of positive feedback strategies. In the same vein, Wermers (1999) argues that a large proportion of mutual funds' herding behavior can be attributed to positive feedback strategies.

[20] Leland and Connor (1995) derive an optimal interval in which cash holdings fluctuate without incurring any trades. In addition to transaction costs, flow volatility and opportunity costs, they introduce return volatility. As a result, optimal cash holdings increase when the expected excess return on the fund portfolio shrinks, transaction costs increase, when net fund flows are more volatile and when the fund return becomes more volatile. In a dynamic programming framework, Nascimento and Powell (2010) show that the optimal cash ratio depends on transaction costs, borrowing costs, and opportunity costs. Like Leland and Connor, these authors find that it is advantageous for a fund not to adjust its cash level while it stays within a specific range, which implies a lower trading frequency and thus lower transaction costs.

[21] See Wermers (2000) and Edelen (1999).

[22] Constantinides (1986) puts forward the argument that the presence of transaction costs decelerates the adjustment of cash holdings to an "optimum level", since each adjustment implies trading in securities markets. Yan (2007) states that in the absence of market frictions, a continuous rebalancing of the fund portfolio would imply that the cash position does not depend on past flows.

In this paper, we introduce the fund return to control for a third factor too: Following the intuition of Chen et al. (2010), we aim at isolating cash-building activities which depend on the retail-orientation of a fund purely for reasons of risk provision against withdrawals. Therefore we must control for other factors which affect this relationship. Indeed, the lack of monitoring is another reason which could prompt a fund to hold high cash positions. At this point, the composition of the investor base comes in: institutional investors are likely to monitor the fund management more closely, while they discipline it by withdrawing capital if profitable investments are insufficient, with cash holdings being excessive. Conversely, a high return on investment prompts institutional capital providers to stay in the fund, though the liquidity mismatch makes it more fragile.[23] Therefore, it could be argued that a fund's retail orientation is positively related to its cash holdings, implying a weak monitoring intensity and return. Although this relationship should be limited to normal times when returns on assets are positive, we include the lagged return of a fund in our empirical setting to control for the monitoring-driven ownership effect on its cash ratio.

Referring to the fund size, we expect a negative effect on cash holdings. Yan (2007) argues that it signals whether a manager can sell assets easily: He predicts that smaller funds hold more cash than large ones, because they face higher transaction costs. Accordingly, these costs are driven, first, by differences in asset liquidity, and second, by differences in the number of shareholders.[24] In our study, we control for size effects by introducing the natural logarithm of total net assets. Cash holdings decreasing with increasing assets under management would suggest that small funds hold more cash than large ones in order to offset the disadvantage of high transaction costs. Moreover, the empirical specifications presented in the present paper include a number of control variables which are explained in further detail in Annex A. These are the money market rate[25], the number of funds managed within one investment company (e.g. the size of

[23] Diamond and Rajan (2001) argue that a bank commits itself to a sound behaviour when it engages in maturity transformation, reflecting a fragile capital structure and subjecting itself to a potential run, while at the same time earning a liquidity risk-related return. In turn, this fragility commits the bank to creating sufficient liquidity to meet (expected) redemptions.

[24] According to Yan (2007) larger funds need to hold less cash because they tend to hold more liquid stocks, which is due to constraints imposed by the size of positions they can take. Besides this, he emphasises that large funds are in a better position to diversify risks, because they are owned by a larger number of shareholders: under the assumption that outflow risks are not perfectly correlated across shareholders, an increase in the number of shareholders reduces the probability of a large redemption shock.

[25] Here, we use the three-month Euribor rate as an indicator for the holding return on cash or short-term money market paper. At the same time, it serves as a risk indicator, given its crisis-related deviations from Eonia swap rates. Whereas at normal times an increase in cash holdings requires the expected return to be high, an increase in cash holdings could also result from tensions in the short-term interbank markets, which are closely linked to the Euribor level.

the fund family), the load fee charged by the fund, its age, its leverage, its payouts, the volatility of its outflows and its return, and the expected stock market volatility (VDAX).

3 Data and sample construction

Our dataset basically consists of three sources: First, we rely on balance sheet and flow data from the investment fund statistics provided by the Deutsche Bundesbank. This database provides end-of-month information on fund balance sheet items and flows of funds with a residence in Germany. From September 2009 onwards, it includes a breakdown by security. Second, we use bid-ask spread data from Bloomberg to account for cross-section differences in liquidity. As will be shown later in the paper, this liquidity information is combined with portfolio information from the first database. The third database consists of ownership data from the Bundesbank securities holdings statistics. This database provides end-of-quarter information on sectoral security holdings starting from December 2005, given that the holder of the security is a depositor at a German depository institution.[26]

The inclusion of ownership information permits us to explore whether retail-oriented funds behave differently from others, but it requires that the starting date of our sample is no earlier than December 2005. By merging balance sheet, flow and ownership data we construct a unique panel data set of German open-end equity funds, which will be subjected to a segmentation by their equity portfolio liquidity. The detailed construction of the data-set is outlined in Table 1: From the entire data set on German open-end equity funds, we select those which were active between December 2005 and December 2010 and which reported ownership information to the Bundesbank securities holdings statistics. Second, we drop exchange-traded funds because we focus on the cash management of actively managed funds. Third, we eliminate outliers with respect to the cash ratio, the inflow ratio, the outflow ratio, the fund return, and fund size. We do so by ignoring observations that contain values of less than the 1% percentile and more than the 99% percentile.

Fourth, we restrict the panel to funds for which data on their equity portfolios are available in 2009 and 2010. Finally, the high number of launches and exits in the

[26] With respect to German mutual fund shares, this information is augmented by a direct reporting of mutual funds on shareholder accounts at foreign banks. Since the depository institution of German open-end equity funds is always resident in Germany – even when its shares are held via a foreign bank, our dataset benefits from a high coverage of ownership information on open-end equity funds. This almost complete coverage results in insignificant disparities between aggregate assets under management by German open-end equity funds and the sum of the corresponding sectoral holdings reported to the securities holdings statistics provided by Deutsche Bundesbank.

German equity fund industry implies a high number discontinuous series. After these adjustments, the sample consists of 470 open-end equity funds with 21,023 observations. On this basis, the classifications by ownership and liquidity criteria are carried out.

Table 1: Sample construction

			No. of observations (monthly reports)	No. of funds		
All open-end equity funds with reports available in the data base			**81,125**	**913**		
of which exchange-traded funds (ETF)				**102**		
of which non-ETF				**811**		
Outlier elimination (1% and 99% percentile):	*1%*	*99%*				
Cash-to-assets ratio	0	1.000				
Inflow-to-assets ratio	0	0.468				
Outflow-to-assets ratio	0	0.366				
Excess fund return[27]	-0.173	0.142				
Total net assets, €m	1	3,129				
Reports after outlier elimination and merge with security holdings statistics (2005-2010)			**25,704**	**658**	of which new launches	of which exits
2006					68	25
2007					60	30
2008					42	56
2009					51	84
2010					42	73
Reports after merge with data on portfolio liquidity[28] and ownership classes			**21,023**	**470**	**of which funds with a permanent majority of…**	
		Bid-ask spread of the fund portfolio of equities			**…retail investors**	**…institutional investors**	other funds
		permanently above median			40	37	50
		permanently below median			34	36	29
		other funds			84	79	81

Source: Deutsche Bundesbank (securities holdings statistics and investment fund statistics), Bloomberg, the authors' calculations.

[27] Monthly fund return less one-twelfth of the three-month Euribor rate. See Annex A for further details.
[28] Detailed information on fund portfolios is not available before September 2009. The portfolio liquidity measure is computed using fund portfolio structures available from the Bundesbank investment fund statistics and equity bid-ask spreads available from Bloomberg.

4 Fund classification

4.1 Classification by investor group

As regards the weight of retail shareholdings in open-end equity funds, Figure 2 depicts its distribution before and at the peak of the 2007-2009 financial crisis. It reveals that, in early 2006, most ownership constellations were present, including those of a balanced mix of institutional and retail investors. While this points to a rather evenly distributed retail share at that time, a U-shape became more pronounced in the course of the crisis, suggesting that a large number of funds tended to be either institutional-oriented or dominated by retail investors. Apparently, the financial crisis coincided with a form of segregation among funds which entailed more bipolar ownership structures.

Figure 2: Ownership distribution before and at the peak of the financial crisis

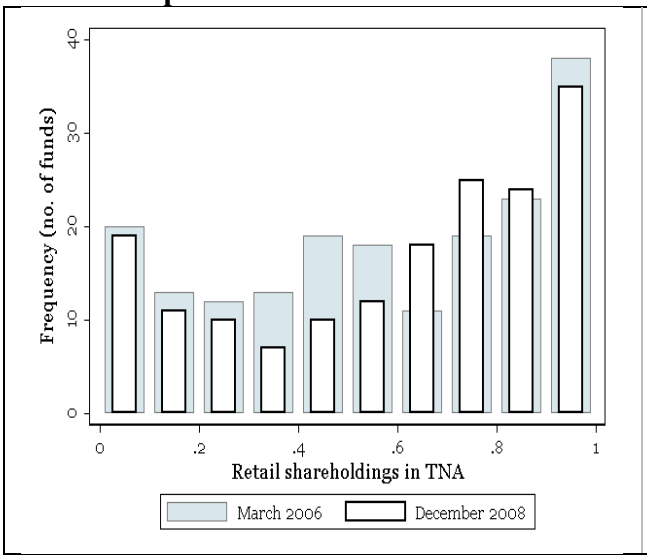
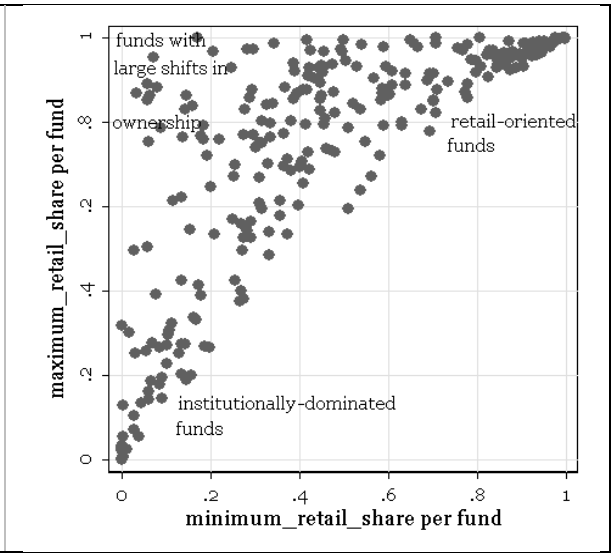


Figure 3: Minimum and maximum retail share between 2005 and 2010



Notes: The retail share denotes shareholdings of retail investors as a percentage of total shareholdings in a fund. Source: Deutsche Bundesbank (securities holdings statistics), the authors' calculations.

To illustrate the extent of shifts in ownership structures, Figure 3 depicts a scatter plot with the minimum and maximum retail share for each fund between December 2005 and December 2010. On this basis, two groups of funds can be distinguished: first, funds in which retail investors permanently hold the majority of fund shares ($D^R_i = 1$: minimum retail share larger than 50% at all dates under review), and second, funds with a temporary or permanent majority of institutional investors ($D^R_i = 0$). Figure 3 shows

that a number of funds were subject to large changes in shareholder base.[29] Regarding the prevention of outflows arising from strategic complementarities, this study finds that managers of funds where retail investors only temporarily hold the majority of shares do not pursue a cash management strategy which is as straightforward as that of funds which are permanently dominated by retail investors. Instead, their cash management resembles more that of permanently institutional-oriented funds.

To detect the presence of strategic complementarities – more precisely: the perception by fund managers of risks arising from strategic complementarities – we will estimate the impact of the retail orientation of a fund on its cash position. To this end, the inflow ratio is subjected to two types of ownership interaction. In a first setting, we focus on the cross-sectional dimension which is captured by the following classification:

$$(1)\quad D_i^R = \begin{cases} 1 & if\ \omega_{it} > 0.5 \quad \forall\ t \in [2005:12,\ 2006:01,\ ...,\ 2010:11,\ 2010:12] \\ 0 & otherwise \end{cases}$$

where ω_{it} denotes the retail shareholdings as a percentage of total shares of fund i at date t. $D^R{}_i$ denotes an interaction dummy which is equal to 1 if a fund is member in the ownership class where the majority of fund shares is permanently held by retail (non-institutional) investors, and 0 otherwise.[30] This classification enables us to explore disparities in the responsiveness of the cash position with a special focus on retail orientation: The empirical approaches applied here include interaction terms: With respect to cross-sectional disparities in the investor base, this interaction term will be represented by the product of $D^R{}_i$ and the variable of interest, for example, the inflow ratio, the outflow ratio, and log fund size. This permits us to estimate an incremental effect caused by funds with a permanent retail majority. In a second set of regressions, we introduce the retail share ω_{it} and its interaction with fund flows to explore the impact of a time-varying retail orientation on cash holdings.

[29] See Figure 3, upper left quarter. All points located on the 45° line (with intersection at the origin) represent funds with no change in ownership structures. Any deviation from this line reflects changes in ownership structures. Funds with a permanent majority of institutional investors are characterized by data points within the lower left quadrant (max. retail share < 0.5); funds with a permanent majority of retail investors are characterized by data points within the upper right quadrant (min. retail share > 0.5).

[30] Since mutual fund shareholdings are reported at a quarterly frequency, we interpolate it linearly to obtain monthly values. In doing so, we assume a smooth, gradual shift in the retail share variable.

4.2 Classification by portfolio liquidity

In line with the work of Chen et al. (2010), we segment our sample by portfolio liquidity. Thus we presume that a negative market impact of fire sales is more likely to be feared by fund shareholders when assets under management exhibit poor liquidity. When the liquidity status of a fund is bad, a shareholder who redeems his/her shares generates negative externalities, which consist in a deteriorating fund performance (through the market impact of fire sales) to the detriment of the remaining shareholders, but are not felt by the shareholder him-/herself. In this study, we test whether retail-oriented fund managers who manage assets with poor liquidity respond to this situation more intensely than others. This analysis is driven by the intuition that these fund managers have a greater incentive to build up cash buffers and hold precautionary liquidity at times of distress. We rely on monthly liquidity information on all equities under management, where data on equity positions are available from the Bundesbank investment fund statistics since September 2009. The liquidity ranking applied in this study relies on the value-weighted bid-ask spread $s_{i,t}^{portfolio}$ of the equity portfolio measured as follows:

$$(2)\quad s_{i,t}^{portfolio} = \frac{\sum_{j=1}^{J} \frac{ask_{j,t} - bid_{j,t}}{(ask_{j,t} + bid_{j,t})/2} \cdot q_{i,j,t} \cdot p_{j,t}}{\sum_{j=1}^{J} q_{i,j,t} \cdot p_{j,t}}$$

where $q_{i,j,t}$ is the number of shares held by fund i in equity j at the end of month t; $p_{j,t}$ is the close price of equity j at time t, $ask_{j,t}$ is the Bloomberg close ask price of equity j at that date, and $bid_{j,t}$ is the corresponding close bid price. J is the number of equities managed in the portfolios. The denominator of the spread, $(ask_{j,t}+bid_{j,t})/2$, corresponds to the mid price. To calculate this liquidity measure for each fund i, we use the complete information on the equity portfolio at the end of the selected months. The close bid-ask spreads available from Bloomberg are multiplied with the value $q_{i,j,t} \cdot p_{j,t}$ which the fund holds in each single equity. For all months under review, we match the end-of-month fund portfolio information of more than 4,000 single equities with the corresponding end-of-month bid-ask spreads provided by Bloomberg. The equity positions are used to derive weights for each stock, as represented by the factor $(q_{i,j,t} \cdot p_{j,t} / \sum \bullet)$ in equation (2).

On this basis, we introduce two different classifications to control for liquidity effects. In the first classification, we select all 'liquid' funds whose equity portfolios exhibit

value-weighted bid-ask spreads below the median in *each* month under review. These funds are opposed to 'illiquid' funds whose equity portfolios exhibit value-weighted bid-ask spreads above the median in *each* month under review. More formally, that is

$$(2.1)\quad fund_i \in \begin{cases} 'illiquid' & for\ s_{i,t}^{portfolio} > s_{[50\%]}^{portfolio}(t) \quad \forall\ t \in [2009:9,\ 2009:10,\ \ldots\ 2010:12] \\ 'liquid' & for\ s_{i,t}^{portfolio} < s_{[50\%]}^{portfolio}(t) \quad \forall\ t \in [2009:9,\ 2009:10,\ \ldots\ 2010:12] \end{cases}$$

where $s_{[50\%]}^{portfolio}(t)$ denotes the median at date t. According to this classification, all funds which stay permanently in the upper half (lower half) of the liquidity distribution remain. This permits a relatively clear distinction of structurally liquid funds from structurally illiquid ones.

In the second classification under review we split the panel of funds using their average portfolio bid-ask spread. This implies that unlike in the first classification, funds with large shifts in portfolio liquidity are taken into account as well:

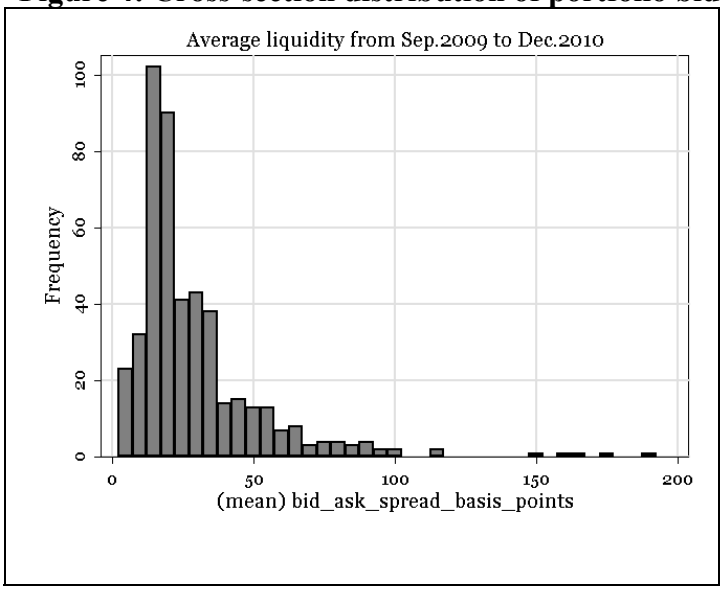
$$(2.2)\quad fund_i \in \begin{cases} 'illiquid' & for\ s_i^{avg} > s_{[60\%]}^{avg} \\ 'liquid' & for\ s_i^{avg} < s_{[40\%]}^{avg} \end{cases}$$

$$where\ s_i^{avg} = \frac{1}{T}\sum_{t=2009:9}^{2010:12} s_{i,t}^{portfolio}$$

where $s_{[40\%]}^{avg}$ and $s_{[60\%]}^{avg}$ denote the 40% and 60% sample percentiles of the *fund-specific average* of the value-weighted portfolio bid-ask spread over the entire period (September 2009 to December 2010) for which portfolio information is available. To increase the discriminatory power and selectiveness, funds which rank in this range are excluded from the second classification. This range corresponds to values of 19 to 26 basis points drawn from the empirical distribution $F(s_i^{avg})$ of the fund-specific average portfolio bid-ask spread s_i^{avg} (Figure 4). Given the restricted data availability on portfolio structures, our analysis relies on the assumption that the liquidity rank of a fund is a structural feature which is stable over time. This assumption implies that the grouping of a fund into 'liquid' versus 'illiquid' funds holds even during the 2007-09 financial crisis and before.[31]

[31] In the Bundesbank investment fund statistics, information on the portfolio composition of German equity funds is not available before 2009. December 2010 is the last month in our sample period, which aims at comprising the 2007-2009 financial crisis, the pre-crisis period and its aftermath. Note that shifts in liquidity do not challenge our liquidity segmentation as long as it impacts all funds to the same degree.

Figure 4: Cross-section distribution of portfolio bid-ask spreads



Notes: One data point in the histogram represents the mean spread of one fund. The frequency (vertical axis) denotes the number of funds in the respective bin. For each fund, the mean spread (horizontal axis) is the value-weighted average bid-ask spread of the equity portfolio over all end-of-month dates under review between September 2009 and December 2010. Sample coverage: German open-end equity funds excluding ETFs. The resulting histogram constitutes the basis for the liquidity classification according to equation (2.1). Source: Bundesbank investment fund statistics, Bloomberg, the authors' calculations.

Table 2: Net flow by cash ratio, breakdown by ownership and liquidity

Under review: 470 open-end equity funds (21,023 observations) according to the sample construction (Table 1).

	liquidity segment / **ownership class**	permanently illiquid funds	permanently liquid funds	other funds
	Funds where the majority of shares is permanently held by…			
Mean cash-to-assets ratio ($C_{i,t}$)	…retail investors	10.6%	4.3%	6.0%
	…institutional investors	8.5%	7.5%	6.4%
Mean net flow ratio conditional on $C_{i,t-1} \leq 4\%$	…retail investors	-0.4%	-1.1%	-0.7%
	…institutional investors	+0.1%	+0.3%	+0.4%
Mean net flow ratio conditional on $C_{i,t-1} > 4\%$	…retail investors	+0.7%	-0.4%	+0.1%
	…institutional investors	+1.0%	+0.5%	+1.0%

Notes: $C_{i,t}$ is defined as cash holdings relative to total net assets of a fund i at time t. Funds termed 'permanently liquid' ('illiquid') exhibit bid-ask spreads of their equity portfolio below (above) the median in all months from Sep.09 to Dec.10). The net flow ratio denotes the difference between a fund's monthly gross inflows less gross redemptions as a percentage of its past total net assets. Source: Deutsche Bundesbank, the authors' calculations.

4.3 Construction of an ownership-liquidity matrix

Bearing in mind the prediction by Chen et al. (2010) that numerous small (retail) shareholders are more likely to withdraw from a distressed fund than a large (institutional) shareholder, we distinguish funds which are permanently dominated by institutional shareholders from funds in which retail investors steadily hold the majority of fund shares. Based on the additional segmentation by its liquidity status – using the aforementioned value-weighted bid-ask spreads of equities in the fund portfolio – we are able to construct an ownership-liquidity matrix. According to the descriptive statistics reported in Table 2, retail-oriented funds exhibit a pronounced negative relationship between their portfolio liquidity and cash holdings. This is supportive to the role of cash holdings as a device for offsetting structural disadvantages in the equity portfolio regarding its degree of liquidity.

Table 3: Summary statistics of key variables

Under review: 470 open-end equity funds according to the sample construction (Table 1).

Period: 2005-2010 21,023 observations	Full sample				of which retail-oriented funds with permanently high liquidity **	of which retail-oriented funds with permanently low liquidity **
	10% percentile	Median	90% percentile	Mean	Mean	Mean
Cash holdings$_{i,t}$ as percentage of total net assets of fund i at time t	2.9	3.1	13.7	5.8	4.2	8.4
Net inflow$_{i,t-1,t}$*	-3.8	-0.4	2.3	-0.6	-0.8	0.2
Gross inflow$_{i,t-1,t}$*	0.1	0.7	5.4	2.0	0.9	2.7
Gross outflow$_{i,t-1,t}$*	0.1	1.5	6.0	2.6	1.8	2.5
Total net assets$_{i,t}$ (€m)	7	54	447	189	168	74
Excess fund return$_{i,t-1,t}$ (in %)	-6.5	0.8	5.8	0.2	0.1	0.5
Home bias of equity$_{i,t}$	0.0	14.1	95.1	26.9	11.5	50.0
Outflow volatility$_{i,t-6,t}$	0.001	0.011	0.057	0.023	0.009	0.017
Age$_{i,t}$ (years)	1.4	9.3	22.5	11.5	11.5	11.2
Load fee$_{i,t}$	0.0	5.0	5.0	4.0	4.1	4.3
Family size$_{i,t}$	13.5	16.0	17.4	15.7	15.9	15.5
Credit$_{i,t}$/TNA$_{i,t}$	0.1	0.2	2.5	1.0	0.6	0.9
Retail share$_{i,t}$	1.2	60.1	94.6	54.1	88.0	84.5

*) as a percentage of total net fund assets at the end of the previous month. **) Funds termed 'permanently liquid' ('permanently illiquid') exhibit bid-ask spreads of their equity portfolio below (above) the median in all months for which data on portfolio structures are available (September 2009 to December 2010). Net flows are defined as monthly gross inflows minus monthly gross outflows as a percentage of total net assets at the end of the previous month. The excess fund return is defined as its monthly mid price change less 1/12 of the three-month Euribor rate. The home bias of equity denotes the share of domestic stocks as a percentage of total equities. Credit denotes total debt of a fund. The load fee is the difference between issue and redemption price as a percentage of the redemption price. Age denotes the number of years since the launch of the fund. The retail share denotes retail shareholdings as a percentage of total shareholdings at the fund level. Source: Deutsche Bundesbank

Referring to the linkage of investor flows to past cash holdings, simple mean comparison tests suggest that net inflows to retail-oriented funds are higher (or less negative) in accordance with high previous cash holdings, where the sample is split into observed cash ratios below and above 4 percent.[32]

The summary statistics for the key variables under review in this paper are reported in Table 3, as well as a breakdown of retail-oriented funds by their liquidity status. The sample distribution points to a positively skewed distribution of cash holdings, inflows and outflows. The same applies to the fund size, since the average total net assets amounting to €189 million are substantially larger than the median ($54 million). Regarding the cash-to-assets ratio of retail-oriented funds, poorly liquid funds hold more cash on average (8.4%) than highly liquid funds (4.2%). A further distinctive feature within retail-oriented funds is the home bias of their equity portfolio, which is high for poorly liquid funds and low for highly liquid funds. Moreover, fund size is more than twice as high for highly liquid funds. In the sample period, however, highly liquid retail-oriented funds apparently had to meet net redemptions on average, while this was not the case for illiquid retail-oriented funds.

5 Empirical approach

In a linear dynamic panel data model, we regress the fund's cash holdings relative to its total net assets, C_{it}, on its past levels and a set of explanatory variables (X_{it}):

$$(3) \quad C_{it} = \alpha_1 C_{i,t-1} + \alpha_2 C_{i,t-2} + X_{it}'\beta + \mu_i + \varepsilon_{it}$$

where C_{it} comprises bank deposits and money market paper, and β is a parameter vector. The fixed-effects model permits a consistent estimation even in the presence of a correlation between the explanatory variables and the unobserved panel-level fixed effect μ_i which captures the individual, time-invariant heterogeneity for each variable. However, dynamic panel data models imply, by construction, inconsistent OLS estimators, because the demeaned lagged dependent variable correlates with the fixed effect μ_i and thus with the demeaned errors (Nickell bias). When the number of consecutive reports (T) becomes large, this bias in the fixed-effects model decreases, but not faster than 1/T. To address the Nickell bias, we rely on a within-group estimator with a minimum number of 30 consecutive reports for each fund.[33] We do so in

[32] Similar results are found for other threshold levels of the cash ratio.
[33] For robustness reasons, an instrumental variable estimator (system GMM) is presented in Annex B.

reference to simulation studies which recommend to use the fixed effect estimator in samples with at least 30 consecutive observations per panel unit.[34]

To contrast the response of retail-oriented funds with that of other funds, we introduce interaction terms for inflows and outflows:

$$(4)\quad C_{it} = \alpha_1 C_{i,t-1} + \alpha_2 C_{i,t-2} + \beta \cdot in_{it}^{gross} + \beta^R D_i^R \cdot in_{it}^{gross} + \gamma \cdot out_{it}^{gross} + \gamma^R D_i^R \cdot out_{it}^{gross}$$

$$+ \sum_{j=1}^{k} \xi_j Z_{j,i,t} + \mu_i + \varepsilon_{it} \quad where$$

$$in_{it}^{gross} \equiv GROSS\ INFLOW_{i,t-1,t} / TNA_{i,t-1}$$

$$out_{it}^{gross} \equiv GROSS\ OUTFLOW_{i,t-1,t} / TNA_{i,t-1}$$

The parameter ξ_j captures the effect of the control variable $Z_{j,i,t}$ which can be macroeconomic or fund-specific.[35] As stated in the previous section, D^R_i denotes an interaction dummy which is equal to 1 if the fund is member of the class of permanently retail-oriented funds. To eliminate serial correlation in the residuals, we include two lagged dependent variables, where α_1 and α_2 denote the corresponding coefficients.

To ensure asymptotics of the dynamic panel estimates in a fixed funds effects model, series with less than 30 consecutive monthly reports are dropped from the sample.[36] For robustness purposes, this restriction is abandoned in Annex B, where we present system GMM estimation results which take into account the aforementioned problems. Unlike within-group regressions, the GMM approach allows for the inclusion of the inflow variable and the outflow variable as predetermined variables to capture possible effects from lagged cash holdings on investor flows. In equation (4), the coefficients β and γ represent the corresponding responses of funds where the majority of shares is not permanently in the hands of retail investors. The coefficients β^R and γ^R represent the incremental ownership effects with respect to gross inflows and gross outflows. A positive interaction term for inflows ($\beta^R > 0$) indicates that managers of retail-oriented funds build up cash buffers more intensely than others, given that $\beta > 0$. Their response to inflows is then given by $\beta+\beta^R$. Conversely, a stronger reaction of retail-oriented funds to outflows would be indicated by $\gamma^R < 0$, provided that $\gamma < 0$.

[34] In doing so, we rely on Kiviet (1995) and Judson and Owen (1999), who claim that under this pre-condition, dynamic panels can be estimated using the fixed-effects estimator.
[35] See Annex A for an overview of the set of variables used as controls to explain cash holdings.
[36] The resulting within-group regressions are presented in Table 4.

However, the separate treatment of gross inflows and gross outflows may give rise to concerns regarding the logic which the fund manager follows. Accordingly, he/she may take his/her cash decisions based on *net* flows rather than on the basis of *gross* flows. In a corresponding regression, cash responses to inflows and outflows are forced to be of equal magnitudes, however. This would imply a symmetric use of cash buffers:[37] Net inflows let cash buffers grow, whereas cash buffers melt down to the same extent to meet net redemptions. However, the introduction of gross inflows and gross outflows in equation (4) captures potential asymmetries in cash responses. To check for this, we test the equality of inflow and outflow coefficients by the hypotheses $\beta+\beta^R-|\gamma+\gamma^R|=0$ and $\beta-|\gamma|=0$ for retail-oriented funds and other funds, respectively. Moreover, we use net flows to check for unequal responses to net inflows and net outflows:

$$(5)\quad C_{it} = \alpha_1 C_{i,t-1} + \alpha_2 C_{i,t-2} + \beta \cdot net_{it} + \beta^R D_i^R \cdot net_{it} + \lambda D_{it}^{out} \cdot net_{it} + \lambda^R D_{it}^{out} D_i^R \cdot net_{it} + \sum_{j=1}^{k} \xi_j Z_{j,i,t} + \mu_i + \varepsilon_{it} \quad where$$

$$net_{it} \equiv in_{it}^{gross} - out_{it}^{gross}$$

Equation (5) is similar to equation (4), but gross inflows are replaced with net inflows, and gross outflows are replaced with net inflows multiplied by the dummy D^{out}_{it}. This dummy is equal to 1 if the net inflow to fund i in month t is negative. In all other cases, D^{out}_{it} is zero.[38] This approach permits a direct inference on the presence of response asymmetries between net redemptions and net inflows. Once $\lambda+\lambda^R$ or the increment λ are significant, this points to an asymmetric response of retail-oriented funds and other funds, respectively.

6 Results

Based on the two liquidity classifications outlined in equations (2.1) and (2.2), the within-group regressions presented in Table 4 point to an economically and statistically significant incremental responses of retail-oriented funds' cash holdings to preceding gross inflows. In both liquidity classifications, the cash allocation of illiquid retail-oriented funds amounts between 45% and 48%, while liquid funds or funds with a stronger institutional linkage use less than 24% of inflows to build up cash buffers.

[37] Changes in cash buffers will affect the numerator of the cash ratio too. Disregarding changes in total net assets, the cash ratio will move in the same direction.
[38] See Gamkhar and Olson (2001) for an overview of models which test for asymmetric responses.

A similar result is obtained when the cash ratio is regressed on net flows according to equation (5): Table 5 reports similar magnitudes of estimated net inflow coefficients conditional on inflows exceeding outflows: While the cash allocation of illiquid retail-oriented funds amounts to 52% to 55%, managers of liquid funds or funds with a stronger institutional linkage use no more than 27% of their net inflows to raise their cash ratios. The estimation result on inflows is robust across estimation methodologies. Controling for the potential endogeneity of investor flows, GMM estimations for a larger sample of funds in the crisis period confirm a reaction coefficient of 32% for retail-oriented funds with limited asset liquidity, while corresponding institutional-oriented funds with poor asset liquidity as well as liquid retail-oriented funds exhibit insignificant inflow coefficients (Table B3). This holds irrespective of the liquidity measure used to classify the funds. This key finding confirms our hypothesis of a linkage of inflows to ownership and liquidity structures at times of distress: conditional on poor liquidity, managers of funds which are permanently dominated by retail shareholders raise their cash ratio more intensely in response to inflows than others. Referring to the arguments put forward by Chen et al. (2010), they build up cash buffers presumably to prevent shareholders taking into account the negative externalities of other shareholders' redemptions in the case of poor performance.[39]

Whereas our findings on cash provisions financed by inflows are highly significant and robust to variations in specifications, the contrary is true of the cash response to outflows. Unexpectedly at first sight, it remains insignificant for retail-oriented funds with poor asset liquidity, while liquid retail-oriented funds as well as funds with a stronger institutional linkage cushion their withdrawals using available cash buffers. This result is common to the regressions on gross flows (Table 4) and on net flows (Table 5). Referring to the latter and much in contrast to net inflows, net *withdrawals* from illiquid retail-oriented funds leave their cash ratio unaffected. The insignificant reaction of the cash ratio suggests that, if at all, cash reserves are reduced proportionally to total net assets. This asymmetry between responses to net inflows and net outflows is mirrored by the increment in Table 5: As far as retail-oriented funds with poor portfolio liquidity are concerned, the expression $\lambda+\lambda^R$ is significantly negative, reflecting the

[39] Chen, Goldstein and Jiang (2010) argue that unlike small retail investors, an institutional investor who holds a large share in an illiquid fund can hardly withdraw from it without being affected by the impact of his withdrawal. Thus, he internalizes the anticipated negative market impact caused by the withdrawal-driven fire sales. This internalization prompts institutional shareholders to stay invested even at bad times.

Table 4: Within-group estimation from 2005 to 2010 using gross flows

Dependent variable : $C_{i,t} \equiv$ Cash holdings$_{i,t}$/TNA$_{i,t}$

Estimation period: 2005:12-2010:12		*Using liquidity measure 1*				*Using liquidity measure 2*			
		(1) permanently liquid funds Portfolio bid-ask spread$_{it}$ < median$_t$ in all months t		**(2) permanently illiquid funds** Portfolio bid-ask spread$_{it}$ > median$_t$ in all months t		**(3) liquid funds** Average portfolio bid-ask spread$_i$ < 40%percentile (19 BP)		**(4) illiquid funds** Average portfolio bid-ask spread$_i$ > 60%percentile (26 BP)	
Clustered robust standard errors in parentheses.									
Explanatory variables	exp. sign	permanent retail majority	other funds[1]	permanent retail majority	other funds[1]	permanent retail majority	other funds[1]	permanent retail majority	other funds[1]
Gross inflow$_{i,t}$/TNA$_{i,t-1}$	+	$\beta+\beta^R$ 0.238**	β 0.172***	$\beta+\beta^R$ 0.478***	β 0.162***	$\beta+\beta^R$ 0.178***	β 0.191***	$\beta+\beta^R$ 0.446***	β 0.165***
		0.099	(0.062)	(0.057)	(0.053)	(0.039)	(0.049)	(0.071)	(0.044)
Gross outflow$_{it}$/TNA$_{i,t-1}$	−	$\gamma+\gamma^R$ -0.179***	γ -0.135***	$\gamma+\gamma^R$ -0.084	γ -0.169***	$\gamma+\gamma^R$ -0.233***	γ -0.075**	$\gamma+\gamma^R$ -0.018	γ -0.108***
		0.051	(0.047)	(0.138)	(0.033)	(0.084)	(0.029)	(0.105)	(0.030)
$C_{i,t-1}$	+	0.678***		0.582***		0.567***		0.607***	
		(0.059)		(0.097)		(0.057)		(0.079)	
$C_{i,t-2}$	+	0.009		0.180*		0.077*		0.135*	
		(0.054)		(0.093)		(0.043)		(0.073)	
Fund size$_{i,t} \equiv$log(TNA$_{i,t}$)	−	-0.006		-0.001		-0.005		0.001	
		(0.006)		(0.004)		(0.004)		(0.004)	
Payouts$_{i,t}$/TNA$_{i,t-1}$	−	0.631		-0.741**		0.222		-0.707***	
		(0.588)		(0.280)		(0.270)		(0.246)	
Age$_{i,t}$	±	-0.002		-0.035		-0.001		-0.013	
		(0.010)		(0.030)		(0.007)		(0.029)	
Credit$_{i,t}$/TNA$_{i,t}$	+	0.094		0.698***		0.149		0.337***	
		(0.143)		(0.098)		(0.090)		(0.114)	
Outflow volatility$_{i,t-5,t}$	+	-0.014		-0.080		-0.034		-0.083*	
		(0.081)		(0.056)		(0.050)		(0.043)	
3M Euribor$_t$	±	0.226**		-0.012		0.186***		-0.005	
		(0.096)		(0.108)		(0.059)		(0.129)	
Excess fund return$_{i,t-1}$	±	0.0018		0.0020		0.0004		-0.0005	
		(0.001)		(0.003)		(0.001)		(0.002)	
Return volatility$_{i,t-6,t-1}$	+	-0.035		-0.136*		-0.0007		0.011	
		(0.071)		(0.078)		(0.057)		(0.077)	
VDAX$_{t-1}$	+	0.0004*		0.0008***		0.0003**		0.0006***	
		(0.0002)		(0.0002)		(0.0001)		(0.0002)	
Load fee$_{i,t}$	±	0.458		-0.574		0.524*		-0.365	
		(0.305)		(0.482)		(0.279)		(0.349)	
Family Size$_t$	−	0.001		0.001		-0.0002		-0.003	
		(0.002)		(0.003)		(0.002)		(0.005)	
Constant	±	0.037		0.100		0.043		0.075	
		(0.079)		(0.141)		(0.055)		(0.155)	
No. of observations		1,280		1,008		2,477		1,673	
No. of funds		31		24		60		42	
R^2 (within-group)		0.557		0.581		0.473		0.553	
Equal responses to inflows and outflows? H_0:		$\beta+\beta^R-\lvert\gamma+\gamma^R\rvert$	$\beta-\lvert\gamma\rvert$	$\beta+\beta^R-\lvert\gamma+\gamma^R\rvert$	$\beta-\lvert\gamma\rvert$	$\beta+\beta^R-\lvert\gamma+\gamma^R\rvert$	$\beta-\lvert\gamma\rvert$	$\beta+\beta^R-\lvert\gamma+\gamma^R\rvert$	$\beta-\lvert\gamma\rvert$
inflow coeff. −|outflow coeff.|=0		0.054	0.037	0.394***	-0.007	-0.055	0.117**	0.428***	0.057
****) equality rejected at 1% level*		(0.091)	(0.053)	(0.106)	(0.059)	(0.083)	(0.083)	(0.081)	(0.042)
Interaction terms[2]:									
$\boldsymbol{D^R_i}$ **· inflow$_{i,t}$/TNA$_{i,t-1}$**	β^R	0.064		0.316***		-0.013		0.281***	
(increment to inflow response)		(0.118)		(0.075)		(0.060)		(0.081)	
$\boldsymbol{D^R_i}$ **· outflow$_{i,t}$/TNA$_{i,t-1}$**	γ^R	-0.047		0.085		-0.158*		0.091	
(increment to outflow response)		(0.065)		(0.137)		(0.092)		(0.109)	

Notes: Within-group estimation with fixed funds effects. D^R_i denotes an interaction dummy which is equal to 1 if the majority of fund shares is permanently held by retail (non-institutional) investors. Age denotes the natural logarithm of one plus age in years. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% level, respectively. Minimum length of time series per fund: 30 months (maximum: 51 months). [1]) Funds in which institutional investors hold a temporary or permanent majority of shares. [2]) Contribution of retail-oriented funds. Regression equation:

$$C_{it} = \alpha_1 \cdot C_{i,t-1} + \alpha_2 \cdot C_{i,t-2} + \beta \cdot in^{gross}_{it} + \beta^R \cdot D^R_i \cdot in^{gross}_{it} + \gamma \cdot out^{gross}_{it} + \gamma^R \cdot D^R_i \cdot out^{gross}_{it} + \sum_{j=1}^{k} \xi_j \cdot Z_{j,i,t} + \mu_i + \varepsilon_{it}$$

Table 5 Within-group estimation from 2005 to 2010 using net flows

Dependent variable: $C_{i,t} \equiv$ Cash holdings$_{i,t}$/TNA$_{i,t}$

Estimation period: 2005:12-2010:12		*Using liquidity measure 1*				*Using liquidity measure 2*			
		(1) permanently liquid funds Portfolio bid-ask spread$_{it}$ < median$_t$ in all months t		**(2) permanently illiquid funds** Portfolio bid-ask spread$_{it}$ > median$_t$ in all months t		**(3) liquid funds** Average portfolio bid-ask spread$_i$ < 40%percentile (19 BP)		**(4) illiquid funds** Average portfolio bid-ask spread$_i$ > 60%percentile (26 BP)	
Clustered robust standard errors in parentheses.									
Explanatory variables	exp. sign	permanent retail majority	other funds	permanent retail majority	other funds	permanent retail majority	other funds	permanent retail majority	other funds
(I) **Net inflow$_{i,t}$/TNA$_{i,t-1}$** conditional on net inflow$_{i,t}$ > 0	+	$\beta+\beta^R$ 0.240** 0.112	β 0.223*** (0.074)	$\beta+\beta^R$ 0.553*** (0.060)	β 0.211** (0.077)	$\beta+\beta^R$ 0.193*** (0.048)	β 0.267*** (0.075)	$\beta+\beta^R$ 0.517*** (0.070)	β 0.182*** (0.058)
(II) **Net inflow$_{it}$/TNA$_{it-1}$** conditional on net inflow$_{i,t}$ < 0	+	$\beta+\beta^R+\lambda+\lambda^R$ 0.193*** 0.051	$\beta+\lambda$ 0.107** (0.046)	$\beta+\beta^R+\lambda+\lambda^R$ 0.009 (0.149)	$\beta+\lambda$ 0.131*** (0.043)	$\beta+\beta^R+\lambda+\lambda^R$ 0.215** (0.088)	$\beta+\lambda$ 0.035 (0.027)	$\beta+\beta^R+\lambda+\lambda^R$ -0.037 (0.107)	$\beta+\lambda$ 0.100** (0.035)
Response differential between (I) and (II)	±	$\lambda+\lambda^R$ -0.046 0.118	λ -0.115* (0.064)	$\lambda+\lambda^R$ -0.544*** (0.154)	λ -0.080 (0.100)	$\lambda+\lambda^R$ 0.023 (0.104)	λ -0.231** (0.090)	$\lambda+\lambda^R$ -0.555*** (0.113)	λ -0.083 (0.071)
$C_{i,t-1}$	+	0.677*** (0.058)		0.581*** (0.097)		0.566*** (0.056)		0.607*** (0.079)	
$C_{i,t-2}$	+	0.011 (0.054)		0.180* (0.094)		0.083* (0.043)		0.134* (0.073)	
Fund size$_{i,t} \equiv$log(TNA$_{i,t}$)	–	-0.006 (0.006)		-0.002 (0.004)		-0.004 (0.004)		-0.0005 (0.004)	
Payouts$_{i,t}$/TNA$_{i,t-1}$	–	0.630 (0.585)		-0.711** (0.263)		0.213 (0.266)		-0.700*** (0.241)	
Age$_{i,t}$	±	-0.002 (0.010)		-0.038 (0.029)		-0.001 (0.007)		-0.015 (0.029)	
Credit$_{i,t}$/TNA$_{i,t}$	+	0.094 (0.147)		0.683*** (0.100)		0.149 (0.091)		0.341*** (0.115)	
Outflow volatility$_{i,t-5,t}$	+	-0.032 (0.078)		-0.120* (0.062)		-0.063 (0.047)		-0.094** (0.046)	
3M Euribor$_t$	±	0.227** (0.095)		-0.016 (0.110)		0.191*** (0.059)		-0.018 (0.131)	
Excess fund return$_{i,t-1}$	±	0.002 (0.001)		0.002 (0.002)		0.0004 (0.001)		-0.0005 (0.002)	
Return volatility$_{i,t-6,t-1}$	+	-0.038 (0.072)		-0.140* (0.078)		-0.002 (0.058)		0.008 (0.079)	
VDAX$_{t-1}$	+	0.0004* (0.0002)		0.0008*** (0.0002)		0.0003** (0.0001)		0.0006*** (0.0002)	
Load fee$_{i,t}$	±	0.459 (0.310)		-0.541 (0.491)		0.527* (0.286)		-0.349 (0.353)	
Family Size$_t$	–	0.001 (0.002)		0.001 (0.003)		-0.0002 (0.002)		-0.002 (0.005)	
Constant	±	0.039 (0.079)		0.120 (0.139)		0.031 (0.054)		0.081 (0.152)	
No. of observations		1,280		1,008		2,477		1,673	
No. of funds		31		24		60		42	
R^2 (within-group)		0.558		0.581		0.474		0.554	
Interaction terms[1]:									
$\boldsymbol{D^R_i}$ **·net inflow$_{i,t}$/TNA$_{i,t-1}$**	β^R	0.017		0.341***		-0.074		0.335***	
(increment to net inflow response)		(0.137)		(0.093)		(0.085)		(0.085)	
$\boldsymbol{D^R_i \cdot D^{out}_{it}}$ **·net inflow$_{i,t}$ /TNA$_{i,t-1}$**	λ^R	0.069 (0.139)		-0.464** (0.182)		0.254* (0.139)		-0.472*** (0.132)	
	$\beta^R+\lambda^R$	0.086		-0.123		0.180*		-0.136	
(increment to net outflow response)		(0.068)		(0.152)		(0.100)		(0.114)	

Notes: Within-group estimation with fixed funds effects. D^{out}_{it} is equal to 1 if net inflow$_{it}$/TNA$_{i,t-1}$ < 0 and equal to zero otherwise. D^R_i denotes an interaction dummy which is equal to 1 if the majority of fund shares is permanently held by retail investors. Age denotes the natural logarithm of one plus age in years. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% level. Minimum length of time series per fund: 30 months (max. 51 months). [1]) Contribution of retail-oriented funds. Regression equation:

$$C_{it} = \alpha_1 \cdot C_{i,t-1} + \alpha_2 \cdot C_{i,t-2} + \beta \cdot net_{it} + \beta^R \cdot D^R_i \cdot net_{it} + \lambda \cdot D^{out}_{it} \cdot net_{it} + \lambda^R \cdot D^R_i \cdot D^{out}_{it} \cdot net_{it} + \sum_{j=1}^{k} \xi_j \cdot Z_{j,i,t} + \mu_i + \varepsilon_{it}$$

response differential between the net inflow case and the net outflow case. Irrespective of the liquidity measure by which funds are classified, the same applies to Table 4: The expression $\beta+\beta^R-|\gamma+\gamma^R|$ is significantly different from zero, which suggests that the gross inflow coefficient of illiquid retail-oriented funds significantly exceeds the corresponding outflow coefficient. This result is surprising – all the more so since other fund categories do not show systematic asymmetries in these magnitudes. The risk characteristics of illiquid retail-oriented funds – for example, the threat of a costly portfolio rebalancing should fire sales materialize – calls for an intense use of cash buffers in the case of outflows. Given their advantage in avoiding sales in illiquid markets, why do retail-oriented funds shy away from using the buffer function of their cash positions? To explain this conundrum, it is helpful to call in mind the role of cash holdings in the redemption signal received by investors.[40] The fund manager might want to send the "right" signal when deciding on how to meet redemptions: a) generate additional cash through borrowing, b) generate additional cash through asset sales, and c) a reduction of cash buffers. With regard to the latter, fund managers' perceptions of investor attitudes during periods of distress may have prompted them to weigh the benefit of avoiding costly transactions against the cost of a "gloomy message" sent to the remaining shareholders: Indeed, selling illiquid assets might not have been the only "no go"; some managers apparently attempted to avoid running out of cash too. Though this is subject to further analysis, one explanation is that within the portfolio of equities, part of these managers' assets might still be marketable at reasonable prices to meet redemptions – no matter how illiquid the remainder of the portfolio is.

It appears that the shareholders' cash sensitivity outweighs their fear of fire-sales and induced losses – most likely because of the presence of the financial crisis in the sample. If fund managers expect their shareholders to worry about an outflow spiral triggered by a shortfall in cash, managers might prefer a sale – and a worsening of the liquidity structure of the remaining assets – over an excessive meltdown of their cash position. The tradeoff between absorbing net outflows using cash buffers and impairing the portfolio liquidity (while preserving high cash buffers) is most obvious for funds with poor asset liquidity. Using kernel density estimations, a graphical analysis (Figure 5a) suggests that their managers have to make a choice between tolerating a meltdown of their cash buffers and, alternatively, a worsened liquidity ranking position: The latter implies that to meet redemptions, selling some liquid part of their portfolio enables managers to preserve a strong cash position, which investors may perceive as a good signal in crisis periods. Against this background, the estimated subdued absorption of withdrawal shocks by illiquid retail-oriented funds may be traced back to the fund managers' fear of discouraging *future* inflows when cash reserves are insufficient: Despite the cost of asset sales (to restore cash buffers), fund managers may

[40] See Liu and Mello (2011).

consider it even more critical to maintain a low cash ratio which could suppress future inflows.[41]

Unlike others, fund managers of retail-oriented funds with poor asset liquidity exhibit, after all, a pronounced interest in raising the cash ratio using inflows, but no interest in melting it down to meet redemptions. Moreover, GMM estimations for poorly liquid funds indicate that, from mid-2008 to mid-2009, retail-oriented funds even raise their cash ratio (Table B1 contd.), whereas institutional-oriented funds use it as a buffer during the 2008-09 financial crisis. The strong response to inflows and sluggish response to outflows suggests that illiquid retail-oriented funds expedite their precautionary cash building activities at the expense of transaction costs or borrowing costs, presumably envisaging the prevention of future outflow shocks. Their intention could be the provision of sufficient absorption capacitities, thereby reassuring investors that they will not run out of cash even in bad scenarios.

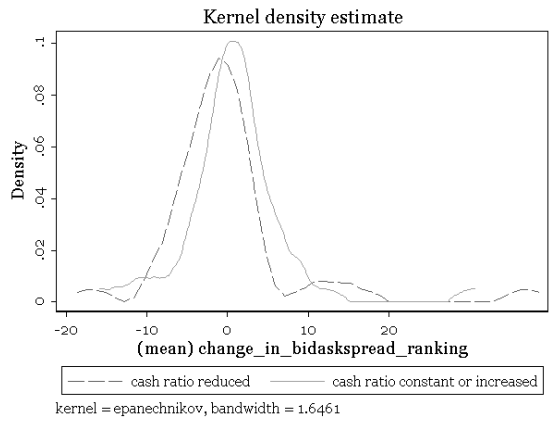
When the coefficients of the lagged dependent variables $C_{i,t-2}$ are compared across liquidity segments, funds with poor portfolio liquidity exhibit a higher persistence than liquid funds in Table 4 and Table 5. This suggests that, as expected, transaction costs tend to play a larger role for this group of funds. However, tests for autocorrelation in the GMM estimations carried out for the crisis period (Table B3) do not confirm the need for a second lag when endogeneity is controled for. Turning to the role of expected stock market volatility, there is a significantly positive cash response of the VDAX in all within-group estimations, reflecting that the implied volatility from DAX options plays a role. To this effect, the statistical and economic significance is highest for illiquid funds. While this suggests that an increased VDAX level prompts managers of funds with deficient asset liquidity, in particular, to raise their cash ratios, GMM estimations do not confirm the significance of this effect. Regarding the money market rate (three-month Euribor), there is a positive impact on the cash holdings of liquid funds in the within-group estimations, but not on those of less liquid ones. This suggests that either the return in money markets or credit risk premia play an important role for the cash management of liquid equity funds. Referring to the latter, growing tensions in interbank markets – as reflected by the rising spread between the Euribor and Eonia swap rates since August 2007 – are likely to have prompted fund managers to highten their precautionary cash holdings in the course of the crisis. Surprisingly, GMM estimations draw a different picture: The coefficient of the money market rate is significantly negative for liquid funds, perhaps reflecting the economic outlook. The alternating signs of the money market coefficient across estimations point to an ambiguous cash reaction to the money market rate.[42] More in line with the within-group estimations is the GMM estimate of the response of the cash ratio to the credit ratio: Its positive sign for poorly liquid funds suggests that these funds

[41] This argument would hold under the assumption that investors focus on the cash holdings of a fund rather than looking at its performance.
[42] Annex A describes explanatory factors that explain a negative vs. positive effect of the money market rate.

have a greater interest than others in borrowing, which can be interpreted as an alternative to selling assets at high discounts in the event of a shortfall in cash to meet redemptions.

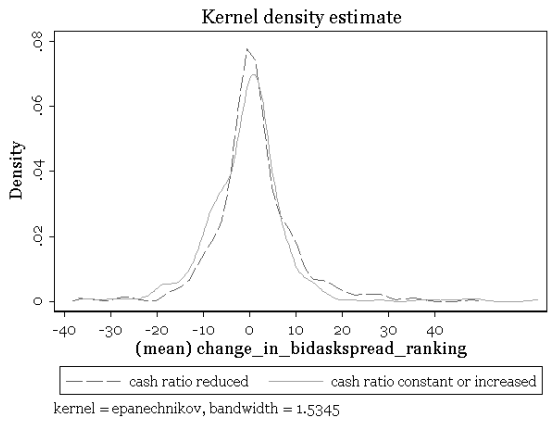
Figure 5: Change in the liquidity ranking position conditional on net redemptions…

5a: …of retail-oriented funds with poor portfolio liquidity



1,475 observations, net redemptions only.

5b: …of other funds



10,951 observations, net redemptions only.

Notes: The change in the bid-ask spread ranking denotes the change in the relative liquidity status of the equity portfolio of each fund (mean over the period September 2009 to December 2010), conditional on the presence of net redemptions and on the direction of change in the cash ratio. The relative liquidity status (ranking position) is defined as $F(s_i^{avg}) = r/n \;\; for \;\; s_{[r]}^{avg} \leq s_i^{avg} < s_{[r+1]}^{avg}$ where n is the number of funds in the sample, and r is the ranking number of the fund when s_i^{avg} is arranged in ascending order. A ranking position of r/n=0 corresponds to the most liquid fund (lowest bid-ask spread), and a ranking positon of r/n=1 corresponds to the least liquid fund (highest bid-ask spread). The scale of the horizontal axis (change in the ranking position) is in percentage points (PP). The density (vertical axis) denotes the estimated kernel density of the change in the ranking position. A move to the left corresponds to an improved liquidity rank. Referring to Figure 5a, the bid-ask-spread ranking position decreases, on average, by -0.1 PP conditional on a reduced cash ratio, but it increases by 0.9 PP in the opposite case. Referring to Figure 5b, the bid-ask-spread ranking position increases, on average, by 1.1 PP conditional on a reduced cash ratio, but decreases by -0.5 PP in the opposite case. Sample coverage: German open-end equity funds excluding ETFs. Liquidity measure: average value-weighted bid-ask spread within the equity portfolio at the fund level. Source: Deutsche Bundesbank, Bloomberg, the authors' calculations and estimations.

Over the entire period from 2005 to 2010, system GMM estimates with a moving 12-month-estimation window indicate time variations in the coefficients of interest. Table B1 and B2 present the estimation results for cash holdings on gross inflows and net inflows, respectively. Controling for the predetermination of the excess fund return and investor flows, both settings confirm that permanently retail-oriented funds with limited liquidity show a positive cash response to inflows in 2009 only. On the other hand, no such response is evident in the case of illiquid institutional-oriented funds or in the case of liquid retail-oriented funds around the peak of the crisis (2008-09). These unequal responses highlight the fact that, even when the GMM methodology is used, retail-oriented funds with a poor asset liquidity are particularly interested in raising their cash ratios. As far as the GMM estimations are concerned, the significance of these disparities is, however, limited to the years of the financial crisis 2008

and 2009. This is an indication that the linkage between ownership, liquidity, and cash provisions may not constant over time, but plays an important role in periods of distress.

As a side-result, the within-group regressions (Table 4 and Table 5) show that, conditional on the management of liquid equity portfolios, inflows entail a significant cash response by institutional-oriented funds. Within institutional-oriented funds, liquid ones obviously tended to allocate inflows to its cash positions more intensely than illiquid ones. With regard to cash management it is, nonetheless, unlikely that the institutional-oriented funds pursue the same objectives as retail-oriented funds: Here, it is more likely that institutional-oriented funds use informational advantages to force fund managers to reshift their focus to cash holdings, probably to avoid expected negative returns on equity. With respect to the period of the financial crisis, GMM estimations do not contradict these findings. However, the GMM-related evidence is weak for the category of liquid funds, since the corresponding Sargan test rejects the hypothesis of valid GMM instruments (Table B3).

7 Conclusion

Motivated by recent work on the nature of runs and the role of liquidity as a stabilizing factor, this paper explores the cash management conducted by German open-end equity funds for the period between 2005 and 2010. In addition to the explanatory factors discussed in earlier studies, we explicitly capture the impact related to ownership structures and asset liquidity when analysing the cash response to inflows and outflows. Our contribution to the literature is two-fold: First, our study on the cash management of equity funds adds to existing evidence highlighting the role of the investor base and portfolio liquidity conditions as determinants of mutual fund flows arising from strategic complementarities. Second, our analysis of the flow-ownership interaction complements – and corroborates – the findings of Chen et al. (2010) who claim that a rise in trading liquidity decreases US mutual funds cash holdings, and that a high level of institutional ownership is associated with smaller cash holdings. Conditional on the ownership-liquidity constellation, fund managers appear to be aware of the threat of self-fulfilling outflows and negative externalities.

We construct a unique data-set by augmenting the German equity funds' balance sheet statistics with information on their investor base and their portfolio liquidity. We distinguish funds whose shares are predominantly held by retail investors from funds with a stronger institutional orientation. On the presumption that fund portfolios' liquidity ranking positions are stable over time, our key finding is that fund managers consider ownership and liquidity information when making their cash decisions. More precisely, managers of retail-oriented funds tend to move towards higher cash-to-asset positions if the liquidity status of their portfolio is relatively poor. Cash-building intensities are found to be lower within more liquid funds as well as within poorly liquid funds with a stronger institutional linkage. The striking

effort undertaken by poorly liquid retail-oriented funds can be explained by their exposure to the risk of strategic investor behavior at times of distress.

The cash responsiveness to inflows is at the heart of the present analysis. Insofar as inflows are not eaten up by contemporary outflows, it is available for other purposes, including precautionary cash-building to meet or even avoid future outflows. Our regression results are conclusive with respect to gross inflows and with respect to net inflows: Within poorly liquid funds, the interaction dummy which captures the incremental response of permanently retail-oriented funds to the inflow ratio is highly significant. This strengthens the view that managers of these funds build up cash buffers in order to contain their exposure to outflow risks, while neither liquid retail-oriented funds nor illiquid funds with a stronger institutional linkage make such strong attempts. Apparently, the latter fund categories are less interested in pre-empting future withdrawals by means of cash adjustments.

Unlike the incremental cash response to inflows, retail-oriented funds do not exhibit a symmetric response to outflows: If at all, cash buffers recede proportionally to total net assets. Funds with poorly liquid portfolios are found to attach little importance to the absorption of current outflow shocks, but much importance to the provisioning for future shocks. This holds for gross outflows, but likewise for net redemptions. The sluggish responsiveness is surprising at first sight, because illiquid funds with a permanent retail majority risk being highly exposed to the risk of strategic redemptions. The reluctance of managers could, however, be explained by the strategic importance of cash holdings: This constitutes a signal to investors that the fund is able to meet potential redemptions. If fund managers expect their shareholders to worry about an outflow spiral triggered by shortfall in cash, managers might prefer a sale of some liquid part of their portfolio over an excessive meltdown of their cash position. The pronounced cash-building intensity of retail-oriented funds with poor asset liquidity suggests that they attempt to avoid any herding behavior on the part of their investors. The higher responsiveness of illiquid retail-oriented funds to inflows points to self-stabilization attempts when a heightened exposure to withdrawal risks is present: Since the equity portfolio having a poor liquidity status could discourage retail investors, its managers move towards higher cash ratios in an attempt to stabilize their funding situation in order to pre-empt outflows. The combination of a high retail orientation and a poor liquidity status of the fund portfolio appears to be a prerequisite for extraordinary precautionary cash-building activities, which we interpret as a greater interest on the part of its managers in preventing a harmful spiral of outflows.

Conversely, managers of institutional-oriented funds seem to worry less about the role of cash for a stable funding base at times of stress: Even when their portfolios consist of poorly liquid equities, large institutional investments are perceived as a stable source of finance. The reason mentioned in the literature is that shareholders are more likely to internalize the unfavourable effects of potential fire sales. Against this backdrop, cash provisions are not a strategic

requirement for this fund category, while avoiding negative asset returns may have become a strong motive in crisis periods. This could explain the fact that, apart from *illiquid retail*-oriented funds, the cash ratio of *liquid institutional*-oriented funds is highly responsive to inflows across specifications (net flows vs. gross flows) and across estimation methods.

Taking the GMM estimation results into account, there is evidence that the cash management of permanently retail-oriented funds differs across liquidity segments around the peak of the financial crisis. Accordingly, the stress level in the market appears to be a critical factor for equity funds. Conditional on strong retail ownership and low portfolio liquidity, our findings support the view that fund managers use cash so as to mitigate their exposure to shocks on funding liquidity. This strengthens the view that cash holdings can contain ownership-related financial fragility by pre-empting a herding-induced outflow cascade. Therefore, we conclude that the behavior of managers of open-end equity funds contributes to their stabilization, thereby supporting the self-stabilization of the financial system.

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ANNEX A: Control variables

Annex A describes the set of control variables used as additional regressors in the estimations according to equations (4) and (5). In these equations, the set of k control variables is represented by the term $\sum_{j=1}^{k} \xi_j Z_{j,i,t}$.

1. Money market rate and excess fund return

We derive the fund return as the relative change of the mid price of a mutual fund share. To derive the monthly excess return of a fund ($ER_{i,t-1,t}$), we deduct one-twelfth of the contemporaneous three-month Euribor rate p.a. from this return measure:

$$ER_{i,t-1,t} = \frac{midprice_{i,t}}{midprice_{i,t-1}} - 1 - Euribor^{p.a.}_{i,t-1,t} / 12$$

$$where \quad midprice_{i,t} = \frac{redemption\ \ price_{i,t} + sale\ \ price_{i,t}}{2}$$

In addition, we consider the three-month Euribor rate itself separately. The reason for this is that the cash position, which consists of cash holdings, bank deposits and money market paper, is likely to earn a rate similar to that in the money market. While, at normal times, this suggests a positive effect on the fund's cash position, in times of crisis a rise in money market rates could reflect higher credit risk premia. Finally, an increasing money market rate could suggest better economic perspectives, too, which would imply a negative sign. Reduced cash holdings driven by a rising money market rate could reflect increased profit expectations and reduced corporate default rates. It could prompt fund managers to anticipate a pick-up in asset prices and shift part of their cash reserves into alternative uses. The expected sign is therefore ambiguous.

2. Measures of uncertainty

Next, three measures of uncertainty are introduced to capture moves in cash holdings which are driven by precautionary motives. They comprise the VDAX index – a measure of expected stock market volatility derived from option prices –, a backward-looking indicator of outflow volatility, and a backward-looking indicator of return volatility. To capture the fund managers interest in smoothed returns, which may result from limited possibilities of

diversifying their portfolio, we introduce the volatility on the excess return which is six months backward-looking:

$$\sigma^{return}_{i,t-6,t} \equiv \sqrt{\frac{1}{6}\sum_{\tau=1}^{6}\left(\left[R^{pf}_{i,t-\tau,t-\tau+1} - Euribor_{t-\tau}/12\right] - \frac{1}{6}\sum_{\tau=1}^{6}\left[R^{pf}_{i,t-\tau,t-\tau+1} - Euribor_{t-\tau}/12\right]\right)^2}$$

Second, we introduce the VDAX as a macroeconomic indicator which reflects expected volatility in stock markets. Cao, Chang and Wang (2008) as well as Huang (2009) have identified volatility in financial markets as a driver of mutual fund cash holdings: Given that fund managers expect a volatile market environment to be followed by high redemptions, a precautionary behavior implies a positive dependence of cash holdings on expected volatility.[43] In the present study, we include VDAX values with a lag of one month to avoid effects on fund valuations and, thus, on the denominator of the cash ratio.

Third, several empirical studies on US mutual funds stress the impact of volatile flows on cash holdings. Chordia (1996) as well as Yan (2007) show that the more volatile the flows, the more cash is held by the fund. The fund manager's rationale is that an effective cash management reduces the cost of volatile flows. For example, Coval and Stafford (2007) find that cash holdings absorb part of the outflow shocks, though large shocks entail trades in asset markets and may create pressure on stock prices. Accordingly, the fund's cash position contributes to greater stability, because it mitigates a decoupling of equity prices from its fundamental drivers. In the present empirical setting, we introduce a rolling window of outflow volatility at the fund level which is six months backward-looking:

$$\sigma^{out}_{i,t-6,t} \equiv \sqrt{\frac{1}{6}\sum_{\tau=1}^{6}\left(OUTFLOW_{i,t-\tau,t-\tau+1} - \frac{1}{6}\sum_{\tau=1}^{6} OUTFLOW_{i,t-\tau,t-\tau+1}\right)^2}$$

3. Age, fund family size, load fee, and leverage

Finally, we introduce four fund-specific explanatory factors which capture the age and family size of a fund, its load fee, its leverage position.

The age of a fund – measured by the logarithm of one plus the number of years since its launch – is included, because investors might consider older funds as more experienced. Such an assessment would imply a high degree of confidence even when cash ratios are low. On

[43] However, holding cash is not the only way to reduce risks when expected volatility is rising: Other ways are volatility timing or reducing the portfolio beta – which denotes its correlation with a benchmark. This is described by Busse (1999) in a study on US equity funds.

the other hand, older funds might be more interested in stable flows for reputational reasons, which suggests larger cash holdings. Thus, the expected sign is ambiguous too.

The size of the fund family can affect cash holdings too. We define it as the number of open-end equity funds belonging to one investment company. Engen and Lehnert (2000) emphasize that funds facing unexpectedly high outflows will have a limited ability to lend to each other within a small asset management company.[44] This suggests that, for small funds and funds in small fund families, the precautionary motive for holding cash is more important, which should be reflected in higher cash holdings. On the other hand, there is an argument against this inverse relationship, since the risk of high outflows may be higher for funds within a large family. Jank and Wedow (2010), for example, provide evidence that existing investors in large families punish poor performance more severely than investors in small families.

The level of the load fee can influence future fund flows, thereby indirectly affecting cash holdings. The effect is not clear, however. On the one hand, Chordia (1996) and Nanada et al. (2000) stress that a fund with a high load fee is less likely to be redeemed and that the manager's expectation of lower withdrawals induced him/her to hold less cash. On the other hand, Fecht and Wedow (2009) suggest that funds with a high load fee are held mainly by retail investors, who are more driven by expectations of the withdrawing decisions of other investors and thus are more likely to make large withdrawals in times of crisis. Barber et al. (2005) also stress that a high load fee requires funds to hold more cash, as it dampens future inflows.

Lastly, when cash holdings or inflows are insufficient to finance unexpectedly high outflows, asset sales are not the only option. Borrowing is an option too. However, the regulator imposes a limit on mutual funds' borrowing. More precisely, investment funds are allowed to take out short-term credit only up to 10% of total net assets. Against this background, previous empirical work emphasizes that a high liabilities-to-assets ratio implies less scope for additional loans.[45] Therefore future withdrawals from funds which are already leveraged will increasingly have to be absorbed through cash holdings. This suggests that the level of the credit ratio has a positive effect on the cash position. However, the character of cash as a substitute for credit is only valid in a cross-section view. In a time-series perspective, a positive sign may also suggest that an increase in cash holdings is contemporaneously financed via a rise in borrowing.

[44] These authors rely on the following intuition: When a fund experiences unexpectedly high outflows, it relies less heavily on its own cash position when it belongs to a large investment company where funds have scope to lend to each other. By contrast, the ability to do so is limited for funds within a small company. This suggests that large fund families can better diversify outflow risks than small families.

[45] See Coval and Stafford (2007).

ANNEX B: Robustness analysis using GMM

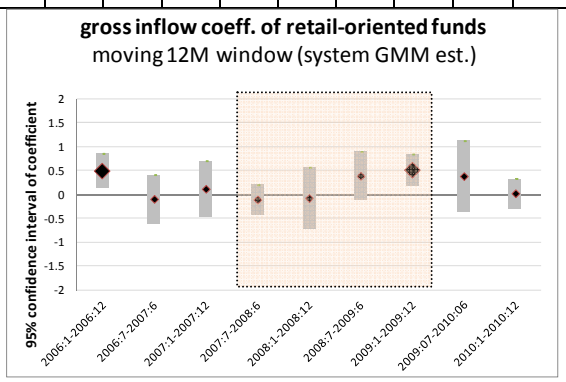
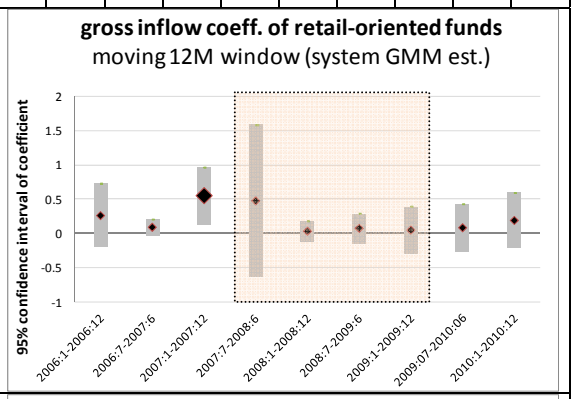
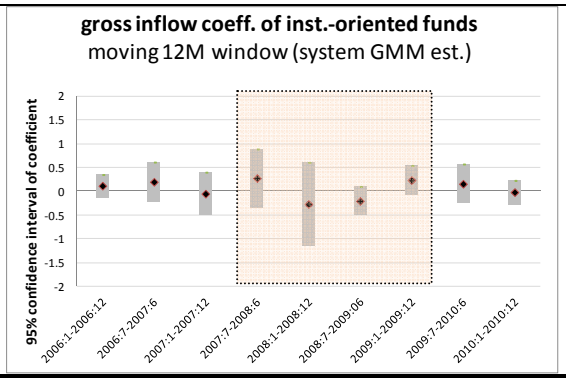
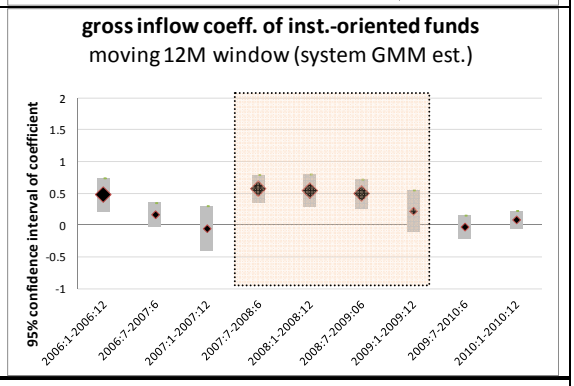
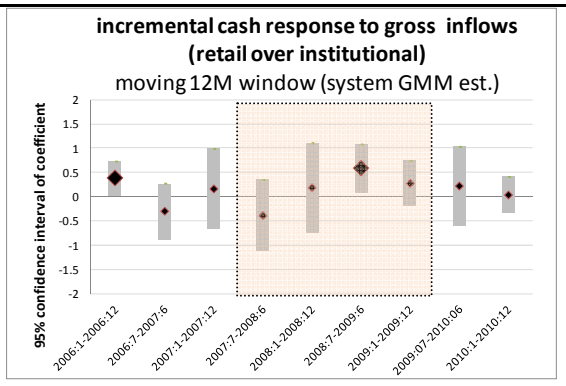
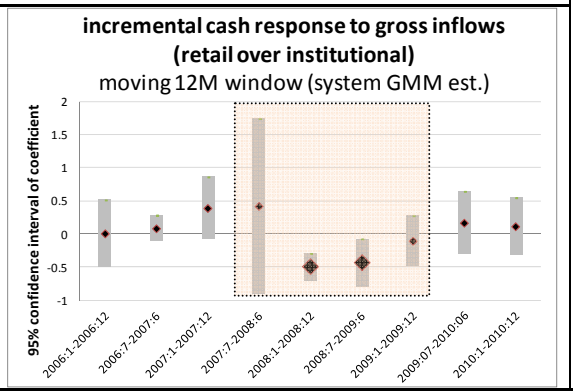
Annex B summarizes the results of GMM estimations which are carried out as a robustness check for the within-group estimation results reported in Table 4 and Table 5. The use of the GMM methodology permits an instrumentation in the presence of endogenous regressors. Though we exclude contemporaneous correlation of other regressors, the lagged dependent variable implies endogeneity, by construction, due to the correlation of its demeaned series with the fixed effect and thus with the demeaned errors. The GMM methodology controls for the Nickell bias. Moreover, it controls for the dependence of inflows and outflows on past cash holdings of the fund. In addition, the excess fund return is treated as a predetermined variable. Regarding the estimation horizon, we choose a moving 12-month estimation window. This allows us to identify time-varying coefficients which played a special role in the course of the financial crisis in the years 2008 to 2009.

The system estimator proposed for dynamic panels by Arellano and Bover (1995) and Blundell and Bond (1998) combines the moment conditions generated from the equation in levels (instruments in first differences) with the moment conditions generated by the equation in first differences (instruments in levels). We introduce the following instrumentation for the equation in levels and in first differences, respectively: six lags for the dependent variable, and four lags for the predetermined variables.

Moreover, the sample used for our GMM estimations differs in several ways from the sample used for the within-group estimations: First, fund-specific series shorter than 30 consecutive reports are included. Second, permanently retail-oriented funds are contrasted with permanently institutional-oriented funds: As a sub-sample of the category “other funds”, the latter group comprises all funds where the majority of shares is held by institutional investors at all points in time. By the same token, funds with large shifts in ownership structures are excluded from the analysis, conditional on changing majorities between retail investors and institutional shareholders. As regards the breakdown by liquidity, liquidity classification according to equation (2.1) is used. Here, the value-weighted end-of-month bid-ask spreads of liquid funds’ equities are required not to exceed the median in all months under review, while ‘illiquid’ funds with equities whose value-weighted end-of-month bid-ask spreads are above the median in all months under review.

Table B1 System GMM estimation with ownership interaction of gross flows

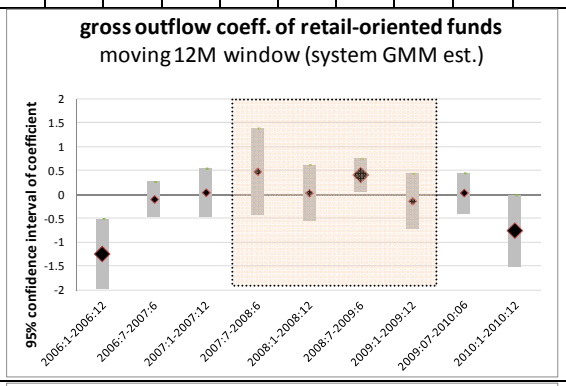
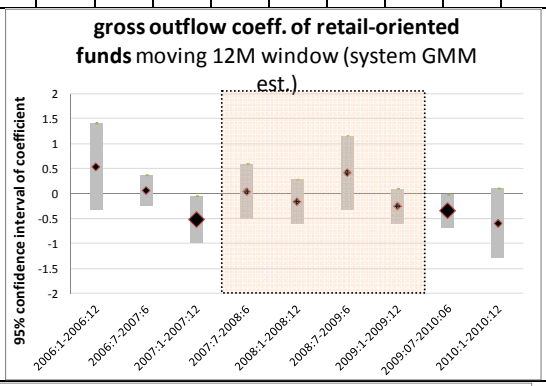
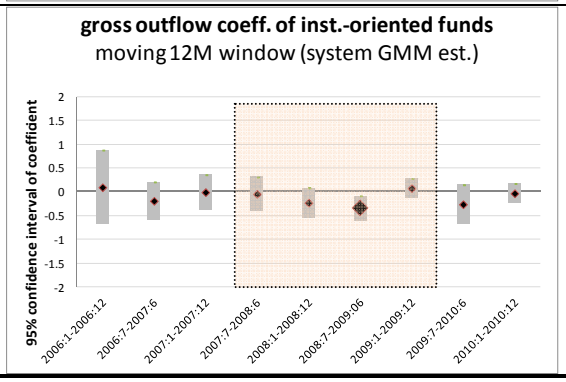
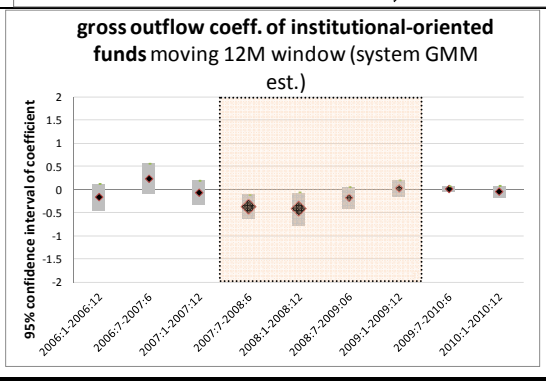
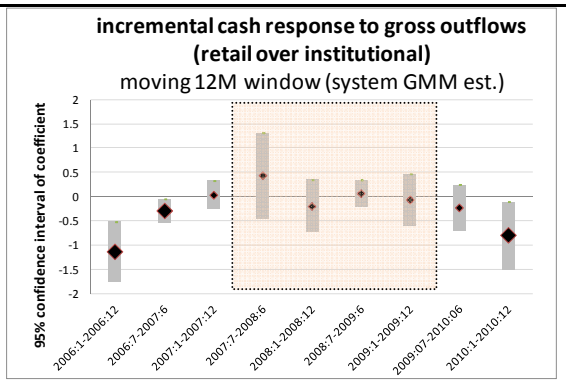
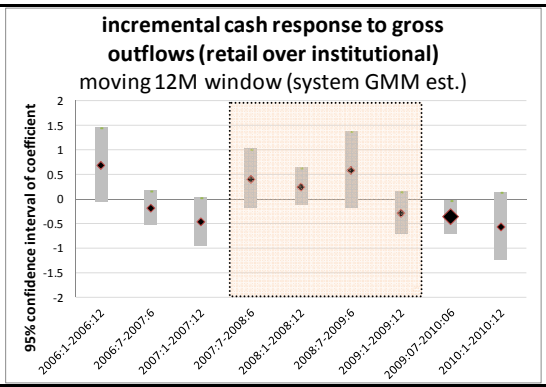
Dependent variable: $C_{i,t} \equiv$ cash holdings$_{i,t}$/TNA$_{i,t}$. Fund classification into liquidity segments according to equation (2.1)

	Permanently illiquid funds*									**Permanently liquid funds***								
Estimation period	2006:01-2006:12	2006:07-2007:06	2007:01-2007:12	2007:07-2008:06	2008:01-2008:12	2008:07-2009:06	2009:01-2009:12	2009:07-2010:06	2010:01-2010:12		2006:01-2006:12	2006:07-2007:06	2007:01-2007:12	2007:07-2008:06	2008:01-2008:12	2008:07-2009:06	2009:01-2009:12	2009:07-2010:06	2010:01-2010:12
No. of funds	33	37	45	47	51	52	40	46	50		35	38	39	39	37	38	39	43	43
No. of observations	183	359	412	449	371	234	220	325	377		202	386	396	377	345	307	288	304	326
Sargan p-value	0.10	0.29	0.29	0.89	0.02	0.29	0.87	1.00	0.64		0.00	0.94	0.85	0.03	0.82	0.00	0.27	1.00	0.27
Retail-oriented funds																		
Institutional-oriented funds																		
Incremental response of retail-oriented funds to gross inflows																			
Coefficient of interaction																		

*) Funds termed 'permanently illiquid' ('permanently liquid') exhibit bid-ask spreads of their equity portfolio above (below) the median in all months for which data on portfolio structures are available (September 2009-December 2010). Notes: The system GMM estimator is a combined dynamic panel estimator as proposed by Arellano and Bover (1995) and Blundell and Bond (1998). It combines the moment conditions generated by the first difference equation with those from the level equation. The Sargan test statistic is a test of over-identifying restrictions proposed by Sargan (1958). It tests the validity of the instruments on the right-hand side. 80 instruments are used. The lagged dependent variable is instrumented with 6 lags, and the predetermined variables (inflow ratio, outflow ratio, lagged fund return) are instrumented with 4 lags in both the level equation and the first difference equation. Fund-specific controls are its log size, its payout ratio, the leverage ratio, the load fee, its age, the outflow volatility, the lagged fund return and its volatility. Macroeconomic controls are the three-month Euribor rate and the VDAX volatility index.

Table B1 (continued)

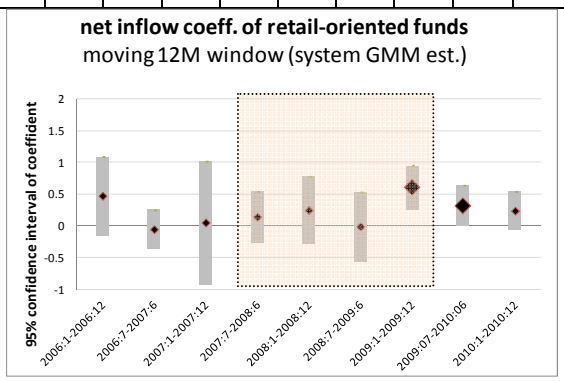
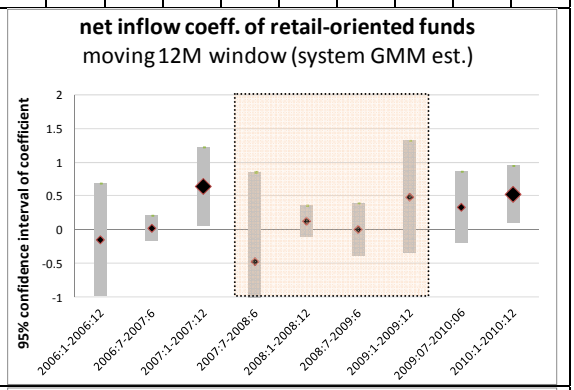
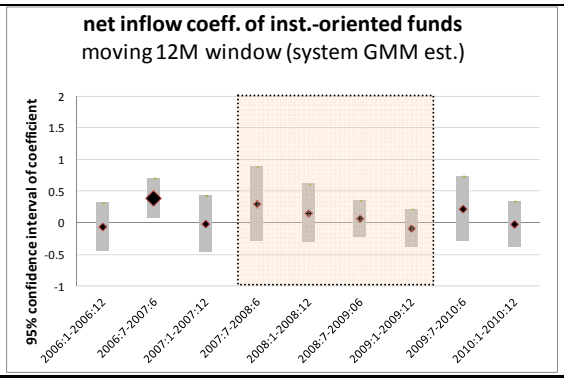
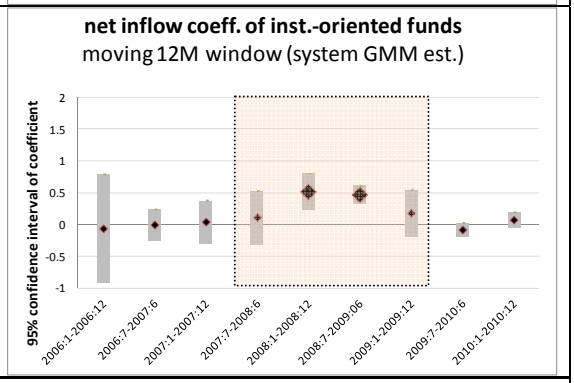
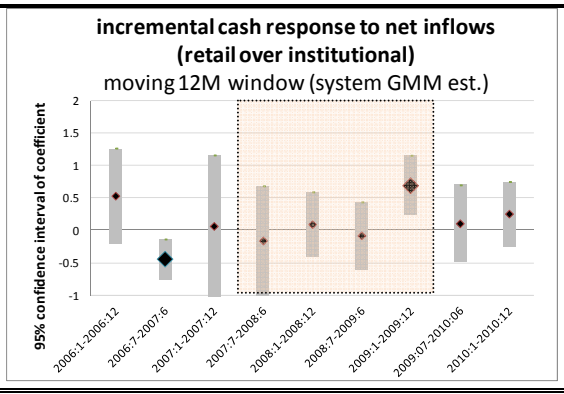
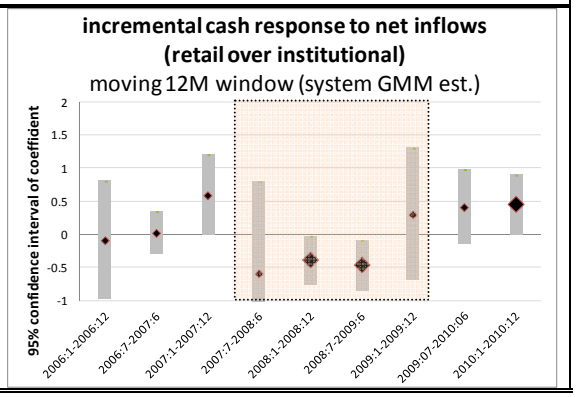
Dependent variable: $C_{i,t} \equiv$ cash holdings$_{i,t}$/TNA$_{i,t}$. Fund classification into liquidity segments according to equation (2.1)

	Permanently illiquid funds*									**Permanently liquid funds***								
Estimation period	2006:01-2006:12	2006:07-2007:06	2007:01-2007:12	2007:07-2008:06	2008:01-2008:12	2008:07-2009:06	2009:01-2009:12	2009:07-2010:06	2010:01-2010:12	2006:01-2006:12	2006:07-2007:06	2007:01-2007:12	2007:07-2008:06	2008:01-2008:12	2008:07-2009:06	2009:01-2009:12	2009:07-2010:06	2010:01-2010:12
No. of funds	33	37	45	47	51	52	40	46	50	35	38	39	39	37	38	39	43	43
No. of observations	183	359	412	449	371	234	220	325	377	202	386	396	377	345	307	288	304	326
Sargan p-value	0.10	0.29	0.29	0.89	0.02	0.29	0.87	1.00	0.64	0.00	0.94	0.85	0.03	0.82	0.00	0.27	1.00	0.27
Retail-oriented funds																		
Institutional-oriented funds																		
Incremental response of retail-oriented funds to gross outflows																		
Coefficient of interaction																		

*) Funds termed 'permanently illiquid' ('permanently liquid') exhibit bid-ask spreads of their equity portfolio above (below) the median in all months for which data on portfolio structures are available (September 2009-December 2010). Notes: The system GMM estimator is a combined dynamic panel estimator as proposed by Arellano and Bover (1995) and Blundell and Bond (1998). It combines the moment conditions generated by the first difference equation with those from the level equation. The Sargan test statistic is a test of over-identifying restrictions proposed by Sargan (1958). It tests the validity of the instruments on the right-hand side. 80 instruments are used. The lagged dependent variable is instrumented with 6 lags, and the predetermined variables (inflow ratio, outflow ratio, lagged fund return) are instrumented with 4 lags in both the level equation and the first difference equation. Fund-specific controls are its log size, its payout ratio, the leverage ratio, the load fee, its age, the outflow volatility, the lagged fund return and its volatility. Macroeconomic controls are the three-month Euribor rate and the VDAX volatility index.

Table B2 System GMM estimation with ownership interaction of net flows

Dependent variable: $C_{i,t} \equiv$ cash holdings$_{i,t}$/TNA$_{i,t}$. Fund classification into liquidity segments according to equation (2.1)

	Permanently illiquid funds*									Permanently liquid funds*								
Estimation period	2006:01-2006:12	2006:07-2007:06	2007:01-2007:12	2007:07-2008:06	2008:01-2008:12	2008:07-2009:06	2009:01-2009:12	2009:07-2010:06	2010:01-2010:12	2006:01-2006:12	2006:07-2007:06	2007:01-2007:12	2007:07-2008:06	2008:01-2008:12	2008:07-2009:06	2009:01-2009:12	2009:07-2010:06	2010:01-2010:12
No. of funds	33	37	45	47	51	52	40	46	50	35	38	39	39	37	38	39	43	43
No. of observations	183	359	412	449	371	234	220	325	377	202	386	396	377	345	307	288	304	326
Sargan p-value	0.15	0.64	0.95	0.79	0.01	0.06	0.96	0.99	0.95	0.95	0.92	0.63	0.13	0.23	0.00	0.04	1.00	0.49
Retail-oriented funds																		
Institutional-oriented funds																		
Incremental response of retail-oriented funds to net inflows																		
Coefficient of interaction																		

*) Funds termed 'permanently illiquid' ('permanently liquid') exhibit bid-ask spreads of their equity portfolio above (below) the median in *all* months for which data on portfolio structures are available (September 2009-December 2010). Notes: The system GMM estimator is a combined dynamic panel estimator as proposed by Arellano and Bover (1995) and Blundell and Bond (1998). It combines the moment conditions generated by the first difference equation with those from the level equation. The Sargan test statistic is a test of over-identifying restrictions proposed by Sargan (1958). It tests the validity of the instruments on the right-hand side. 50 instruments are used. The lagged dependent variable is instrumented with 6 lags, and the predetermined variables (net inflow ratio, lagged fund return) are instrumented with 4 lags in both the level equation and the first difference equation. Fund-specific controls are its log size, its payout ratio, leverage ratio, load fee, its age, its outflow volatility, the lagged fund return and its volatility. Macroeconomic controls are the three- month Euribor rate and the VDAX volatility index.

Table B3 System GMM estimation with ownership interaction in the crisis period

Dependent variable: $C_{i,t} \equiv$ cash holdings$_{i,t}$/TNA$_{i,t}$
Fund classification into liquidity segments according to equation (2.1)

Estimation period: 2008:07-2009:12		*Using gross flows*				*Using net flows*			
		Permanently liquid funds		**Permanently illiquid funds**		**Permanently liquid funds**		**Permanently illiquid funds**	
Robust standard errors in parentheses.		Portfolio bid-ask spread$_{it}$ < median$_t$ in all months t		Portfolio bid-ask spread$_{it}$ > median$_t$ in all months t		Portfolio bid-ask spread$_{it}$ < median$_t$ in all months t		Portfolio bid-ask spread$_{it}$ > median$_t$ in all months t	
Explanatory variables	exp. sign	permanent retail majority	permanent institutional majority	permanent retail majority	permanent institutional majority	permanent retail majority	permanent institutional majority	permanent retail majority	permanent institutional majority
Gross inflow$_{i,t}$/TNA$_{i,t-1}$	+	0.005	0.271***	0.325***	0.092				
		(0.056)	(0.062)	(0.066)	(0.127)				
Gross outflow$_{i,t}$/TNA$_{i,t-1}$	−	-0.187*	-0.080*	0.059	-0.118				
		(0.102)	(0.048)	(0.191)	(0.078)				
Net inflow$_{i,t}$/TNA$_{i,t-1}$	+					0.132	0.351***	0.320***	0.043
						(0.099)	(0.105)	(0.098)	(0.077)
$C_{i,t-1}$	−	0.930***		0.729***		0.916***		0.790***	
		(0.051)		(0.077)		(0.106)		(0.102)	
Fund size$_{i,t} \equiv$log(TNA$_{i,t}$)	−	0.010		0.006		0.010		-0.002	
		(0.010)		(0.005)		(0.018)		(0.008)	
Payouts$_{i,t}$/TNA$_{i,t-1}$	−	-0.511		1.091		-1.673		1.206	
		(0.538)		(1.127)		(1.320)		(0.755)	
Age$_{i,t}$	±	-0.045**		-0.003		-0.051*		0.012	
		(0.018)		(0.007)		(0.030)		(0.012)	
Credit$_{i,t}$/TNA$_{i,t}$	+	-0.405		0.777*		0.066		0.721*	
		(0.246)		(0.416)		(0.565)		(0.411)	
Outflow volatility$_{i,t-5,t}$	+	0.085		0.104		-0.044		0.138	
		(0.078)		(0.204)		(0.157)		(0.212)	
3M Euribor$_t$	±	-0.080**		0.004		-0.146***		0.043	
		(0.032)		(0.047)		(0.055)		(0.064)	
Excess fund return$_{i,t-1}$	±	0.065		-0.093		0.109		-0.020	
		(0.054)		(0.143)		(0.076)		(0.158)	
Return volatility$_{i,t-6,t-1}$	+	-0.492**		-0.425		-0.755		-0.095	
		(0.242)		(0.350)		(0.501)		(0.365)	
VDAX$_{t-1}$	+	0.0015*		0.001		0.001		0.001	
		(0.0008)		(0.001)		(0.001)		(0.001)	
Load fee$_{i,t}$	±	0.293		0.277		-0.002		0.458	
		(0.564)		(0.266)		(0.874)		(0.370)	
Family Size$_{i,t}$	−	-0.006		-0.013		-0.008		-0.007	
		(0.005)		(0.008)		(0.012)		(0.009)	
Constant	±	0.073		0.012		0.165		0.045	
		(0.076)		(0.092)		(0.114)		(0.131)	
No. of observations		460		364		460		364	
No. of funds		39		53		39		53	
Average length of series		11.8 months		6.9 months		11.8 months		6.9 months	
Sargan test, p-value		0.000		0.5733		0.000		0.472	
Wald test, p-value		0.000		0.000		0.000		0.000	
AR(1) A-Bond test, p-value		0.0024		0.0007		0.0018		0.0017	
AR(2) A-Bond test, p-value		0.5274		0.4801		0.8747		0.3076	
Interaction terms[1]:									
$\boldsymbol{D^R_i}$ **· gr.inflow$_{i,t}$/TNA$_{i,t-1}$**	+	-0.265***		0.233*					
		(0.090)		(0.133)					
$\boldsymbol{D^R_i}$ **· gr.outflow$_{i,t}$/TNA$_{i,t-1}$**	+	-0.107		0.177					
		(0.136)		(0.175)					
$\boldsymbol{D^R_i}$ **· net inflow$_{i,t}$/TNA$_{i,t-1}$**	−					-0.218		0.277**	
						(0.187)		(0.131)	

Notes: The system GMM estimator is a combined dynamic panel estimator as proposed by Arellano and Bover (1995) and Blundell and Bond (1998). It combines the moment conditions generated by the first difference equation with those from the level equation. The GMM estimation controls for the endogeneity of the lagged dependent variable as well as for predetermined variables (influence of the lagged cash ratio on the inflow ratio, outflow ratio and excess fund return). The Sargan test statistics tests the over-identifying restrictions and validity of the instruments. D^R_i denotes an interaction dummy which is equal to 1 if the majority of fund shares is permanently held by retail (non-institutional) investors. Age denotes the natural logarithm of one plus age in years. *, **, and *** indicate statistical significance at the 1%, 5%, and 10% level, respectively. [1]) Contribution of retail-oriented funds.