Rev Quant Finan Acc (2016) 47:213–247
DOI 10.1007/s11156-014-0488-7

ORIGINAL RESEARCH

# Do liquidity and idiosyncratic risk matter? Evidence from the European mutual fund market

**Javier Vidal-García · Marta Vidal · Duc Khuong Nguyen**

Published online: 27 November 2014


**Abstract** This paper examines the interaction of idiosyncratic risk, liquidity and return across time in determining fund performance, as well as across investment style portfolios of European mutual funds. This study utilizes a unique data set including returns for equity mutual funds registered in six European countries. Overall, using monthly data, we find that both liquidity and idiosyncratic risk are relevant in determining mutual fund returns. Our results are robust across different model specifications. We show that model specifications up to six factors are useful as these risk factors capture different aspects in the cross-section of mutual funds returns. The evidence regarding mutual funds subgroups is strongly in favor of the significance of liquidity, and idiosyncratic risk to a lesser extent, as risk factors. Even if liquidity and idiosyncratic risk are considered at the same time, one factor is not significantly decreasing the importance of the other factor.

**Keywords** Mutual fund performance · Idiosyncratic risk · Liquidity · Style analysis

**JEL Classification** G12 · G15 · G23

J. Vidal-García (✉)
Department of Financial Economics III, Facultad de Ciencias Económicas y Empresariales, Complutense University of Madrid, Spain, Campus de Somosaguas, Pabellón de sexto, 28223 Pozuelo De Alarcón, Madrid, Spain
e-mail: javiervidal7@hotmail.com

M. Vidal
Department of Business Administration, Facultad de Ciencias Económicas y Empresariales, Complutense University of Madrid, Spain, Campus de Somosaguas, 28223 Pozuelo De Alarcón, Madrid, Spain

D. K. Nguyen
IPAG Business School, 184 Boulevard Saint-Germain, 75006 Paris, France

## 1 Introduction

Recent academic studies have researched the role of idiosyncratic risk and liquidity in expected stock returns, which are commonly recognized as two of the most important stock market anomalies. Most studies explain that liquidity is negatively related to expected stock returns (e.g., Acharya and Pedersen 2005; Baker and Stein 2004; Hasbrouck 2005). Another stream of research documents a positive relation between idiosyncratic risk and expected returns (e.g., Campbell et al. 2001; Goyal and Santa-Clara 2003). In this paper we analyse the roles played by liquidity and idiosyncratic risk in mutual fund returns from the European perspective. To date, there is no study that associates these lines of research for the most important mutual fund countries in Europe. Our study fills this gap by using Fama–French and Carhart models to analyse whether liquidity and idiosyncratic risk are systematically priced on fund performance.

Numerous empirical studies show that liquidity is a relevant risk factor in the explanation of the cross section of asset returns. Pastor and Stambaugh (2003) incorporate a liquidity factor into the Fama–French three-factor model and show that market-wide liquidity is a state variable important for stock pricing. O'Hara (2003) points out that asset pricing models need to incorporate the transaction cost of liquidity and the risks of price discovery, which leads the author to develop an asymmetric information asset pricing model that adds these effects. Acharya and Pedersen (2005) find that a liquidity-adjusted CAPM model explains the data better than the standard CAPM. They also find weak evidence that liquidity risk is relevant above the effects of market risk and the level of liquidity. Watanabe and Watanabe (2008) discover that liquidity betas vary significantly over time, and the transition from the low to the high liquidity-beta state is predicted by a rise in trading volume. Lee (2011) tests the liquidity-adjusted capital asset pricing model of Acharya and Pedersen (2005) globally, and finds that liquidity risks are priced independently of market risk in international financial markets. Accordingly, a security's required rate of return depends on the covariance of its own liquidity with the aggregate local market liquidity, as well as on the covariance of its own liquidity with local and global market returns.

More recently, Dong et al. (2012) study the role of liquidity risk in the United States' mutual fund markets. They document that the systematic liquidity-risk exposures of mutual funds can predict their performance in the cross-section. In particular, funds with a high liquidity-risk exposure earn significantly high future returns during the 1984–2009 period. Although, only a small fraction of the outperformance of high-liquidity-beta funds relative to low-liquidity-beta funds can be explained by systematic risk factors. Thus, they suggest that the liquidity-risk exposure of a fund is correlated with its manager's ability to generate abnormal performance.

Considering market liquidity, Ho et al. (2005) show positive changes in liquidity and volatility around seasoned equity offerings in the Taiwanese stock market. They also show evidence that changes in liquidity is positively related to stock price adjustment. Hachmeister and Schiereck (2010) examine the introduction of post-trade anonymity in an order driven market, the German stock market. They find that liquidity increased significantly, they explain that informed traders change their behavior in providing liquidity more aggressively in an anonymous environment. Biktimirov and Li (2014) examine market reactions for companies that are added to or deleted from the FTSE indexes. They explain that companies promoted from a smaller-cap to a larger-cap FTSE index show an improvement in liquidity. Simirlarly, companies downgraded from a larger-cap to a smaller-cap FTSE index show a decline in liquidity. Chiu et al. (2014) explain that a high degree of fearful market-based sentiment produce more sell orders and a reduction in market liquidity, and vice versa. They show that net buying volume and market liquidity decrease more significantly when the fearful market-based sentiment increases.

Another line of research shows that liquidity is negatively related to expected stock returns. In this sense, Chordia et al. (2001), measuring liquidity by trading activity such as volume and turnover, find that stocks with more volatile liquidity have lower expected returns. Amihud (2002) shows that asset expected returns are increasing in illiquidity. The main argument is that the stock excess return compensates for the lower liquidity of stocks compared to that of Treasury securities, and expected stock excess returns vary over time as a consequence of changes in market illiquidity. Additionally, unexpected illiquidity has a significant negative effect on stock return, and the effects of illiquidity are stronger on the returns of small stock portfolios. These findings lead the author to conclude that the stock excess return is a premium for stock illiquidity. Other authors reporting a negative relation include Acharya and Pedersen (2005), Baker and Stein (2004), and Hasbrouck (2005). The most frequent explanation given for a negative relation between stock liquidity and returns is that illiquid stocks have higher transaction costs or higher sensitivity to a liquidity risk factor (Acharya and Pedersen 2005).

There is however limited research on the joint importance of liquidity and idiosyncratic risk, although earlier research stated theoretical grounds of why idiosyncratic risk should be inversely related to a stock's overall liquidity. For instance, Ho and Stoll (1980) strategic inventory control models or Spiegel and Avanidhar (1995) competitive models lead to this relationship. Some recent papers re-examine the relation between idiosyncratic risk and liquidity. Spiegel and Wang (2005) document that there exists a theoretical negative relationship between idiosyncratic risk and liquidity. They find also that idiosyncratic risk is a much stronger predictor of returns than liquidity and often eliminates the power of liquidity to explain returns. Bali et al. (2005) find no evidence of a significant link between idiosyncratic risk and future market returns after controlling for market liquidity in a screening process which excludes the smallest, least liquid and lowest-priced stocks from their sample. Malkiel and Xu (2006) find that liquidity does not diminish the explanatory power of idiosyncratic risk. Angelidis and Andrikopoulos (2010) explore the interactions between idiosyncratic risk, return and liquidity in the London stock exchange using 20 years of daily data on trading activity, returns and volatility, while taking into account size-based portfolios. Using a VAR modelling approach, they find significant volatility spillovers from large cap stocks to small cap ones and vice versa, and also the predictive ability of illiquidity shocks on volatility shocks. They also reveal some evidence of asymmetric liquidity spillovers, from large cap stocks to small cap ones. Wagner and Winter (2013) find, from analysing 529 actively managed mutual funds with European investment focus, that liquidity and idiosyncratic risk are relevant for mutual fund performance, and that these factors provide important extensions to the well-known Fama–French (1992, 1993) and the Carhart (1997) models. Specifically, even if liquidity and idiosyncratic risk are considered at the same time, one factor does not diminish the importance of the other factor. Finally, their results suggest that mutual fund managers prefer more liquid stocks as the liquidity risk factor implies a positive return premium.

The evidence that liquidity and idiosyncratic risk are important risk factors for asset pricing motivates us to explore their contributions in explaining the performance of mutual funds in the main European markets. To the best of our knowledge, the combined importance of idiosyncratic risk and liquidity in fund performance has not been investigated in a large capitalization area like Europe. Other European-focused studies are very limited in terms of their markets coverage and time periods. Wagner and Winter (2013) only consider eight-year time period (October 2002–September 2009) and cover a small capitalization percentage of equity funds in Europe. Their funds are registered in Austria, Germany or Switzerland, the three countries together only account for 15 % of total mutual fund assets in Europe, while UK, France and Germany together accounted for 65 % of total mutual fund assets in Europe at the end of 2012 (see EFAMA 2012 annual statistics). Our research aims to provide a comprehensive and thorough study in Europe using the largest available database for fund returns and covering the largest European financial markets, which account for 90 % of market capitalization.

We find that an important number of style portfolios present significant idiosyncratic risk and liquidity factor loadings. Specifically, model specifications up to six factors are useful and that the liquidity and idiosyncratic risk effects found are even robust to such stricter models with many factors. The importance of these two risk factors is not significantly diminished by considering them at the same time in addition to valuation, market, size and momentum risk factors. Hence, these risk factors capture different aspects in the cross-section of mutual funds returns, even if they may be theoretically and empirically linked to some extent. Our model comparisons indicate that the Carhart (1997) model is only slightly superior compared to the liquidity and idiosyncratic risk augmented Fama and French (1992, 1993) models. Our results, which are also robust to several subperiods and alternative model specifications, provide clear evidence that liquidity and idiosyncratic risk factors are important for mutual fund performance.

The remainder of this paper is organized as follows. Section 2 describes our dataset and the research design. Section 3 presents our estimation procedure for liquidity and idiosyncratic risk measures. Section 4 reviews the basic models and the methodology. Section 5 reports the empirical results and provides an examination on the importance of idiosyncratic risk and liquidity in fund performance. Section 6 summarises our main findings and concludes the paper.

## 2 Data and research design

### 2.1 European mutual funds

We use data on mutual funds with a European focus. We consider the six most important European mutual fund markets, which account for almost 90 % of total mutual fund assets in Europe. The funds are registered in France, Germany, Italy, and Netherlands, Spain, and the United Kingdom.[1] All returns are in local currency.

We construct a database including the six most important mutual fund countries. We restrict our sample to domestic equity funds with at least 24 months of data. We exclude index funds, sector funds (e.g. technology or health care), equity funds that invest internationally, or funds that became one of these types in a subsequent year during the sample period. We do not include index funds as we want to examine the role of liquidity and idiosyncratic risk for actively managed funds. Our sample contains 1,233 equity mutual funds with monthly returns from January 1988 to December 2012. In each country we separate funds by investment styles to test whether this affects performance. We organize our set of mutual funds into different value-weighted mutual fund style portfolios. We use Morningstar Direct to obtain the style classification of mutual funds. Data on returns comes

[1] See European Fund and Asset Management Association (EFAMA) 2012 annual statistics. We exclude Luxemburg as it is considered an offshore centre, as a result of fiscal advantages.

from Lipper,[2] and all returns include any dividend paid. Fund returns are net of any management fee and other operating expenses, and only the primary share class is included. Table 1 reports descriptive statistics of the resulting mutual fund style portfolios.

Survivorship bias is a relevant aspect for mutual fund research (see for example Elton et al. (1996)). This issue can influence our results if dead funds disappear from the sample the average performance will be overestimated. We include dead fund in the sample until they disappear. Afterwards, the portfolios are re-weighted with the surviving funds. Datastream contains data on dead funds for all countries.

Similarly to Otten and Bams (2002), we compare the mean returns of all funds (dead + surviving) with the return on surviving funds. We specify the overestimation by survivorship bias for all our European countries, and find that restricting our sample to surviving funds yields to overestimate average returns by 0.31 % (Germany), 0.24 % (Spain), 0.40 % (United Kingdom), 0.17 % (Italy), 0.33 % (France) and 0.12 % (Netherlands) per year. The percentage of dead funds during the sample period was 24 % for (Germany), 29 % (Spain), 17 % (United Kingdom), 45 % (Italy), 22 % (France) and 22 % (Netherlands).

### 2.2 Benchmarks

In each country, we construct a European version of the Carhart 4-factor and Fama–French models, we consider all stocks included in the Worldscope database (Thomson Financial Company) for each country. Worldscope includes over 98 % of total market capitalization per country. We restrict our selection to only primary quotes of major securities, the prices are adjusted and we also include dead and suspended stocks. The market excess return is calculated as the difference between the value-weighted average return in local currency of all stocks in each country and the local 1-month Treasury bill rate. For each country, we estimate the Fama–French factors using six value-weight portfolios formed on size and book-to-market. The SMB (Small Minus Big) factor is the average return on the three small portfolios minus the average return on the three big portfolios. The HML (High Minus Low) factor is the average return on the two value portfolios minus the average return on the two growth portfolios. We calculate the Momentum factor (MOM) using six value-weight portfolios formed on size and prior (2–12) returns. The portfolios, which are formed monthly, are the intersections of two portfolios formed on size (market equity, ME) and three portfolios formed on prior (2–12) return. The monthly size breakpoint is the median market equity in each country. The monthly prior (2–12) return breakpoints are the 30th and 70th percentiles in each country. The MOM factor is the monthly average return in local currency on the two high-prior return portfolios minus the monthly average return on the two low-prior return portfolios.

## 3 Estimation of liquidity and idiosyncratic risk

### 3.1 The liquidity measure

Using a panel of liquidity measures, Stoll (2000) shows that there is no single measure that captures all dimensions of liquidity. Amihud (2002) argues that liquidity has a number of aspects that cannot be captured in a single measure. The author states that illiquidity shows

[2] Source: Lipper, a Thomson Reuters company.

**Table 1** Summary statistics for European mutual funds

| | Total number | By current status | | | | | |
|---|---|---|---|---|---|---|---|
| | | Live funds | Dead funds | Mean return | SD | Skewness | Kurtosis |
| *Germany* | 103 | 79 | 24 | 0.869 | 1.556 | 0.117 | 3.292 |
| Large blend | 38 | 35 | 3 | 0.849 | 1.123 | 0.071 | 2.280 |
| Large value | 15 | 4 | 11 | 0.808 | 1.363 | −0.025 | 0.781 |
| Mid blend | 13 | 10 | 3 | 1.024 | 1.792 | 0.005 | −0.095 |
| Mid growth | 11 | 8 | 3 | 0.963 | 1.634 | 0.136 | 0.094 |
| Small blend | 15 | 14 | 1 | 1.033 | 1.701 | 0.206 | 0.104 |
| Small growth | 11 | 8 | 3 | 1.102 | 1.458 | 0.056 | 0.563 |
| *Italy* | 97 | 57 | 40 | 0.722 | 1.088 | 0.188 | 2.342 |
| Large blend | 13 | 7 | 6 | 1.117 | 0.669 | −0.022 | 1.475 |
| Large value | 37 | 20 | 17 | 0.715 | 0.838 | 0.168 | 1.529 |
| Mid blend | 11 | 3 | 8 | 0.639 | 0.793 | 0.127 | 0.666 |
| Mid value | 11 | 7 | 4 | 0.800 | 1.107 | 0.011 | 0.456 |
| Small blend | 13 | 10 | 3 | 0.525 | 1.381 | 0.038 | 0.346 |
| Small value | 12 | 10 | 2 | 0.310 | 0.985 | 0.112 | 0.542 |
| *Spain* | 142 | 98 | 44 | 0.689 | 1.441 | −0.131 | 4.463 |
| Large blend | 17 | 6 | 11 | 0.634 | 1.592 | −0.145 | 2.374 |
| Large growth | 12 | 7 | 5 | 0.636 | 1.691 | 0.273 | 1.145 |
| Large value | 71 | 54 | 17 | 0.722 | 1.235 | −0.095 | 2.953 |
| Mid blend | 11 | 7 | 4 | 0.721 | 0.635 | −0.366 | 2.478 |
| Mid value | 17 | 15 | 2 | 0.704 | 1.477 | 0.098 | 0.936 |
| Small value | 14 | 9 | 5 | 0.781 | 1.056 | −0.296 | 2.012 |
| *Netherlands* | 65 | 48 | 17 | 0.848 | 2.830 | 0.262 | 1.359 |
| Large blend | 11 | 8 | 3 | 0.021 | 1.896 | 0.245 | 1.586 |
| Large value | 18 | 13 | 5 | 0.842 | 1.942 | 0.011 | 1.072 |
| Mid value | 12 | 9 | 3 | 0.536 | 2.885 | 0.552 | −0.096 |
| Small blend | 11 | 7 | 4 | 0.841 | 2.435 | 0.487 | 1.234 |
| Small value | 13 | 10 | 3 | 0.968 | 2.435 | 0.155 | 0.432 |
| *France* | 232 | 179 | 53 | 0.650 | 1.938 | −0.040 | 2.583 |
| Large blend | 26 | 11 | 15 | 0.463 | 1.939 | −0.185 | 1.792 |
| Large growth | 12 | 9 | 3 | 0.417 | 1.155 | 0.458 | 1.658 |
| Large value | 135 | 111 | 24 | 0.661 | 1.692 | −0.035 | 2.024 |
| Mid blend | 11 | 8 | 3 | 0.515 | 1.923 | 0.093 | −0.361 |
| Mild value | 21 | 20 | 1 | 0.561 | 2.134 | −0.026 | −0.044 |
| Small blend | 15 | 11 | 4 | 0.530 | 1.597 | 0.425 | 1.002 |
| Small value | 12 | 9 | 3 | 0.565 | 1.165 | 0.045 | 2.142 |
| *UK* | 594 | 487 | 107 | 1.043 | 2.084 | 0.206 | 2.997 |
| Large blend | 286 | 245 | 41 | 1.014 | 1.599 | 0.138 | 2.636 |
| Large growth | 47 | 39 | 8 | 0.988 | 1.922 | 0.105 | 1.670 |
| Large value | 78 | 50 | 28 | 1.053 | 1.818 | 0.094 | 1.999 |
| Mid blend | 55 | 45 | 10 | 0.981 | 2.124 | 0.155 | 1.009 |
| Mid growth | 22 | 18 | 4 | 1.170 | 1.617 | −0.025 | 0.338 |
| Mid value | 20 | 18 | 2 | 1.013 | 2.076 | 0.027 | 0.907 |

**Table 1** continued

| | Total number | By current status | | | | | |
|---|---|---|---|---|---|---|---|
| | | Live funds | Dead funds | Mean return | SD | Skewness | Kurtosis |
| Small blend | 43 | 37 | 6 | 1.143 | 2.195 | 0.062 | 0.792 |
| Small growth | 28 | 24 | 4 | 1.175 | 1.975 | 0.110 | 0.898 |
| Small value | 15 | 11 | 4 | 0.919 | 2.081 | 0.109 | 0.357 |

The table reports summary statistics of the funds in the sample from January 1988 to December 2012. The return data includes reinvestment of all dividends, based on local currencies. The first column shows the total number of funds, the second and third column present the number of live and dead funds, respectively. Mean returns, standard deviation, skewness and kurtosis statistics are presented in columns fourth, fifth, sixth and seventh, respectively

the impact of order flow on price as a result from adverse selection costs and inventory costs.

We create a market liquidity factor for the main European capital markets. To our knowledge, there is actually no work that studies market liquidity for several European capital markets. Our approach of liquidity is in the spirit of the return-to-volume measure of Amihud (2002), which he proposes to capture the price-impact dimension of liquidity. He measures liquidity as:

$$\mathrm{I_{i,t}} = \left|\mathrm{r_{i,t}}\right| / \mathrm{Vol_{i,t}} \tag{1}$$

where $|r_{i,t}|$ is the absolute return on stock *i* on day *t* and $Vol_{i,t}$ is the reported trading volume. The average is computed over all days in the sample for which the ratio is defined. *I* captures the absolute return impact of a cumulative unsigned volume. The square root variant is defined as:

$$\mathrm{I}^{1/2} = \sqrt{\left|r_{i,t}\right|} / \mathrm{Vol_{i,t}} \tag{2}$$

The Amihud ratio is highly correlated to other liquidity measures which use microstructure data. However, Amihud's (2002) illiquidity ratio has two shortcomings. First, the illiquidity ratio increases when a stock price also increases, even when the liquidity is constant. Second, the Amihud illiquidity ratio could be correlated to market capitalization, as trading volume is related to the market capitalization of traded stocks. As the liquidity measure of Amihud (2002) is defined as the ratio of the daily absolute return to daily dollar (euro in this study) trading volume averaged over 1 year, if a stock's trading volume is zero in a given trading date, then its return-to-volume ratio cannot be calculated.

For these reasons, we will follow Lo and Wang (2000) using the natural log of the ratio of absolute return to turnover to reduce the effect of outliers that are common during periods of low trading activity, and to minimize the influence of market capitalization on turnover:

$$\Phi_{\mathrm{i,t}} = \ln\left|\mathrm{r_{i,t}}\right| / \mathrm{Turnover_{i,t}} \tag{3}$$

where $\Phi_{i,t}$ is a measure for the illiquidity of stocks traded, $|r_{i,t}|$ and $Turnover_{i,t}$ are, respectively, the absolute return and turnover on month *t* for stock *i*. We first calculate the monthly liquidity measure for each individual stock and then perform an aggregation. We construct monthly value-weighted and equally-weighted liquidity measures. Lo and Wang (2000) state that the relation between market capitalization and volume comes from

Merton's (1987) model of capital market equilibrium in which investors hold only the stocks they are familiar with. This means that larger-capitalization companies might have more active trading, as they tend to have more diversified ownership. The analysis that follows refers to liquidity as measured by the Lo and Wang (2000) estimator.

We create some filters to help reduce the measurement error in the monthly illiquidity series. Stocks are included in a given month if they have a return for that month and satisfy the following conditions:

(1) A stock's liquidity is computed only if the stock has return and volume data for at least 24 observations. This makes the calculated parameters more reliable. The monthly observations are not required to be consecutive. The stock must be listed at the end of the previous year.
(2) The stock price at the beginning of the year is between 5 and 1,000 in local currency.[3]

Table 2 presents summary statistics for the liquidity measure for each of the six countries. We see that the return for Germany has underperformed the others (but not by a huge amount) and the dividend yield has been fairly consistently lower until recent years. As expected, the liquidity measure is highly negatively correlated with the turnover measure, showing that the liquidity measure well captures the trading quantity characteristic of liquidity. The equally weighted liquidity measure is higher, except for Netherlands, than that of the value-weighted since the latter measure resembles that of the largest capitalization stocks. However, the standard deviation of the less liquid markets is lower than that of the more liquid ones. Figure 1 plots the time series for each market.

## 3.2 Liquidity implications of portfolio theory

Recent research has addressed the importance of factors such as idiosyncratic risk, asymmetric information, transaction costs and other forms of market imperfections which could be relevant for asset pricing and trading activity. To evaluate their relevance in explaining liquidity, a new model that can take into account these factors is needed.

Asset pricing models have been used extensively in empirical investigations in the time-series and cross-sectional characteristics of asset returns. While examining the behavior of liquidity, we aim to prove that the liquidity implication of these models is relevant for asset pricing.

Pastor and Stambaugh (2003) argue that liquidity appears to be a good candidate for a priced state variable. They point that it is often viewed as a relevant characteristic of the investment environment and the macroeconomy, and recent research studies show that fluctuations in several measures of liquidity are correlated across assets. Pastor and Stambaugh (2003) investigate whether marketwide liquidity is indeed priced, and find that expected stock returns are related cross-sectionally to the sensitivities of returns to fluctuations in aggregate liquidity. Their research focuses on systematic liquidity risk in returns and show that stocks whose returns are more exposed to marketwide liquidity fluctuations present higher expected returns.

Wagner and Winter (2013) state that mutual fund managers may actively manage their exposure towards a liquidity risk factor. They consider two assumptions. First, mutual fund managers may focus on illiquidity to benefit from positive expected returns. Second,

[3] Returns on low-price stocks are influenced by the minimum tick of $1/8 (see Harris 1994), which adds noise to the estimations. Prices are converted to euros before the introduction of the currency.

**Table 2** Descriptive statistics for equally weighted and value-weighted liquidity measure

| Countries | Statistic | Turnover VW | Turnover EW | Return VW | Return EW | Liquidity VW | Liquidity EW |
|---|---|---|---|---|---|---|---|
| Germany | Mean | 8,165.456 | 7,368.703 | 383.339 | 354.759 | −0.372 | −0.482 |
| | Median | 487.163 | 469.197 | 139.336 | 125.502 | −0.320 | −0.436 |
| | SD | 10,893.149 | 9,588.273 | 793.206 | 746.093 | 2.592 | 2.646 |
| | Skewness | 6.036 | 6.801 | 4.967 | 4.988 | 0.083 | 0.055 |
| | Kurtosis | 66.277 | 89.837 | 36.931 | 37.175 | 0.074 | 0.220 |
| Italy | Mean | 44,511.372 | 34,826.367 | 734.889 | 656.942 | −1.834 | −1.847 |
| | Median | 2,949.701 | 2,734.198 | 152.413 | 150.852 | −2.668 | −2.529 |
| | SD | 200,058.471 | 150,118.361 | 2,026.397 | 1,620.686 | 2.416 | 2.264 |
| | Skewness | 6.488 | 5.554 | 5.275 | 4.576 | 0.064 | 0.105 |
| | Kurtosis | 55.309 | 44.004 | 34.061 | 26.677 | 0.759 | 0.633 |
| Spain | Mean | 37,929.015 | 31,154.457 | 475.588 | 487.757 | −2.645 | −2.928 |
| | Median | 4,065.644 | 3,529.419 | 237.028 | 238.081 | −2.573 | −2.901 |
| | SD | 123,277.329 | 97,594.797 | 598.441 | 625.632 | 2.519 | 2.424 |
| | Skewness | 4.761 | 4.525 | 2.510 | 2.536 | 0.211 | 0.329 |
| | Kurtosis | 26.379 | 23.361 | 8.171 | 8.227 | −0.343 | −0.094 |
| Netherlands | Mean | 22,901.520 | 19,944.451 | 1,948.017 | 1,533.862 | −1.146 | −1.085 |
| | Median | 1,115.242 | 1,069.927 | 354.780 | 323.393 | −1.314 | −1.315 |
| | SD | 62,896.058 | 53,615.512 | 7,288.761 | 5,661.914 | 3.993 | 3.886 |
| | Skewness | 3.673 | 3.575 | 5.533 | 4.698 | −0.027 | −0.041 |
| | Kurtosis | 15.051 | 14.363 | 42.203 | 33.227 | −0.160 | −0.194 |
| France | Mean | 5,373.980 | 5,057.566 | 1,863.508 | 1,308.510 | 0.817 | 0.823 |
| | Median | 219.873 | 359.120 | 187.441 | 179.748 | 0.797 | 0.778 |
| | SD | 25,365.027 | 22,553.579 | 34,477.211 | 25,652.902 | 3.077 | 3.050 |
| | Skewness | 9.447 | 8.944 | 18.188 | 15.049 | 0.180 | 0.172 |
| | Kurtosis | 118.824 | 109.197 | 382.017 | 298.195 | 0.462 | 0.265 |
| UK | Mean | 47,397.233 | 48,627.056 | 3,527.910 | 3,062.920 | −1.977 | −2.021 |
| | Median | 6,522.645 | 8,990.790 | 571.815 | 734.508 | −2.042 | −2.057 |
| | SD | 200,284.129 | 181,483.851 | 22,203.425 | 20,390.645 | 2.805 | 2.746 |
| | Skewness | 11.803 | 10.501 | 5.993 | 5.806 | 0.179 | 0.131 |
| | Kurtosis | 218.001 | 187.221 | 53.092 | 51.715 | 0.123 | 0.223 |

The table presents summary statistics for monthly value-weighted and equal-weighted turnover and return indexes from January 1988 to December 2012. Turnover shows the aggregation of number of shares traded multiplied by the closing price for each stock. Return presents the theoretical growth in value of a notional stock holding. Liquidity is the result of Eq. (3). Figures are expressed in thousands. VW and EW represent value-weighted and equal-weighted measures, respectively. Stocks included for each country are the following: Germany (675), Italy (287), Spain (145), Netherlands (143), France (689), and UK (1270)

mutual fund managers will focus on the liquidity of their funds' assets, which affect their average exposure to liquidity risk.

We will examine the implications of liquidity on mutual funds pricing. The theoretical asset pricing models serve as valuable framework for our empirical analysis. We aim to develop a more complete understanding of trading and pricing in asset markets.

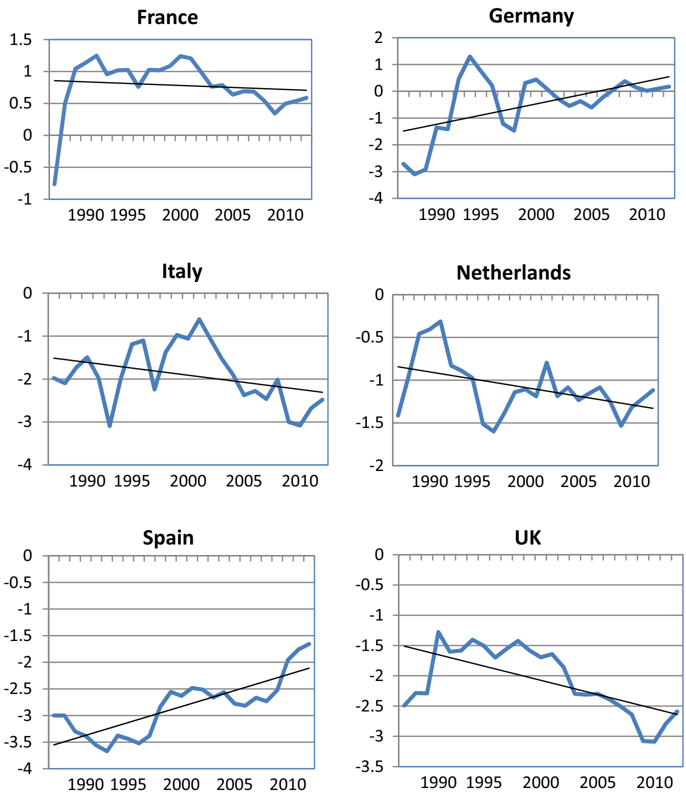


**Fig. 1** Liquidity measure performance. The figure reports the annual performance of the value-weighted liquidity measure for each country in a different graph. The sample period is from January 1988 to December 2012

## 3.3 The idiosyncratic risk measure

Following the current literature, we will use the three-factor model of Fama and French (1993). We define idiosyncratic risk as the standard deviation of the residual $\varepsilon_{i,t}$ in the regression:

$$R_{i,t} = \alpha_i + \beta_{mkt,i} R_{mkt,t} + \beta_{smb,i} R_{smb,t} + \beta_{hml,i} R_{hml,t} + \varepsilon_{i,t} \tag{4}$$

where $R_{i,t}$ is the time *t* excess return on fund *i,* $R_{mkt,t}$ is the market return at time *t*, with $R_{smb}$ and $R_{hml}$ respectively representing the returns on portfolios formed to capture the size and the book-to-market equity effect. When we refer to idiosyncratic risk, we mean idiosyncratic risk relative to the Fama–French model. A fund is included in the sample if 24 out of the 120 previous observations are available for estimation.

Volatility is time varying and exhibits an asymmetric effect. Thus, we will use a dynamic model like EGARCH (Exponential Generalized Autoregressive Conditional Heteroskedasticity) in order to capture time variation in a fund's variance. The EGARCH method is more suitable than both ARCH and GARCH methods, as it allows for an asymmetric response of volatility to stock returns. Furthermore, unlike GARCH, the

EGARCH model, specified in logarithms, does not impose the non-negativity constraints on parameters.

Standard GARCH models assume that good and bad news have a symmetrical effect on volatility. The basic advantage of EGARCH models (Nelson 1991) is that they do not hold the assumption of symmetrical result on volatility, allowing for different effects of good and bad news. The GARCH model considers volatility as an additive function of the lagged error terms, while in the EGARCH it is a multiplicative function of lagged innovations that can respond asymmetrically to good and bad news.

Spiegel and Wang (2005) and Fu (2009) explained that dynamic models like EGARCH better capture the time-varying characteristic of idiosyncratic risk. Spiegel and Wang (2005) compare the accuracy of the OLS and EGARCH idiosyncratic risk estimators, and show that the EGARCH estimates of idiosyncratic risk are superior to the ones generated by the OLS model. Similarly, Fu (2009) finds that the EGARCH model's estimates explain better the cross sectional stock returns than do those from an OLS model. The analysis that follows refers to the EGARCH measure of idiosyncratic risk. The EGARCH model estimates the changes in the conditional variance of the residuals through the following equations:

$$\varepsilon_{i,t} = \sqrt{h_{i,t}} \times \upsilon_t \tag{5a}$$

$$\ln\left(h_{i,t}\right) = k_i + \sum_{j=1}^{P} \theta_{i,j} \ln\left(h_{i,t-j}\right) + \sum_{k=1}^{q} d_{i,k}\left(|\upsilon_{t-k}| - E|\upsilon_{t-k}| + x_i \upsilon_{t-k}\right) \tag{5b}$$

where $h_{i,t}$ is the conditional variance of $\varepsilon_{i,t}$, $vt$ is an i.i.d. error term with zero mean and unit variance. The $k_i$, $\Theta_{i,j}$, $d_{i,k}$ and $x_i$ terms are estimated parameters. Equation (5b) specifies the conditional variance of the Fama–French residuals at time $t$.

At each month $t$, we estimate the EGARCH model using all observations since January 1988, the beginning of the sample, up to month $t-1$. Funds with fewer than 60 observations available are excluded in the sample. For Eq. (5a, 5b), we allow all permutations of $p$ and $q$ such that $1 \leq p \leq 3$ and $1 \leq q \leq 3$. We choose the estimate generated by the model that gives the lowest Akaike Information Criterion (AIC). EGARCH (1, 1) is the best-fitting model for the most number of observations:

$$\ln\left(\sigma_t^2\right) = w_t + \beta \ln\left(\sigma_{t-1}^2\right) + a\left(|\varepsilon_{t-1}|/\sigma_{t-1} - \sqrt{2/\pi}\right) + \gamma\, \varepsilon_{t-1}/\sigma_{t-1} \tag{6}$$

In order to provide an overview of idiosyncratic risk in each market, we plot the average idiosyncratic risk calculated from the residuals of the three-factor model for the six countries in Fig. 2. Clearly there is a positive trend in idiosyncratic risk in each country, except for Germany.

## 4 Empirical evidence

### 4.1 Correlations

Inventory control models such as Merton (1987) or Brunnermeier and Pedersen (2009) state that there is a negative correlation between idiosyncratic risk and market liquidity. Brunnermeier and Pedersen (2009) create a model that links an asset's market liquidity and traders funding liquidity. They prove that, given specific conditions, market liquidity and

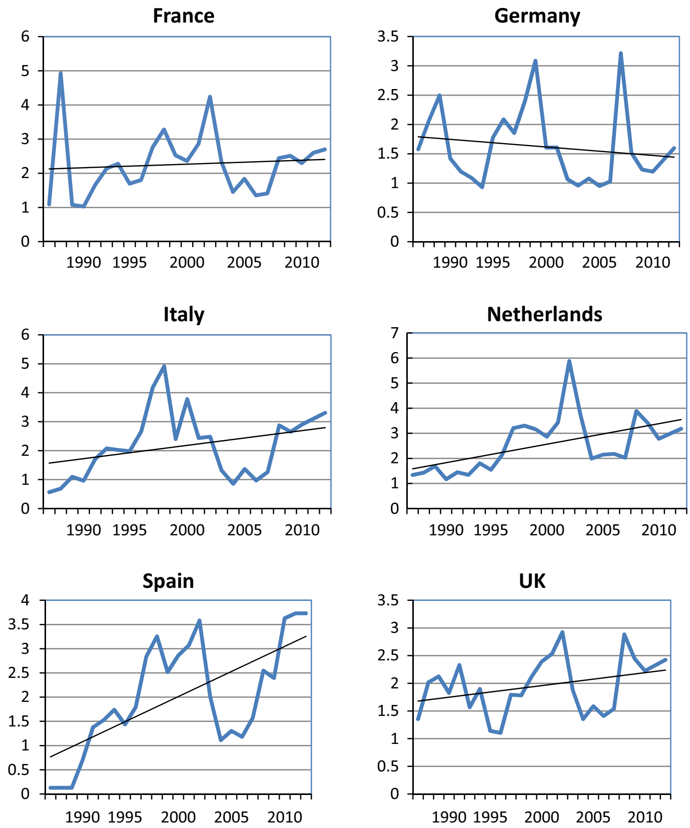


**Fig. 2** Annual performance of idiosyncratic risk. The figure shows the annual performance of the idiosyncratic risk measure for each country, from January 1988 to December 2012

funding liquidity are mutually reinforcing, leading to liquidity spirals. They explain several empirically documented features, including that market liquidity is related to volatility, as trading more volatile assets requires higher margin payments, and market liquidity co-moves with the market since funding conditions do.

We sort fund styles by liquidity and idiosyncratic risk and examine the sort of the other variables. Panel A of Table 3 sorts fund styles by liquidity, Panel B sorts the data by idiosyncratic risk. We will examine whether or not there is a rank correlation and its robustness. As shown by previous studies, small companies present more idiosyncratic risk than large companies, and high idiosyncratic risk companies have low levels of liquidity. Which has not been stated in previous research is whether idiosyncratic risk causes lower liquidity or if it is due to idiosyncratic risk's correlation with size.

## 4.2 Multifactor models

Most research on mutual fund performance evaluation uses multifactor models. Grinblatt and Titman (1994) state that tests of performance are sensitive to the risk factors included in the model. As we have a range of investment styles, single-factor models can yield

**Table 3** The relationship between idiosyncratic risk, liquidity and size

| Rank | | Idiosyncratic risk | | Size | |
|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD |
| Panel A: funds sorted by liquidity | | | | | |
| | *Germany* | | | | |
| 1 (low) | Small growth | 1.401 | 1.542 | 18.051 | 19.552 |
| 2 | Large value | 1.469 | 1.469 | 20.309 | 19.897 |
| 3 | Large blend | 1.237 | 1.237 | 19.989 | 20.332 |
| 4 | Mid blend | 1.898 | 1.898 | 19.273 | 19.395 |
| 5 | Mid growth | 1.618 | 1.618 | 18.781 | 18.273 |
| 6 (high) | Small blend | 1.950 | 1.950 | 16.663 | 16.700 |
| | *Italy* | | | | |
| 1 (low) | Small value | 1.292 | 2.014 | 18.601 | 18.552 |
| 2 | Large value | 2.114 | 1.853 | 18.713 | 19.937 |
| 3 | Mid blend | 1.567 | 1.856 | 18.713 | 17.272 |
| 4 | Small blend | 1.793 | 1.954 | 17.793 | 17.313 |
| 5 | Large blend | 0.857 | 1.311 | 17.837 | 17.639 |
| 6 (high) | Mid value | 1.563 | 2.139 | 17.228 | 16.687 |
| | *Spain* | | | | |
| 1 (low) | Large growth | 0.940 | 1.045 | 19.177 | 18.001 |
| 2 | Mid blend | 0.479 | 0.827 | 17.026 | 17.876 |
| 3 | Large blend | 1.792 | 1.518 | 17.953 | 17.435 |
| 4 | Large value | 1.637 | 1.708 | 17.921 | 18.115 |
| 5 | Mid value | 2.022 | 1.790 | 17.121 | 17.496 |
| 6 (high) | Small value | 1.034 | 1.151 | 16.978 | 16.689 |
| | *Netherlands* | | | | |
| 1 (low) | Large blend | 1.789 | 1.985 | 20.034 | 19.124 |
| 2 | Small blend | 0.468 | 1.652 | 16.234 | 16.770 |
| 3 | Large value | 2.580 | 1.362 | 19.922 | 20.349 |
| 4 | Mid value | 2.345 | 1.855 | 16.915 | 18.552 |
| 5 (high) | Small value | 1.668 | 2.096 | 19.646 | 19.728 |
| | *France* | | | | |
| 1 (low) | Large value | 2.033 | 1.098 | 21.085 | 21.644 |
| 2 | Large growth | 0.970 | 1.307 | 19.923 | 16.780 |
| 3 | Large blend | 1.926 | 1.198 | 18.079 | 18.160 |
| 4 | Mid value | 1.896 | 1.103 | 17.529 | 18.094 |
| 5 | Mid blend | 1.917 | 1.186 | 16.901 | 16.582 |
| 6 | Small value | 1.637 | 1.742 | 16.479 | 15.677 |
| 7 (high) | Small blend | 1.319 | 1.307 | 15.557 | 15.119 |
| | *UK* | | | | |
| 1 (low) | Large blend | 1.909 | 0.959 | 19.183 | 20.004 |
| 2 | Large growth | 0.924 | 0.717 | 19.059 | 19.183 |
| 3 | Large value | 1.827 | 1.113 | 19.337 | 19.996 |
| 4 | Mid blend | 1.812 | 1.103 | 18.341 | 18.816 |
| 5 | Mid growth | 2.026 | 1.053 | 19.082 | 19.975 |

**Table 3** continued

| Rank | | Idiosyncratic risk | | Size | |
|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD |
| 6 | Mid value | 1.458 | 1.006 | 18.884 | 19.369 |
| 7 | Small blend | 1.816 | 0.996 | 18.643 | 19.114 |
| 8 | Small growth | 2.120 | 0.985 | 18.357 | 18.708 |
| 9 (high) | Small value | 1.004 | 1.050 | 18.543 | 19.124 |
| Rank | | Liquidity | | Size | |
| | | Mean | SD | Mean | SD |
| Panel B: funds sorted by idiosyncratic risk | | | | | |
| | *Germany* | | | | |
| 1 (low) | Small growth | 0.088 | 0.067 | 18.051 | 18.986 |
| 2 | Large blend | 0.017 | 0.016 | 19.989 | 20.333 |
| 3 | Large value | 0.012 | 0.031 | 20.309 | 19.897 |
| 4 | Mid growth | 0.067 | 0.189 | 18.781 | 18.273 |
| 5 | Mid blend | 0.044 | 0.067 | 19.273 | 19.396 |
| 6 (high) | Small blend | 0.599 | 0.950 | 16.663 | 16.700 |
| | *Italy* | | | | |
| 1 (low) | Large blend | 0.200 | 0.014 | 17.837 | 17.639 |
| 2 | Small value | 0.233 | 0.034 | 16.221 | 17.042 |
| 3 | Mid value | 0.264 | 0.063 | 17.228 | 16.687 |
| 4 | Mid blend | 0.047 | 0.025 | 18.712 | 17.272 |
| 5 | Small blend | 0.098 | 0.042 | 17.793 | 17.312 |
| 6 (high) | Large value | 0.016 | 0.018 | 18.712 | 19.936 |
| | *Spain* | | | | |
| 1 (low) | Mid blend | 0.023 | 0.015 | 17.002 | 16.987 |
| 2 | Large growth | 0.112 | 0.067 | 18.678 | 17.998 |
| 3 | Small value | 0.331 | 0.059 | 16.978 | 16.689 |
| 4 | Large value | 0.119 | 0.016 | 17.922 | 18.115 |
| 5 | Large blend | 0.101 | 0.023 | 17.953 | 17.667 |
| 6 (high) | Mid value | 0.258 | 0.037 | 17.122 | 17.496 |
| | *Netherlands* | | | | |
| 1 (low) | Large blend | 0.025 | 0.052 | 20.345 | 18.552 |
| 2 | Mid value | 0.024 | 0.034 | 18.345 | 17.431 |
| 3 | Small blend | 0.030 | 0.012 | 16.915 | 16.234 |
| 4 | Small value | 0.028 | 0.065 | 19.647 | 19.728 |
| 5 (high) | Large value | 0.018 | 0.028 | 19.922 | 20.349 |
| | *France* | | | | |
| 1 (low) | Large growth | 0.009 | 0.014 | 19.923 | 13.123 |
| 2 | Small blend | 0.929 | 0.434 | 15.557 | 15.119 |
| 3 | Small value | 0.394 | 0.234 | 16.479 | 14.234 |
| 4 | Mid value | 0.136 | 0.029 | 17.529 | 18.094 |
| 5 | Mid blend | 0.235 | 0.121 | 16.901 | 16.581 |
| 6 | Large blend | 0.065 | 0.025 | 18.079 | 18.160 |

**Table 3** continued

| Rank | | Liquidity | | Size | |
|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD |
| 7 (high) | Large value | 0.005 | 0.011 | 21.085 | 21.644 |
| | *UK* | | | | |
| 1 (low) | Large growth | 0.052 | 0.089 | 19.059 | 19.182 |
| 2 | Small value | 0.081 | 0.103 | 18.542 | 19.124 |
| 3 | Mid value | 0.063 | 0.080 | 18.884 | 19.369 |
| 4 | Mid blend | 0.106 | 0.143 | 18.341 | 18.816 |
| 5 | Small blend | 0.091 | 0.109 | 18.643 | 19.114 |
| 6 | Large value | 0.042 | 0.037 | 19.337 | 19.996 |
| 7 | Large blend | 0.047 | 0.033 | 19.183 | 20.004 |
| 8 | Mid growth | 0.060 | 0.034 | 19.082 | 19.975 |
| 9 (high) | Small growth | 0.125 | 0.148 | 18.357 | 18.707 |

The table presents the time series cross sectional average and standard deviation in the columns named Mean and SD, respectively, of idiosyncratic risk, size, and liquidity for each investment style. Idiosyncratic risk and liquidity are estimated at the fund level. Size measures total net assets per fund. The statistics are calculated using monthly logarithmic data. In each month value-weighted measures are created. Sample period: January 1988 to December 2012

biased estimates of performance. The single-factor model assumes that a single market index is enough to account for the fund's investment strategies. Fama and French (1993, 1996) research on the cross-sectional variation of stock returns has showed strong evidence of the importance of two risk factors: size and book-to-market. Fama and French (1993) argue that SMB and HML are state variables in an intertemporal asset pricing model. We will focus on liquidity and idiosyncratic risk in the context of the Fama and French three-factor (1992, 1993) and Carhart (1997) models.

Previous studies have considered multifactor models including liquidity and idiosyncratic risk. Pastor and Stambaugh (2003) create a liquidity factor that has an important effect on returns. They explain that the return earned by the decile portfolio with the highest sensitivity to liquidity risk exceeds by 7.5 % per year the decile portfolio with the lowest sensitivity to their liquidity factor. Avramov and Chordia (2006) point that rational asset pricing theories have been silent about how SMB and HML are related to the underlying undiversifiable macroeconomic risks. They use the Fama–French model augmented with a proxy for the Pastor and Stambaugh (2003) liquidity factor. Their liquidity factor is the difference between value-weighted average return on stocks with high sensitivities to liquidity less the value-weighted average return on stocks with low sensitivities to liquidity. They conclude that the inclusion of the liquidity factor does not improve the model ability to explain the predictive power of equity characteristics. Furthermore, the liquidity factor does not capture the impact of turnover on the cross-section of individual stock returns.

Research on mutual fund performance has been geographically limited and mainly focused on the US and the UK markets. Developments in fund performance multi-factor models have not yet been explored in many other markets. Elton et al. (1995) stated that a country's mutual fund market shows a high degree of leverage as its net value is similar to the country's stock market. Mutual funds are normally composed by a wide class of stocks from different industries and therefore embody cross-sector trends and information from the whole economy. Thus, knowing the factors influencing mutual funds would be beneficial for both practitioners and academics.

We contribute to the international mutual fund performance literature by providing a comprehensive analysis of the performance of European-domiciled mutual funds investing in the largely unexplored European market. Our goal is to examine whether liquidity and idiosyncratic risk can explain the performance of mutual funds. Using Fama–French and Carhart factors we consider financial market anomalies like the size effect [see Banz (1981) or Reinganum (1981)] and the explanatory power of growth and value stocks [see Fama and French (1996)]. We investigate whether a fundś expected return is related to the sensitivity of its return to the innovation in liquidity, *Lt,* and idiosyncratic risk, *It.* The sensitivity is denoted for fund *i* by its liquidity and idiosyncratic risk beta $\beta_{L,i}$, and $\beta_{I,i}$, respectively, is the slope coefficient on *Lt* and *It* in a multiple regression model with other independent factors which are important for asset pricing. At the end of each year, starting with 1988, we sort funds on the basis of their investment style and form portfolios. The returns on these portfolios during the next 12 months are linked across years to create a single return series for each investment style portfolio. We regress the excess returns of these portfolios on factors that are normally used in empirical asset pricing research. When alphas differ from zero, $\beta_{L,i}$ and $\beta_{I,i}$ explain a component of expected returns not captured by the other factors.

We define $\beta_{L,i}$ and $\beta_{I,i}$ as the coefficients on $R_{L,t}$ and $R_{I,t}$ in a regression that also includes the three and four factors of Fama and French (1993) and Carhart (1997) models:

$$R_{i,t} = \alpha_i + \beta_{L,i}R_{L,t} + \beta_{I,i}R_{I,t} + \beta_{mkt,i}R_{mkt,t} + \beta_{smb,i}R_{smb,t} + \beta_{hml,i}R_{hml,t} + \varepsilon_{i,t} \quad (7)$$

$$R_{i,t} = \alpha_i + \boldsymbol{\beta}_{L,i,}R_{L,t} + \boldsymbol{\beta}_{I,i}R_{I,t} + \boldsymbol{\beta}_{mkt,i}R_{mkt,t} + \boldsymbol{\beta}_{smb,i}R_{smb,t} + \boldsymbol{\beta}_{hml,i}R_{hml,t} + \boldsymbol{\beta}_{mom,i}R_{mom,t} + \varepsilon_{i,t} \quad (8)$$

where $R_{i,t}$ is the return on fund *i* in excess of the one-month T-bill return; $R_{mkt}$ is the excess return on a value-weighted broad market index; $R_{smb}$, $R_{hml}$, and $R_{mom}$ are returns on value-weighted, zero-investment, factor-mimicking portfolios for size, book-to-market equity, and one-year momentum in stock returns; $\alpha_i$ is the average return left unexplained by the benchmark models; and $\varepsilon_{i,t}$ is the regression residual. $R_{L,t}$ and $R_{I,t}$ are returns on liquidity and idiosyncratic risk captured from the fund's co-movement with aggregate liquidity and idiosyncratic risk that is distinct from its co-movement with the other commonly used factors.

For our study, we consider $R_{smb,t}$, $R_{hml,t}$, $R_{mom,t}$, $R_{L,t}$ and $R_{I,t}$ as diversified passive benchmarks returns that represent patterns in average returns during the sample period of our study. The slopes on the explanatory returns in Eqs. (7) and (8) represent a diversified portfolio of passive benchmarks that replicates the exposures of the fund on the left to common factors in returns. The regression alpha captures the average return provided by a fund in excess of the return on a comparable passive portfolio. Following Dybvig and Stephen (1985), we understand a positive expected alpha as good performance, and a negative expected alpha means bad performance.

## 5 Results

The results of the relationship between idiosyncratic risk and liquidity are reported in Table 3. Panel A reports funds sorted by liquidity, and panel B funds sorted by idiosyncratic risk. Each panel has several rows representing the number of fund investment styles over which the ranking have been evaluated. The first two columns report the rank and the fund investment style for all the countries under consideration. In both panels, the measures of liquidity, idiosyncratic risk and size are the value-weighted average of the funds in each investment style.

Panel A's sort by liquidity does not show any conclusive result on idiosyncratic risk, but instead produces almost perfect sort on size, it seems that the size effect may to a large extent depend on liquidity. Previous studies and theoretical models predict that high idiosyncratic risk companies have low levels of liquidity. In this study, there is mixed evidence, thus such a conclusion cannot be stated. In the same sense, it cannot be stated that small capitalization funds have more idiosyncratic risk than the large capitalization ones, there is also mixed evidence. Panel B, which sorts the data by idiosyncratic risk, also leads to the same conclusion reached by Panel A: size and liquidity are highly correlated with each other, while idiosyncratic risk and liquidity show no correlation.

The correlation between idiosyncratic risk and liquidity might be an indicator of high redundancy. Furthermore, a correlation might be a sign that both risk factors proxy for the same underlying systematic risk. Multicollinearity could be another problem of using highly correlated factors in multifactor models. The fact that liquidity and idiosyncratic risk present no correlation makes them quite appropriate for the use in multifactor models.

Results of Fama and French and Carhart models augmented with different liquidity and idiosyncratic risk are reported in Tables 4, 5, 6, 7, 8, 9. For each country, we create value-weighted portfolios containing all funds within a specific investment style. We also form a portfolio consisting of all funds within a particular country. We estimate these different multifactor models via OLS regressions, covering the time period January 1988 to December 2012. We use the covariance matrix of Newey and West (1987) for the estimation of standard errors in order to take into account heteroskedasticity and autocorrelation. The number of statistically significant investment style portfolios is given with respect to the 10, 5 and 1 % levels.

Tables 4, 5 and 6 present idiosyncratic risk and liquidity augmented Fama and French models. On average, the per annum alphas, in the multifactor regressions are quite significantly negative with respect to all models. Most investment style portfolios for the six countries show a significant positive exposure to the market excess return, most investment style portfolios are also significantly positive for the size factor, except for Italy and Netherlands, where the majority of portfolios are not significant. The results with regard to valuation present mixed evidence, while most portfolios are significantly positive, prefer value over growth, two countries present negative exposure. These results are quite stable in all multifactor models. Furthermore, in Table 4, 22 out of the 45 portfolios significantly load on the idiosyncratic risk factor. More portfolios positively load on idiosyncratic risk, mainly Spain and Netherlands, while in the UK, all portfolios are significantly negative. In Table 5, 36 portfolios significantly load on the liquidity factor. France, Netherlands and UK present a significantly negative liquidity factor, while it is significantly positive for Spain and Germany. Thus, over the whole observation period, there are a larger number of funds significantly loading on liquidity than on idiosyncratic risk. Table 6 includes both idiosyncratic risk and liquidity in a Fama and French model, the amount of significant fund portfolios for the liquidity factor do not change, but the idiosyncratic risk factor shows a significant exposure for 24 funds. Thus, although the results regarding liquidity and idiosyncratic risk are quite stable when considering both factors together, idiosyncratic risk significance slightly changes when liquidity is included. This is consistent with the results of Malkiel and Xu (2006) which document that the explanatory power of idiosyncratic risk is not taken away by controlling for liquidity. It is of interest the evidence regarding

**Table 4** Fama–French regression augmented by idiosyncratic risk

| | αi | Id. risk | Mk. Ex. Re. | Size | Value | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|
| *Germany* | −0.351*** | −0.041 | 0.543*** | 0.204*** | 0.011 | 0.851 | 132.960 |
| Large blend | −0.323*** | −0.071 | 0.747*** | −0.016* | 0.120*** | 0.798 | 498.535 |
| Large value | −0.522*** | 0.281 | 0.708*** | −0.033** | 0.071*** | 0.808 | 345.859 |
| Mid blend | −0.720*** | −0.041 | 0.647*** | 0.217*** | 0.091*** | 0.810 | 207.468 |
| Mid growth | −0.803*** | 0.075 | 0.406*** | 0.089*** | 0.072* | 0.861 | 69.524 |
| Small blend | −1.027*** | −0.021 | 0.242*** | 0.130*** | 0.077*** | 0.885 | 124.996 |
| Small growth | −0.459*** | −0.275 | 0.591*** | 0.322*** | 0.110** | 0.786 | 104.293 |
| *Italy* | −0.056*** | *0.051*** | 0.301*** | 0.016** | −0.127*** | 0.819 | 121.520 |
| Large blend | −0.022*** | *0.203** | 0.306** | −0.007 | −0.149*** | 0.877 | 45.971 |
| Large value | −0.110*** | *0.097**** | 0.417*** | 0.023** | −0.132*** | 0.794 | 104.237 |
| Mid blend | −1.227*** | −0.030 | 0.215*** | 0.055** | −0.164*** | 0.841 | 72.128 |
| Mid value | −0.264*** | −0.020 | 0.455*** | −0.005 | −0.137*** | 0.934 | 88.510 |
| Small blend | −1.172*** | −0.058 | 0.403*** | 0.014 | −0.029 | 0.902 | 157.965 |
| Small value | −1.093*** | −0.244 | 0.233** | −0.012 | −0.390*** | 0.803 | 36.389 |
| *Spain* | −0.730*** | *0.258**** | 0.516*** | 0.010*** | 0.041*** | 0.915 | 527.017 |
| Large blend | −0.431*** | *0.284**** | 0.499*** | 0.011*** | −0.003 | 0.851 | 414.846 |
| Large growth | −0.933*** | *0.286**** | 0.465*** | 0.010 | −0.089*** | 0.848 | 217.704 |
| Large value | −1.059*** | *0.271**** | 0.570*** | 0.010*** | 0.037*** | 0.782 | 559.266 |
| Mid blend | −0.768*** | −0.008 | 0.230*** | 0.004 | 0.146*** | 0.892 | 265.089 |
| Mid value | −1.221*** | *0.163**** | 0.400*** | 0.009*** | 0.099*** | 0.863 | 438.960 |
| Small value | −0.178*** | 0.037 | 0.155*** | 0.022 | 0.104*** | 0.823 | 307.768 |
| *Netherlands* | −0.225*** | *0.201**** | 0.447*** | 0.012*** | 0.088*** | 0.812 | 245.514 |
| Large blend | −1.079 | 0.128 | 0.079** | −0.010 | 0.021 | 0.916 | 21.552 |
| Large value | −1.086*** | *0.141**** | 0.480*** | 0.011*** | 0.089*** | 0.856 | 276.605 |
| Mid value | −0.962*** | 0.274 | 0.611*** | 0.015 | 0.226*** | 0.840 | 96.069 |
| Small blend | −1.138*** | *0.271**** | 0.395*** | 0.015 | 0.081 | 0.905 | 135.807 |
| Small value | −0.348*** | *0.360**** | 0.253*** | 0.015 | 0.041*** | 0.802 | 61.188 |
| *France* | −0.695*** | −0.001 | 0.485*** | 0.018*** | −0.045*** | 0.865 | 295.938 |
| Large blend | −0.629*** | −0.032 | 0.486*** | 0.018*** | −0.005*** | 0.904 | 228.929 |
| Large growth | −1.848*** | 0.024 | 0.495*** | 0.026** | −0.015* | 0.803 | 116.184 |
| Large value | −0.544*** | 0.003 | 0.523*** | 0.017*** | −0.025*** | 0.801 | 315.911 |
| Mid blend | −1.128*** | −0.022 | 0.375*** | 0.021*** | −0.001** | 0.844 | 174.441 |
| Mid value | −1.204*** | 0.009 | 0.365*** | 0.023*** | −0.006*** | 0.834 | 234.471 |
| Small blend | −0.359*** | 0.013 | 0.132*** | 0.050** | −0.000 | 0.855 | 212.563 |
| Small value | −0.331*** | *0.069** | 0.163*** | 0.065** | −0.004 | 0.867 | 185.220 |
| *UK* | −0.175*** | *−0.034**** | 0.529*** | 0.016*** | 0.047*** | 0.856 | 378.517 |
| Large blend | −0.307*** | *−0.029**** | 0.551*** | 0.066*** | 0.049*** | 0.902 | 420.726 |
| Large growth | −0.959*** | *−0.023** | 0.577*** | 0.006*** | 0.027*** | 0.877 | 392.061 |
| Large value | −0.303*** | *−0.029**** | 0.509*** | 0.016*** | 0.059*** | 0.820 | 359.398 |
| Mid blend | −0.410*** | *−0.038**** | 0.479*** | 0.003*** | 0.043*** | 0.923 | 328.051 |
| Mid growth | −0.736*** | *−0.033** | 0.433*** | 0.004*** | 0.038*** | 0.834 | 314.738 |
| Mid value | −0.177*** | −0.006 | 0.541*** | 0.000*** | 0.072*** | 0.704 | 318.595 |
| Small blend | −1.328*** | *−0.053**** | 0.475*** | 0.085*** | 0.044*** | 0.733 | 284.010 |

**Table 4** continued

| | αi | Id. risk | Mk. Ex. Re. | Size | Value | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|
| Small growth | −1.688*** | *−0.089**** | 0.556*** | 0.077** | 0.028* | 0.834 | 261.077 |
| Small value | −0.411*** | *−0.064** | 0.443*** | 0.043 | 0.059** | 0.844 | 186.574 |

The table reports regression coefficients on value-weighted portfolios grouped by investment style for the idiosyncratic risk augmented Fama–French model. Significance at the 1, 5, 10 % level is denoted by ***, **, and *, respectively. Regressions are performed considering the covariance matrix of Newey and West (1987). Sample period: January 1988 to December 2012. All alphas in the Table are annualised. Fund italicized indicate significant idiosyncratic risk factor at the 10 % level

liquidity, which is rather recent in performance evaluation, and is not less significant than the valuation or size factors which are part of most standard performance models.

Tables 7, 8 and 9 report idiosyncratic risk and liquidity augmented Carhart models. As in the Fama and French model, alphas are significantly negative in all variation of the Carhart model. This means that, on average, the investor loses money when investing in these mutual funds after consideration of risk. The results for the market excess return, valuation and size factor exposures are quite similar to the Fama and French models mentioned above for every augmented Carhart model. A considerably large amount of funds significantly positively loads on momentum, which means that fund managers try to find past winners, 31 out of 45 portfolios show a significant momentum factor when idiosyncratic risk is included in a Carhart model, 36 portfolios significantly load on momentum when liquidity is included, while only 32 portfolios present a significantly positive momentum factor when both idiosyncratic risk and liquidity are included in the Carhart model. Thus, the inclusion of idiosyncratic risk into the Carhart model reduces the number of portfolios loading on momentum. In models with momentum, funds show a positive exposure towards valuation, that is prefer value over growth, in Germany, Spain and the UK, and a negative exposure towards valuation, preferring growth over value, in Italy and France. Table 7 reports that 17 portfolios significantly load on idiosyncratic risk factor, which is a smaller amount than in the previous Fama and French models. While in Table 8 the amount of investment style portfolios which significantly load on liquidity are the same as in the Fama and French models. Thus, the inclusion of a momentum factor into a multifactor model reduces the average loading on idiosyncratic risk factor. In Table 9 both idiosyncratic risk and liquidity are included into an augmented Carhart model, as in the Fama and French model, the amount of significant fund portfolios for the liquidity factor do not change, but the idiosyncratic risk factor shows a significant exposure for 14 fund portfolios, a small change in idiosyncratic risk significance compared to Table 7. As in the previous Fama and French models considered, we could also state that the explanatory power of idiosyncratic risk is not taken away by controlling for liquidity, and the liquidity factor is not less significant than the most standard valuation or size factors.

Our results which show that alphas after costs are negative are similar to the results of other previous U.S. performance studies, like Jensen (1968), Grinblatt and Titman (1989a), or Gruber (1996). It is important to consider that we cover the time period of the burst of the technology bubble and the financial crisis. Our results are consistent with Gruenbichler and Pleschiutschnig (1999) who also report a negative risk-adjusted performance with respect to the Carhart model for specific fund categories. However, our results are in contrast to Otten and Bams (2002), who find that European mutual funds present positive risk-adjusted performance after costs.

**Table 5** Fama–French regression augmented by liquidity

| | αi | Liquidity | Mk. Ex. Re. | Size | Value | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|
| *Germany* | −0.521*** | *0.887**** | 0.410*** | 0.140*** | −0.004 | 0.803 | 213.838 |
| Large blend | −0.312*** | *0.222**** | 0.749*** | −0.014 | 0.118*** | 0.838 | 527.299 |
| Large value | −0.301*** | *0.181**** | 0.713*** | −0.024 | 0.067*** | 0.848 | 365.161 |
| Mid blend | −0.131*** | *0.369**** | 0.651*** | 0.170*** | 0.088*** | 0.930 | 211.668 |
| Mid growth | −0.314*** | *0.463*** | 0.408*** | 0.103*** | 0.065 | 0.851 | 71.629 |
| Small blend | −1.012*** | *0.483**** | 0.228*** | 0.033*** | 0.077*** | 0.775 | 123.618 |
| Small growth | −0.321*** | 0.403 | 0.557*** | 0.093*** | 0.108** | 0.886 | 91.109 |
| *Italy* | −0.073*** | *0.244**** | 0.328*** | 0.038*** | −0.129*** | 0.904 | 122.841 |
| Large blend | −0.326*** | 0.007 | 0.423** | −0.009 | −0.158*** | 0.855 | 95.933 |
| Large value | −0.213*** | *0.288**** | 0.412*** | 0.031*** | −0.138*** | 0.845 | 105.271 |
| Mid blend | −0.767*** | 0.278 | 0.332*** | 0.026 | −0.164*** | 0.845 | 73.019 |
| Mid value | −0.312*** | 0.183 | 0.289*** | −0.006 | −0.138*** | 0.839 | 89.462 |
| Small blend | −0.622*** | 0.171 | 0.245*** | 0.058* | −0.029 | 0.844 | 159.293 |
| Small value | −0.613*** | −0.441 | −0.014** | 0.044** | −0.383*** | 0.806 | 36.409 |
| *Spain* | −0.523*** | *2.919**** | 0.552*** | 0.113*** | 0.066*** | 0.944 | 530.322 |
| Large blend | −0.522*** | *2.728**** | 0.529*** | 0.104*** | 0.013 | 0.867 | 397.380 |
| Large growth | −0.722*** | *2.822**** | 0.500*** | 0.108*** | −0.079*** | 0.895 | 200.200 |
| Large value | −0.642*** | *2.804**** | 0.591*** | 0.089*** | 0.061*** | 0.855 | 565.683 |
| Mid blend | −0.432*** | *3.720**** | 0.350*** | 0.177*** | 0.180*** | 0.933 | 250.950 |
| Mid value | −1.053*** | *3.244**** | 0.489*** | 0.195*** | 0.134*** | 0.945 | 460.049 |
| Small value | −0.321*** | *2.509**** | 0.200*** | 0.190*** | 0.112*** | 0.899 | 249.111 |
| *Netherlands* | −0.321*** | *−2.176**** | 0.434*** | 0.013*** | 0.091*** | 0.875 | 260.937 |
| Large blend | −1.222 | 0.396 | 0.086** | −0.008 | 0.015 | 0.888 | 22.443 |
| Large value | −0.821*** | *−1.823**** | 0.467*** | 0.012*** | 0.091*** | 0.866 | 291.211 |
| Mid value | −0.200*** | *−2.267**** | 0.588*** | 0.016 | 0.234*** | 0.904 | 101.521 |
| Small blend | −0.426*** | *−2.552**** | 0.246*** | 0.017 | 0.038 | 0.903 | 64.242 |
| Small value | −0.899*** | *−2.886**** | 0.389*** | 0.026** | 0.085*** | 0.789 | 146.245 |
| *France* | −0.533*** | *−0.778**** | 0.512*** | 0.019*** | −0.001*** | 0.923 | 315.913 |
| Large blend | −0.149*** | *−0.769**** | 0.514*** | 0.021*** | −0.005*** | 0.845 | 244.641 |
| Large growth | −1.511*** | *−0.765** | 0.525*** | 0.028** | −0.045** | 0.902 | 125.749 |
| Large value | −0.311*** | *−0.727**** | 0.550*** | 0.018*** | −0.013*** | 0.883 | 339.359 |
| Mid blend | −1.338*** | *−0.926**** | 0.401*** | 0.024*** | −0.007** | 0.834 | 182.137 |
| Mid value | −1.104*** | *−0.809**** | 0.393*** | 0.026*** | −0.011*** | 0.888 | 245.061 |
| Small blend | −0.255*** | −0.029 | 0.143*** | 0.060** | −0.000 | 0.802 | 210.931 |
| Small value | −0.612*** | −0.369 | 0.177*** | 0.066*** | −0.006 | 0.788 | 184.999 |
| *UK* | −0.234*** | *−1.013**** | 0.539*** | 0.006*** | 0.040*** | 0.933 | 396.474 |
| Large blend | −0.234*** | *−0.992**** | 0.560*** | 0.002*** | 0.042*** | 0.877 | 442.537 |
| Large growth | −0.612*** | *−1.035**** | 0.585*** | 0.016*** | 0.019** | 0.803 | 413.164 |
| Large value | −0.610*** | *−0.979**** | 0.518*** | 0.033*** | 0.051*** | 0.773 | 376.449 |
| Mid blend | −0.345*** | *−1.066**** | 0.493*** | 0.005*** | 0.036*** | 0.789 | 342.041 |
| Mid growth | −0.566*** | *−0.899**** | 0.444*** | 0.008*** | 0.030** | 0.844 | 326.879 |
| Mid value | −0.323*** | *−1.003**** | 0.545*** | 0.007*** | 0.066*** | 0.893 | 332.872 |
| Small blend | −1.052*** | *−1.045**** | 0.483*** | 0.073*** | 0.038*** | 0.802 | 293.838 |

**Table 5** continued

| | αi | Liquidity | Mk. Ex. Re. | Size | Value | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|
| Small growth | −0.845*** | *−1.163**** | 0.566*** | 0.076*** | 0.025 | 0.823 | 271.977 |
| Small value | −0.843*** | *−1.115**** | 0.449*** | 0.086** | 0.055** | 0.964 | 194.288 |

The table reports regression coefficients on value-weighted portfolios grouped by investment style for the liquidity augmented Fama–French model. Significance at the 1, 5, 10 level is denoted by ***, **, and *, respectively. Regressions are performed considering the covariance matrix of Newey and West (1987). Sample period: January 1988 to December 2012. All alphas are annualised. Fund italicized indicate significant liquidity factor at the 10 % level

The factor loadings for both models (Fama and French, and Carhart) show significant positive size factor for most fund portfolios, which means that fund returns are driven by smaller stocks. The valuation factor is also significantly positive, except for Italy and France, indicating that funds follow a more value oriented style. The momentum factor is significantly positive in most cases, indicating that mutual fund managers focus more on past winners. There is also a small tendency that mutual fund managers focus more on stock with a negative exposure towards market liquidity and a positive one towards idiosyncratic risk. The preferences of mutual fund managers in our study resembles the results of Otten and Bams (2002), their research based on the five most important European countries find that European funds prefer smaller stocks and stocks with high book-to market ratios (value). Mutual fund managers may look for small, eventually undervalued stocks which are overseen by the investors. This is part of the selection component of active investing. The focus on such a strategy is profitable, as it is known that over certain periods of time smaller stocks provide for abnormal returns.

The average adjusted R-squared in all models is around 54 %, which implies that a considerable part of the performance of the mutual funds can be explained by the different multifactor models. The adjusted R-squared is slightly increased by including both liquidity and idiosyncratic risk in the multifactor models. Moreover, all F-statistics are in favor of the joint significance of the multiple risk factors for each fund portfolio. It is interesting to point that when investing in a large number of assets, which are linked to the market, the market excess return can normally not be actively managed. Thus mutual funds cannot hedge market risk, as it is difficult for mutual fund managers to avoid exposure to the market excess return.

## 5.1 Robustness analysis

We use the cross-sectional time-series procedure developed by Fama and MacBeth (1973) to provide a more complete analysis in our regression analysis. We want to examine whether our results from the multifactor models are statistically and qualitatively similar to those of the Fama–MacBeth methodology.

We estimate the relation between mutual fund performance and our liquidity and idiosyncratic risk factors using the Fama–MacBeth two-step approach to account for cross correlation in returns. First, we regress returns against the explanatory variables in the cross section for each period and then take a time series average of the cross-sectional estimates.

Table 10 shows the Fama–MacBeth regression results. We indeed run a cross-sectional regression of fund returns averaged across all months of the year, on our fund variables measured at the beginning of the year, we do the same every year. Our results confirm the

**Table 6** Fama–French regression augmented by liquidity and idiosyncratic risk

| | αi | Liquidity | Id. Risk | Mk. Ex. Re. | Size | Value | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|---|
| *Germany* | −0.599*** | 0.898*** | −0.007 | 0.411*** | 0.171*** | 0.004 | 0.833 | 313.078 |
| Large blend | −0.003*** | 0.226*** | −0.006 | 0.748*** | −0.010 | 0.119*** | 0.847 | 486.506 |
| Large value | −0.113*** | 0.179*** | 0.000 | 0.708*** | −0.027 | 0.071*** | 0.866 | 326.989 |
| Mid blend | −0.034*** | 0.334*** | −0.005 | 0.649*** | 0.228*** | 0.088*** | 0.900 | 188.418 |
| Mid growth | −0.123*** | 0.553** | 0.134 | 0.413*** | 0.108*** | 0.066 | 0.844 | 80.703 |
| Small blend | −0.426*** | 0.470*** | −0.015 | 0.245*** | 0.138*** | 0.073*** | 0.755 | 113.871 |
| Small growth | −0.322*** | 0.351 | −0.009 | 0.597*** | 0.332*** | 0.106** | 0.816 | 87.651 |
| *Italy* | −0.033** | 0.238*** | 0.051** | 0.438*** | 0.018** | −0.128*** | 0.913 | 119.856 |
| Large blend | −0.032** | −0.012 | 0.204* | 0.423*** | −0.007 | −0.149*** | 0.823 | 40.176 |
| Large value | −0.210*** | 0.279*** | 0.097*** | 0.328*** | 0.010*** | −0.134*** | 0.873 | 102.001 |
| Mid blend | −0.233*** | 0.274 | −0.029 | 0.476*** | 0.017** | −0.165*** | 0.912 | 64.203 |
| Mid value | −0.033*** | 0.176 | −0.020 | 0.527*** | −0.006 | −0.138*** | 0.844 | 81.170 |
| Small blend | −0.443*** | 0.159 | −0.056 | 0.212*** | 0.018* | −0.030 | 0.822 | 145.854 |
| Small value | −0.332*** | −0.462 | −0.249 | −0.114** | 0.022** | −0.389*** | 0.811 | 30.353 |
| *Spain* | −0.837*** | 2.855*** | 0.164*** | 0.549*** | 0.113*** | 0.062*** | 0.955 | 530.852 |
| Large blend | −0.213*** | 2.654*** | 0.206*** | 0.528*** | 0.104*** | 0.007 | 0.915 | 384.773 |
| Large growth | −0.453*** | 2.771*** | 0.245*** | 0.498*** | 0.105*** | −0.086*** | 0.910 | 178.281 |
| Large value | −0.359*** | 2.741*** | 0.151*** | 0.588*** | 0.088*** | 0.057*** | 0.920 | 562.688 |
| Mid blend | −0.386*** | 3.706*** | 0.119* | 0.352*** | 0.178*** | 0.178*** | 0.948 | 220.693 |
| Mid value | −0.031*** | 3.191*** | 0.147*** | 0.488*** | 0.194*** | 0.129*** | 0.960 | 442.801 |
| Small value | −0.233*** | 2.765*** | 0.144** | 0.205*** | 0.151*** | 0.108*** | 0.910 | 219.981 |
| *Netherlands* | −0.342*** | −2.205*** | 0.043 | 0.439*** | 0.013*** | 0.087*** | 0.833 | 252.148 |
| Large blend | −0.213 | 0.766 | 0.228 | 0.101** | −0.010 | 0.015 | 0.740 | 18.321 |
| Large value | −0.545*** | −1.894*** | 0.007 | 0.471*** | 0.012*** | 0.087*** | 0.855 | 277.313 |
| Mid value | −0.126*** | −2.237*** | 0.096 | 0.596*** | 0.016 | 0.229*** | 0.877 | 83.792 |

**Table 6** continued

| | αi | Liquidity | Id. Risk | Mk. Ex. Re. | Size | Value | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|---|
| Small blend | −0.345*** | *−2.356**** | *0.245** | 0.260*** | 0.047* | 0.035 | 0.912 | 55.700 |
| Small value | −0.677*** | *−2.909**** | 0.077 | 0.398*** | 0.036** | 0.081*** | 0.810 | 131.659 |
| *France* | −0.034*** | *−1.109**** | *0.032**** | 0.522*** | 0.022*** | −0.005*** | 0.933 | 311.690 |
| Large blend | −0.234*** | *−1.123**** | −0.005 | 0.521*** | 0.023*** | −0.004*** | 0.811 | 233.101 |
| Large growth | −0.765*** | *−1.117*** | 0.055 | 0.538*** | 0.031*** | −0.002** | 0.915 | 106.885 |
| Large value | −0.067*** | *−1.065**** | *0.038**** | 0.559*** | 0.021*** | −0.003*** | 0.920 | 334.874 |
| Mid blend | −0.633*** | *−1.242**** | 0.006 | 0.412*** | 0.026*** | −0.061** | 0.811 | 167.025 |
| Mid value | −0.867*** | *−1.094**** | *0.041** | 0.402*** | 0.028*** | −0.012*** | 0.897 | 231.748 |
| Small blend | −0.633*** | −0.050 | 0.028 | 0.145*** | 0.071** | −0.000 | 0.786 | 178.785 |
| Small value | −0.213*** | −0.488 | *0.092*** | 0.183*** | 0.067*** | −0.000 | 0.813 | 157.849 |
| *UK* | −0.023*** | *−1.024**** | *−0.035**** | 0.537*** | 0.000*** | 0.043*** | 0.965 | 386.797 |
| Large blend | −0.003*** | *−1.001**** | *−0.030**** | 0.559*** | 0.011*** | 0.045*** | 0.897 | 430.234 |
| Large growth | −0.125*** | *−1.043**** | *−0.023** | 0.584*** | 0.014*** | 0.022** | 0.945 | 394.829 |
| Large value | −0.122*** | *−0.987**** | *−0.029**** | 0.516*** | 0.071*** | 0.055*** | 0.845 | 363.861 |
| Mid blend | −0.245*** | *−1.074**** | *−0.041**** | 0.489*** | 0.009*** | 0.037*** | 0.978 | 329.674 |
| Mid growth | −0.277*** | *−0.928**** | *−0.038*** | 0.443*** | 0.003*** | 0.032** | 0.940 | 306.868 |
| Mid value | −0.344*** | *−1.033**** | −0.007 | 0.546*** | 0.007*** | 0.069*** | 0.910 | 313.092 |
| Small blend | −0.889*** | *−1.079**** | *−0.055**** | 0.483*** | 0.046*** | 0.039*** | 0.899 | 283.029 |
| Small growth | −0.773*** | *−1.162**** | *−0.089**** | 0.562*** | 0.082*** | 0.022 | 0.867 | 258.369 |
| Small value | −0.745*** | *−1.114**** | *−0.065*** | 0.448*** | 0.093* | 0.054** | 0.953 | 177.713 |

The table reports regression coefficients on value-weighted portfolios grouped by investment style for the liquidity and idiosyncratic risk augmented Fama–French model. Significance at the 1, 5, 10 % level is denoted by ***, **, and *, respectively. Regressions are performed considering the covariance matrix of Newey and West (1987). Sample period: January 1988 to December 2012. All alphas are annualised. Fund italicized indicate significant liquidity and idiosyncratic risk factor at the 10 % level

**Table 7** Carhart regression augmented by idiosyncratic risk

| | αi | Id. risk | Mk. Ex. Re. | Size | Value | Momentum | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|---|
| *Germany* | −1.004*** | −0.000 | 0.456*** | 0.202*** | 0.023 | 0.051*** | 0.934 | 310.670 |
| Large blend | −0.553** | −0.000 | 0.748*** | −0.016 | 0.122*** | 0.021*** | 0.922 | 489.048 |
| Large value | −0.054*** | 0.003 | 0.708*** | −0.032 | 0.073*** | 0.019*** | 0.821 | 329.810 |
| Mid blend | −0.069*** | −0.005 | 0.647*** | 0.218*** | 0.096*** | 0.035*** | 0.845 | 188.806 |
| Mid growth | −0.817*** | 0.080 | 0.408*** | 0.093*** | 0.083** | 0.054*** | 0.873 | 61.361 |
| Small blend | −0.319*** | −0.004 | 0.242*** | 0.129*** | 0.081*** | 0.012 | 0.890 | 112.697 |
| Small growth | −0.608*** | −0.015 | 0.591*** | 0.319*** | 0.116** | 0.025 | 0.814 | 87.083 |
| *Italy* | −0.663*** | −0.019 | 0.345*** | 0.017** | −0.124*** | 0.145*** | 0.910 | 122.658 |
| Large blend | −1.021*** | 0.109 | 0.337*** | −0.008 | −0.143*** | 0.198*** | 0.856 | 142.162 |
| Large value | −0.676*** | 0.021 | 0.328*** | 0.009** | −0.129*** | 0.160*** | 0.740 | 104.868 |
| Mid blend | −1.383*** | −0.106 | 0.434*** | 0.016** | −0.161*** | 0.158*** | 0.745 | 65.992 |
| Mid value | −1.516*** | −0.098 | 0.222*** | −0.006 | −0.134*** | 0.157*** | 0.903 | 83.503 |
| Small blend | −0.220*** | −0.076 | 0.329*** | 0.022** | −0.029 | 0.036 | 0.924 | 146.007 |
| Small value | −0.528*** | −0.351 | 0.114** | −0.037 | −0.389*** | 0.236** | 0.803 | 31.598 |
| *Spain* | −1.024*** | *0.257**** | 0.516*** | 0.011*** | 0.042*** | 0.001 | 0.945 | 522.573 |
| Large blend | −1.008*** | *0.285**** | 0.499*** | 0.011*** | −0.004 | −0.001 | 0.899 | 395.905 |
| Large growth | −0.923*** | *0.317**** | 0.464*** | 0.014 | −0.082*** | −0.051 | 0.856 | 191.088 |
| Large value | −1.328*** | *0.279**** | 0.569*** | 0.017*** | 0.039*** | −0.009 | 0.790 | 551.957 |
| Mid blend | −0.264*** | −0.047 | 0.230*** | 0.013 | 0.139*** | 0.056** | 0.923 | 233.799 |
| Mid value | −0.322*** | *0.140**** | 0.401*** | 0.009*** | 0.094*** | 0.033*** | 0.867 | 419.870 |
| Small value | −0.322*** | 0.012 | 0.155*** | 0.043** | 0.098*** | 0.038* | 0.788 | 270.397 |
| *Netherlands* | −0.786*** | *0.198**** | 0.448*** | 0.013*** | 0.088*** | 0.002 | 0.910 | 237.811 |
| Large blend | −1.744 | −0.002 | 0.075* | −0.010 | 0.010 | 0.080 | 0.736 | 18.312 |
| Large value | −0.721*** | *0.121**** | 0.479*** | 0.012*** | 0.088*** | 0.017 | 0.884 | 264.717 |
| Mid value | −0.659*** | 0.303 | 0.614*** | 0.015 | 0.229*** | −0.023 | 0.840 | 79.824 |
| Small blend | −0.630*** | *0.408**** | 0.256*** | 0.025*** | 0.046 | −0.049 | 0.933 | 52.710 |

**Table 7** continued

| | αi | Id. risk | Mk. Ex. Re. | Size | Value | Momentum | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|---|
| Small value | −0.653*** | *0.309**** | 0.398*** | 0.019** | 0.085*** | −0.036 | 0.866 | 122.464 |
| *France* | −0.633*** | *−0.017*** | 0.495*** | 0.017*** | −0.008*** | 0.114*** | 0.888 | 298.968 |
| Large blend | −0.631*** | *−0.047*** | 0.495*** | 0.018*** | −0.003*** | 0.118*** | 0.913 | 224.503 |
| Large growth | −1.343*** | 0.012 | 0.502*** | 0.026** | −0.019* | 0.087* | 0.845 | 100.359 |
| Large value | −1.234*** | −0.012 | 0.532*** | 0.016*** | −0.005*** | 0.116*** | 0.878 | 318.562 |
| Mid blend | −0.343*** | −0.037 | 0.384*** | 0.021*** | −0.000* | 0.102*** | 0.888 | 164.011 |
| Mid value | −0.416*** | −0.007 | 0.373*** | 0.023*** | −0.001*** | 0.100*** | 0.887 | 228.353 |
| Small blend | −0.678*** | 0.011 | 0.133*** | 0.040* | −0.047 | 0.020 | 0.866 | 185.971 |
| Small value | −0.002*** | 0.012 | 0.155*** | 0.063** | 0.098 | 0.038*** | 0.855 | 270.397 |
| *UK* | −0.567*** | *−0.022**** | 0.532*** | 0.006*** | 0.046*** | 0.042*** | 0.889 | 379.963 |
| Large blend | −1.007*** | *−0.019**** | 0.553*** | 0.016*** | 0.048*** | 0.038*** | 0.945 | 421.188 |
| Large growth | −0.456*** | −0.013 | 0.579*** | 0.006*** | 0.026*** | 0.039*** | 0.898 | 385.774 |
| Large value | −0.456*** | *−0.016** | 0.513*** | 0.076*** | 0.057*** | 0.049*** | 0.834 | 357.678 |
| Mid blend | −0.678*** | *−0.026**** | 0.483*** | 0.003*** | 0.042*** | 0.040*** | 0.966 | 324.118 |
| Mid growth | −0.678*** | −0.023 | 0.435*** | 0.007*** | 0.037*** | 0.030*** | 0.822 | 303.272 |
| Mid value | −0.678*** | 0.010 | 0.544*** | 0.036*** | 0.071*** | 0.058*** | 0.756 | 308.814 |
| Small blend | −1.003*** | *−0.035*** | 0.478*** | 0.086*** | 0.042*** | 0.054*** | 0.798 | 280.398 |
| Small growth | −0.345*** | *−0.075**** | 0.559*** | 0.081** | 0.026 | 0.050*** | 0.911 | 254.534 |
| Small value | −0.234*** | −0.040 | 0.448*** | 0.074 | 0.056*** | 0.071*** | 0.876 | 177.120 |

The table presents regression coefficients on value-weighted portfolios grouped by investment style for the idiosyncratic risk augmented Carhart model. Idiosyncratic risk is estimated from an EGARCH model on Fama–French 3-factor model. Significance at the 1, 5, 10 % level is denoted by ***, **, and *, respectively. Regressions are performed considering the covariance matrix of Newey and West (1987). The sample period is January 1988 to December 2012. All alphas are annualised. Fund italicized indicate significant idiosyncratic risk factor at the 10 % level

**Table 8** Carhart regression augmented by liquidity

| | αi | Liquidity | Mk. Ex. Re. | Size | Value | Momentum | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|---|
| *Germany* | −0.733*** | *0.855**** | 0.416*** | 0.143*** | 0.006 | 0.046*** | 0.848 | 314.389 |
| Large blend | −0.783*** | *0.207**** | 0.749*** | −0.014 | 0.120*** | 0.018*** | 0.902 | 516.725 |
| Large value | −0.533*** | *0.167**** | 0.712*** | −0.024 | 0.069*** | 0.018*** | 0.855 | 347.950 |
| Mid blend | −0.234*** | *0.342**** | 0.652*** | 0.177*** | 0.091*** | 0.034*** | 0.956 | 192.548 |
| Mid growth | −1.004* | *0.425*** | 0.409*** | 0.106*** | 0.076* | 0.051** | 0.876 | 62.969 |
| Small blend | −0.045*** | *0.475**** | 0.228*** | 0.033*** | 0.081*** | 0.014*** | 0.854 | 111.543 |
| Small growth | −0.543*** | 0.381 | 0.556*** | 0.091*** | 0.116** | 0.030 | 0.803 | 76.227 |
| *Italy* | −1.056*** | *0.251**** | 0.375*** | 0.008*** | −0.125*** | 0.141*** | 0.912 | 124.012 |
| Large blend | −1.768** | −0.028 | 0.434*** | −0.038 | −0.148*** | 0.207*** | 0.799 | 42.448 |
| Large value | −0.101*** | *0.276**** | 0.356*** | 0.010*** | −0.131*** | 0.159*** | 0.878 | 106.075 |
| Mid blend | −1.045*** | 0.299 | 0.449*** | 0.056** | −0.159*** | 0.146*** | 0.912 | 66.623 |
| Mid value | −0.045*** | 0.205 | 0.334*** | −0.006 | −0.132*** | 0.146*** | 0.922 | 84.183 |
| Small blend | −0.567*** | 0.188 | 0.429*** | 0.051** | −0.028 | 0.029 | 0.912 | 147.159 |
| Small value | −0.895*** | −0.409 | −0.008** | 0.072* | −0.379*** | 0.201** | 0.934 | 31.267 |
| *Spain* | −0.345*** | *2.904**** | 0.552*** | 0.114*** | 0.061*** | 0.027*** | 0.933 | 526.691 |
| Large blend | −0.123*** | *2.711**** | 0.530*** | 0.105*** | 0.007 | 0.033** | 0.823 | 380.107 |
| Large growth | −0.045*** | *2.821**** | 0.500*** | 0.108*** | −0.079*** | 0.003 | 0.910 | 174.942 |
| Large value | −0.022*** | *2.796**** | 0.591*** | 0.089*** | 0.058*** | 0.013** | 0.930 | 558.416 |
| Mid blend | −0.039*** | *3.691**** | 0.348*** | 0.176*** | 0.164*** | 0.086*** | 0.845 | 224.056 |
| Mid value | −0.343*** | *3.212**** | 0.488*** | 0.195*** | 0.123*** | 0.059*** | 0.932 | 442.715 |
| Small value | 0.003* | *2.736**** | 0.204*** | 0.174*** | 0.099*** | 0.073*** | 0.910 | 221.957 |
| *Netherlands* | −0.374*** | *−2.174**** | 0.434*** | 0.013*** | 0.091*** | 0.001 | 0.920 | 252.749 |
| Large blend | 0.056 | 0.671 | 0.090** | −0.009 | 0.000 | 0.099* | 0.847 | 19.532 |
| Large value | −0.217*** | *−1.798**** | 0.467*** | 0.012*** | 0.090*** | 0.011 | 0.923 | 278.595 |
| Mid value | −0.423*** | *−2.309**** | 0.588*** | 0.016* | 0.236*** | −0.018 | 0.912 | 84.332 |
| Small blend | −0.567*** | *−2.597**** | 0.246*** | 0.027** | 0.041 | −0.028 | 0.913 | 55.095 |

**Table 8** continued

| | αi | Liquidity | Mk. Ex. Re. | Size | Value | Momentum | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|---|
| Small value | −0.232*** | *−2.957**** | 0.390*** | 0.036** | 0.089*** | −0.032 | 0.809 | 131.824 |
| *France* | −0.441*** | *−0.794**** | 0.521*** | 0.019*** | −0.005*** | 0.110*** | 0.903 | 318.951 |
| Large blend | −1.203*** | *−0.798**** | 0.523*** | 0.021*** | −0.006*** | 0.108*** | 0.876 | 239.309 |
| Large growth | −1.030*** | *−0.799** | 0.532*** | 0.028** | −0.001** | 0.088* | 0.911 | 108.682 |
| Large value | −0.678*** | *−0.738**** | 0.559*** | 0.018*** | −0.002*** | 0.111*** | 0.914 | 341.927 |
| Mid blend | −0.733*** | *−0.953**** | 0.411*** | 0.024*** | −0.013** | 0.102*** | 0.884 | 171.275 |
| Mid value | −0.033*** | *−0.834**** | 0.402*** | 0.025*** | −0.000*** | 0.102*** | 0.911 | 238.871 |
| Small blend | −0.143*** | −0.017 | 0.144*** | 0.050* | −0.003 | 0.022 | 0.842 | 184.586 |
| Small value | −0.088*** | −0.317 | 0.182*** | 0.065** | −0.015 | 0.097*** | 0.828 | 165.2492 |
| *UK* | −1.265*** | *−1.004**** | 0.539*** | 0.006*** | 0.039*** | 0.011*** | 0.945 | 396.471 |
| Large blend | −1.033*** | *−0.984**** | 0.561*** | 0.016*** | 0.041*** | 0.009*** | 0.899 | 441.613 |
| Large growth | −1.025*** | *−1.026**** | 0.586*** | 0.005*** | 0.018* | 0.011*** | 0.814 | 405.339 |
| Large value | −0.266*** | *−0.971**** | 0.519*** | 0.017*** | 0.050*** | 0.010*** | 0.810 | 372.497 |
| Mid blend | −1.023*** | *−1.058**** | 0.495*** | 0.033*** | 0.035*** | 0.013*** | 0.834 | 336.852 |
| Mid growth | −1.342*** | *−0.895**** | 0.446*** | 0.027*** | 0.029** | 0.012** | 0.910 | 314.408 |
| Mid value | −0.563*** | *−0.991**** | 0.546*** | 0.007*** | 0.065*** | 0.014*** | 0.870 | 320.364 |
| Small blend | −0.545*** | *−1.037**** | 0.484*** | 0.034*** | 0.037*** | 0.014*** | 0.826 | 288.317 |
| Small growth | −0.567*** | *−1.153**** | 0.567*** | 0.066*** | 0.024 | 0.013*** | 0.841 | 264.149 |
| Small value | −0.044*** | *−1.103**** | 0.451*** | 0.053** | 0.052** | 0.021*** | 0.960 | 182.936 |

The table presents regression coefficients on value-weighted portfolios grouped by investment style for the idiosyncratic risk augmented Carhart model. Idiosyncratic risk is estimated from an EGARCH model on Fama-French 3-factor model. Significance at the 1, 5, 10 % level is denoted by ***, **, and *, respectively. Regressions are performed considering the covariance matrix of Newey and West (1987). The sample period is January 1988 to December 2012. All alphas are annualised. Fund italicized indicate significant liquidity factor at the 10 % level

**Table 9** Carhart regression augmented by liquidity and idiosyncratic risk

| | αi | Liquidity | Id. risk | Mk. Ex. Re. | Size | Value | Momentum | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|---|---|
| *Germany* | −0.234*** | *0.862****** | −0.015 | 0.502*** | 0.168*** | 0.015 | 0.049*** | 0.843 | 413.719 |
| Large blend | −0.678*** | *0.210****** | −0.004 | 0.747*** | −0.009 | 0.121*** | 0.018*** | 0.866 | 477.079 |
| Large value | −0.678*** | *0.164****** | 0.000 | 0.708*** | −0.026 | 0.072*** | 0.018*** | 0.890 | 312.388 |
| Mid blend | −0.833*** | *0.308****** | −0.001 | 0.648*** | 0.228*** | 0.092*** | 0.032*** | 0.912 | 172.904 |
| Mid growth | −1.238*** | *0.516**** | 0.139 | 0.414*** | 0.111*** | 0.077* | 0.052** | 0.867 | 54.578 |
| Small blend | −1.077*** | *0.464****** | −0.005 | 0.245*** | 0.137*** | 0.076*** | 0.011 | 0.810 | 103.676 |
| Small growth | −0.443*** | 0.336 | −0.014 | 0.596*** | 0.329*** | 0.112** | 0.025 | 0.800 | 75.251 |
| *Italy* | −1.225*** | *0.237****** | −0.019 | 0.434*** | 0.058*** | −0.124*** | 0.145*** | 0.920 | 121.002 |
| Large blend | −1.027*** | −0.055 | 0.109 | 0.256*** | −0.067 | −0.143*** | 0.198*** | 0.811 | 37.435 |
| Large value | −0.686*** | *0.259****** | 0.019 | 0.367*** | 0.090*** | −0.129*** | 0.159*** | 0.910 | 102.639 |
| Mid blend | −0.678*** | 0.289 | −0.106 | 0.422*** | 0.057*** | −0.162*** | 0.158*** | 0.850 | 59.488 |
| Mid value | −1.106*** | 0.189 | −0.097 | 0.351*** | −0.006 | −0.135*** | 0.157*** | 0.864 | 77.124 |
| Small blend | −0.733*** | 0.176 | −0.075 | 0.223*** | 0.112*** | −0.029 | 0.038 | 0.834 | 135.637 |
| Small value | −0.222*** | −0.435 | −0.354 | 0.156** | 0.133*** | −0.388*** | 0.236** | 0.855 | 27.095 |
| *Spain* | −0.834*** | *2.854****** | *0.159****** | 0.549*** | 0.113*** | 0.061*** | 0.006 | 0.958 | 526.443 |
| Large blend | −1.009*** | *2.652****** | *0.200****** | 0.528*** | 0.104*** | 0.006 | 0.007 | 0.936 | 367.988 |
| Large growth | −1.753*** | *2.772****** | *0.268****** | 0.497*** | 0.103*** | −0.081*** | −0.030 | 0.935 | 158.519 |
| Large value | −1.559*** | *2.743****** | *0.159****** | 0.589*** | 0.088*** | 0.058*** | −0.009 | 0.934 | 555.426 |
| Mid blend | −0.221*** | *3.685****** | 0.055 | 0.348*** | 0.177*** | 0.164*** | 0.079*** | 0.930 | 199.138 |
| Mid value | −0.567*** | *3.180****** | *0.111****** | 0.487*** | 0.194*** | 0.122*** | 0.044*** | 0.954 | 425.211 |
| Small value | −0.124*** | *2.859****** | *0.102** | 0.206*** | 0.191*** | 0.099*** | 0.064*** | 0.946 | 198.031 |
| *Netherlands* | −0.003*** | *−2.208****** | 0.049 | 0.439*** | 0.013*** | 0.087*** | −0.005 | 0.879 | 244.489 |
| Large blend | 0.117 | 0.772 | 0.098 | 0.097** | −0.009 | 0.004 | 0.081 | 0.790 | 16.016 |
| Large value | −0.356*** | *−1.888****** | −0.006 | 0.469*** | 0.013*** | 0.086*** | 0.011 | 0.894 | 265.784 |
| Mid value | −0.779*** | *−2.261****** | 0.137 | 0.599*** | 0.015 | 0.233*** | −0.034 | 0.870 | 71.688 |
| Small blend | −0.688*** | *−2.388****** | *0.301**** | 0.263*** | 0.046** | 0.041 | −0.055 | 0.956 | 49.046 |

**Table 9** continued

| | αi | Liquidity | Id. risk | Mk. Ex. Re. | Size | Value | Momentum | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|---|---|
| Small value | −0.889*** | *−2.941**** | 0.128 | 0.401*** | 0.053*** | 0.086*** | −0.046* | 0.802 | 120.105 |
| *France* | −1.067*** | *−1.137**** | 0.010 | 0.530*** | 0.022*** | −0.005*** | 0.122*** | 0.948 | 315.681 |
| Large blend | −1.022*** | *−1.172**** | −0.026 | 0.530*** | 0.022*** | −0.003*** | 0.129*** | 0.856 | 229.638 |
| Large growth | −0.876*** | *−1.165**** | 0.038 | 0.545*** | 0.031*** | −0.004** | 0.098** | 0.920 | 94.541 |
| Large value | −0.606*** | *−1.087**** | *0.017** | 0.567*** | 0.020*** | −0.006*** | 0.121*** | 0.956 | 338.334 |
| Mid blend | −0.499*** | *−1.287**** | −0.015 | 0.422*** | 0.026*** | −0.004** | 0.117*** | 0.833 | 158.498 |
| Mid value | −0.688*** | *−1.135**** | 0.021 | 0.412*** | 0.027*** | −0.001*** | 0.113*** | 0.910 | 226.802 |
| Small blend | −0.998*** | −0.035 | 0.024 | 0.146*** | 0.091** | −0.009 | 0.024 | 0.810 | 158.979 |
| Small value | −0.188*** | −0.436 | *0.078** | 0.186*** | 0.116*** | −0.006 | 0.089*** | 0.910 | 142.689 |
| *UK* | −1.056*** | *−1.092**** | *−0.019**** | 0.540*** | 0.006*** | 0.040*** | 0.059*** | 0.955 | 389.836 |
| Large blend | −1.440*** | *−1.061**** | *−0.016**** | 0.561*** | 0.012*** | 0.043*** | 0.055*** | 0.910 | 432.429 |
| Large growth | −1.233*** | *−1.099**** | −0.008 | 0.585*** | 0.006*** | 0.020** | 0.056*** | 0.966 | 390.166 |
| Large value | −0.586*** | *−1.058**** | −0.012 | 0.520*** | 0.007*** | 0.053*** | 0.066*** | 0.910 | 363.941 |
| Mid blend | −0.844*** | *−1.156**** | *−0.025*** | 0.494*** | 0.015*** | 0.035*** | 0.058*** | 0.980 | 327.211 |
| Mid growth | −0.644*** | *−1.011**** | −0.024 | 0.447*** | 0.025*** | 0.030** | 0.044*** | 0.966 | 297.101 |
| Mid value | −0.598*** | *−1.105**** | 0.014 | 0.549*** | 0.008*** | 0.067*** | 0.073*** | 0.955 | 305.356 |
| Small blend | −0.665*** | *−1.177**** | *−0.033*** | 0.488*** | 0.033*** | 0.036*** | 0.069*** | 0.910 | 280.655 |
| Small growth | −0.468*** | *−1.235**** | *−0.070**** | 0.566*** | 0.036*** | 0.019 | 0.066*** | 0.890 | 252.943 |
| Small value | −0.687** | *−1.233**** | −0.037 | 0.455*** | 0.041* | 0.049* | 0.086*** | 0.967 | 170.111 |

The table presents regression coefficients on value-weighted portfolios grouped by investment style for the idiosyncratic risk and liquidity augmented Carhart model. Idiosyncratic risk is estimated from an EGARCH model on Fama-French 3-factor model. Significance at the 1 %, 5 %, 10 % level is denoted by ***, **, and *, respectively. Regressions are performed considering the covariance matrix of Newey and West (1987). The sample period is January 1988 to December 2012. All alphas are annualised. Fund italicized indicate significant idiosyncratic risk and liquidity factor at the 10 % level

**Table 10** Fama-MacBeth regression augmented by liquidity and idiosyncratic risk

| | αi | Liquidity | Id. risk | Mk. Ex. Re. | Size | Valuation | Momentum | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|---|---|
| *Germany* | −0.198*** | *0.701*** | −0.089 | 0.016** | −0.207*** | 0.045* | 0.058*** | 0.083 | 27.004 |
| Large blend | −0.456*** | *0.311**** | −0.069 | 0.501** | −0.018 | 0.178** | 0.024** | 0.511 | 323.124 |
| Large value | −0.412*** | *0.101**** | 0.055 | 0.400*** | −0.034* | 0.099*** | 0.034*** | 0.422 | 298.123 |
| Mid blend | −0.655*** | *0.522*** | −0.053 | 0.389** | 0.189*** | 0.173** | 0.041*** | 0.533 | 283.611 |
| Mid growth | −0.988*** | *0.324**** | 0.160 | 0.333** | 0.156** | 0.111** | 0.060** | 0.323 | 87.112 |
| Small blend | −0.877*** | *0.322**** | −0.022 | 0.401*** | 0.187*** | 0.098*** | 0.023 | 0.567 | 213.301 |
| Small growth | −0.298*** | 0.280 | −0.026 | 0.309*** | 0.245*** | 0.143** | 0.031 | 0.498 | 89.345 |
| *Italy* | −0.876*** | *0.189**** | −0.037 | 0.034*** | −0.078*** | −0.087*** | 0.154*** | 0.298 | 312.023 |
| Large blend | −0.856*** | −0.123 | 0.145 | 0.031** | −0.087 | −0.109** | 0.215** | 0.345 | 59.610 |
| Large value | −0.555** | *0.334*** | 0.034 | 0.024** | −0.089*** | −0.100** | 0.167*** | 0.398 | 123.456 |
| Mid blend | −0.832*** | *0.388**** | −0.122 | 0.033*** | −0.023** | −0.175** | 0.178** | 0.355 | 87.223 |
| Mid value | −0.765*** | 0.267 | −0.024 | 0.030** | −0.021* | −0.138*** | 0.168*** | 0.311 | 87.345 |
| Small blend | −0.511*** | 0.244 | −0.067 | 0.024** | 0.043 | −0.032 | 0.054 | 0.398 | 198.112 |
| Small value | −0.099** | −0.607 | −0.145 | −0.017 | 0.034 | −0.365*** | 0.289** | 0.374 | 67.345 |
| *Spain* | −0.654*** | *1.765**** | *0.104**** | 0.322*** | 0.145*** | 0.068*** | 0.014 | 0.534 | 345.333 |
| Large blend | −0.855*** | *1.554*** | *0.177*** | 0.211** | 0.122*** | 0.012 | 0.015** | 0.433 | 277.078 |
| Large growth | −1.002** | *1.723**** | *0.089**** | 0.270** | 0.115** | −0.097*** | −0.039* | 0.498 | 177.433 |
| Large value | −0.560*** | *2.945*** | *0.214**** | 0.311*** | 0.124*** | 0.063** | −0.022 | 0.541 | 589.236 |
| Mid blend | −0.078*** | *2.625**** | 0.007 | 0.271*** | 0.186** | 0.178*** | 0.098*** | 0.674 | 214.135 |
| Mid value | −0.377*** | *2.040**** | *0.389**** | 0.503*** | 0.220*** | 0.129** | 0.049*** | 0.546 | 342.009 |
| Small value | −0.078*** | *1.755**** | *0.078** | 0.104*** | 0.134** | 0.074*** | 0.071*** | 0.534 | 213.231 |
| *Netherlands* | −0.023*** | *−1.008**** | 0.127 | 0.280*** | 0.044*** | 0.082*** | −0.017 | 0.612 | 287.145 |
| Large blend | 0.178* | *0.956*** | 0.144 | 0.110** | −0.012 | 0.023** | 0.098** | 0.315 | 56.345 |
| Large value | −0.187*** | *−1.234**** | −0.089 | 0.304** | 0.029*** | 0.080*** | 0.019* | 0.436 | 314.144 |
| Mid value | −0.533*** | *−1.887**** | *0.189*** | 0.654** | 0.033 | 0.230*** | −0.017 | 0.589 | 98.123 |
| Small blend | −0.456*** | *−2.009**** | *0.201*** | 0.310*** | 0.025 | 0.034* | −0.028** | 0.387 | 61.654 |

**Table 10** continued

| | αi | Liquidity | Id. risk | Mk. Ex. Re. | Size | Valuation | Momentum | Adj. $R^2$ | F-stat. |
|---|---|---|---|---|---|---|---|---|---|
| Small value | −0.423*** | *−1.678**** | *0.078*** | 0.323*** | 0.055* | 0.081*** | −0.067* | 0.344 | 167.234 |
| *France* | −0.756*** | *−1.345**** | 0.089 | 0.345*** | 0.010*** | −0.025*** | 0.138*** | 0.621 | 289.332 |
| Large blend | −0.677*** | *−1.345**** | −0.099 | 0.324** | 0.020** | −0.015*** | 0.156*** | 0.432 | 241.334 |
| Large growth | −0.595* | *−1.223**** | 0.120 | 0.382*** | 0.028*** | −0.033** | 0.123** | 0.411 | 145.334 |
| Large value | −0.488*** | *−1.342**** | *0.080** | 0.218** | 0.016** | −0.026*** | 0.156** | 0.409 | 277.087 |
| Mid blend | −0.377*** | *−0.987**** | −0.089 | 0.255*** | 0.024*** | −0.025** | 0.123** | 0.324 | 210.144 |
| Mid value | −0.570*** | *−1.535**** | *0.066** | 0.510** | 0.022** | −0.011** | 0.145*** | 0.378 | 301.456 |
| Small blend | −0.745*** | −0.188 | 0.089 | 0.234*** | 0.026** | −0.035 | 0.032* | 0.459 | 134.066 |
| Small value | −0.034*** | *−0.543*** | *0.120** | 0.301*** | 0.035*** | −0.023 | 0.117*** | 0.510 | 187.678 |
| *UK* | −0.755*** | −0.876*** | −0.078*** | 0.378*** | 0.019** | 0.046*** | 0.068*** | 0.678 | 278.567 |
| Large blend | −0.978*** | *−1.234*** | *−0.110*** | 0.416** | 0.022*** | 0.054** | 0.069*** | 0.562 | 344.300 |
| Large growth | −0.877*** | *−1.334**** | −0.026 | 0.415*** | 0.023*** | 0.029** | 0.080*** | 0.543 | 323.678 |
| Large value | −0.613*** | *−0.855**** | −0.034 | 0.332** | 0.015** | 0.051*** | 0.076*** | 0.498 | 311.621 |
| Mid blend | −0.633*** | *−0.765**** | *−0.081** | 0.311*** | 0.017*** | 0.042*** | 0.059*** | 0.444 | 278.004 |
| Mid growth | −0.401*** | *−1.233**** | *−0.067** | 0.328*** | 0.012** | 0.038** | 0.068** | 0.476 | 234.345 |
| Mid value | −0.345*** | *−8.678**** | 0.056 | 0.610** | 0.017*** | 0.075** | 0.088*** | 0.540 | 255.233 |
| Small blend | −0.433*** | *−0.678**** | *0.008*** | 0.327*** | 0.011*** | 0.039*** | 0.073*** | 0.439 | 223.245 |
| Small growth | −0.297*** | *−0.876**** | *−0.030**** | 0.320*** | 0.026*** | 0.024 | 0.043*** | 0.587 | 310.343 |
| Small value | −0.455** | *−0.807**** | −0.078 | 0.518*** | 0.018* | 0.056* | 0.094*** | 0.321 | 213.411 |

The table presents time-series average regression coefficients from cross-sectional regressions on value-weighted portfolios grouped by investment style for the idiosyncratic risk and liquidity augmented Carhart model. Idiosyncratic risk is estimated from an EGARCH model on Fama-French 3-factor model. Significance at the 1, 5, 10 % level is denoted by ***, **, and *, respectively. Regressions are performed considering the covariance matrix of Newey and West (1987). The sample period is January 1988 to December 2012. All alphas are annualised. Fund italicized indicate significant idiosyncratic risk and liquidity factor at the 10 % level previous findings using multifactor models since the amount of significant fund portfolios for the liquidity and idiosyncratic risk factors are very similar to the augmented Carhart model. As in the previous models considered, we could also state that the explanatory power of idiosyncratic risk is not taken away by controlling for liquidity, and the liquidity factor is not less significant than the most standard valuation or size factors.

We also examine different subperiods. We divide the period of our study in two halves, one from 1988 to December 1999, and the other one from January 2000 to December 2010. The first half includes the spike of the stock market in the late 90s, while the second half covers the burst of the technology bubble, a short upturn and the crash of the financial crisis. The results of the Carhart factors are similar regarding both subperiods (we have omitted the tables for brevity). However, in the first subperiod idiosyncratic risk is more significant than in the second one or compared to the whole observation period. Furthermore, the size factor is more important during the second than during the first subperiod, which indicates that fund returns are more driven by smaller stocks. Thus, we can conclude that mutual fund managers change their preferences towards different risk factors over time.

### 5.2 Management fees

So far we have only considered mutual fund returns net of costs, management fees were already deducted from the funds ́ return. Some mutual funds might present a positive performance before fees. Although, if they charge high fees compared to other funds, this reduces the risk-adjusted performance after fees. Sharpe (1966) was the first to analyze the impact of mutual fund fees on the performance results.

US evidence finds that fund under-perform the market by the amount of fees they charge the investor when management fees are deducted. To analyze the influence of fees on European mutual fund performance we obtain current monthly percentage charges for each mutual fund in our data set, for some of our mutual funds there are no monthly percentage charges available, in this case we use information on maximum monthly percentage charges. We present average alphas after costs for every investment style portfolio in all countries, and then we add back management fees to fund returns in order to test their performance.

The average annual fees of the investigated mutual funds are 1.6 % with a minimum of zero annual fees and a maximum of 4.66 %. We examine risk-adjusted performance with respect to the liquidity and idiosyncratic risk augmented Carhart model. We find that, before fees, the average risk-adjusted performance is still negative, although in all portfolios is better than the monthly performance after fees (we have omitted the table for brevity). Overall, the results show that even before costs most mutual funds do not provide for a positive risk-adjusted performance. Five out of six countries under-perform at the 5 % level. This means that European funds, similar to US funds, are not successful in finding and implementing new information to offset their fees, and therefore add value for the investor. The only exception is Spanish funds, which out-perform significantly after and before fees. We also analyze the relationship between alphas and the monthly percentage charges. We find mixed evidence and thus we cannot establish that mutual fund managers that charge higher fees provide better performance.

## 6 Conclusion

Studies on the performance of European mutual funds are relatively scarce, compared to the vast literature on US mutual fund performance. Examples of US performance studies include Grinblatt and Titman (1989a, b), Malkiel (1995), Gruber (1996), Carhart (1997). There is an increasing flow of funds received by the mutual fund industry in Europe, as the growing private retirement provisions acts as substitute for the decreasing ability of the government retirement systems, which are negatively influenced by the demographic change. Moreover, regulatory differences in the European financial services industry have decreased in the recent years. This fosters the study of cross-country performance of European mutual funds.

Our study contributes to the mutual fund literature by providing new models and empirical findings on long-term risk-adjusted fund performance using a wide European data set. Our findings do not support the idea that liquidity and idiosyncratic risk are closely intertwined variables. However, our analysis confirms that liquidity and idiosyncratic risk are relevant for mutual fund performance. Liquidity and idiosyncratic risk are useful and important risk factors for quite large fund style subgroups of mutual funds. We show that model specifications up to six factors are useful and that the liquidity and idiosyncratic risk effects found are even robust to such stricter models with many factors. The importance of these two risk factors is not significantly diminished by considering them at the same time in addition to valuation, market, size and momentum risk factors. Hence, these risk factors capture different aspects in the cross-section of mutual funds returns, even if they may be theoretically and empirically linked to some extent.

Our model comparisons indicate that the Carhart (1997) is slightly superior compared to the liquidity and idiosyncratic risk augmented Fama and French (1992, 1993) models. Our results have been backtested with respect to several subperiods and taking into account different model specifications. In different countries, the evidence regarding mutual funds subgroups is strongly in favor of the significance of liquidity, and idiosyncratic risk to a lesser extent, as risk factors. The liquidity factor is as relevant as size, valuation and momentum, but still market excess return is the most important factor in mutual fund performance. Even if liquidity and idiosyncratic risk are considered at the same time, one factor is not significantly decreasing the importance of the other factor. Thus, these factors capture different characteristics.

Our evidence leads us to conclude that liquidity and idiosyncratic risk factors are important for mutual fund performance. Analyzing fund style subgroups, both the well-known Fama and French and Carhart models are significantly complemented by liquidity and idiosyncratic risk.

## References


Acharya V, Pedersen LH (2005) Asset pricing with liquidity risk. J Financ Econ 77:375–410

Amihud Y (2002) Illiquidity and stock returns: cross-section and time-series effects. J Financ Mark 5:31–56

Angelidis T, Andrikopoulos A (2010) Idiosyncratic risk, returns and liquidity in the London Stock Exchange: a spillover approach. Int Rev Financ Anal 19:214–221

Avramov D, Chordia T (2006) Asset pricing models and financial market anomalies. Rev Financ Stud 19:1001–1040

Baker M, Stein J (2004) Market liquidity as a sentiment indicator. J Financ Mark 7:271–299

Bali T, Nusret C, Xuemin Y, Zhe Z (2005) Does idiosyncratic risk really matter? J Financ 60:905–929

Banz RW (1981) The relative efficiency of various portfolios: some further evidence: discussion. J Financ 32:663–682

Biktimirov E, Li B (2014) Asymmetric stock price and liquidity responses to changes in the FTSE Small Cap index. Rev Quant Financ Acc 42:95–122

Brunnermeier MK, Pedersen LH (2009) Market liquidity and funding liquidity. Rev Financ Stud 22:2201–2238

Campbell JY, Martin L, Malkiel BG, Xu Y (2001) Have individual stocks become more volatile? An empirical exploration of idiosyncratic risk. J Financ 56:1–43

Carhart M (1997) On persistence in mutual fund performance. J Financ 52:57–82

Chiu J, Chung H, Ho K (2014) Fear sentiment, liquidity, and trading behavior: evidence from the index ETF market. Rev Pac Basin Financ Mark Polic 17:1–25

Chordia T, Subrahmanyam A, Anshuman VR (2001) Trading activity and expected stock returns. J Financ Econ 59:3–32

Dong X, Feng S, Sadka R (2012) Does liquidity beta predict mutual-fund alpha? Working Paper

Dybvig PH, Stephen AR (1985) The analytics of performance measurement using a security market line. J Financ 40:401–416

Elton E, Gruber M, Blake C (1995) Fundamental economic variables, APT, and bond fund performance. J Financ 50:1229–1256

Elton EJ, Gruber MJ, Blake CR (1996) The persistence of risk-adjusted mutual fund performance. J Bus 69:133–157

Fama EF, French K (1992) The cross-section of expected stock returns. J Financ 47:427–465

Fama EF, French K (1993) Common risk factors in the return on stocks and bonds. J Financ Econ 33:3–56

Fama EF, French K (1996) Multifactor explanations of asset pricing anomalies. J Financ 51:55–84

Fama E, MacBeth J (1973) Risk, return, and equilibrium: empirical tests. J Polit Econ 81:607–636

Fu F (2009) Idiosyncratic risk and the cross-section of expected stock returns. J Financ Econ 91:24–37

Goyal A, Santa-Clara P (2003) Idiosyncratic risk matters! J Financ 58:975–1008

Grinblatt M, Titman S (1989a) Mutual fund performance: an analysis of quarterly portfolio holding. J Bus 62:393–416

Grinblatt M, Titman S (1989b) Portfolio performance evaluation: old issues and new insights. Rev Financ Stud 2:393–421

Grinblatt M, Titman S (1994) A study of mutual fund returns and performance evaluation techniques. J Financ Quant Anal 29:419–444

Gruber MJ (1996) Another puzzle: the growth in actively managed mutual funds. J Financ 51:783–810

Gruenbichler A, Pleschiutschnig U (1999) Performance persistence: evidence for the European mutual funds market. Working Paper, University of St. Gallen

Hachmeister A, Schiereck D (2010) Dancing in the dark: post-trade anonymity, liquidity and informed trading. Rev Quant Financ Acc 34:145–177

Harris LE (1994) Minimum price variation, discrete bid–ask spreads, and quotation sizes. Rev Financ Stud 7:149–178

Hasbrouck J (2005) Trading costs and returns for US equities: the evidence from daily data. J Financ 64:1445–1477

Ho T, Stoll H (1980) On dealer markets under competition. J Financ 35:259–267

Ho C, Lee C, Lin C, Wang E (2005) Liquidity, volatility and stock price adjustment: evidence from seasoned equity offerings in an emerging market. Rev Pac Basin Financ Mark Polic 8:31–51

Jensen MC (1968) The performance of mutual funds in the period 1945–1964. J Financ 23:389–416

Lee K (2011) The world price of liquidity risk. J Financ Econ 99:136–161

Lo A, Wang J (2000) Trading volume: definitions, data analysis, and implications of portfolio theory. Rev Financ Stud 13:257–300

Malkiel BG (1995) Returns from investing in equity mutual funds 1971–1991. J Financ 50:549–572

Malkiel BG, Xu Y (2006) Idiosyncratic risk and security returns. Working Paper, University of Texas at Dallas

Merton R (1987) A simple model of capital market equilibrium with incomplete information. J Financ 42:483–510

Newey W, West K (1987) A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. Econometrica 55:703–708

Nelson DB (1991) Conditional heteroskedasticity in asset returns: new approach. Econometrica 59:347–370

O'Hara M (2003) Presidential address: liquidity and price discovery. J Financ 58:1335–1354

Otten R, Bams D (2002) European mutual fund performance. Eur Financ Manag 8:75–101

Reinganum M (1981) A misspecification of capital asset pricing: empirical anomalies based on earnings' yields and market values. J Financ Econ 9:19–46

Pastor L, Stambaugh R (2003) Liquidity risk and expected stock returns. J Polit Econ 111:642–685
Sharpe W (1966) Mutual fund performance. J Bus 39:119–138
Spiegel MI, Avanidhar S (1995) On intraday risk premia. J Financ 50:319–339
Spiegel MI, Wang X (2005) Cross-sectional variation in stock returns: liquidity and idiosyncratic risk. Yale ICF Working Paper No. 05-13
Stoll H (2000) Presidential address: friction. J Financ 55:1479–1514
Wagner NF, Winter E (2013) A new family of equity style indices and mutual fund performance: do liquidity and idiosyncratic risk matter? J Empir Financ 21:69–85
Watanabe A, Watanabe M (2008) Time-varying liquidity risk and the cross section of stock returns. Rev Financ Stud 21:2449–2486