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Liquidity as an Investment Style - New evidence

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Dissertation

Master in Finance

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2015

Biographical Note

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Acknowledgements

First, I would like to thank my Supervisor, Professor Ana Paula Serra, for her continuous patience, perseverance, kindness and valuable insights. It was a great pleasure to work with her.

Secondly I would like to thank all my professors throughout my Master's degree, without exception. They converted an interest that was accidentally born during my bachelor degree into a continuous curiosity and a desired professional endeavor.

I would also like to thank my father and mother, the first and greatest teachers I had in life and who've always supported me. My gratitude extends to my greatest friend: my brother. I also thank my family, both living and departed. Their importance in shaping who I am today is immeasurable. I love you all.

Last, but not least, thank you to my closest friends. You've made my life immensely happy and worth living. Since we are can't yet re-live past years, my greatest wish is to enjoy your company for the remainder of my life.

Abstract

Some recent studies have attempted to establish and implement liquidity as an investment style. Liquidity has been shown to be negatively correlated with excess stock returns in several developed markets. The main goal of this dissertation is to expand the existing evidence by reexamining the returns of liquidity-based strategies *i*) in several stock markets; *ii*) using different proxies for liquidity; and *iii*) controlling for seasonality effects, namely the January effect. Our results suggest that investors should look at liquidity-based investment styles, if even its effectiveness is dependent on the proxy chosen and the geographic market considered.

Keywords: Liquidity, Stock Returns, Investment Style, Portfolio Management
JEL-codes: G110 – Portfolio Choice; Investment Decisions

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1. Introduction

Liquidity may be understood as the ease with which an investor is able to sell or buy an asset at any point defined in time. If an investor, wanting to trade an asset for a certain price, has to wait a relatively long time to find a buyer/seller that accepts that price, then the asset may be considered illiquid. Concurrently, if the investor is not able to, or does not want to, wait to find a counterpart for the trade and has to settle for a significantly different price than the one he deems fair, then that asset may also be considered relatively illiquid. An alternative definition of liquidity is the asset's price movement in response to each unit traded. Regardless of how illiquidity is defined, it is a cost that an investor cannot ignore.

Over times, academics have shown interest in the dynamics of liquidity in stock returns. Most notably, Amihud and Mendelson (1986) demonstrated that liquidity should be negatively correlated with excess stock returns. The relationship should be convex in time, since illiquidity costs increase at smaller rates as holding periods increase. This seminal study was followed by many others and the discussion grew to encompass various markets, numerous proxies for liquidity and the possible seasonality in the relationship between liquidity and stock returns.

The study of liquidity is indeed relevant since, during periods of global financial distress, investors tend to withdraw from less liquid assets, and invest more heavily in highly liquid assets. This effect, known as *Flight to Liquidity*, is usually associated, or interchanged, with *Flight to Quality*, but may bear very different dynamics. In fact, it has been previously shown that the former effect played a significant role in the recent credit crisis in Europe (De Santis, 2014).

Ibbotson, Chen, Kim and Hu (2013) suggest that liquidity should rank together with other well established investment strategies, such as Momentum, Value/Growth and Size strategies. They argue that if illiquidity is related with excess returns, then investors should consider this factor in the formation of their investment strategies. They provide evidence that portfolios formed based on liquidity proxies comply with the requirements for the establishment of a unique style. They also demonstrate that relatively illiquid portfolios beat the ones based on Momentum and Size. Yet portfolios composed by High Value stocks provide higher returns.

Ibbotson *et al.* (2013) considered only one proxy for liquidity, the turnover ratio, only one market, the U.S. market, and constrained their sample to the 3,500 largest firms (exceeding $5 million in market capitalization). Given that: i) there are numerous proxies for liquidity and no established consensus on which is the best one, ii) other markets may have different liquidity dynamics than the U.S. market, and iii) low liquidity is usually associated with small market capitalization, there seems to be a gap in the existing literature looking at the liquidity effects on stock returns.

As such, we expand the work done by Ibbotson *et al.* (2013) by not only considering other stock markets – specifically, we study the European, UK and the Japanese stock markets - , but also using another proxy for liquidity. With these data, we re-examine the investment strategy based on liquidity. We start by establishing that a liquidity-based investment strategy complies with the four criteria listed in Sharpe (1988) and Sharpe (1992). Namely, the investment style is required to be identifiable before the fact and not easily beaten, be viable and with low implementation costs. As done by Ibbotson *et al.* (2013), the analysis consists of a time-series regression, and stock migration analysis (across portfolio quartiles sorted by the alternative investment factors). This is done for each investment strategy and for each liquidity proxy.

We also control for seasonality in returns and reexamine previous literature findings on this effect (Eleswarapu and Reinganum (1993)): we thus test whether a portfolio strategy based upon liquidity complies with the four criteria required for a benchmark style, in either January or non-January months.

We find that the effectiveness of the Liquidity investment style depends on the geographic market considered, as well as on the proxy chosen to represent liquidity. Regarding the January effect, results are mixed, varying on either the proxy or the region analyzed.

The remainder of this dissertation is organized as follows. Section 2 contains a Literature Review focusing on the relationship between excess returns and liquidity.

Section 3 describes the data and methodology. In section 4 we show the returns characteristics of the portfolios formed based upon liquidity and other investment styles; the results using the CAPM and the Fama-French three factor-model for the liquidity portfolios; and the migration of stocks between quartiles. Section 5 concludes.

2. Literature Review

2.1. The Relationship between Liquidity and Returns

Amihud and Mendelson (1986) suggest that expected asset returns are increasing in the (relative) bid-ask spread. By modeling the effects of the spread on asset returns, they hypothesize that returns are an increasing and concave function of the bid-ask spread. To test this hypothesis, they ran empirical tests using NYSE data for the 1961 – 1980 period, and their evidence was supportive of the proposed hypothesis. Given that the spread of a stock tends to be negatively related with the size of the firm (Banz (1981), Reinganum (1981a) and Reinganum (1981b)), Amihud and Mendelson added either the size variable or its logarithm to the regression and found that the bid-ask spread effect remained statistically and conceptually significant.

However, due to the nature of the data used in Amihud and Mendelson (1986), namely the fact that it consisted of annual returns, the authors were not able to test for the presence of any seasonality. Nevertheless, Amihud and Mendelson (1986) work remains the seminal study of the relationship between liquidity and stock returns.

Extending Amihud and Mendelson (1986), Eleswarapu and Reinganum (1993) hypothesize that a stock's relative bid-ask spread – their proxy for liquidity – is negatively correlated with excess returns but only January. The authors also claim that Amihud and Mendelson (1986) worked with very restrictive conditions, namely the need for a stock to survive for an eleven year period, which could lead to a survivorship bias and a false conclusion on the statistical significance of the relative bid-ask spread in the presence of size variables. To overcome, the authors allowed that a stock had data on returns for three consecutive years – instead of eleven - and then perform the same tests as Amihud and Mendelson (1986) for the 1961 – 1990 period, using the NYSE stocks. The number of firms included in their analysis increased by 45% and their evidence supports the hypothesis that excess returns for illiquid portfolios were only significant in of January.

On the other hand, Brennan and Subrahmanyam (1996) argued that the relative bid-ask spread, as used by Amihud and Mendelson (1986) and by Eleswarapu and Reinganum (1993), is a noisy indicator of liquidity since many large trades occur outside of the spread and many small ones occur within the spread. As such, the authors state that the liquidity effects are most likely captured by the price impact of a trade or by trading costs, the latter of which was chosen to be the focus of their study. Brennan and Subrahmanyam, then, use a fixed and a variable cost component of a stock trade, while using the NYSE stock data for the 1984 - 1991 period. Their main findings were that there is a significant and concave risk premium related with the variable costs of transacting and a significant and convex relation with the fixed costs. This latter result is especially relevant since it contradicts Amihud and Mendelson (1986). The authors hypothesize this result may be due to their own inability to accurately estimated the fixed cost component, or due to an incomplete risk adjustment by the three-factor risk model. Further, the authors found no evidence of seasonality in the relationship of the excess returns and the two trading cost components.

Eleswarapu (1997) also re-run Amihud and Mendelson (1986) empirical tests using data on NASDAQ, instead of NYSE, over the 1973 – 1990 period. The rationale for this is the argument that the market microstructure of the former differs greatly from the latter, with the author stating that the inside quotes of the NASDAQ were likely to be a better representation for the actual costs of transacting. Following Eleswarapu and Reinganum (1993), stocks are only required to have return data for three consecutive years to be included in each test portfolio and, in an attempt to avoid a survivorship bias, firms that disappear during the test year are not excluded. The author finds that returns are positively related with illiquidity both in January, and non-January months. Yet, unlike Eleswarapu and Reinganum (1993), they noted that the liquidity premium was higher for January than for non-January periods.

Datar, Y. Naik and Radcliffe (1998) expand on Amihud and Mendelson (1986) by changing the proxy for liquidity: they replace the relative bid-ask spread by the turnover rate (calculated as the number of shares of a stock traded divided by the number of shares of the firm outstanding), on the basis that data for this indicator is more readily obtainable and a better proxy for liquidity. Using data for the NYSE for the period 1962 - 1991, the authors used this indicator, along with a size indicator (natural logarithm of market capitalization), book-to-market indicator (also measured by its logarithm) and beta (portfolio betas). The authors find that the turnover ratio is negatively related with stock returns. The authors also find contradictory evidence to the conclusions offered by Eleswarapu and Reinganum (1993) regarding seasonality. More specifically, by running the regressions using only January returns and non-January returns, the authors find that the slope of the turnover coefficient does not change much, with or without the other explainable variables. The reason for this divergent results could be that by choosing the relative bid-ask spread, Eleswarapu and Reinganum have constrained their proxy for liquidity to be constant throughout the year, while the turnover rate changes from month to month.

A security is not only affected by its own liquidity characteristic, but also by the aggregate systematic market liquidity. This hypothesis was proposed by Amihud (2002). The author used an autoregressive model to test the effect over time of market illiquidity on expected stock returns on the NYSE stocks in the years 1963 - 1997. The reasoning is that investors use the previous year’s observed illiquidity to forecast liquidity for the following years, and reach the conclusion that expected stock excess returns are an increasing function of expected market illiquidity. On the other hand, they find that *un*expected market illiquidity has a negative and significant effect on contemporaneous stock return. Small stocks were also observed to be more sensitive to market illiquidity and the relationship between expected returns and expected illiquidity held for January and non-January months. To proxy for illiquidity, Amihud used an indicator defined as the ratio of the daily absolute return to the (dollar) trading value, on any particular day, averaged over a certain period of time. While admitting that this measure was less accurate than others, the author justifies the option on the basis that the information required for the calculation is more readily available.

The positive relationship between an asset’s excess returns and illiquidity means that investors require a higher remuneration for holding assets that have low liquidity. Pointing that the CAPM applies for returns net of illiquidity costs, Acharya and Pedersen (2005) develop a liquidity adjusted capital asset pricing model that takes into account the covariance between a security illiquidity and the market illiquidity, the covariance between the security return and market illiquidity and the covariance between the security illiquidity and the market return. By empirically studying the

NYSE and AMEX stocks, in the 1962 – 1999 period, they show that the required rate of return was increasing in the first component and decreasing in the latter two.

2.2. Liquidity Effects in non-US markets

The negative relationship between excess stock returns and liquidity has also been studied in markets other than the US stock markets. For example, Jun, Marathe and Shawky (2003) studied 27 emerging stock markets for a seven-year period, 1992 - 1999. Using the turnover ratio, trading volume and the turnover-volatility multiple, the authors find that stock returns are positively correlated with aggregate market liquidity. Yet, the results of the cross-sectional analysis, as presented by the authors, seem to be contrary to previous findings in developed markets (Amihud, 2002).

Marshall (2006) studied the Australian Stock Exchange, considered to be a small pure order-driven market, in contrast with hybrid order-driven and larger markets, like the NYSE, the AMEX and the NASDAQ stock markets. The author used the *Weighted Order Value* (WOV) to proxy for liquidity, which takes into account both the bid-ask spread and the market depth, and considered the 1991 – 2002 period. He finds that this liquidity proxy is negatively correlated with excess returns, thus evidencing a liquidity premium, consistent with the literature for the developed markets. Furthermore, results do not confirm a seasonality effect in this relationship (January effect), contrasting with Eleswarapu and Reinganum (1993).

2.3. Proxies for Liquidity

There are numerous proxies for liquidity, and academics have been trying to establish the best and most accurate measures that should be used by both authors and practitioners.

Aitken and Comerton-Forde (2003) tried to shed light on this. The authors first separate the various measures for liquidity into two broadly distinct categories: trade-based measures and order-based measures (noting that the correlation between the two is low). The authors focused on the Asian economic crisis of 1997 and 1998 in the context of the Jakarta Stock Exchange, using 178 stocks, where, as a consequence of the crisis itself, investors were expected to withdraw from the market and, thus, reduce liquidity.

By measuring the noted liquidity by various proxies, the authors were able to identify which category provided the results most consistent with expectations on changes of liquidity before and after the economic crisis. The conclusion was that order-based measures provided a more accurate representation of expectations on changes of liquidity than trade-based measures. They suggest that this was due to the fact of trade-based measures being ex-post, in the sense that they indicate the liquidity that was available in the past. Aitken and Comerton Forde introduce a new liquidity measure based on the value of orders in the order book weighted by the probability of execution. The authors note that, although order-based measures fare better than trade-based ones, they seem to underestimate liquidity, since the spreads only indicate the cost of trading when an order can be satisfied by the volume at the best bid or ask, not considering many large investors, which often trade outside the bid-ask spread.

Goyenko, Holden and Trzcinka (2009) also shed light on the differences between the various proxies for liquidity. The authors divide the proxies into two categories: measures based on spreads and measures based on price impact. In the former, they conclude that the “Holden” measure (stemming from Holden (2009)), using both serial correlation and price clustering to estimate the effective spread, is the best measure, although computationally intensive. As for the price impact measures, the Amihud (2002) measure alongside a new set of measures introduced by the authors were considered the most accurate. The authors used a random sample of 400 stocks primarily listed in either NYSE, AMEX or NASDAQ (over the 1993 – 2005 period) and, thus, provide warning to any conclusions. However, they state that low-frequency measures capture high-frequency measures of transaction costs and, as such, the effort of using high-frequency measures – both more time consuming and more complex – is not worth the cost.

Liquidity proxies are also studied on commodities by Marshall, Nguyen and Visaltanachoti (2011). Over the 1996 – 2009 period, and studying low frequency proxies in twenty-four commodities, they find that the Amihud measure of liquidity (absolute return on day *t* divided by the dollar volume on day *t*) has the largest correlation with commodity transaction costs and liquidity benchmarks, followed by Amivest (dollar volume on day *t* divided by absolute return on day *t*) and Effective Tick (a measure of probability-weighted average of each effect spread sized divided by the average price in the examined time interval).

2.4. Liquidity as an Investment Style

Ibbotson *et al.* (2013) considered that, given the support and evidence for the relationship between liquidity and returns, an investment strategy based on liquidity should be tested and ranked against three other fairly used strategies: momentum, value/growth and size. The authors follow the previous work set out by William F. Sharpe (Sharpe (1988) and Sharpe (1992)). Accordingly, they check if an investment strategy based on liquidity pass the four criteria that characterize a benchmark style, namely: (i) that it is identifiable before the fact, (ii) that it is not easily beaten, (iii) that is a viable alternative, and (iv) is low in cost. Using the turnover ratio as the proxy for liquidity, and studying the top 3,500 stocks in the main US stock markets (NASDAQ, AMEX and the NYSE markets) for the 1972 – 2011 period, the authors conclude that the investment style based on liquidity should rank together with the other three widely accepted styles. Also, given, the historical returns for the considered period, they show that the Liquidity strategy outperforms all the others, except the Value strategy.

2.5. Critical Analysis of Literature

The evidence that liquidity is negatively correlated with excess returns, for individual stocks, seems fairly established for the U.S. market (as for developed markets in general) and is generally accepted in the academia. However, and since liquidity cannot be observed directly, but only through proxies, there seems to be a number of measures to be used, although some – like the relative bid-ask spread and the turnover ratio – are more commonly used than others, presumably due to its ease of computation and availability of data.

The study of liquidity as an investment style has seen recent developments (Ibbotson *et al.*, 2013), and is also the focus of my dissertation. Although the work done by Ibbotson *et al.* (2013) seems fairly comprehensive, and in line with previous results (namely Amihud and Mendelson (1986) and Datar *et al.* (1998)), the possibility that the turnover ratio may not be the best proxy for liquidity, and the contrast of the conclusions reached for emerging markets (Jun *et al.*, 2003), bring forth the need for further tests in new markets, using other proxies for liquidity, and controlling for eventual seasonality effects following Eleswarapu and Reinganum (1993).

The purpose of this dissertation is thus to expand on the study of the relationship between stock returns and liquidity. We aim to follow the tests performed by Ibbotson *et al.* (2013), which are comprehensive for both investors and academics, for new markets and using a new proxy, while also controlling for seasonality effects (January effect).

3. Data and Methodology

The sample comprises all stocks listed on the AMEX, NASDAQ, NYSE, London Stock Exchange, Tokyo Stock Exchange and European stock exchanges (of the countries that adhered to the common currency (Euro) upon its beginning[1]), over the period from 2000 to 2014.

We use daily observations for: Closing Price, annualized Earnings per Share (EPS), Common Shares Outstanding at year-end and daily Volume Traded, obtained from Thomson Reuters' Datastream Database[2].

We computed for each stock Market Capitalization (Closing Price multiplied by Common Shares Outstanding), Earnings to Price (EPS divided by the Closing Price), daily and annual returns, and Value Traded (assumed as the Volume Traded multiplied by the Closing Price[3]).

We include only stocks that are listed in their local currency.

The Momentum style was defined on an annual basis computing each year winners and losers (respectively, shares with the higher and lower returns, as measured by whole-year returns), the Value style was calculated using Earnings to Price (with high Earnings to Price indicating a "value stock" and low Earnings to Price indicating a "growth stock"), and the Size style was defined using year-end market capitalization.

Two liquidity proxies were considered: Relative Volume and Amihud (2002) illiquidity.

Relative Volume is here defined as the daily number of shares traded divided by the daily Number of Common Shares Outstanding at year end, as represented below:

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[1] Namely Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain.

[2] Datastream datatypes: P#T (Prices), EPS (Earnings Per Share), WC05301 (Common Shares Outstanding) and VO (Volume Traded). Closing Prices are adjusted for capital actions.

[3] This does not reflect the "true" value traded, which can only be measured by taking into account all individual trades. Thomson Reuters' Datastream provides a datatype for Value Traded (Datastream datatype: VA) but it is severely lacking or inexistent in many shares. As such, we opted to assume this definition for Value Traded, with the caveat that imprecisions may occur.

$$Relative\ Volume_{\,t} = \frac{Number\ of\ Shares\ Traded_{\,t}}{Common\ Shares\ Outstanding_{\,t}} \tag{3.1}$$

This is a simple and intuitive measure of liquidity: the higher the number of shares traded relative to the total number of shares outstanding, the more liquid they may be considered to be. Relative Volume is also similar to the liquidity proxy used by Ibbotson *et al.* (2013), the Turnover Ratio, defined as the sum of the 12 monthly volumes divided by each month's shares outstanding. The measure used here differs slightly from the one used by Ibbotson *et al.* (2013) given that we use daily frequency, instead on monthly. For the purpose of the creation of portfolios, the yearly average of this proxy was considered.

Amihud (2002) stock illiquidity is defined as the ratio of the daily absolute return to the currency unit trading volume on that day, giving the absolute price change per currency unit of trading volume, as represented below.

$$Amihud\ Illiquidity_{\,t} = \frac{|\,Stock\ Return_{\,t}\,|}{Dollar\ Volume_{\,t}} \tag{3.2}$$

This proxy is different from the Relative Volume and the Turnover Ratio, by focusing on the price impact of liquidity. Illiquid assets are expected to have a higher price movement for each unit or currency unit traded. On the other hand, a highly liquid asset may be traded heavily without expecting a major price change. The yearly average of this proxy was considered for the purpose of portfolio formation.

We consider these two measures to be appropriate in the scope of this dissertation. Firstly, since Relative Volume is similar to the Turnover Ratio used by Ibbotson *et al.* (2013), it will allow to compare their results with the ones obtained. Secondly, the Amihud (2002) illiquidity measure takes into consideration, in its computation, stock returns and, thus, price movements. As such, this measure bears a characteristic that is not present in the Relative Volume or Turnover Ratio measures, which further enriches the comparison between the two.

The formation of portfolios for each investment style, and for each liquidity proxy, follows a two-step approach composed by a Portfolio-Formation Year and a Portfolio-Performance Year. At the end of each Portfolio-Formation Year (which is *year t*), the eligible stocks are ranked by quartiles for each style and proxy. An equal-weighted portfolio is then formed with the stocks of each quartile, and is passively held through the next year (*year t+1*), the Portfolio-Performance Year. By proceeding in this manner, it is guaranteed that each investment strategy is *identifiable before the fact*, a key requirement for a benchmark style defined by Sharpe (1988) and Sharpe (1992). Delistings of any kind are converted to cash at the last available closing price and also held until the end of the year. This two-step approach is performed every year.

The two-step approach described above is done for the years between 2000 and 2014, with 2000 being the first Portfolio Formation year, and 2001 the first Portfolio-Performance Year. As such, returns are obtained for each investment style from 2001 onwards, until 2014. This period (2001-2014) can be considered appropriate since it covers both moments of financial boom and global financial distress (namely, the early 2000s recession and the Global Financial Crisis of 2007-08), for all the countries considered.

For a stock to be eligible to be a part of any portfolio, it has to have available data for Price, EPS, number of common shares outstanding and number of shares traded for a minimum number of days during the Portfolio-Formation year. This minimum number was considered to be the maximum number of days possible in each year, minus 5 (e.g. if year X has a total of 260 trading days, then a stock with data for 255 days would be eligible to be part of a portfolio; on the other hand, a stock with data for 254 days would not be eligible). This restriction was imposed in accordance with Ibbotson *et al.* (2013), although they require observations for the totality of the 12 months in each year.

As in Ibbotson *et al.* (2013), other requirements were imposed. Namely, and for the U.S. capital markets, a stock should have a year-end minimum price of $2. It should also rank within the top 3,500 stocks, measured by market capitalization at year-end, and have a year-end size of a minimum of $5 million, again measured by market capitalization. For the stocks of the London Stock Exchange, a minimum year-end price of £2 and a minimum year-end market capitalization of £5 million were required. On the European stock exchanges, the requirements were €2 as a minimum year-end price and €5 million as a minimum year-end market capitalization. For the Japanese Stock Market, the requirements were a minimum of ¥200 as year-end price and ¥500.000 million as year-end market capitalization.

Table 1 below presents the stocks' characteristics across each quartile of both the Relative Volume (Panel A) and Amihud (2002) (Panel B) measures, for the regional markets analyzed. Note that both measures seem to have lower capitalization stocks in their most illiquid quartile. This is more apparent when analyzing the median of *Size*.

Appendix I presents de description of stock data across investment quartiles for the remaining investment styles.

Table 1 – Description of Stock Data Across Investment Quartiles

Panel A – Relative Volume

Relative Volume		Amihud (2002)		Size		Momentum		Relative Volume		Value	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
US	1Q	6.0276	1.0383	1,640.07	187.80	1.1481	1.0706	1.8264	1.7731	6.5193	4.3050
	2Q	2.0844	0.1489	4,580.08	412.79	1.1933	1.0908	4.4273	4.2647	5.4653	3.9672
	3Q	0.7677	0.0392	4,847.99	816.87	1.2389	1.0987	7.8446	7.6841	4.5585	3.5809
	4Q	0.3731	0.0153	3,793.97	1,057.47	1.2599	1.0418	23.0746	15.7111	5.8276	2.8739
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
UK	1Q	8.3443	2.3547	2,254.15	156.20	1.1085	1.0750	1.4106	1.3403	6.5359	5.9447
	2Q	3.2750	0.6338	3,395.76	238.75	1.1307	1.0819	2.7295	2.7816	7.0402	6.1580
	3Q	1.8630	0.1227	3,544.88	547.06	1.1578	1.0872	4.2333	4.2498	7.1124	6.3617
	4Q	1.3941	0.0366	2,469.17	908.79	1.1716	1.0180	8.6000	7.2654	7.4289	6.0081
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Japan	1Q	3.4489	1.5270	65.01	20.41	1.0478	1.0072	0.6714	0.6155	5.6550	4.8923
	2Q	1.4609	0.4220	158.37	31.25	1.1025	1.0351	1.7048	1.6454	6.7586	5.2558
	3Q	0.6502	0.0934	319.01	71.37	1.1358	1.0501	3.3046	3.2771	5.6767	4.8569
	4Q	0.5585	0.0584	275.88	67.53	1.3012	1.0730	211.6674	7.1666	5.5426	4.0230
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Europe	1Q	11.9811	2.2576	1,548.35	153.53	1.0650	1.0417	0.1272	0.0860	7.5399	6.2812
	2Q	9.5336	2.4015	131.63	19.45	1.1110	1.0408	0.7268	0.6836	7.3597	5.9123
	3Q	4.3726	0.4486	296.69	34.25	1.1636	1.0606	1.8369	1.7253	7.1477	5.2667
	4Q	1.1994	0.0216	742.75	159.04	1.1041	1.0257	6.7058	4.8694	7.3302	5.1313

Panel B – Amihud (2002)

Amihud (2002)		Amihud (2002)		Size		Momentum		Relative Volume		Value	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
US	1Q	8.7482	2.4253	129.03	91.99	1.3389	1.0478	3.8125	2.4394	8.0142	1.6552
	2Q	0.4386	0.2330	384.15	294.97	1.1978	1.0645	6.8943	4.8474	4.6135	3.2801
	3Q	0.0565	0.0350	1,059.00	847.73	1.1642	1.0896	11.1986	8.1333	4.7039	3.8976
	4Q	0.0065	0.0039	1,327.89	4,365.75	1.1393	1.0940	15.2710	10.0841	5.0382	4.4711
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
UK	1Q	1.3236	0.6814	82.83	43.77	1.1323	0.9550	2.6438	2.0983	6.9981	4.1023
	2Q	0.1409	0.1077	212.80	156.20	1.1846	1.0789	3.2370	2.5675	6.8899	5.8889
	3Q	0.0202	0.0133	706.99	564.26	1.1559	1.1167	4.7455	3.7787	7.3287	6.3700
	4Q	0.0018	0.0009	10,636.66	3,430.78	1.0961	1.0773	6.3481	5.1312	6.9004	6.6266
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Japan	1Q	5.2123	2.9804	146.33	95.26	1.1639	1.0306	2.1887	0.9252	6.5611	5.0250
	2Q	0.7257	0.6304	327.92	228.41	1.1447	1.0307	3.1976	1.5347	6.4638	5.1366
	3Q	0.1594	0.1261	784.79	589.82	1.1609	1.0374	4.7814	2.7662	5.7752	4.7969
	4Q	0.0203	0.0147	6,916.22	3,012.40	1.1178	1.0414	207.1829	4.1701	4.8338	4.3451
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Europe	1Q	2.7297	1.3262	68.91	5.74	1.0791	1.0107	0.8332	0.5255	7.0939	5.4110
	2Q	0.2551	0.2206	545.57	28.48	1.1507	1.0534	1.1580	0.6565	8.5396	5.6688
	3Q	0.0407	0.0315	796.24	75.15	1.1348	1.0521	2.0567	1.2813	6.8876	5.6936
	4Q	0.0025	0.0012	1,311.31	474.61	1.0795	1.0567	5.3539	3.8428	6.8647	5.7639

Values in Table 1 may be multiplied by factors of 10 for easier reading.

Table 2 below presents a description of the data used for each market.

Table 2 – Description of stock data for US, Japan, UK and European (Euro) stocks

US					
Year	No. of Stocks	Average no. Stocks per Quartile	Lowest Market Cap.	Median Market Cap.	Highest Market Cap.
2000	2877	719	$5.08 M	$229.56 M	$475 003.10 M
2001	2284	571	$5.22 M	$456.65 M	$397 889.20 M
2002	2390	598	$5.38 M	$351.12 M	$276 630.70 M
2003	2657	664	$7.57 M	$471.75 M	$311 755.30 M
2004	2707	677	$6.47 M	$514.85 M	$385 882.80 M
2005	2806	702	$5.92 M	$517.01 M	$370 343.70 M
2006	2777	694	$5.24 M	$582.92 M	$383 564.30 M
2007	2672	668	$5.66 M	$526.57 M	$374 636.90 M
2008	2383	596	$5.04 M	$404.51 M	$172 929.80 M
2009	2526	632	$5.07 M	$486.12 M	$270 635.40 M
2010	2526	632	$8.47 M	$607.11 M	$295 886.30 M
2011	2428	607	$6.06 M	$587.25 M	$377 518.80 M
2012	2410	603	$5.56 M	$682.70 M	$499 695.90 M
2013	2509	627	$5.47 M	$889.27 M	$500 740.40 M

Japan					
Year	No. of Stocks	Average no. Stocks per Quartile	Lowest Market Cap.	Median Market Cap.	Highest Market Cap.
2000	1157	289	¥1 213.74 Bn	¥55 743.77 Bn	¥19 770 920.00 Bn
2001	1154	289	¥1 171.20 Bn	¥48 672.66 Bn	¥15 455 440.00 Bn
2002	1188	297	¥1 294.38 Bn	¥41 248.46 Bn	¥11 010 661.42 Bn
2003	1496	374	¥1 838.88 Bn	¥41 082.46 Bn	¥12 054 314.02 Bn
2004	1855	464	¥1 390.00 Bn	¥37 456.86 Bn	¥13 627 889.43 Bn
2005	2207	552	¥1 507.11 Bn	¥47 137.62 Bn	¥19 839 552.84 Bn
2006	2072	518	¥986.00 Bn	¥43 681.91 Bn	¥25 455 578.52 Bn
2007	1999	500	¥534.65 Bn	¥36 425.56 Bn	¥19 021 651.20 Bn
2008	1640	410	¥623.79 Bn	¥32 390.18 Bn	¥9 109 737.21 Bn
2009	1633	408	¥559.69 Bn	¥35 007.35 Bn	¥12 167 660.60 Bn
2010	1683	421	¥832.05 Bn	¥34 645.02 Bn	¥10 096 950.78 Bn
2011	1617	404	¥575.23 Bn	¥29 972.50 Bn	¥8 122 867.65 Bn
2012	1719	430	¥704.48 Bn	¥32 567.28 Bn	¥12 685 553.15 Bn
2013	2009	502	¥804.51 Bn	¥36 435.87 Bn	¥20 349 897.72 Bn

UK					
Year	No. of Stocks	Average no. Stocks per Quartile	Lowest Market Cap.	Median Market Cap.	Highest Market Cap.
2000	788	197	£5.15 M	£120.68 M	£136 147.03 M
2001	549	137	£5.02 M	£251.56 M	£119 787.29 M
2002	501	125	£6.24 M	£228.60 M	£98 635.50 M
2003	541	135	£5.07 M	£295.54 M	£100 215.42 M
2004	632	158	£5.09 M	£239.31 M	£109 351.97 M
2005	632	158	£5.74 M	£280.60 M	£121 784.66 M
2006	602	151	£5.76 M	£384.95 M	£112 745.66 M
2007	612	153	£5.05 M	£351.65 M	£129 794.54 M
2008	491	123	£8.00 M	£276.38 M	£105 660.06 M
2009	488	122	£9.61 M	£450.29 M	£123 389.37 M
2010	520	130	£9.28 M	£496.97 M	£135 778.79 M
2011	514	129	£6.04 M	£423.48 M	£152 640.86 M
2012	564	141	£8.96 M	£457.15 M	£137 152.74 M
2013	566	142	£6.00 M	£596.96 M	£143 535.48 M

European (Euro)					
Year	No. of Stocks	Average no. Stocks per Quartile	Lowest Market Cap.	Median Market Cap.	Highest Market Cap.
2000	1514	379	€ 5.17 M	€ 448.15 M	€ 473 140.97 M
2001	1427	357	€ 5.35 M	€ 408.43 M	€ 397 818.34 M
2002	1170	293	€ 5.21 M	€ 443.91 M	€ 293 114.64 M
2003	1236	309	€ 6.12 M	€ 535.84 M	€ 287 770.26 M
2004	1223	306	€ 5.04 M	€ 489.18 M	€ 289 463.89 M
2005	1636	409	€ 5.41 M	€ 478.66 M	€ 169 521.71 M
2006	1692	423	€ 5.58 M	€ 595.08 M	€ 168 299.66 M
2007	1676	419	€ 5.08 M	€ 645.36 M	€ 178 979.84 M
2008	1351	338	€ 5.27 M	€ 405.51 M	€ 114 781.35 M
2009	1312	328	€ 5.21 M	€ 550.42 M	€ 770 046.23 M
2010	1306	327	€ 6.19 M	€ 593.81 M	€ 685 510.15 M
2011	1289	322	€ 6.47 M	€ 507.84 M	€ 639 133.40 M
2012	1121	280	€ 5.13 M	€ 721.55 M	€ 164 709.40 M
2013	1255	314	€ 5.38 M	€ 950.56 M	€ 223 201.43 M

4. Results

4.1. Liquidity Portfolio Returns

Returns on the quartile portfolios were measured over the period from 2001 to 2014 (14 years of performance), for all investment styles and across the studied stock markets. **Table 3** presents the geometric and arithmetic means of annual returns, as well as the standard deviation of yearly returns, across investment styles. Geometric Mean refers to the Cumulative Annual Growth Rate (CAGR) which is less affected by the volatility of returns than the arithmetic mean. The Sharpe Ratio is calculated by dividing each quartile portfolio arithmetic average of returns by the same quartile's standard deviation of returns.

Henceforth, "Universe" refers to all the stocks that were considered "eligible" for each stock market.

4.1.1. US Stocks

As can be observed in Panel A of **Table 3**, the portfolios formed using the Amihud (2002) and the Relative Volume proxies for illiquidity provide average annual (geometric) returns that are negatively related with liquidity. As such, more illiquid stocks provide higher returns, with the returns between the most liquid and the less liquid quartiles (4Q and 1Q respectively) being very distinct. However, a significant difference between the two measures appears to be in the relationship between volatility and return. In fact, and when measured by the standard deviation of annual returns, the Relative Volume proxy provides growing returns with lowering volatility. The same does not hold for the Amihud (2002) proxy, which shows higher volatility associated with higher returns. Both measures allow the *Illiquid Portfolios* to, on average, outperform the Universe of stocks as whole.

Table 3 – Style Portfolio Returns and Sharpe Ratios, 2001-2014

Panel A – US Stocks

Investment Style		Q1	Q2	Q3	Q4
Size					
(Q1 = micro; Q4 = large)	Geometric Mean of Returns	14.40%	10.73%	8.70%	7.27%
	Arithmetic Mean of Returns	20.04%	13.98%	11.00%	9.58%
	Standard Deviation of Returns	37.70%	27.44%	22.29%	21.95%
Value					
(Q1 = value; Q4 = growth)	Geometric Mean of Returns	12.59%	10.36%	8.04%	9.26%
	Arithmetic Mean of Returns	15.43%	12.09%	10.67%	15.14%
	Standard Deviation of Returns	25.57%	19.25%	23.54%	37.69%
Momentum					
(Q1 = winners; Q4 = losers)	Geometric Mean of Returns	7.14%	10.58%	11.80%	10.81%
	Arithmetic Mean of Returns	10.08%	12.58%	14.37%	17.58%
	Standard Deviation of Returns	24.68%	20.74%	24.33%	41.99%
Relative Volume (Liquidity)					
(Q1 = low; Q4 = high)	Geometric Mean of Returns	13.54%	11.72%	9.62%	6.71%
	Arithmetic Mean of Returns	16.33%	14.49%	12.74%	11.13%
	Standard Deviation of Returns	25.10%	25.31%	26.11%	31.40%
Amihud (2002) (Liquidity)					
(Q1 = low; Q4 = high)	Geometric Mean of Returns	14.42%	10.36%	9.32%	7.30%
	Arithmetic Mean of Returns	19.22%	13.77%	11.80%	9.90%
	Standard Deviation of Returns	34.90%	27.92%	23.33%	23.42%
Universe (All Stocks)					
	Geometric Mean of Returns		10.54%		
	Arithmetic Mean of Returns		13.67%		
	Standard Deviation of Returns		26.57%		

Sharpe Ratio	Q1	Q2	Q3	Q4
Size	0.531	0.509	0.494	0.437
Value	0.604	0.628	0.453	0.402
Momentum	0.408	0.606	0.591	0.419
Relative Volume (Liquidity)	0.651	0.572	0.488	0.354
Amihud (2002) (Liquidity)	0.551	0.493	0.506	0.423

Panel B – UK Stocks

Investment Style		Q1	Q2	Q3	Q4
Size					
(Q1 = micro; Q4 = large)	Geometric Mean of Returns	4.24%	5.68%	5.96%	4.40%
	Arithmetic Mean of Returns	12.03%	9.86%	9.23%	6.55%
	Standard Deviation of Returns	45.59%	30.51%	25.76%	20.93%
Value					
(Q1 = value; Q4 = growth)	Geometric Mean of Returns	9.82%	8.27%	3.33%	-1.43%
	Arithmetic Mean of Returns	15.24%	11.00%	6.55%	4.89%
	Standard Deviation of Returns	35.18%	24.15%	25.40%	38.90%
Momentum					
(Q1 = winners; Q4 = losers)	Geometric Mean of Returns	8.85%	7.89%	4.37%	-1.41%
	Arithmetic Mean of Returns	11.45%	10.66%	8.45%	7.12%
	Standard Deviation of Returns	23.89%	24.00%	28.93%	48.95%
Relative Volume (Liquidity)					
(Q1 = low; Q4 = high)	Geometric Mean of Returns	7.71%	6.27%	5.48%	2.06%
	Arithmetic Mean of Returns	12.24%	9.68%	8.76%	7.01%
	Standard Deviation of Returns	31.86%	27.43%	26.96%	32.96%
Amihud (2002) (Liquidity)					
(Q1 = low; Q4 = high)	Geometric Mean of Returns	6.98%	3.18%	6.71%	4.10%
	Arithmetic Mean of Returns	13.04%	7.91%	10.40%	6.35%
	Standard Deviation of Returns	38.78%	32.99%	28.07%	21.39%
Universe (All Stocks)					
	Geometric Mean of Returns	5.49%			
	Arithmetic Mean of Returns	9.43%			
	Standard Deviation of Returns	29.52%			

Sharpe Ratio	Q1	Q2	Q3	Q4
Size	0.264	0.323	0.358	0.313
Value	0.433	0.455	0.258	0.126
Momentum	0.479	0.444	0.292	0.145
Relative Volume (Liquidity)	0.384	0.353	0.325	0.213
Amihud (2002) (Liquidity)	0.336	0.240	0.370	0.297

Panel C – Japanese Stocks

Investment Style		Q1	Q2	Q3	Q4
Size					
(Q1 = micro; Q4 = large)	Geometric Mean of Returns	9.43%	5.96%	4.56%	2.41%
	Arithmetic Mean of Returns	13.89%	8.90%	7.18%	5.14%
	Standard Deviation of Returns	32.94%	26.19%	24.86%	24.89%
Value					
(Q1 = value; Q4 = growth)	Geometric Mean of Returns	10.53%	5.87%	3.49%	2.45%
	Arithmetic Mean of Returns	14.16%	8.46%	6.17%	6.31%
	Standard Deviation of Returns	29.12%	24.35%	25.21%	30.47%
Momentum					
(Q1 = winners; Q4 = losers)	Geometric Mean of Returns	4.04%	5.90%	6.04%	5.95%
	Arithmetic Mean of Returns	7.96%	8.46%	8.49%	10.20%
	Standard Deviation of Returns	31.06%	25.02%	24.02%	30.90%
Relative Volume (Liquidity)					
(Q1 = low; Q4 = high)	Geometric Mean of Returns	7.16%	8.10%	6.21%	0.43%
	Arithmetic Mean of Returns	8.94%	10.85%	9.57%	5.76%
	Standard Deviation of Returns	20.62%	25.65%	27.95%	34.91%
Amihud (2002) (Liquidity)					
(Q1 = low; Q4 = high)	Geometric Mean of Returns	9.08%	7.34%	3.53%	2.47%
	Arithmetic Mean of Returns	12.86%	10.43%	6.37%	5.46%
	Standard Deviation of Returns	30.42%	27.15%	25.69%	25.83%
Universe (All Stocks)					
	Geometric Mean of Returns	5.70%			
	Arithmetic Mean of Returns	8.78%			
	Standard Deviation of Returns	26.95%			

Sharpe Ratio	Q1	Q2	Q3	Q4
Size	0.422	0.340	0.289	0.207
Value	0.486	0.347	0.245	0.207
Momentum	0.256	0.338	0.354	0.330
Relative Volume (Liquidity)	0.433	0.423	0.342	0.165
Amihud (2002) (Liquidity)	0.423	0.384	0.248	0.211

Panel D – European Stocks

Investment Style		Q1	Q2	Q3	Q4
Size					
(Q1 = micro; Q4 = large)	Geometric Mean of Returns	-2.33%	1.91%	4.13%	0.05%
	Arithmetic Mean of Returns	1.39%	5.88%	7.37%	2.77%
	Standard Deviation of Returns	26.68%	27.83%	25.22%	22.46%
Value					
(Q1 = value; Q4 = growth)	Geometric Mean of Returns	4.63%	4.48%	0.59%	-7.09%
	Arithmetic Mean of Returns	7.99%	7.21%	3.50%	-1.29%
	Standard Deviation of Returns	24.99%	23.33%	23.59%	31.65%
Momentum					
(Q1 = winners; Q4 = losers)	Geometric Mean of Returns	5.02%	2.86%	1.95%	-7.21%
	Arithmetic Mean of Returns	7.78%	5.19%	5.42%	-0.99%
	Standard Deviation of Returns	23.46%	21.09%	25.85%	34.13%
Relative Volume (Liquidity)					
(Q1 = low; Q4 = high)	Geometric Mean of Returns	3.49%	2.07%	0.49%	-2.35%
	Arithmetic Mean of Returns	5.95%	5.06%	4.50%	1.89%
	Standard Deviation of Returns	21.74%	24.01%	27.72%	28.26%
Amihud (2002) (Liquidity)					
(Q1 = low; Q4 = high)	Geometric Mean of Returns	1.47%	1.35%	1.31%	1.28%
	Arithmetic Mean of Returns	4.34%	4.82%	4.89%	4.16%
	Standard Deviation of Returns	24.25%	25.85%	26.50%	23.53%
Universe (All Stocks)					
	Geometric Mean of Returns	1.03%			
	Arithmetic Mean of Returns	4.35%			
	Standard Deviation of Returns	25.22%			

Sharpe Ratio	Q1	Q2	Q3	Q4
Size	0.052	0.211	0.292	0.123
Value	0.320	0.309	0.148	-0.041
Momentum	0.332	0.246	0.210	-0.029
Relative Volume (Liquidity)	0.274	0.211	0.162	0.067
Amihud (2002) (Liquidity)	0.179	0.187	0.185	0.177

As for the other investment styles, Size is the one that provides higher returns, with increasing returns being associated with higher volatility. The Value investment style delivers different returns across quartiles, as the Size style, but provides lower returns for the top quartile, Q1 (although it also provides higher returns for the lower quartile, Q4), and its volatility-return relation is not clear. As for the Momentum investment style, it neither provides a clear return nor volatility profile, and its “winners” portfolio is not able to outperform, on average, the Universe.

When the Sharpe Ratio is calculated for each portfolio of each investment style, the Relative Volume most illiquid portfolio provides the best return for the amount of volatility. The Value investment style provides the second best relationship between the two factors, with Amihud (2002) being ranked third.

Figure 1 – Investment Styles' Q1 Portfolio Returns (US Stocks), 2001-2014

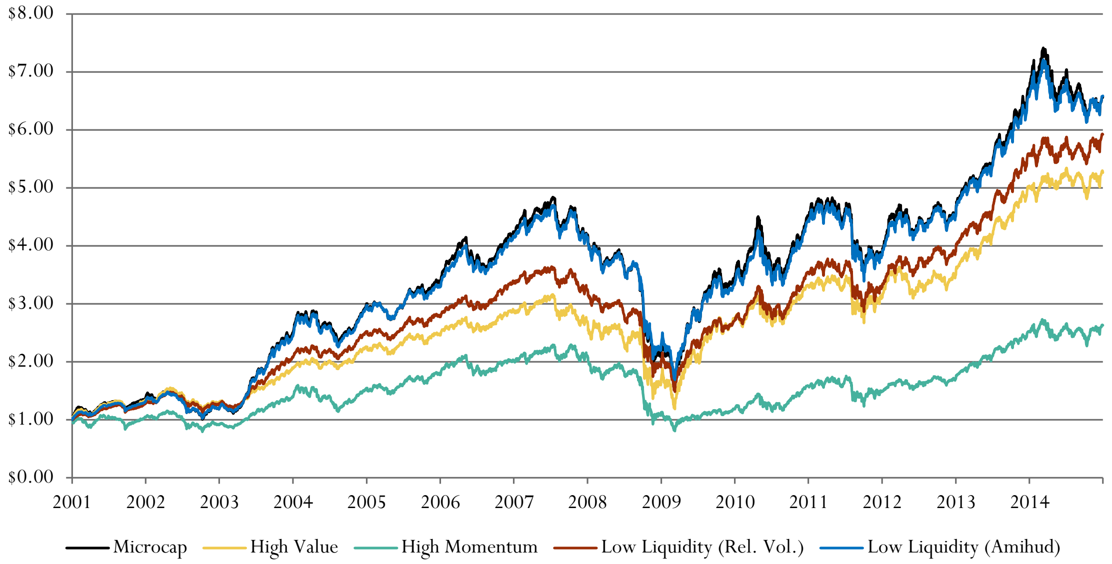


Figure 1 above presents the returns for each Q1 equally-weighted portfolio over the period 2001-2014 The portfolio comprised of microcap stocks outperforms the remaining portfolios, with the exception of Amihud (2002). The pattern of the performance of the two portfolios seems to be very closely related. High momentum portfolio underperforms compared with the other investment styles.

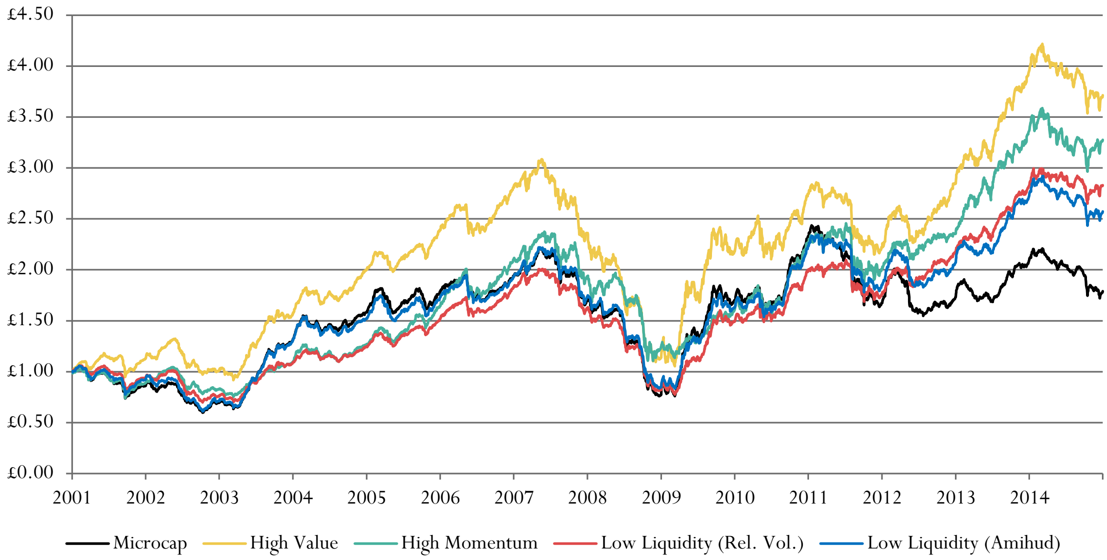
4.1.2. UK Stocks

The analysis for the samples of UK stocks provides different conclusions from the ones discussed above for US stocks. In fact, and as can be observed in Panel B of Table 3, the Amihud (2002) proxy no longer results in a clear differentiation of returns across quartile portfolios. The Relative Volume proxy, on the other hand, remains consistent in providing a positive association between returns and illiquidity.

As for the other investment styles, Value is the one that provides the higher returns, when holding a portfolio composing of the past year "high value stocks". Further, the Q1 Momentum portfolio shows lower volatility when compared with the other investment styles' Q1 portfolios.

When analyzing the Sharpe Ratio across investment styles and quartiles, the Momentum investment style is able to provide the best volatility-return relationship, when compared with the other styles. Out of the liquidity styles, the Relative Volume proxy has the best Sharpe Ratio profile

Figure 2 - Investment Styles' Q1 Portfolio Returns (UK Stocks), 2001-2014



As can be observed in **Figure 2** above, the High Value portfolio outperforms the remaining portfolios through the majority of the periods. The high Momentum outperforms the remaining Q1 portfolios, with the Microcap portfolio seemingly replicating its pattern throughout much of the studied period, before deviating in 2012 and becoming the worst performing portfolio.

4.1.3. Japanese Stocks

On what regards Japanese stocks, the Amihud (2002) proxy provides the highest return for illiquidity, as can be observed in Panel C of **Table 3**. The results for this measure, regarding volatility and its relation with geometric mean of returns, are similar to those observed in the UK and US stocks. The portfolios formed using the Relative Volume measure do not show returns increasing with liquidity, across quartiles (e.g. geometric mean of returns is lower in Q2 than Q1, but higher than Q3 or Q4).

The analysis of the Sharpe Ratios, further presented in Panel C of **Table 3** show that Q1 portfolios, across investment styles, show similar relationship between returns and volatility. Only the high momentum portfolio differs from the remaining portfolios, by providing a comparatively lower return for volatility. Portfolios formed based on liquidity measures appear to not differ much from Size or Value portfolios.

Figure 3 - Investment Styles' Q1 Portfolio Returns (Japanese Stocks), 2001-2014

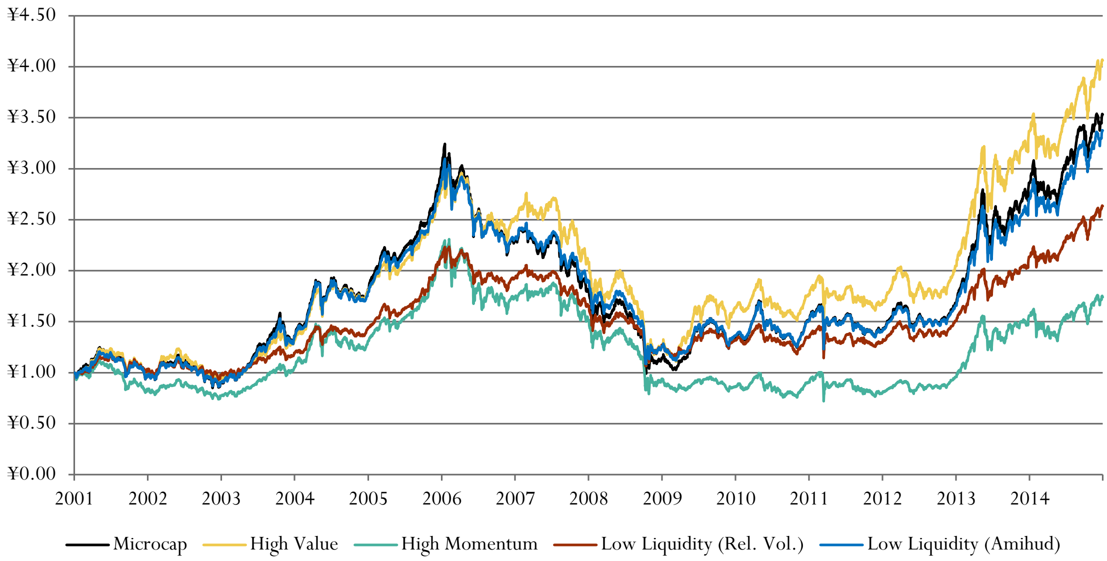


Figure 2 plots the historical performance of the 1Q portfolios. It seems to suggest a close relationship between the Amihud (2002) portfolio and the portfolio composed by Microcap stocks. The High Value portfolio is able to outperform the remaining throughout much of the studied period, with a more pronounced outperformance from 2009 onwards.

4.1.4. European Stocks

In the results for the European stocks, presented in Panel D of **Table 3**, the Relative Volume measure is the liquidity proxy that provides the highest annual returns, with associated diminishing volatility (as measured by the returns' standard deviation). The low liquidity portfolio formed using the Amihud (2002) measure presents returns above the Universe of stocks, yet these are lower than those yielded by the Q1 portfolio formed using the Relative Volume measure, with the relation between the geometric mean of annual returns and volatility not seeming clear.

As for the non-liquidity-based portfolios, the Momentum investment strategy is able to provide the best returns among Q1 portfolios. Size strategy underperforms the remaining investment styles for Q1 and Q2 portfolios. Also, and when measured by its geometric mean, returns on small capitalization stocks present negative returns, with relatively high volatility.

For the most illiquid portfolios, and as observed in calculations for the Sharpe Ratio, the Relative Volume proxy is able to provide the best trade-off between return and volatility. Yet, the Momentum and Value investment strategies present a Sharpe Ratio for Q1 portfolios that are higher than any remaining portfolio.

Figure 4 - Investment Styles' Q1 Portfolio Returns (European Stocks), 2001-2014

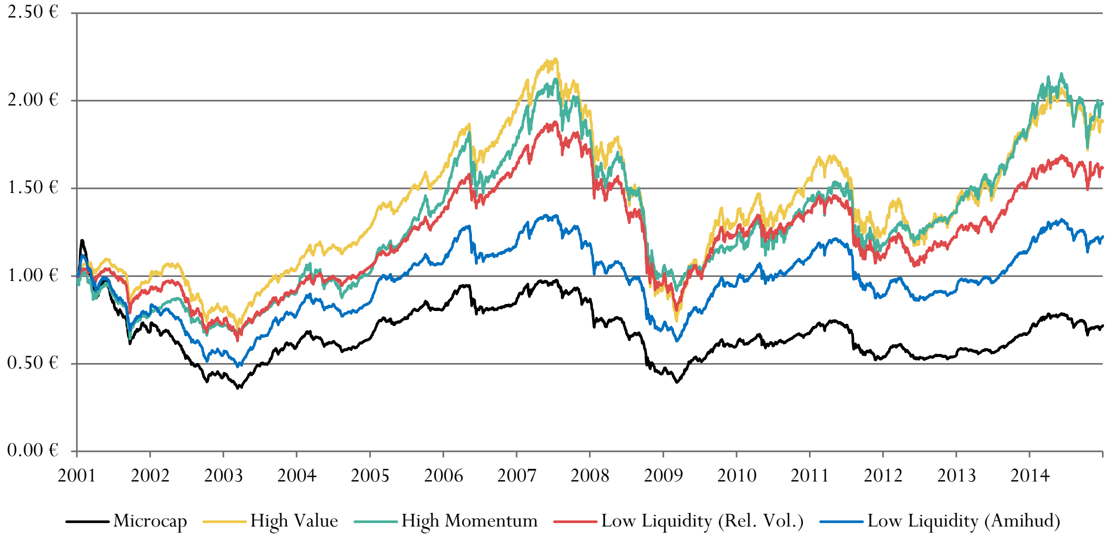


Figure 4 above shows that the High Momentum or High Value portfolios outperform the remaining portfolios, consistently. The illiquid portfolio formed using the Relative Volume measure is, also, shown to outperform the remaining investment styles.

4.2. Liquidity as an Investment Factor and Seasonality Effects

To test liquidity as a factor we create a liquidity factor for each proxy studied, following Ibbotson *et al.* (2013). This was done by constructing monthly returns of a long-short portfolio in which the returns of the most liquid quartile were subtracted from the returns of the least liquid quartile.

Returns on this portfolio were obtained in EViews using their logarithmic values, and by calculating the following formula:

$$Portfolio\ Return_t = \log(PorValue_t/PorValue_{t-1}) \tag{4.1}$$

Where *PorValue* refers to Portfolio Value, and *t* refers to each day or month.

Following this, we regress each long-short liquidity portfolio on the capital asset pricing model (CAPM) and the Fama-French Three-Factor Model (Fama and French, 1993). In the CAPM, each liquidity long-short factor is regressed on the excess returns of the market portfolio:

$$R_{it} = \alpha + \beta_{iM}\left(R_{Mt} - R_{ft}\right) + \varepsilon_{it} \tag{4.2}$$

Where R_{Mt} represents the returns of the Market Portfolio in period t and R_{ft} represents the returns of a risk-free asset in period t.

In the Three-Factor Model framework, each liquidity long-short factor is regressed on the long market portfolio and the long-short Size and Value portfolios:

$$R_{it} = \alpha + \beta_{iM}\left(R_{Mt} - R_{ft}\right) + S_i SMB + h_i HML + \varepsilon_{it} \tag{4.3}$$

Where *SMB* is the average return of small market capitalization stocks over high market capitalization stocks, and *HML* is the average return of value stocks over growth stocks, as defined by Fama and French (1993).

Data for the excess return of the market portfolio above the return of a risk-free asset, the return of a risk-free asset and dollar-neutral returns for size and value portfolios were obtained from Kenneth R. French website[4]. The data provided is available for the US and Japanese stock markets. Kenneth R. French aggregates the data for the European and London Stock Market under the category “Europe”, which poses a problem for the methodology used thus far. In particular, we’ve assumed that a potential investor would not hold any currency risk. The conjunction of the European and UK stock markets into one dataset, by Kenneth R. French does not, then, complies with the assumption made thus far. As such, in this section we only calculate the results for the US and Japanese stock markets. Finally, daily values exist only for the US stock market. These are provided in Appendix II.

[4] Kenneth R. French website can be accessed through http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/

Table 4 and **Table 5** below present the Pearson correlations of returns across each Investment Style Long-Short portfolios, for the US and Japanese stocks. We note that, for both the US and Japanese stocks, the correlation obtained between the Relative Volume liquidity proxy and the Value investment style is similar and relatively high (for the US stocks, it is the highest). For the Japanese stocks, the highest correlation is between the Size investment style and the Amihud (2002).

Table 4 – Pearson Correlations of Monthly Liquidity Factors with Other Factors (US Stocks), 2001-2014

Variable	Size	Value	Momentum	Relative Volume	Amihud (2002)
Size	1	-0.184	-0.217	0.190	0.431
Value	-0.184	1	0.085	0.756	-0.661
Momentum	-0.217	0.085	1	-0.035	-0.083
Relative Volume	0.190	0.756	-0.035	1	-0.411
Amihud (2002)	0.431	-0.661	-0.083	-0.411	1

Table 5 - Pearson Correlations of Monthly Liquidity Factors with Other Factors (Japanese Stocks), 2001-2014

Variable	Size	Value	Momentum	Relative Volume	Amihud (2002)
Size	1	-0.696	-0.006	-0.545	0.936
Value	-0.696	1	0.016	0.758	-0.857
Momentum	-0.006	0.016	1	0.023	-0.016
Relative Volume	-0.545	0.758	0.023	1	-0.593
Amihud (2002)	0.936	-0.857	-0.016	-0.593	1

4.2.1. Liquidity as an Investment Factor

Table 6 presents the coefficients for each factor, under each model, for the US stock market. It can be observed that, using the CAPM, the Monthly Alpha is positive and statistically significant at the 95% confidence level, when using the Relative Volume measure. As with Ibbotson *et al.* (2013), the interpretation can be that a dollar neutral liquidity portfolio, when formed basing on the Relative Volume measure is not "easily beaten". However, the portfolio formed using the Amihud (2002) proxy presents a monthly alpha with a *p-value* of 0.061, which means that this Alpha is only statistically significant at the 90% confidence level.

Table 6 - Regression Analyses of Long-Short Liquidity Portfolios (US Stocks), Monthly data, 2001-2014

(p-value in parentheses)	*Monthly Alpha (%)*	*Mkt-Rf*	*SMB*	*HML*	*January Dummy*	*Adjusted R^2 (%)*	*N*
Illiquidity (Relative Volume)							
CAPM	0.759	-0.618				45.79	167
	(0.001)	(0.000)					
CAPM (January Effect)	0.789	-0.619			-0.004	45.52	167
	(0.002)	(0.000)			(0.677)		
F&F Three-Factor	0.609	-0.580	-0.212	0.661		65.66	167
	(0.002)	(0.000)	(0.007)	(0.000)			
F&F Three-Factor (January Effect)	0.610	-0.580	-0.212	0.661	0.000	65.45	167
	(0.002)	(0.000)	(0.008)	(0.000)	(0.993)		
Illiquidity (Amihud)							
CAPM	0.437	-0.089				1.18	167
	(0.061)	(0.086)					
CAPM (January Effect)	0.230	-0.077			0.026	6.04	167
	(0.330)	(0.125)			(0.002)		
F&F Three-Factor	0.200	-0.183	0.451	0.402		27.38	167
	(0.321)	(0.000)	(0.000)	(0.000)			
F&F Three-Factor (January Effect)	0.005	-0.168	0.432	0.411	0.025	31.92	167
	(0.981)	(0.000)	(0.000)	(0.000)	(0.001)		

Regressions were performed using the CAPM and Three-Factor Model frameworks, as expressed in formulas 4.2 and 4.3 above. *Mkt-Rf* refers to the average excess return of the Market Portfolio over the returns of a Risk-free asset. *SMB* and *HML* refer to the *Small-minus-Big* and *High-minus-Low* factors generally used. *January Dummy* is a dummy variable that assumed the value of "1" in January months and "0" in the remaining months. *N* refers to the number of observations in each regression.

Under the Fama-French three factor model, the monthly alpha remains positive and statistically significant for the regressions using the Relative Volume measure. This seems to suggest that this proxy for illiquidity has an adding explanatory power. When analyzing the regressions using the Amihud (2002) measure, we conclude that its monthly alpha is not statistically significant, suggesting thus that this proxy for liquidity does not yield non-negative significant risk-adjusted returns.

Table 7 below provides the results for the same regressions on the Japanese stock sample. Under the CAPM framework, the Monthly Alpha presented by the Relative Volume measure is positive and statistically significant at the 95% confidence level. With a *p-value* of 0.068, the Amihud (2002)'s Monthly Alpha is statistically significant only at the 90% confidence level. These results are consistent with the ones provided above for the US stocks.

Table 7 - Regression Analyses of Long-Short Liquidity Portfolios (Japanese Stocks), Monthly data, 2001-2014

(p-value in parentheses)	*Monthly Alpha (%)*	*Mkt-Rf*	*SMB*	*HML*	*January Dummy*	*Adjusted R^2 (%)*	*N*
Illiquidity (Relative Volume)							
CAPM	0.552	-0.598				47.77	167
	(0.015)	(0.000)					
CAPM (January Effect)	0.661	-0.603			-0.014	48.33	167
	(0.005)	(0.000)			(0.098)		
F&F Three-Factor	0.280	-0.561	0.070	0.414		52.97	167
	(0.210)	(0.000)	(0.399)	(0.000)			
F&F Three-Factor (January Effect)	0.401	-0.565	0.114	0.432	-0.018	54.14	167
	(0.078)	(0.000)	(0.178)	(0.000)	(0.025)		
Illiquidity (Amihud)							
CAPM	0.407	-0.079				1.02	167
	(0.068)	(0.101)					
CAPM (January Effect)	0.209	-0.070			0.025	6.00	167
	(0.354)	(0.134)			(0.002)		
F&F Three-Factor	-0.025	-0.036	0.944	0.287		73.57	167
	(0.833)	(0.152)	(0.000)	(0.000)			
F&F Three-Factor (January Effect)	-0.052	-0.035	0.935	0.284	0.004	73.54	167
	(0.676)	(0.162)	(0.000)	(0.000)	(0.368)		

Under the Fama & French framework, no measure is able to provide statistically significant Monthly Alphas. This seems to suggest that illiquidity, as measured by these two proxies, does not provide any increasing explanatory power to the already considered risk-adjusting factors.

Results for the monthly alphas using the Relative Volume proxy also have economic significance. That is due to the fact that not only the alphas are, generally, statistically significant, they are also positive. Annual alphas, for the US stocks, vary from 7.32% (Fama-French with *January Dummy*) to 9.46% (CAPM with *January Dummy*), with both being statistically significant. The highest statistically significant annual alpha for Japanese stocks is 7.93% (CAPM with *January Dummy*).

4.2.2. The January Effect Seasonality Test

As mentioned in the Literature Review, some authors find evidence of a seasonality effect for the portfolios formed following liquidity proxies. As such, we also test for the *January effect*. To do this, we use a dummy variable that assumes the value of "1" for each January month and the value of "0" for the remaining months.

For the US stocks, the regressions suggest that there is a *January effect* in the Amihud (2002) long-short portfolios, with the coefficient of this variable being positive and statistically significant. This seasonality effect was not found in the long-short portfolios formed using the Relative Volume measure. When considering Japanese stocks, there seems to be a seasonality effect for the Relative Volume measure under the Three-Factor Model framework. The effect is also observed when using the CAPM framework on the Amihud (2002) proxy.

As such, an investor considering this liquidity investment style, depending on either the market or the proxy used to measure liquidity, would have different returns in January than in the rest of the months.

4.3. Further Tests: Stock Stability and Migration

For Liquidity to be successfully established as an investment style, it must also be "*low in cost*". The process of portfolio formation considered here requires that an investor reorganizes his portfolio only once a year, at year's end. Through the remainder of the year, it has been assumed that he passively holds his investments. As such, and as done by Ibbotson *et al.* (2013), the potential cost of following each style here analyzed can be assumed as closely linked to the extension to which the investor reorganizes his portfolio.

Table 8 provides the migration of stocks between quartiles from year *t* to year *t+1*, across the Size, Value, Momentum and Liquidity styles. The values presented are averages across all the regional stock markets studied. The full table for each market is presented in Appendix III.

Size style portfolios constitute the most stable, with an average 81.27% of stocks remaining on the same quartile from each year to the next. Liquidity style portfolios, when measured by the Relative Volume or by the Amihud (2002) proxy are relatively more stable than any other style, excepting the aforementioned Size style. There is, thus, evidence that these portfolios have lower cost than most and comply with this requirement for a benchmark investment style.

Table 8 – Average Stock Migration Across Quartiles, One Year After Portfolio Formation, 2001-2014

	Year *t+1* Size			
	1 (micro)	2	3	4 (large)
A. Size migration (81.27% stay in the same quartile)				
Year *t* Size				
1 (micro)	**83.92%**	15.48%	0.61%	0.00%
2	14.17%	**71.61%**	14.11%	0.11%
3	0.88%	13.21%	**77.77%**	8.15%
4 (large)	0.02%	0.32%	7.87%	**91.79%**
	Year *t+1* Value			
B. Value migration (57.02% stay in the same quartile)				
Year *t* Value				
1 (value)	**62.28%**	23.15%	8.69%	6.13%
2	22.98%	**48.12%**	23.78%	6.49%
3	8.39%	23.21%	**48.70%**	16.88%
4 (growth)	7.07%	6.67%	18.46%	**68.99%**
	Year *t+1* Momentum			
C. Momentum migration (28.43% stay in the same quartile)				
Year *t* Momentum				
1 (winners)	**24.52%**	23.45%	24.55%	27.49%
2	21.71%	**29.04%**	28.56%	20.69%
3	20.89%	28.63%	**28.71%**	21.77%
4 (losers)	24.43%	21.21%	22.92%	**31.43%**
	Year *t+1* Liquidity (Relative Volume)			
D. Liquidity (Relative Volume) migration (65.81% stay in the same quartile)				
Year *t* Liquidity (Rel. Vol.)				
1 (low)	**77.36%**	18.41%	3.28%	0.95%
2	19.22%	**55.99%**	20.98%	3.81%
3	2.91%	23.07%	**55.57%**	18.44%
4 (high)	0.66%	3.73%	21.30%	**74.30%**
	Year *t+1* Liquidity (Amihud)			
E. Liquidity (Amihud) migration (78.06% stay in the same quartile)				
Year *t* Liquidity (Amihud)				
1 (low)	**77.88%**	20.42%	1.65%	0.05%
2	17.65%	**67.11%**	14.99%	0.25%
3	1.00%	14.22%	**75.82%**	8.96%
4 (high)	0.04%	0.30%	8.21%	**91.45%**

Notwithstanding the full tables for the migration of stocks being presented in Appendix III, the table below summarizes the average number of stocks that stay in the same quartile from one year to the next, across styles and across markets.

Table 9 - Stock Migration Across Styles and Markets, One Year After Portfolio Formation, 2001-2014

Stock Migration	US	London	Tokyo	Europe
Size	78.51%	78.24%	82.30%	86.02%
Value	54.35%	65.70%	52.37%	55.67%
Momentum	27.23%	30.48%	27.10%	28.89%
Relative Volume (Liquidity)	64.92%	58.75%	65.00%	74.56%
Amihud (Liquidity)	77.94%	74.48%	79.05%	80.78%

The Size investment style is consistently the most stable (*i.e.* with the lowest average stock migration), while the Relative Volume and Amihud (2002) based portfolios tend to rank immediately after the Size investment style.

Low stock migration also has economic significance. In fact, by, on average, keeping the majority of stocks in a portfolio from one year to the next, an investor would incur in less transaction *fees*. **Table 9** demonstrates, for example, that an investor would only need to substitute 35.08% of the stocks in a portfolio, on average each year, if he or she were to invest in US stocks and would use the Relative Volume measure. On the other hand, and if using a Momentum strategy, the investor would be required to substitute, each year, an average of 72.87% of the stocks in the portfolio.

5. Conclusions

Ibbotson *et al.* (2013) show that liquidity should be considered by investors as an investment strategy that ranks among Size, Value and Momentum strategies. To test this, they examine the criteria set by Sharpe (1992) to establish a liquidity benchmark strategy, using the turnover ratio as the proxy for liquidity.

In this dissertation, we provide further evidence on this, analyzing alternative proxies for liquidity. We use the liquidity proxy suggested by Amihud (2002) and Relative Volume.

When comparing the least liquid quartile returns for each proxy, we find that liquidity measures are generally able to provide returns that outperform or are close to the returns of other established investment styles. Results obtained for US stocks are similar with those presented by Ibbotson *et al.* (2013). Further, the results for the other markets show that, in general, illiquidity is associated with higher returns.

Yet, results suggest that the returns of a liquidity-based investment strategy are not independent of the proxy the investor chooses to measure liquidity and the markets selected.

We seem to find economically and statistically significant results for the Relative Volume proxy, when regressing long-short portfolios under both the CAPM and the Fama-French three-factor model, but statistical significance for the Amihud (2002) measure is weak.

Tests for seasonality suggest that results are sometimes affected by the January effect, a particular seasonality effect. However, this is also dependent on both the liquidity proxy considered and the region.

Further tests should assess the robustness of these results using a longer time-series, allowing the study of sub-periods with distinct economic conditions (*e.g.* bull and bear markets, different market volatility). Alternative measures of liquidity should also be tested, for example, using intraday, very high frequency data.

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Appendix I – Description of Stock Data Across Investment Quartiles

Table 10 - Description of Stock Data Across Investment Quartiles

Panel A – Size Investment Style

Size		Amihud (2002)		Size		Momentum		Relative Volume		Value	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
US	1Q	8.2040	2.0214	91.79	84.71	1.1519	0.9517	0.5952	0.3132	7.0046	0.8226
	2Q	0.8904	0.2288	319.14	297.80	1.2457	1.0659	0.8103	0.4962	5.7990	3.5068
	3Q	0.1376	0.0359	975.35	880.50	1.2402	1.1186	1.0156	0.7672	4.7092	3.9499
	4Q	0.0150	0.0040	13,460.30	4,469.42	1.2018	1.1290	1.2955	0.8320	4.8501	4.4369
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
UK	1Q	11.6340	4.9465	45.47	35.68	1.0494	0.8801	3.6102	2.6673	7.2737	3.6199
	2Q	2.7479	1.1247	197.99	180.33	1.1900	1.0749	3.3967	2.5040	7.1017	6.2504
	3Q	0.4516	0.1382	674.41	597.02	1.1999	1.1290	4.5277	3.5014	6.9875	6.3293
	4Q	0.0342	0.0093	10,722.19	3,456.56	1.1297	1.1008	5.4422	4.7055	6.7540	6.5147
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Japan	1Q	4.6011	2.3945	86.51	83.88	1.0956	1.0000	204.8876	1.4307	6.6285	4.9950
	2Q	1.1289	0.5900	251.68	238.13	1.1598	1.0334	3.9643	1.6500	6.8587	5.2927
	3Q	0.3241	0.1309	709.64	657.17	1.1744	1.0418	3.9114	2.3391	5.4557	4.7867
	4Q	0.0633	0.0150	7,127.89	3,172.40	1.1575	1.0613	4.5883	3.5677	4.6894	4.3200
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Europe	1Q	2.1777	0.9249	5.20	4.47	1.0104	0.9530	2.0144	1.0364	8.1906	4.4753
	2Q	0.3529	0.1372	28.87	25.78	1.1330	1.0535	2.2445	0.9423	6.7956	5.6097
	3Q	0.1019	0.0142	143.59	120.13	1.1485	1.0909	2.5444	1.4176	7.3392	5.8745
	4Q	0.0748	0.0018	2,541.29	1,260.79	1.1520	1.0674	2.5967	1.3352	7.0520	6.0930

Panel B – Momentum Investment Style

Momentum		Amihud (2002)		Size		Momentum		Relative Volume		Value	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
US	1Q	8.7482	2.4253	129.03	91.99	1.3389	1.0478	3.8125	2.4394	8.0142	1.6552
	2Q	0.4386	0.2330	384.15	294.97	1.1978	1.0645	6.8943	4.8474	4.6135	3.2801
	3Q	0.0565	0.0350	1,059.00	847.73	1.1642	1.0896	11.1986	8.1333	4.7039	3.8976
	4Q	0.0065	0.0039	1,327.89	4,365.75	1.1393	1.0940	15.2710	10.0841	5.0382	4.4711
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
UK	1Q	1.3236	0.6814	82.83	43.77	1.1323	0.9550	2.6438	2.0983	6.9981	4.1023
	2Q	0.1409	0.1077	212.80	156.20	1.1846	1.0789	3.2370	2.5675	6.8899	5.8889
	3Q	0.0202	0.0133	706.99	564.26	1.1559	1.1167	4.7455	3.7787	7.3287	6.3700
	4Q	0.0018	0.0009	10,636.66	3,430.78	1.0961	1.0773	6.3481	5.1312	6.9004	6.6266
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Japan	1Q	5.2123	2.9804	146.33	95.26	1.1639	1.0306	2.1887	0.9252	6.5611	5.0250
	2Q	0.7257	0.6304	327.92	228.41	1.1447	1.0307	3.1976	1.5347	6.4638	5.1366
	3Q	0.1594	0.1261	784.79	589.82	1.1609	1.0374	4.7814	2.7662	5.7752	4.7969
	4Q	0.0203	0.0147	6,916.22	3,012.40	1.1178	1.0414	207.1829	4.1701	4.8338	4.3451
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Europe	1Q	2.7297	1.3262	68.91	5.74	1.0791	1.0107	0.8332	0.5255	7.0939	5.4110
	2Q	0.2551	0.2206	545.57	28.48	1.1507	1.0534	1.1580	0.6565	8.5396	5.6688
	3Q	0.0407	0.0315	796.24	75.15	1.1348	1.0521	2.0567	1.2813	6.8876	5.6936
	4Q	0.0025	0.0012	1,311.31	474.61	1.0795	1.0567	5.3539	3.8428	6.8647	5.7639

Panel C – Value Investment Style

Value		Amihud (2002)		Size		Momentum		Relative Volume		Value	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
US	1Q	2.2228	0.0844	4,257.10	479.46	1.0648	1.0237	0.0092	0.0050	15.1725	8.5823
	2Q	1.2155	0.0385	5,702.78	887.09	1.1777	1.1136	0.0091	0.0054	5.1291	4.8889
	3Q	1.1588	0.0438	4,346.66	808.57	1.3097	1.1599	0.0096	0.0067	2.4153	2.3994
	4Q	4.1932	0.3438	105.03	228.10	1.2903	1.0110	0.0093	0.0060	0.0076	0.0000
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
UK	1Q	0.4657	0.0586	2,612.47	239.45	1.0796	1.0379	4.4112	3.2364	15.2729	11.6865
	2Q	0.1859	0.0127	4,100.10	588.57	1.1285	1.1067	4.0884	3.2400	7.6306	7.3743
	3Q	0.2192	0.0212	3,219.32	534.64	1.1797	1.1209	3.9865	3.1073	4.7084	4.7312
	4Q	0.6165	0.1739	1,734.31	107.87	1.1808	0.9490	4.4902	3.2241	0.5011	0.0000
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Japan	1Q	1.8517	0.5765	1,610.73	232.82	1.1284	1.0397	43.8508	1.9132	12.4012	9.7710
	2Q	1.1651	0.2119	2,117.27	492.24	1.1203	1.0357	3.2556	2.1777	6.0426	5.6287
	3Q	1.0648	0.1367	2,615.22	676.28	1.1543	1.0403	97.5816	2.3814	3.9081	3.7857
	4Q	2.0377	0.3558	1,837.89	329.87	1.1843	1.0250	72.7419	2.6149	1.2793	1.0802
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Europe	1Q	0.6545	0.0836	897.36	59.33	1.0674	1.0364	2.0608	0.8652	16.7327	11.6158
	2Q	0.4570	0.0506	787.14	77.24	1.0949	1.0700	2.0208	1.0261	7.1908	6.8280
	3Q	0.5371	0.0455	763.65	89.17	1.1674	1.0672	2.0632	1.0874	4.4311	4.3404
	4Q	1.0597	0.1468	273.05	20.46	1.1140	0.9805	3.2537	1.5062	1.0199	0.4987

Appendix II – Results for Liquidity Regressions on US Stock Market Using Daily Dataset

Table 11 - Regression Analyses of Long-Short Liquidity Portfolios (US Stocks), Daily Data, 2001-2014

(p-value in parentheses)	Monthly Alpha (%)	Mkt-Rf	SMB	HML	January Dummy	Adjusted R^2 (%)	N
Illiquidity (Relative Volume)							
CAPM	-0.019	0.076				2.82	3520
	(0.045)	(0.000)					
CAPM (January Effect)	-0.028	0.076			0.001	3.08	3520
	(0.004)	(0.000)			(0.001)		
F&F Three-Factor	-0.018	0.086	0.219	-0.377		24.52	3520
	(0.034)	(0.000)	(0.000)	(0.000)			
F&F Three-Factor (January Effect	-0.025	0.086	0.219	-0.376	0.001	24.67	3520
	(0.005)	(0.000)	(0.000)	(0.000)	(0.005)		
Illiquidity (Amihud)							
CAPM	0.027	-0.364				39.01	3520
	(0.005)	(0.000)					
CAPM (January Effect)	0.019	-0.364			0.001	39.12	3520
	(0.057)	(0.000)			(0.007)		
F&F Three-Factor	0.018	-0.409	0.365	0.299		51.81	3520
	(0.036)	(0.000)	(0.000)	(0.000)			
F&F Three-Factor (January Effect	0.011	-0.409	0.365	0.300	0.001	51.92	3520
	(0.245)	(0.000)	(0.000)	(0.000)	(0.003)		

Appendix III – Stock Stability and Migration

Table 12 - Stock Migration Across Quartiles, One Year After Portfolio Formation, 2001-2014
Panel A – US Stocks

	Year *t+1* Size			
	1 (micro)	2	3	4 (large)
A. Size migration (78.51% stay in the same quartile)				
Year *t* Size				
1 (micro)	**81.27%**	17.76%	0.96%	0.00%
2	16.98%	**67.20%**	15.62%	0.20%
3	1.01%	15.12%	**74.61%**	9.25%
4 (large)	0.01%	0.35%	8.68%	**90.96%**
	Year *t+1* Value			
B. Value migration (54.35% stay in the same quartile)				
Year *t* Value				
1 (value)	**55.12%**	25.92%	11.90%	8.07%
2	23.63%	**47.37%**	27.43%	7.05%
3	8.66%	18.96%	**45.58%**	15.53%
4 (growth)	12.59%	7.75%	15.08%	**69.34%**
	Year *t+1* Momentum			
C. Momentum migration (27.23% stay in the same quartile)				
Year *t* Momentum				
1 (winners)	**22.40%**	21.87%	24.95%	30.78%
2	21.34%	**28.39%**	28.85%	21.42%
3	20.77%	30.42%	**28.85%**	19.96%
4 (losers)	26.86%	22.34%	21.53%	**29.27%**
	Year *t+1* Liquidity (Relative Volume)			
D. Liquidity (Relative Volume) migration (64.92% stay in the same quartile)				
Year *t* Liquidity (Rel. Vol.)				
1 (low)	**76.85%**	17.77%	3.87%	1.51%
2	18.03%	**55.92%**	21.69%	4.35%
3	3.26%	23.38%	**53.10%**	20.26%
4 (high)	0.74%	3.74%	21.70%	**73.82%**
	Year *t+1* Liquidity (Amihud)			
E. Liquidity (Amihud) migration (77.94% stay in the same quartile)				
Year *t* Liquidity (Amihud)				
1 (low)	**78.35%**	19.68%	1.87%	0.10%
2	16.26%	**68.41%**	14.93%	0.41%
3	0.86%	14.18%	**74.56%**	10.40%
4 (high)	0.02%	0.42%	9.11%	**90.44%**

Panel B – UK Stocks

	Year *t+1* Size			
	1 (micro)	2	3	4 (large)
A. Size migration (78.24% stay in the same quartile)				
Year *t* Size				
1 (micro)	**81.75%**	17.64%	0.62%	0.00%
2	18.63%	**66.75%**	14.62%	0.00%
3	1.84%	15.53%	**74.45%**	8.18%
4 (large)	0.06%	0.78%	9.17%	**89.99%**

	Year *t+1* Value			
B. Value migration (65.70% stay in the same quartile)				
Year *t* Value				
1 (value)	**67.91%**	22.18%	6.17%	3.74%
2	23.48%	**54.03%**	21.07%	1.43%
3	8.02%	22.81%	**59.52%**	9.65%
4 (growth)	3.14%	2.65%	12.85%	**81.35%**

	Year *t+1* Momentum			
C. Momentum migration (30.48% stay in the same quartile)				
Year *t* Momentum				
1 (winners)	**26.39%**	25.03%	23.79%	24.78%
2	23.10%	**31.21%**	27.03%	18.66%
3	21.56%	27.20%	**29.04%**	22.19%
4 (losers)	22.50%	18.55%	23.67%	**35.28%**

	Year *t+1* Liquidity (Relative Volume)			
D. Liquidity (Relative Volume) migration (58.75% stay in the same quartile)				
Year *t* Liquidity (Rel. Vol.)				
1 (low)	**67.38%**	25.30%	6.29%	1.04%
2	25.30%	**46.03%**	23.84%	4.83%
3	4.94%	24.02%	**49.82%**	21.22%
4 (high)	1.26%	5.65%	21.33%	**71.75%**

	Year *t+1* Liquidity (Amihud)			
E. Liquidity (Amihud) migration (74.48% stay in the same quartile)				
Year *t* Liquidity (Amihud)				
1 (low)	**71.96%**	26.07%	1.96%	0.00%
2	24.51%	**60.53%**	14.89%	0.07%
3	2.51%	14.59%	**74.78%**	8.11%
4 (high)	0.06%	0.61%	8.69%	**90.64%**

Panel C – Japanese Stocks

	Year *t+1* Size			
	1 (micro)	2	3	4 (large)
A. Size migration (82.30% stay in the same quartile)				
Year *t* Size				
1 (micro)	**82.90%**	16.24%	0.86%	0.00%
2	9.77%	**74.12%**	15.88%	0.22%
3	0.47%	10.17%	**79.11%**	10.25%
4 (large)	0.00%	0.10%	6.82%	**93.08%**
	Year *t+1* Value			
B. Value migration (52.37% stay in the same quartile)				
Year *t* Value				
1 (value)	**62.83%**	23.00%	8.83%	5.34%
2	20.83%	**44.12%**	25.54%	9.50%
3	7.88%	25.08%	**43.20%**	23.84%
4 (growth)	6.28%	9.75%	24.64%	**59.33%**
	Year *t+1* Momentum			
C. Momentum migration (27.10% stay in the same quartile)				
Year *t* Momentum				
1 (winners)	**23.14%**	22.35%	24.47%	30.04%
2	20.58%	**28.12%**	29.06%	22.24%
3	20.29%	28.04%	**28.42%**	23.25%
4 (losers)	25.32%	23.00%	22.94%	**28.73%**
	Year *t+1* Liquidity (Relative Volume)			
D. Liquidity (Relative Volume) migration (65.00% stay in the same quartile)				
Year *t* Liquidity (Rel. Vol.)				
1 (low)	**78.52%**	17.84%	2.39%	1.25%
2	20.14%	**55.55%**	19.86%	4.45%
3	2.22%	23.80%	**55.06%**	18.92%
4 (high)	0.50%	3.99%	24.63%	**70.88%**
	Year *t+1* Liquidity (Amihud)			
E. Liquidity (Amihud) migration (79.05% stay in the same quartile)				
Year *t* Liquidity (Amihud)				
1 (low)	**76.86%**	21.20%	1.82%	0.11%
2	13.22%	**69.16%**	17.26%	0.36%
3	0.41%	12.53%	**76.81%**	10.24%
4 (high)	0.02%	0.02%	6.58%	**93.38%**

Panel D – European (Euro) Stocks

	Year *t+1* Size			
	1 (micro)	2	3	4 (large)
A. Size migration (86.02% stay in the same quartile)				
Year *t* Size				
1 (micro)	**89.74%**	10.26%	0.00%	0.00%
2	11.32%	**78.36%**	10.33%	0.00%
3	0.18%	12.02%	**82.88%**	4.91%
4 (large)	0.00%	0.08%	6.81%	**93.12%**
	Year *t+1* Value			
B. Value migration (55.67% stay in the same quartile)				
Year *t* Value				
1 (value)	**63.28%**	21.49%	7.84%	7.38%
2	23.99%	**46.97%**	21.06%	7.98%
3	9.00%	26.00%	**46.50%**	18.50%
4 (growth)	6.28%	6.51%	21.29%	**65.93%**
	Year *t+1* Momentum			
C. Momentum migration (28.89% stay in the same quartile)				
Year *t* Momentum				
1 (winners)	**26.14%**	24.55%	24.97%	24.34%
2	21.82%	**28.45%**	29.32%	20.41%
3	20.93%	28.87%	**28.54%**	21.66%
4 (losers)	23.06%	20.95%	23.54%	**32.44%**
	Year *t+1* Liquidity (Relative Volume)			
D. Liquidity (Relative Volume) migration (74.56% stay in the same quartile)				
Year *t* Liquidity (Rel. Vol.)				
1 (low)	**86.70%**	12.74%	0.56%	0.00%
2	13.43%	**66.47%**	18.52%	1.59%
3	1.23%	21.10%	**64.32%**	13.36%
4 (high)	0.16%	1.55%	17.53%	**80.76%**
	Year *t+1* Liquidity (Amihud)			
E. Liquidity (Amihud) migration (80.78% stay in the same quartile)				
Year *t* Liquidity (Amihud)				
1 (low)	**84.34%**	14.73%	0.93%	0.00%
2	16.63%	**70.34%**	12.87%	0.15%
3	0.22%	15.57%	**77.12%**	7.08%
4 (high)	0.07%	0.13%	8.47%	**91.33%**