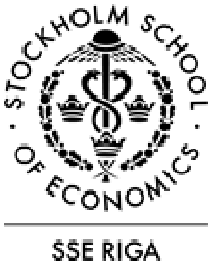

Bachelor thesis

Liquidity risk and performance of Lithuanian mutual funds

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April 2012,

Riga

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Title of the Thesis as approved by the SSE Riga Degree Committee

Liquidity risk and performance of Lithuanian mutual funds

Signed

Tomas Urniežius

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Date : 2nd of April, 2012

Acknowledgements

I would like to express my gratitude to the supervisor Jevgenijs Babaicevs for his valuable critique, insight and guidance. Also, I am thankful to Tālis Putniņš for his advice in the time of need. In addition, I would like to thank my friends and everyone else who was close for encouragement and valuable comments.

Lastly, I am grateful to my family for support and always being there for me.

Abstract

Recent financial crisis raised the issue of understanding the liquidity risk of financial assets and institutions. This thesis studies the ability that exposure and sensitivity to liquidity risk has in predicting future performance of Lithuanian mutual funds from 2004 till 2010. The paper observes that mutual funds loaded on liquidity risk (with higher liquidity factor betas) outperform their peers by 6,16% per annum. Additionally, other documented performance determinants of mutual funds, i.e., performance persistence and “smart money effects”, are present in Lithuanian mutual funds and are related to liquidity risk.

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Introduction

Recent financial crisis raised the issue of understanding the liquidity risk of financial assets and institutions. Liquidity risk as such is important not only for finance practitioners, but there has been an increase of interest in liquidity risk among academics as well. Holstrom and Tirole (2001) challenge intertemporal CAPM (capital asset price model), which predicts that asset's prices are equal to future payoff, to the favor of LAPM (Liquidity asset price model). They demonstrate that liquidity can be a very important asset price determinant, asset prices can be fully derived from investors' need for liquidity, and that they avoid financial assets which sell at a premium. Keene and Petersen (2007) observe that prior studies find that liquidity is an important factor when considering investment decisions. Their analysis, employing the Fama-French time-series regressions approach to examine liquidity as a risk factor affecting stock returns, supports these findings. They conclude that liquidity risk is an important factor even after controlling for the effects of market, size, book-to-market equity and momentum.

Mutual funds are subject to quite heavy regulation (leveraging, usage of derivatives, short selling, etc.), and therefore the possibility of enhancing performance through exposure to systematic risk is very limited. To wit, academic literature states that mutual funds, as any other depository financial institutions, although subject to liquidity risks, still have very little incentive to use it to enhance their performance. In contrast to this view, studies carried by Pastor & Stambaugh (2002), Sadka, Dong, & Feng (2011), and others, raise the issue of mutual funds' exposure to liquidity risk and observe that various assets exposed to liquidity risk, as well as mutual funds heavy on it (exhibiting higher liquidity factor betas), outperform their peers by 6-7% per anum. Similar results (6,16% per anum) are seen in the sample of Lithuanian mutual funds in interest in period from 2004 to 2010. Such outperformance can be seen as stemming from liquidity risk premium alone, or can be correlated with the fund manager's ability or skill to generate abnormal returns. This study will look at this outperformance from the standpoint of liquidity risk premium alone, and then try to check if performance persistence and "smart money effects", documented by other researchers, are present in the sample of mutual funds. What is more, it will see whether liquidity risk premium is present in these effects.

Following, the main research question of this paper is **can liquidity risk be used as a predictor of mutual fund future performance?** The main research question is complemented by two subquestions:

1. Is liquidity risk related to a fund's performance persistence?

2. Do funds experiencing capital inflow use liquidity risk to enhance their performance?

To the author's knowledge, this is an unprecedented paper exploring the performance of Lithuanian mutual funds through performance persistence and "smart money" effects with respect to liquidity risk. It should be noted that well-established and documented methodology is used throughout.

The paper is arranged so as to provide higher readability. The first section, background information, briefly introduces mutual funds, their characteristics, management and recent trends in Lithuania. The second section, literature review, introduces general concepts of liquidity risk (asset side and liability side liquidity risk), recent researches and papers on the topic of liquidity risk premium, liquidity risk measurements and mutual fund liquidity. The third section presents documented methodology used to estimate liquidity sensitivity of the mutual funds, previously mentioned performance persistence, and smart money effects. The fourth section, data, presents the sample of Lithuanian mutual funds on which research was carried out. Finally, the fifth section presents the main empirical findings of this paper and the sixth discusses and concludes the findings of the paper.

1. Background information

In this section, the paper will briefly introduce mutual funds, describing their characteristics, regulation and recent trends in Lithuania.

1.1. Mutual funds

"A mutual fund is a type of investment company that pools money from many investors and invests the money in stocks, bonds, money-market instruments, other securities, or even cash." (U.S. Securiteis and Exchange commission, 2010). The investment company (fund manager) allocates pooled money according to the fund's objectives. Mutual funds are classified according to the securities they invest in. The most common types are bond funds, equity funds, money market funds, and balanced (mixed) funds.

Bond funds or *income funds* invest mainly in bonds (governmental or institutional) and other sorts of debt securities. Depending on its investment objectives, a bond fund may concentrate in a particular type of bond or debt security – government bonds, municipal bonds, corporate bonds, convertible bonds, mortgage-backed securities, zero-coupon bonds or a mixture of these. To fully achieve the benefits of diversification, the securities that fund holds will differ with respect to risk and returns, duration, volatility, etc.

Equity funds or *stock funds* invest mostly in stocks. Stock selection depends on the fund's objectives and policies. Equity funds are classified according to their scope of investment: there are growth funds (investing in companies which have a lot of potential for growth, for example technology companies), income funds (investing in companies which pay regular dividends) and sector funds (investing in to companies which operate in specific sector, for example manufacturing).

Index mutual funds typically try to follow the returns of a selected market or industry index by purchasing exactly the same or a representative sample of shares of companies included in the index. Due to this specific nature of index mutual funds, they are subject to the same risks as the stocks included index. These funds are perceived to be 'passive' funds since fund manager only needs to track the composition of an index, which usually leads to lower expenses and fees than other funds.

Money market funds invest in low-risk and very liquid (easily traded) securities, such as certificates of deposits or commercial papers. Money market funds are usually less risky than other funds. Due to the nature of the assets they invest in, the dividends paid by such funds are close to short-term interest rates.

Additionally, there are three main categories within mutual funds: closed-end, open-end and exchange traded funds. The main difference between first two is that an investor willing to purchase or sell shares of an open-ended investment fund deals directly with a mutual fund and can buy/sell shares any work day. Conversely, the shares of closed-end investment funds are distributed to the public only once, through an initial public offering, and then traded on secondary markets. Exchange traded funds (ETF) are a relatively recent innovation, combining the characteristics of both closed-end and open-end mutual funds. Like closed-end funds, ETF's are traded every trading day on a stock exchange at a market price. However, as with open-end funds, the price is close to net asset value of the fund. (U.S. Securiteis and Exchange commission, 2010).

1.2. Mutual funds in Lithuania

All Lithuanian financial institutions, including mutual fund managing companies, are obliged to report to a supervision body of financial markets of Lithuania. Until the 31st of December, 2011, the Securities Commission of the Republic of Lithuania carried out this task. On the 1st of January, 2012, however, the Securities Commission was liquidated and its functions were transferred to the Bank of Lithuania.

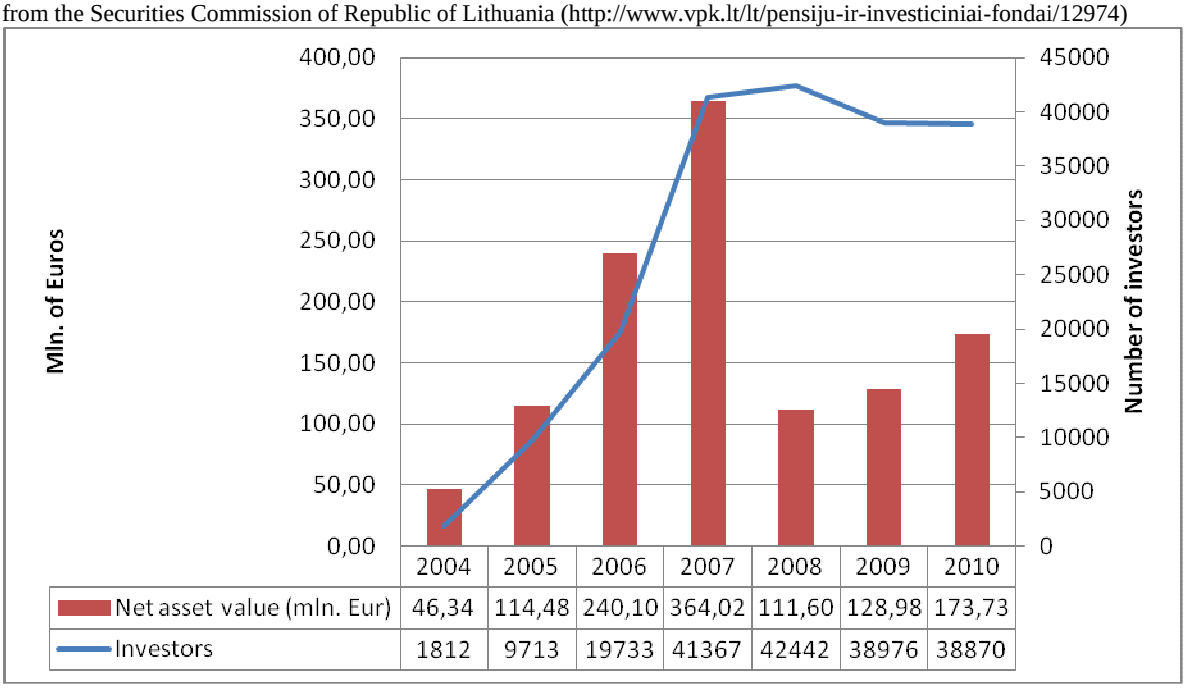
According to the Securities Commission, from 2004 until 2007 the number of Lithuanian mutual funds constantly grew (from 10 mutual funds in 2004 to 34 in 2007), and then stabilized afterwards (Table 1). By the end of 2010, there were 10 registered mutual fund managers (8 in 2004) which had registered 37 mutual funds by that time (19 equity funds, 2 bond funds, 10 mixed funds, 1 money market fund and 5 alternative investment funds). The funds that have received investments by the end of 2010, and have periodically reported to the Commission, are listed in Table 4 (apendix1). These funds are the primary interest of this paper.

Table 1
Lithuanian mutual funds by types from 2004 till 2010. Compiled by author using data from the Securities Commission of Republic of Lithuania (http://www.vpk.lt/lt/pensiju-ir-investiciniai-fondai/12974)

	2004	2005	2006	2007	2008	2009	2010
Mutual funds in total	**10**	**19**	**27**	**34**	**33**	**35**	**37**
Equity funds	7	11	13	16	17	23	19
Bond funds	2	4	5	5	4	2	2
Mixed funds			2	5	4	7	10
Money market funds	1	2	2	2	2	2	1
Alternative investment funds						1	5
Fund of funds		2	5	6	6		

From 2004 to 2007 both the total net asset value and number of individuals investing in to Lithuanian mutual funds was growing rapidly (Figure 1). The total net asset value of all funds in that period increased from 46.34 to 364.02 million Euros. The number of individuals investing in mutual funds increased from 1812 to 41367. From 2008, the number of investors started to mildly decrease, and in the end of 2010, it was less than 39000. The total net asset value of Lithuanian mutual funds decreased by more than 250 mln. Euros in 2008, but grew steadily in 2009 and 2010.

Figure 1
Dynamics of net asset value and investors of Lithuanian mutual funds in 2004-2010. Compiled by author using data from the Securities Commission of Republic of Lithuania (http://www.vpk.lt/lt/pensiju-ir-investiciniai-fondai/12974)



Lithuanian academics and practitioners explain these developments in the mutual fund industry in Lithuania from 2004 to 2007 by pointing to an increase of financial literacy of individuals, and improvement of regulations of financial institutions and taxation rules after accession to European Union. All developments after 2008 are attributed to the late-2000's financial crisis (Gavrilova, 2011).

2. Literature review

There are a number of academic books, journal articles and working papers on the topics of liquidity of various financial assets, institutions and markets, but surprisingly few focus on mutual fund liquidity. The paragraphs below will briefly introduce the concept of liquidity risk (asset side and liability side liquidity risk), as well as recent researches and papers on the topic of liquidity risk premium, liquidity risk measurements, mutual fund liquidity and performance.

2.1. Liquidity

Liquidity, especially after recent financial crisis, is one of the most commonly used financial concepts. Although the rationale seems rather intuitive and easy to grasp, there is still no clear definition for the term as of yet.

One of the first definitions of liquidity could be attributed to the English economist John Maynard Keynes (1936). He described liquidity of a financial asset as the time it takes to close buy or sell deal with associated transaction costs. More recent works, like Madhavan & Cheng (1997) or O'Hara (2004), attribute liquidity to trading volume – liquid markets should be able to absorb trade and liquid assets could be sold in high volumes without no or very little impact on assets price. Most recent and probably the most complete definition is proposed by Alzahrani (2011): *"A market is considered perfectly liquid if a participant can trade at observed prices irrespective to the quantity, time and order type (buy or sell) desired. It is defined as the ability to buy or sell significant quantities of a security quickly, anonymously and with little price impact"*.

In general, liquidity is a very wide and crucial characteristic of financial markets and assets, and therefore it is very important to understand, quantify and measure liquidity and its risk. Liquidity is a multidimensional concept and every dimension has its own measure (explained here following Alzahrani, 2011):

- Tightness- cost of turning position around (long to short and vice versa) in a short period of time;
- Breadth or Width - ability to close a deal without creating any impact on the securities price;
- Depth - ability to execute a deal after a number of similar deals before at the same price have been carried out;
- Resiliency - speed at which the price returns to the previous level after a large trade was closed;
- Immediacy - cost at which it is possible to immediately execute an order.

This study will focus on the depth dimension of liquidity. For this purpose Amihud's (2002) ILLIQ measure, which shows price impact of the trade, will be used. It measures the average absolute change in share price per euro of volume traded. A More detailed description of this measure is presented in the Methodology section of this paper (equation 2).

2.2. Liquidity risk

Financial institutions are faced with various types of risk, such as interest rate risk, market risk, credit risk, operational risk and other risks that threaten the solvency of financial institution, but most of academic literature perceives liquidity risk as a normal aspect of everyday processes in financial institutions. Various sources distinguish two types of liquidity risk: asset side of balance (market liquidity in some sources) and liability side of balance (funding liquidity in some sources) liquidity risk (Brunnermeier & Pedersen, 2009). To shortly summarize the main difference between the two - asset's side liquidity is related to the ease with which assets are traded and liability's side liquidity is related to the ease with which financial institutions can obtain funding or meet their obligations (Tirole, 2009).

Liability side liquidity risk arises when financial institutions liability holders, such as depositors, investors or insurance policy holders, seek cash in their financial claims immediately. Usually financial institutions tend to minimize their holdings in cash, since it does not pay any interest, and tend to invest in less liquid and longer maturity financial assets to generate interests. If financial institutions have less cash than their liability holders wish to withdraw, it has to liquidate their assets to cover the difference (Saunders, 2003)

Asset side liquidity risk arises when a given security or asset cannot be traded quickly enough or at wanted price in the market to prevent a loss (or make the required profit). Most of the assets can be turned into cash eventually, but if some assets have to be liquidated immediately, there is a chance that this might be done either at very high cost or at much lower price than financial institution would be able to get in some near future. This happened in the recent financial crisis, when nobody wanted to buy or to sell any assets, since they weren't sure what will be happening next (Allen & Carlletti, 2008). This should not be confused with the situation when asset price is zero or close to it. In such a case the market just says that asset is worthless. During illiquidity there are just no buyers for sellers (Saunders, 2003).

2.3. Liquidity risk premium in assets and mutual funds

For security holders and investors (individual or institutional), situations described above, mainly asset side liquidity, introduce additional risks for which any rational investor will demand compensation. Pastor & Stambaugh, (2002) determine that the average return on stocks with high sensitivities to liquidity (high liquidity betas) exceeds that for stocks with low sensitivities by 7.5% annually over a 34 year period. Their results stay significant even when adjusted for exposures to the market return, size, value, and momentum factors. Acharaya & Pedersen, (2005) decompose liquidity risk of a security into three main components:

1) covariance between the security's illiquidity and the market illiquidity (required return of a security is increasing if the covariance is increasing);
2) covariance between the security's return and the market illiquidity (required return of a security is decreasing if the covariance is increasing);
3) covariance between the security's illiquidity and market returns (required return of a security is decreasing if the covariance is increasing).

Their model shows that a positive shock to illiquidity (increase in liquidity) can be associated with low one-time returns and high future returns. Sadka, (2005) demonstrates that liquidity factors can be used to test whether asset-pricing carries a premium for liquidity risk. Overall, these works demonstrate liquidity risk incorporation into asset prices and cross-sectional differences in returns between assets which have different sensitivities (betas) to liquidity.

Academic literature agrees that mutual funds, as any other financial institutions, are subject to liquidity risk, but should have very little incentive to use it to enhance their performance due to their nature and business model. A recent study, the first on the topic, carried out by Dong, Feng, & Sadka, (2011a,b) challenges this view and find that mutual funds that load on liquidity risk and have higher liquidity betas (have higher sensitivity to changes in market liquidity), subsequently outperform low-loading funds by around 6% in the period of 1983-2009.

2.4. Mutual fund performance

Quite a few studies analyzing data argue that mutual funds with positive future risk-adjusted returns can be determined by observing various characteristics, such as:

1) the styles that the funds follow,
2) the location of the stocks that the funds hold,
3) the extent to which the manager's decisions resemble the decisions of other managers with distinguished performance records,
4) the industry concentration of fund holdings,
5) the motivation for trading,
6) fund dependence on analyst recommendations.

Dong, Feng, & Sadka, (2011a,b) in their studies look at a majority of these effects in relationship with liquidity risk. They determine that a fund's positive future risk-adjusted performance cannot be explained due to these effects alone, but rather that a fund's exposure to liquidity risk may signify the fund manager's skill or ability to generate abnormal performance.

This paper will look at other fund characteristics related to performance in relationship to liquidity risk. The first of these is performance persistence, and the second the so-called 'smart money' effect.

2.4.1. Performance persistence effect

The first effect researched in this paper, i.e. the performance persistence effect, is based on the idea that a fund's past results can be used as indicators for the fund's future performance. Chevalier and Ellison (1997) and Sirri and Tufano (1999) state that mutual fund

investors tend to chase performance. They find that such predictability occurs because inflow and outflow of money into funds generate incentives for fund managers to adjust the riskiness of their portfolio, consequentially adjusting their returns in the short run. Dong, Feng, & Sadka, (2011) analyze the investors' willingness to move to well performing funds and conclude that if liquidity risk is correlated with the fund manager's ability or skill in boosting performance, their performance should be more or less persistent. They use the return-persistence phenomenon, documented by Carhart (1997), and find that funds with high returns in year *t* tend to outperform their peers in year *t+1*. Because such outperformance is not explained by the funds' previous years' momentum beta, they conclude that year *t* returns must be driven by liquidity risk.

2.4.2. Smart money effect

The second effect researched in this paper is the 'smart money' effect. It is based on the idea that markets and investors can distinguish potentially successful funds in the future and invest in them beforehand. Gruber (1996) analyzes why investors buy actively managed open-end funds. He finds that inflow and outflow of money to funds follows performance predictors (analysts), and that the funds' past performance is used to determine future performance by the same predictors. Zheng (1998) researched if aggregate newly invested money in funds is able to predict positive short term performance in mutual funds. He documents that funds experiencing inflow of capital in the short run outperform their peers experiencing outflow. Dong, Feng, & Sadka, (2011) look at this effect in funds as well. They find that liquidity-beta spread is present in both, inflow and outflow funds, but smart money effect is evident in funds with high liquidity exposure. They conclude that inflows can predict outperforming funds and at least part of this effect stems from the liquidity risk exposure of funds.

3. Methodology

3.1. Sensitivity to liquidity risk

Following the works of Brown, Harlow, & Starks (1996) and Chevalier & Ellison (1997, 1999), who advocate and find significant results in evaluation of fund performance with respect to risk taking incentives in 12 and 6 months windows (representing the fund managers' reporting frequency); and considering the methodology established by Dong,

Feng, & Sadka, (2011), individual fund betas are estimated using rolling window regression of past 6-month fund return on the market returns ant the liquidity risk factor (Equation 1).

$$r_{i,t} = Const_i + \beta_{i,MKT} * r_{MKT} + \beta_{i,ILLIQ} * liq_t + e_{i,t} \quad \text{(eq. 1)}$$

Where:

$Const_i - intercept\ term,$

$r_{i,t} - mutual\ funds\ returns\ at\ time\ t,$

$r_{MKT} - market\ returns\ at\ time\ t,$

$liq_t -$ *none traded liquidity factor at time t,*

$e_{i,t} - residual\ term\ at\ time\ t.$

Dong, Feng, & Sadka (2011) use the permanent-variable price-impact measure of Sadka (2006) as the none-traded liquidity factor at time *t* (denoted liq_t) but it can be changed with the measurements of Amihud (2002) or Pastor and Stambaugh (2003), since all of them produce directionally consistent and almost identically significant results (Dong, 2010). This study will use Amihuds (2002) ILLIQ this factor (equation 2).

$$ILLIQ_i = \frac{1}{D}\sum_{t=1}^{D}\frac{|r_{i,t}|}{V_{i,t}} * 10000 \quad \text{(eq. 2)}$$

Where:

$D - number\ of\ trading\ days\ in\ period\ t,$

$|r_{i,t}| - absolute\ returns\ in\ time\ t,$

$V_{i,t} - dollar\ volume\ of\ trading\ per\ time\ t.$

Illiquidity of stocks included in portfolios of funds is calculated over a one calendar month period. A multiplier of 10000 is used in order to get results which can be interpreted as illiquidity if 10000 Euros worth of stock was sold to the market. The size of this multiplication was chosen after observing sizes of holdings by investors of the funds. Estimated individual liquidity betas of funds in each period (monthly or semiannual) will be used to carry out further analysis.

3.2. Performance persistence

First, following the methodology by Dong, Feng, & Sadka (2011), it is necessary to check if performance persistence is present in the sample of funds, meaning if past returns are a good predictor of future returns. This is done using following regression:

$$r_{i,t} = Const_i + \beta_{i,r_{i,t-1}} * r_{i,t-1} + e_{i,t} \quad \text{(eq. 3)}$$

Where:

$Const_i$ – *intercept term,*

$r_{i,t}$ – *mutual funds returns in period t,*

$r_{i,t-1}$ – *mutual funds returns in period* $t-1$,

$e_{i,t}$ – *residual term in period t.*

Furthermore, using the results from a rolling six-month regression, where fund returns are decomposed into three parts (intercept term, market beta component and liquidity beta component), for every month the funds are sorted into two portfolios according to their last month's returns and their estimated illiquidity beta. Return spread between these two sorting options is analyzed using a mean comparison test. No statistical difference between the spreads would indicate that performance persistence arises from the funds' liquidity exposure. Since all fourteen funds included in the sample are operational from June 2008, until December 2010, and regressions estimating their illiquidity betas use a six-month window, they are sorted following to criteria mentioned above from January 2009 until December 2010.

3.3. Smart money effect

Firstly, following the methodology by Dong, Feng, & Sadka (2011), the percentage net flow to fund *i* during period *t* is estimated using the following equation:

$$Flow_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1} * (1 + R_{i,t}) - MergeTNA_{i,t}}{TNA_{i,t-1}} \quad \text{(eq. 4)}$$

Where:

$TNA_{i,t}$ – *total net assets of the fund in period t,*

$TNA_{i,t-1}$ – *total net assets of the fund in period* $t-1$*,*

$R_{i,t}$ – *fund returns in period t,*

$MergeTNA_{i,t}$ – *increase in TNA due to mergers in period t.*

Secondly, presence of 'smart money' effect in the sample is checked using the following regression:

$$r_{i,t} = Const_i + \beta_{Flow_{i,t-1}} * Flow_{i,t-1} + e_{i,t} \quad \text{(eq. 5)}$$

Where:

$Const_i$ – *intercept term,*

$r_{i,t}$ – *mutual funds returns in period t,*

$Flow_{i,t-1}$ – *mutual funds inflow or outflow in period* $t-1$*,*

$e_{i,t}$ – *residual term at time t.*

Due to the nature of available data, the fund flows and 'smart money' effect are estimated semiannually. In every period, the funds are sorted into two portfolios (those with inflows versus those with outflows during the previous period). In each group the funds are sorted into two portfolios according to their liquidity beta. The presence of liquidity beta spread between these two portfolios would indicate that performance persistence arises from liquidity exposure. Since all fourteen funds included in the sample are operational from June 2008 until December 2010, and the regressions to estimate their illiquidity betas use a six-month window, they will be sorted following the criteria above, for the period from January 2009 until December 2010.

3.4. General comments

When dealing with panel data, one has to deal with two problems: serial correlation (the relationship between a given variable and itself over various time intervals, or *time effects*) and cross correlation (similarity of two variables when a function of time-lag is applied to one of them, or *firm effects*). The choice of empirical method depends on which of

the characteristics is present in the data. To correctly estimate coefficients and their standard errors, it is necessary to ensure that neither serial nor cross correlation is present. This is done by controlling for time and firm effects (including dummy variables), and by clustering the data by both time and firm dimension simultaneously. Such an approach gives the most correct coefficients and standard errors. Petersen (2009), after reviewing various approaches to coefficient and standard error estimation, found that the percentage of t-statistics that are greater than 2.58 is 5% whether the standard errors are clustered by the more frequent variable or both (time and firm). He concludes that "*when there are only a few clusters in one dimension, clustering by the more frequent cluster yields results that are almost identical to clustering by both firm and time"*. Following these findings, this study will use linear regressions with a large dummy-variable set absorbing one categorical factor, and will cluster errors by the larger cluster (date or firm):

1) Cluster by date when estimating coefficients for equation 1;
2) Cluster by date when estimating coefficients for equation 3;
3) Cluster by firm (fund) when estimating coefficients for equation 5.

4. Data

The population of interest includes 29 licensed Lithuanian mutual funds (shown in Appendix 1), which have received investments by the end of 2010, and have periodically reported to the Securities Commission of the Republic of Lithuania. To be consistent with Dong, Feng, & Sadka (2011), the sample excludes the following: money market, index, alternative investment, funds who invest purely in bonds (debt securities), funds of funds and funds who operate for less than a year. The total sample included 14 mutual funds, operating from 2004 till 2010. Information about the funds was gathered from their semiannual reports which are published in the website of the Central bank of the republic of Lithuania. These reports include:

1. general information about fund manager,
2. fund total net assets (TNA) at the beginning and the end of the period,
3. statistics about fund depositors (residents, non residents, private persons, legal entities, sizes of their respective investments and similar),

4. portfolio composition (cash holdings, financial asset holdings (ISIN numbers, exchange in which traded, price when acquired and current price),
5. investments in other financial institutions,
6. significant events related to the fund during the period (change in fund management, merge with another fund, etc.).

Monthly portfolios of mutual funds are constructed according to their semiannual reports in the research period of 2004-2010, assuming that the respective portfolio was held throughout the whole upcoming period. There are a few reasons for this assumption, the first of which are the findings documented by academics. Agarwal, Gay, & Ling, (2011) find that mutual fund managers "window dress" by strategically buying winner stocks and selling loser stocks near the end of the reporting period when they have to disclose portfolio composition (in Lithuania this period is every six months – June 31st and December 31st), since more frequent adjustment of portfolio would lead to high fund expenses and would make it unattractive for potential and current investors. The second, more practical, reason is the observation of portfolio compositions in the sample of mutual funds. They tend to keep approximately the same stocks (at most they change 25% of companies in their portfolio), just adjusting their weights in the portfolio.

Daily data about the companies included in the portfolios of funds was acquired from stock exchanges they trade in (disclosed in fund semiannual reports), Bloomberg, Reuters or Yahoo finance databases. The data was adjusted for dividends and stock splits. All non-euro valued observations (price and close prices, dividends, trading volumes and similar), were converted in to Euros using exchange rates posted by the European Central Bank. In total, information about 162 European, US, Russian, and Baltic companies was gathered. For market returns, the EURO STOXX 50 Index was used, since the majority of stocks held by funds were from the Euro zone. "*The EURO STOXX 50 Index, provides a Blue-chip [1]representation of supersector leaders in the Eurozone. The index covers 50 stocks from 12 Eurozone countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain."* (STOXX Limited).

The final data set used to estimate liquidity betas of funds (equation 1) and performance persistence effect of funds (equation 3) is a panel data set consisting of 14 firms

[1] According to the New York Stock Exchange, a blue chip is stock of a corporation with a national reputation for quality, reliability and the ability to operate profitably in good times and bad.

(Lithuanian mutual funds), with monthly observations of their returns and illiquidity factors. For a summary of the statistics, see Table 2.

Table 2

Summary statistics of data set #1

Variable	Obs	Mean	Std. Dev.	Min	Max
return	776	-0.0021	0.0932	-0.5442	0.2569
market_r	776	-0.0041	0.0528	-0.1993	0.1240
log_illiq	776	-3.0489	1.7782	-7.8822	3.1697

return is the monthly return of mutual fund portfolio.
market_r is the monthly return of market return equivalent (EURO STOXX 50 Index).
Log_illiq is the natural logarithm of monthly ILLIQ (equation 2) measure of the mutual fund portfolio.

The final data set used to estimate the 'smart money' effect of funds (equation 5) is a panel data set consisting of 14 firms (Lithuanian mutual funds), with semiannual observations of mutual fund returns and inflows and outflows of funds in to them. For a summary of the statistics see Table 3.

Table 3

Summary statistics of data set #2

Variable	Obs	Mean	Std. Dev.	Min	Max
Return_6	127	0.0244	0.2994	-0.7849	0.5164
Flow	104	4.7397	46.6575	-1.2330	475.9081

Return_6 is the semi annual return of mutual fund portfolio.
flow is the semiannual inflow (equation 4) of funds into the mutual funds.

5. Empirical findings

5.1. Sample analysis

An attempt is made to determine whether calculated liquidity measurement can be used to explain mutual fund returns in further analysis. Results in Table 5 (Appendix 2) show that the chosen market returns equivalent is statistically significant at the 0.1% level and suggest high economic significance since fund returns can be explained by market returns on a 1 on 1 basis, which is in line with the findings of earlier studies demonstrating that mutual funds on average get the same returns as the market .

Illiquidity measurement results are statistically significant at the 1% level. Although results seem counterintuitive (coefficient close to 0), highly illiquid stocks should show negative returns since they should be sold at lower than market price and bought at higher than market price, and vice versa. Stocks with low illiquidity should show close to 0 returns since they can be bought or sold almost instantly at market price. Following this logic, the returns of funds and stocks should be negatively correlated with their respected ILLIQ measurement and have close to 0 regression coefficients. This is in line with the body of academic literature which documents that liquidity dries up when markets fall and liquidity is high when markets are rising. From the results in Table 7 (Appendix 3), it can be seen that the majority of stocks (80,24%) in which sample funds invest and all funds (Table 6) included in the sample are illiquid.

Overall, findings suggest that the chosen measurements and empirical methods carry statistical and economic significance, and can be used for further analysis.

5.2. Liquidity risk betas and fund returns

As described in the methodology section of this paper, individual liquidity betas of funds are estimated using a 6 month rolling window. Figure 2 (Appendix 4) graphically depicts the dynamics of all estimated liquidity risk coefficients and illustrates their 95% confidence interval. Table 8 (Appendix 4) presents summary statistics of estimated coefficients and their standard errors. Although significance of results varies from highly significant to highly insignificant, following the results from the overall sample regression in Table 5 (Appendix 2) where the liquidity risk beta coefficient is significant even at 1% level it is assumed that these results are valid for use in further analysis.

Funds are distributed into 2 portfolios according to their liquidity risk beta (sensitivity to the illiquidity of their holdings): high beta funds and low beta funds. Returns are calculated as average returns of all funds included in that portfolio over the corresponding period. Returns of each portfolio each month (Table 11), average returns of portfolios (Table 12) and the corresponding t statistics are reported in Appendix 6(1) and 6(2). It can be seen that funds with higher liquidity risk betas on average outperform those with low betas by 0,5% per month (6,16% annually) in the period from January 2009 until December 2010, when all the funds included in the sample were operational.

5.3. Performance persistence

Firstly, it is checked if performance persistence is present in sample mutual funds. From the results in Table 9 (Appendix 5), it is seen that mutual fund returns last month is a good predictor for its current returns. Additional regressions are done to ensure the robustness of this result. Adding up to six lags (returns of the previous 6 months), the results of last month returns remain significant at 0,01%. Further, funds are distributed into two portfolios according to two criteria: i) liquidity factor beta (funds with high betas and funds with low betas); and (ii) t-1 month returns (funds with high returns previous month and funds with low returns previous month).

Average returns of funds included in each portfolio each month (Table 10 and Table 11), average returns of portfolios for the period when all funds were operational (Table12), corresponding t statistics, and results of Student's t test are reported in appendices 6 (1) and 6(2). A two-sample unequal variance test (two-tailed) Student's t test, which compares distributions of high-low portfolios, is carried out. The first distribution here is the returns of a portfolio sorted by sensitivity to liquidity risk (sorting variable β_{ILLIQ}) and the second a distribution of portfolio sorted by returns of previous month (sorting variable $r_{i,t-1}$) suggest that there is no statistical difference between two distributions and at least part of the performance persistence effect is stemming from the fund's sensitivity to liquidity risk.

5.4. 'Smart money' effect

It is tested whether the 'smart money' effect is present in sample mutual funds. The first observation (first period of operations) of each fund is excluded from analysis, since, under current regulations in Lithuania, funds have to have only 10 000 Litas (2890 Euros) in assets at the beginning of their life, which introduces outliers (inflows of 10 000 % and similar). Results of regressions and average performance of funds are reported in Table 13 (Appendix 7(1)).

Although the regression has a low R-squared, the extremely high significance level of estimates and average performance of funds which experience inflow, which is higher in all periods, in comparison to those which experience outflow, allows us to conclude that the smart money effect is present in the sample of funds used for this study.

To continue the analysis, funds within inflow and outflow portfolios are sorted in 2 groups according to their illiquidity betas. In the case that there is an unequal number of funds in any of the inflow or outflow portfolios so that they cannot be distributed into 2 (high and low beta) groups evenly, median observation is included in the calculation of average returns in both (high and low beta groups). From the results, which are presented in Table 15 (Appendix 7(2)), it seems that, in both portfolios, funds which have lower illiquidity betas (have lower sensitivity to liquidity risk) on average outperform those who are more sensitive to the mentioned market conditions.

6. Discussion

This paper shows the importance of considering a fund's liquidity risk exposure as a determinant of future performance. Results from the analysis of the sample indicate that liquidity risk premium is present in Lithuanian mutual funds, and suggest that liquidity risk exposure (beta) can provide valuable information to investors when choosing mutual funds in which to invest.

6.1. Research questions

Is liquidity risk related to a fund's performance persistence?

The findings of this study confirm that performance persistence effect, documented in other studies, is present in the sample of Lithuanian mutual funds; i.e., future returns of mutual funds can be predicted from past returns. The positive sign of the regression indicates that, consistent with Carhart (1997) and Dong, Feng, and Sadka (2011), winner funds tend to outperform while looser funds then to underperform. Consequently, this indicates that fund managers generate returns due to their skill or ability. Since performance persistence exists in conjunction with liquidity risk it can be stated that fund managers skill is related to liquidity risk and at least a part of performance persistence stems from exposure to liquidity risk. Additionally, the significant performance of the portfolio spread suggests that high liquidity risk loading funds will significantly outperform low liquidity risk loading funds in the future as well.

Do funds experiencing capital inflow use liquidity risk to enhance their performance?

Results indicate that the 'smart money' effect is present in the sample of Lithuanian mutual funds and inflow of funds has high statistical power in predicting future performance of mutual funds. Consistently with other studies, funds that experience inflow of capital tend to outperform those experiencing outflow. Yet, when liquidity risk exposure of funds is utilized, contrary to results of Dong, Feng, and Sadka (2011), funds with low liquidity risk betas tend to, on average, perform better in both inflow and outflow groups. This indicates that well performing Lithuanian mutual funds, regardless of inflow or outflow, are drawn to liquidity and hence do not use liquidity risk to enhance their performance.

Can liquidity risk be used as a predictor of mutual fund future performance?

The results from the overall sample analysis indicate that liquidity risk premium is indeed present in the performance results of Lithuanian mutual funds. Yet, the existence of liquidity risk premium in the portfolios of funds does not necessarily explain differences between high minus low liquidity risk loading funds. This study shows that the outperformance of high liquidity risk loading funds is not coming from liquidity risk premium alone, but is rather related to the fund managers' ability or skill when it comes to generating performance. This finding is due to the fact that if all funds would load on liquidity risk to earn liquidity risk premium, we would not observe significant differences in performance of high minus low loading funds. This is also supported by results of two investigated effects. All in all, it can be stated that liquidity risk exposure is an important factor to consider when predicting mutual fund future performance.

6.2. Limitations

It is widely recognized that liquidity has many dimensions and can be measured in different ways, capturing different aspects of liquidity. In their studies, which were the first ones to document performance and liquidity risk of mutual funds, Dong, Feng, and Sadka (2011), used the permanent variable price impact measure of Sadka (2006), which focuses on the information asymmetry of market liquidity. This study uses Amihuds (2002) ILLIQ which focuses on contemporaneous volume induced price impact, which, due to the systematic nature of liquidity, produces directionally consistent results (Dong, 2010). The author of this study wants to emphasize that estimated relationships might be of somewhat different nature due to the different component of liquidity risk being approximated.

Secondly, this study finds that mutual funds who load on liquidity risk outperform those who don't, and it follows that such outperformance should be persistent in the future. Nonetheless, due to the nature of the methodology utilized throughout the paper, it remains unclear what fraction of this phenomenon can be explained solely by liquidity risk premium and what fraction is stemming from fund managers ability or skill to generate positive performance.

Thirdly, results suggest that liquidity risk is related to a few other documented mutual fund performance effects, such as performance persistence and "smart money" effect. This means that the findings should not be taken separately, but instead all aspects (the previous two plus liquidity risk exposure) should be considered together so as to predict mutual fund future performance.

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Appendix 1

Table 4

Licensed Lithuanian mutual funds. Retrieved from: Central bank of the republic of the Lithuania: http://www.lb.lt/investment_funds

1	Finasta Delta special alternative investment funds
2	Finasta Infinity Investment in Transferable Securities Investment Fund
3	Finasta Integrity Investment in Transferable Securities Investment Fund
4	Finasta Vitality investment in transferable securities investment fund
5	Finasta My Residence
6	Finasta PE Feeder Fund I
7	Finasta Umbrella Fund
8	Axia Value Fund
9	Parex Baltic Sea Equity Fund Investment
10	DNB equity fund of funds
11	DNB money market fund
12	Inside Dovre Nordic
13	Lords LB Baltic Fund I.
14	Lords LB Baltic Fund II
15	Lords LB Opportunity Fund I
16	Lords LB Opportunity Fund II
17	Novus Strategic Investment Fund in transferable securities investment fund
18	ORION AGROLAND Value Fund I
19	Prudentis Baltic Fund
20	Prudentis Global Value Fund
21	Prudentis United Alternative Fund
22	Rigel Global Macro Fund
23	SEB's portfolio is actively managed funds 100
24	SEB's portfolio is actively managed funds 60
25	Synergy Private Equity Fund
26	Ukio Bankas Investment Opportunities Fund
27	Agricultural Bank Bond Fund
28	Agricultural Bank of rational investment fund
29	ZPR U.S. Small Cap equities investment fund open

Appendix 2

Table 5

Mutual fund returns, market returns and illiquidity measure of mutual funds

	return
market_r	1.091***
	(5.51)
log_illiq	-0.0113**
	(-2.68)
_cons	-0.0321
	(-1.93)
N	776
R-sq	0.453
adj. R-sq	0.442

Dependant variable:
return is the monthly return of mutual fund portfolio.
Independent variables:
market_r is the monthly return of market return equivalent (EURO STOXX 50 Index).
log_illiq is the natural logarithm of monthly ILLIQ (equation 2) measure of the mutual fund portfolio.
_cons is the intercept term.

t statistics are given parentheses. * – significant at 5% level, ** –significant at 1% level, *** – significant at 0,1% level. Coefficients are estimated using STATA (version 11.2) multipurpose statistical software. Errors are clustered by date (83 clusters).

Appendix 3

Table 6

Correlations of fund returns with their ILLIQ measurement. Compiled by author

Fund	Correlation	Fund	Correlation
1	-0.713894008	8	-0.037265265
2	-0.049423904	9	-0.435689245
3	-0.115364106	10	-0.250989574
4	-0.080123707	11	-0.431014689
5	-0.247554691	12	-0.35274758
6	-0.444650978	13	-0.126924625
7	-0.393356518	14	-0.16376933

Table 7

Correlations of stock returns with their ILLIQ measurement. Compiled by author

Correlation range	Number of stocks within the range	% of stocks in range
1 - 0.9	0	19.75%
0.9 - 0.8	0	
0.8 - 0.7	0	
0.7 - 0.6	0	
0.6 - 0.5	0	
0.5 - 0.4	0	
0.4 - 0.3	3	
0.3 - 0.2	5	
0.2 - 0.1	8	
0.1 - 0	16	
0 - -0.1	36	80.24%
-0.1 - -0.2	26	
-0.2 - -0.3	26	
-0.3 - -0.4	19	
-0.4 - -0.5	9	
-0.5 - -0.6	8	
-0.6 - -0.7	3	
-0.7 - -0.8	3	
-0.8 - -0.9	0	
-0.9 - -1	0	

Appendix 4

Figure 2

Dynamics of estimated liquidity risk coefficients

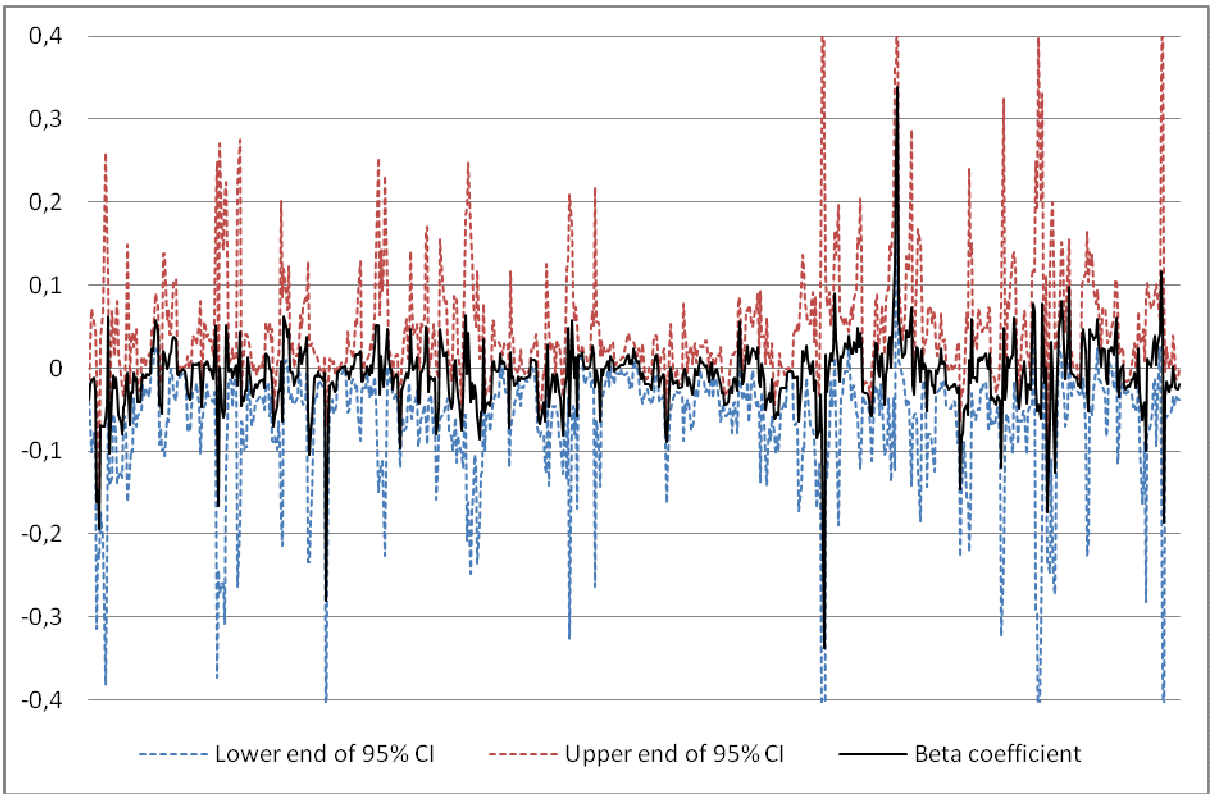

Table 8

Summary statistics of estimated liquidity risk coefficients

Variable	Obs	Mean	Std. Dev.	Min	Max
_b_log_illiq	733	-0.0096	0.0434	-0.3380	0.3388
_se_log_il~q	733	0.0297	0.0347	0.0001	0.4531

_b_log_illiq is the estimated beta coefficient of natural logarithm of monthly ILLIQ (equation 2) measure of the mutual fund portfolio. Estimation is done using 6 months rolling regression.
_se_log_il~q is the estimated standard error of *_b_log_illiq*.

Coefficients are estimated using STATA (version 11.2) multipurpose statistical software.

Appendix 5

Table 9

Regressions of mutual funds returns on its lagged (up to 6 months) returns

	(1) return	(2) return	(3) return	(4) return	(5) return	(6) return
L.return	0.527***	0.566***	0.578***	0.578***	0.576***	0.550***
	(5.44)	(4.96)	(5.10)	(4.53)	(4.75)	(4.22)
L2.return		-0.0716	-0.166	-0.166	-0.145	-0.129
		(-0.86)	(-1.66)	(-1.47)	(-1.35)	(-1.25)
L3.return			0.166	0.166	0.130	0.161
			(1.32)	(0.94)	(0.81)	(1.06)
L4.return				0.00400	0.0942	0.0624
				(0.03)	(0.80)	(0.57)
L5.return					-0.124	-0.000607
					(-1.36)	(-0.01)
L6.return						-0.204*
						(-2.06)
_cons	-0.00122	-0.00140	-0.00127	-0.000930	-0.00108	-0.00161
	(-0.14)	(-0.16)	(-0.15)	(-0.11)	(-0.13)	(-0.20)
N	762	748	734	720	706	692
R-sq	0.284	0.289	0.306	0.307	0.325	0.348
adj. R-sq	0.271	0.274	0.291	0.290	0.307	0.330

Dependant variable:

return is the monthly return of mutual fund portfolio.

Independent variables:

LX.return market_r is the lagged monthly return of mutual fund portfolio. X depicts number of lags (monthly)

t statistics are given parentheses. * – significant at 5% level, ** –significant at 1% level, *** – significant at 0,1% level. Coefficients are estimated using STATA (version 11.2) multipurpose statistical software. Errors are clustered by date (82-77 clusters).

Appendix 6 (1)

Table 10

Returns of portfolios when sorting variable is $r_{i,t-1}$

	2009-01	2009-02	2009-03	2009-04	2009-05	2009-06	2009-07	2009-08	2009-09	2009-10	2009-11	2009-12
High returns	3.9557%	-9.2838%	-6.7787%	11.6081%	12.0585%	10.3177%	-0.5605%	11.5364%	18.4563%	-0.9356%	-0.1206%	1.8536%
Low returns	2.3223%	-7.1762%	-7.2878%	3.7340%	4.4030%	7.2945%	-1.1455%	10.1827%	17.0386%	2.8563%	-3.2562%	-0.5614%
High-low	1.6334%	-2.1076%	0.5091%	7.8741%	7.6555%	3.0232%	0.5850%	1.3537%	1.4178%	-3.7919%	3.1355%	2.4149%

	2010-01	2010-02	2010-03	2010-04	2010-05	2010-06	2010-07	2010-08	2010-09	2010-10	2010-11	2010-12
High returns	6.6222%	6.7227%	5.8697%	4.5670%	-5.4157%	-1.2450%	1.3682%	4.0222%	0.4187%	6.0136%	2.8499%	2.7949%
Low returns	8.5944%	4.7750%	4.0255%	5.6796%	-6.3886%	-0.9107%	-0.4894%	5.2561%	-2.9056%	4.0882%	4.4003%	3.7694%
High-low	-1.9722%	1.9477%	1.8442%	-1.1126%	0.9729%	-0.3344%	1.8576%	-1.2339%	3.3243%	1.9254%	-1.5503%	-0.9744%

Table 11

Returns of portfolios when sorting variable is β_{ILLIQ}

	2009-01	2009-02	2009-03	2009-04	2009-05	2009-06	2009-07	2009-08	2009-09	2009-10	2009-11	2009-12
High betas	4.0300%	-7.7810%	-4.0842%	12.1245%	10.8359%	5.1773%	-1.5014%	10.4106%	17.5804%	-0.4053%	-3.4183%	0.1438%
Low betas	2.2479%	-8.6789%	-9.9822%	3.2177%	5.6257%	12.4349%	-0.2045%	11.3085%	17.9145%	2.3260%	0.0415%	1.1484%
High-low	1.7822%	0.8979%	5.8980%	8.9068%	5.2102%	-7.2576%	-1.2969%	-0.8979%	-0.3341%	-2.7314%	-3.4597%	-1.0046%

	2010-01	2010-02	2010-03	2010-04	2010-05	2010-06	2010-07	2010-08	2010-09	2010-10	2010-11	2010-12
High betas	8.4693%	6.4885%	3.8735%	5.4723%	-6.4674%	-0.9107%	0.5857%	4.8849%	0.5226%	4.9262%	4.1094%	3.8692%
Low betas	6.7474%	5.0093%	6.0217%	4.7743%	-5.3368%	-1.2450%	0.2931%	4.3934%	-3.0095%	5.1756%	3.1408%	2.6950%
High-low	1.7220%	1.4792%	-2.1482%	0.6980%	-1.1306%	0.3344%	0.2925%	0.4915%	3.5322%	-0.2494%	0.9685%	1.1742%

Appendix 6 (2)

Table 12

Average returns of portfolios in the periods

	Sorting variable		
	β_{ILLIQ}		$r_{i,t-1}$
High betas	3.2890%	High returns	3.6123%
	(9.019)		(8.790)
Low betas	2.7524%	Low returns	2.4291%
	(7.173)		(7.522)
High-low	0.5365%	High-low	1.1832%
	(5.123)		(15.621)

*t statistics in parentheses

- Students t test:

Results of, two sample unequal variance test (two tailed) between β_{ILLIQ} and $r_{i,t-1}$ distributions: 0.4596

	Significance level					
	0.1	0.05	0.025	0.01	0.005	0.001
Critical values	1.318	1.711	2.064	2.492	2.797	3.467

Appendix 7 (1)

Table 13

Regression of funds semiannual returns on inflow of one period before

	return_6
L.flow	0.000457***
	(38.92)
_cons	0.0230***
	(413.16)
N	104
R-sq	0.045
adj. R-sq	-0.105

Dependant variable:
Return_6 is the semi annual return of mutual fund portfolio.
Independent variable:
L.flow is the lagged semiannual inflow (equation 4) of funds into the mutual funds.

t statistics are given parentheses. * – significant at 5% level, ** –significant at 1% level, *** – significant at 0,1% level. Coefficients are estimated using STATA (version 11.2) multipurpose statistical software. Errors are clustered by firm (14 clusters).

Table 14

Average semiannual returns of funds sorted by inflow to funds in previous period

	2009-01	2009-02	2010-01	2010-02
Inflow in previous period	35.64%	34.49%	16.92%	22.66%
Outflow in previous periods	16.84%	28.68%	16.56%	12.51%

Appendix 7 (2)

Table 15

Average returns of funds sorted in to portfolios by inflow to funds in previous period and by liquidity risk betas within the portfolios

		2009-01	2009-02	2010-01	2010-02	Average
Inflow	High betas	35.65%	22.83%	6.71%	11.82%	19.25%
	Low betas	35.65%	38.53%	6.58%	15.85%	24.15%
	High-low	0.00%	-15.70%	0.13%	-4.03%	-4.90%
Outflow	High betas	-5.85%	25.49%	14.86%	15.68%	12.55%
	Low betas	23.68%	32.14%	17.55%	7.40%	20.20%
	High-low	-29.54%	-6.65%	-2.69%	8.27%	-7.65%