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Cross-Sectional Stock Returns in the UK Market: the Role of Liquidity Risk

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Abstract

The relationship between liquidity and stock returns has been investigated extensively in recent years. Using the UK data, we show that there is a sizeable difference in the cross-sectional returns between liquid and illiquid assets. Liquidity together with book-to-market equity explains cross-sectional returns. Furthermore, the well-documented value premium can be explained by a liquidity-augmented CAPM, and this result is robust in the presence of distress factor and a battery of macroeconomic variables.

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1. Introduction

Liquidity in the financial markets has been one of the critical issues in both practice and academia. Since the 1980s, a number of episodes of financial market distress have underscored the importance of the smooth functioning of markets for the stability of financial system. At the heart of these episodes was a sudden and drastic reduction in market liquidity, characterised by disorderly adjustments in asset prices, a sharp increase in the costs of executing transactions, and so forth. The well-known 1998 episode involving Long-Term Capital Management (LTCM) is a representative example and has prompted investors to care more about their liquidity risk when making portfolio decisions.

In this study, we investigate the role of liquidity risk in explaining the cross-sectional stock returns. In particular, we examine the link between liquidity and the well-documented value premium. Fama and French (1992) point out that liquidity, though important, does not need to be specifically measured and accounted for, as it is subsumed by the combination of size and book-to-market factors. It is generally accepted that illiquid stocks tend to be small and that people would not be surprised to see the high correlation of size and liquidity. However, Brennan and Subrahmanyam (1996) show that there is a statistically significant positive relationship between expected stock returns and illiquidity, even after taking Fama-French risk factors into account. Additionally, Chordia, Subrahmanyam and Anshuman (2001) prove that liquidity does need to be accounted for individually, even after controlling for size, book-to-market and momentum.

Liquidity is a broad and elusive concept, which is not directly observed. Many liquidity proxies have been proposed, such as bid-ask spread, trading volume, or a combination of return and volume[1]. Among these liquidity measures, a few studies use trading volume as the proxy for the aggregate demand of liquidity traders (see Campbell, Grossman and Wang (1993)), which suggests there could be some link between liquidity and other factors. Lee and Swaminathan (2000) demonstrate that low (high) volume stocks display many characteristics commonly associated with value (growth) stocks. Therefore, the return spread between value and growth could contain the difference of liquidity risk inherited by them.

[1] See section 2 for detail descriptions.

Since Fama and French (1992, 1993), many researches have documented the existence of value premium, i.e., the excess return of value stocks (high book-to-market) over growth stock (low book-to-market). Fama and French (1998) even find international evidence of this value anomaly. There are a surging number of studies that attempt to explain this value anomaly using different theories[2]. None of these, however, can successfully account for this value spread. Although Lee and Swaminathan (2000) document the empirical connection between trading volume and value/growth, they do not investigate the interaction between value/growth and liquidity. We formally test the relationship between value anomaly and liquidity risk in this study.

Our contribution is two-fold: first, we demonstrate that in the UK market there is a significant liquidity premium which can not be explained by the CAPM, Fama and French three-factor model, or Fama and French with a momentum factor model[3]; and second, we provide evidence that liquidity explains the value premium. The value anomaly can be explained by a liquidity-augmented CAPM, which offers important implications for the link between value/growth and liquidity. Furthermore, the evidence of liquidity in explaining the value premium is not subsumed by the distress factor proposed by Agarwal and Taffler (2005) and a number of macroeconomic variables. The results are not consistent with those of Fama and French (1995, 1996) and Saretto (2004) who suggest the excess return of value over growth stocks is due to the distress risk inherited with them.

This study proceeds as follows. The next section describes the development of hypotheses and research designs. Section 3 shows the empirical results. The last section offers concluding remarks and future research directions.

[2] Zhang (2005) uses rational expectation theory in a neoclassical framework to explain this value anomaly. He finds that value is riskier than growth in poor market conditions when the price of risk is high and high book-to-market signals persistent low profitability. Petkova and Zhang (2005) find time-varying risk goes in the right direction in explaining value premium; however the beta-premium covariance in their study is still too small to explain the observed magnitude of the value anomaly. Other studies state that value spread is a premium for distress using a behavioural theory. These argue that this value anomaly is real but irrational, which is the result of investor's overreaction that leads to under pricing of value (distress) stocks and over-pricing of growth stocks.

[3] Overall, a considerable amount of literature has been written about liquidity and asset pricing, but most research is done on the US market, with only a few investigations having been done on the UK market. As pointed out by Dimson, Marsh and Staunton (2003), "*It would be dangerous for investors to extrapolate into future from the US experience. We need to also look outside of the United States.*" Thus the UK data is adopted in this research, which can answer the crucial question in asset pricing "*whether the results obtained for the US stock markets can be generalized to markets in other countries.*"

2. Hypotheses and Calculating Factors

The first part of this section explains the methods by which liquidity is employed to explain cross-sectional stock returns. The constructions of the liquidity measure and factor are then presented in the next subsection. We also explain how we construct size and value/growth factors, which may not necessarily be the same as the method used in the US market.

2.1 Liquidity Effects and Cross-Sectional Stock Returns

Since Fama and French (1992, 1993), many empirical papers have documented that average stock returns are related to firm characteristics, such as size and book-to-market. These return patterns are apparently not explained by the CAPM and are thus called anomalies. The value premium, i.e., the excess return of value stocks (high book-to-market) over growth stock (low book-to-market) has been extensively researched in the literature with Fama and French (1998, 2005) providing additional international evidence for this value anomaly.

There are a surging number of studies that attempt to explain this value anomaly using different theories. Fama and French (1996) empirically demonstrate that, except for the short-term momentum, these anomalies largely disappear in the Fama-French three factor model. Ang and Chen (2005) show that the value premium can be explained by a conditional CAPM. Fama and French (2005), however, argue that Ang and Chen's (2005) evidence is specific to the period of 1926-1963. Other studies such as Zhang (2005), Petkova and Zhang (2005) use different theories and method to explain the value premium, however, their results show that the observed value premium is still too large to be explained. Overall, none of the research has successfully accounted for this value anomaly.

In this paper, UK data is used so that our study can be treated as an out-of-sample investigation of the value premium. Similar to Ang and Chen (2005), the dependent variables in this study are cross-sectional stock return differences related to size and book-to-market. We form decile, quintile, and 30th/ 70th percentile-breakpoint portfolios with regard to stock's characteristics such as size and book-to-market. Taking 10 decile portfolios (Pi,t) for example, at the end of June in year *t*, 10 size decile portfolios are formed on stocks' ranked market value. Similarly at the end of December year *t* based on the stock's book-to-market value, 10 value decile portfolios are formed. Then the dependent variable is a hedge portfolio that takes a long position in small (high book-to-market) portfolio and a short position in big (low book-to-market) portfolio ($P_{L,t} - P_{S,t}$), where $P_{L,t}$ stands for the long position of this portfolio, which are either small or high book-to-market stock groups; and $P_{S,t}$ refers to short position of this portfolio, i.e., either big or low book-to-market portfolios. We denote the hedged portfolios according to the different breakpoints as S-B_d (H-M_d), S-B_q (H-M_q), and S-B_p (H-M_p), which corresponds to the decile, quintile, and 30^{th} /70^{th} percentile-breakpoints respectively.

We test the CAPM upon ($P_{L,t} - P_{S,t}$) to see if there is any unexplained systematic risk, in another word, significant alphas. If the intercept (alpha) is significant, it suggests that either there is a failure of the CAPM or that there is an anomaly which cannot be explained by the CAPM.

Size is commonly referred to as one type of liquidity proxy, as investors would not expect the same level of liquidity between large and small stocks; thus, the return difference between small and big could be the result of the different liquidity risks associated with each of them. Campbell, Grossman and Wang (1993) argue that trading volume proxies for the aggregate demand of liquidity traders. Lee and Swaminathan (2000) demonstrates that low (high) volume stocks display many characteristics commonly associated with value (growth) stocks. Therefore, the return spread between value and growth should contain the differences in the liquidity risk inherited by them. In order to test these two hypothesises we test the liquidity effects over the hedge portfolio, i.e., the following liquidity-augmented CAPM is estimated:

$$P_{L,t} - P_{S,t} = \alpha_i + \beta_{i,1}(Rm_t - R_f) + \beta_{i,2} LIQ_t + \varepsilon_{i,t} \qquad \textbf{(1)}$$

The factor sensitivity for liquidity ($\beta_{i,2}$) should be significant in the above cross-sectional regression if liquidity effects are present.

If liquidity is one of the missing factors, it should be able to explain return anomalies to some extent. Following Pastor and Stambaugh (2003) and Ang and Chen (2005), the intercepts (alphas) of different portfolios strategies (such as, Small minus Big, High minus Low) should not be significantly different from zero if liquidity is included.

2.2 Calculating Factors in the UK Market

2.2.1 Liquidity Measures and Liquidity Factor

Like volatility, liquidity is not directly observed and many different liquidity measures have been proposed for different purposes. Previous research, such as Amihud and Mendelson (1986), Chordia, Roll, and Subrahmanyam (2000), Hasbrouck and Sepppi (2001), has focused on the bid-ask spread as a measure of illiquidity; however, as highlighted by Brennan and Subrahmanyam (1996), bid-ask spread is a noisy measure of illiquidity because many large trades appear outside the spread and many small trades occur within the spread. Brennan and Subrahmanyam (1996) proxy stock illiquidity using price impact, which is measured as the price response to signed order flow (order size), and by the fixed cost of trading using intra-day continuous data on transactions and quotes. Amihud (2002) measures a stock's illiquidity as the ratio of its absolute return to dollar volume. Pastor and Stambaugh (2003) estimate a liquidity risk measure based on the idea that price changes accompanying large volume tend to be reversed when market-wide liquidity is low.

Among these liquidity proxies, Amihud's illiquidity measure (2002) is widely used in empirical studies because of its superior advantage of simple calculation. In addition, this proxy only needs return and volume data so that we can estimate liquidity for a relatively long time span. Amihud's measure is also consistent with Kyle's (1985) concept of illiquidity, the response of price to the order flow, and Silber's (1975) measure of thinness, which is defined as the ratio of the absolute price change to the absolute excess demand for trading. The liquidity measure for stock i is defined as:

$$\gamma_{i,m} = -\frac{1}{D_{i,m}} \sum_{t=1}^{D_{i,m}} \frac{\left| r_{i,m,d} \right|}{v_{i,m,d}} \quad \textbf{(2)}$$

where: $D_{i,m}$ is the number of days for which data are available for stock i in month *m*,

$r_{i,m,d}$ is the return on stock i on day d of month *m*, and

$v_{i,m,d}$ is the dollar trading volume for stock i on day d of month *m*.

However, this measure has two disadvantages; the first of which is that Amihud (2002) takes dollar trading volume as the denominator, which may result in a high correlation between liquidity and size since large stocks are usually more frequently traded than small stocks. We do not expect the same dollar amount of trading for a firm whose market capitalisation is 10 million dollars and a firm whose market capitalisation is 10 billion dollars. In addition, as share prices increase over time, liquidity appears to increase when it is measured by Amihud's method even if there are no changes in liquidity. In order to construct a liquidity measure that is robust to size, we scale the denominator by the market capitalization of the stock; in other words, dollar trading volume is replaced by turnover rate in the denominator. Furthermore, as argued by Lo and Wang (2000), turnover is a canonical measure of trading activity. Therefore, while replacing the dollar trading volume by turnover does not alter the principal of this price reversal nature, it enables us to construct a relative liquidity proxy that is free from size effect.

The second reason is that the liquidity measure may have severe outliers when trading activity is extremely low (i.e., trading volume could be very close to zero); therefore, we use the natural log of these values to minimize these outliers. The modified relative liquidity measure ($\psi_{i,m}$) for stock i is defined as:

$$\psi_{i,m} = -\frac{1}{D_{i,m}} \sum_{t=1}^{D_{i,m}} \ln \frac{\left| r_{i,m,d} \right|}{Turnover_{i,m,d}} \quad \textbf{(3)}$$

where: $D_{i,m}$ is the number of days for which data are available for stock i in month *m*,

$r_{i,m,d}$ is the return on stock i on day d of month *m*, and

$Turnover_{i,m,d}$ is the turnover rate for stock i on day d of month *m*.

The liquidity measures of equation (2) and (3) are calculated for all stocks in every month, from which we obtain the monthly liquidity measures for each stock. We also create two market wide liquidity factors using a similar method to that in Fama and French (1993). At the end of each year, two portfolios are formed on liquidity using the median liquidity as the breakpoint. The return difference of the liquid and illiquid portfolios in the following 12 months is the liquidity factor (LIQ_t). The portfolios are rebalanced at the end of each year. We calculate each stock's liquidity and market wide liquidity factor for Amihud's (2002) illiquidity measure ($\gamma_{i,m}$) and size-adjusted liquidity measure ($\psi_{i,m}$). With this mimicking liquidity factor, we can explore the role of liquidity in explaining the cross-sectional return differences.

2.2.2 Size and Value/Growth Factors

UK *SMB* and *HML* factor returns are calculated in a similar way to that in Fama and French (1993) except for the breakpoints. Fama and French (1993) use the 50th percentile (for size) and 30th and 70th percentiles (for book-to-market) NYSE-based breakpoints. Following Dimson, Nagel and Quigley (2003) [DNQ hereafter], however, we use the 70th percentile of ranked size and 40th and 60th percentiles of book-to-market. In the UK large capitalization stocks are concentrated in the low book-to-market segment, and small capitalization stocks, in contrast, are concentrated in the high book-to-market class[4]. By choosing less extreme book-to-market breakpoints and a wider range for the small-capitalization group, it ensures acceptable levels of diversification in these corner portfolios throughout the sample period. In addition, the 70% breakpoint for the size results in a distribution of aggregate market value across portfolios that is relatively similar to the distribution in Fama and French (1993), where most NASDAQ stocks, most of which are smaller than the NYSE-based 50% breakpoint, are sorted into the small-capitalization group.

3. Empirical Results

3.1 Data

In this study, we use the sample period starting from January 1987 to December 2004 because the trading volume data which we use for calculating liquidity is not available until 1987. All the data on stock returns, market capitalizations, book-to-market ratios, and trading volumes is from DataStream. In calculating liquidity measures, the daily frequency returns and dollar trading volume data are needed. The Book-to-market ratio is the end of the calendar year value,

[4] Similar results are found in this study, which is displayed in the empirical section.

and any negative book-to-market stocks are deleted from the sample; in addition all the delisted equities are also included in the sample so that survivorship bias is controlled for in this study. Initially the number of stocks in this study is 945 in 1987 where this gradually increases to 2306 in 2004. While calculating the liquidity measures, due to the lack of availability of data regarding trading volume, the sample size reduces to less than 200 stocks from 1987 to 1990, 576 stocks in 1991 and 1459 stocks in 2004[5]. For the time-series regression analysis in our study, we choose a sample period from January 1991 to December 2004 in order to minimise any bias that may arise from the small number of stocks in our early sample period.

3.2 Market liquidity

In a manner that is consistent with Amihud (2002) and Pastor and Stambaugh (2003), market illiquidity is defined as the average of individual stock's illiquidity. The first two rows of Table 1 display the value and equally weighted Amihud's illiquidity measure. The value weighted Amihud's illiquidity measure suggests that the most illiquid year is 2001, which corresponds with September 11th; while 1998 is the second lowest liquidity period which corresponds with the Russian Crisis.[6] The equally weighted Amihud's illiquidity also shows similar patterns; however there results are relatively more skewed towards small stocks in the market, and thus is more volatile, suggesting that the level of illiquidity of small stocks changes more than that of large stocks. Figure 1 clearly shows that the illiquidity measures are associated with market crashes; for instance, the 1997 Asian financial crisis, the 1998 Russian default, September 11th in 2001 etc.

[TABLE 1 ABOUT HERE]

[FIGURE 1 ABOUT HERE]

The third row of Table 1 is the relative liquidity measure (adjusted by stocks' market values),

5 The number of stocks used to calculate liquidity measures and factors are displayed in the last row of Table 1.

6 By contrast, the most liquid year is 1989; however, the high liquidity in the early sample period is likely due to a result of the sample selection bias in the early sample period.

described in section 2. Figure 2 plots our relative liquidity measure. While the monthly correlation between this relative measure and the value (equally)-weighted Amihud's measure is 0.29 (0.25), it is interesting to note that there is a significant difference between Amihud's absolute illiquidity measure and the new relative measure. The new relative measure is much smoother and less volatile than Amihud's measure. Severe outliers in Figure 1 are now apparently reduced according to this new liquidity measure. With this measure, we can clearly identify that the most illiquid year is 1998 when market liquidity is widely perceived to have dried up because of the LTCM collapse and Russian default[7]. The next illiquid period is the Asian financial crisis of 1997 and September 11th in 2001. By contrast the most liquid period is during the recent bull market. Amihud (2002) shows liquidity displays persistence, and indeed, the new measure has first and second order autocorrelations of 0.83 and 0.72 which are both significant at 1% level. From Figure 2 it is evident that liquidity remains a relative low level in the late 1990s when the market is down and recovers gradually with the recent bull market.

[FIGURE 2 ABOUT HERE]

3.3 Different Portfolio Strategies in the UK

The existence of return regularities is well documented in the financial markets. Previous work shows that average stock returns are related to firm characteristics like size and book-to-market equity. In this section, we examine the cross-sectional stock returns related to size, book-to-market equity and liquidity in the UK. We also compare the results to the US as in Fama and French (1993), and the previous work on the UK market in DNQ (2003).

3.3.1 Size Sorted Portfolios

As described in the previous section, the 10 decile portfolios are formed based on market equity. Table 2A shows the statistical properties of the 10 decile portfolios. Contrary to the

[7] Pastor and Stambaugh (2003), who use the US data and their proposed price-reversal liquidity measure, identify that the US stock market experience the third largest liquidity drop in 1998. Within the same time span, however, our study shows consistent results with theirs.

findings of Banz (1981) and Fama and French (1993), where they find evidence that small firms outperform big firms, it is interesting to see that big firms perform better than small firms in the UK equity market (there is a 5.7% annual difference in the portfolio returns between the largest and smallest decile portfolios, i.e. S-B_d).

[TABLE 2 ABOUT HERE]

It is evident that the largest 10 percent of stocks represent, on average, 81% of the total market capitalization (the largest 20% stocks account for over 90% of the total market capitalization). During the same period in the US market, the largest 20 % stocks account for about 80 % of the total market capitalization[8]. This suggests a more skewed distribution of large stocks in the UK stock market.

We next calculate the mimicking size factor (*SMB*) for the UK stock market. The statistical properties of the *SMB* are reported in the last column of Table 2A. Over this entire 17 years period, the *SMB* has a negative average monthly return of 0.35% (which is equal to an annual average return of -4.08%) with standard deviation of 2.7%. Our results for the UK market are consistent with the findings of DNQ (2003); where although the data in their research is only up to 2001, the correlation of their monthly *SMB* and ours is nearly 92 percent.

By contrast, the *SMB* is positive with an average monthly return of 0.2% in the US over this period. Nevertheless, the trends for the *SMB* in the UK and US are very similar as shown by Figure 3. Indeed, the annual (monthly) *SMB* between the UK and US has a correlation of 0.70 (0.33). Table 2B compares the statistical properties of monthly *SMB* in the UK and US. The t-tests with regard to a zero mean for the *SMB* suggest that both the UK and US *SMB* is insignificantly different from zero. Ang and Chen (2005) and Dimson and Marsh (1999) also document the disappearance of the size effect in the US and UK respectively.

[FIGURE 3 ABOUT HERE]

[8] The US data over this period is from Professor Kenneth French's Website.

3.3.2 Book-to-Market Sorted Portfolios

Table 3A reports the summary statistics for the 10 decile book-to-market portfolios. The annual return difference between the high and low book-to-market portfolios (H-L_D) is over 10%[9]. Consistent with Fama and French (1998), and DNQ (2003), there is strong evidence of the existence of the book-to-market premium. The results also show that small stocks are usually distributed in the high book-to-market category. Half of the highest book-to-market stocks only account for 20 percent of the total market capitalization. These results are consistent with the finding of Fama and French (1993) and DNQ (2003).

[TABLE 3 ABOUT HERE]

[FIGURE 4 ABOUT HERE]

The mimicking value/growth factor (*HML*) is reported in the last column of Table 3A. With a standard deviation of 2.5%, the monthly *HML* has a return of 0.32% (which equals an annual rate of 3.9%). In the US, these numbers are larger (the annual *HML* is 4.9 %, with a standard deviation is 3.4%). There is again a similar trend in the *HML* during the same period in the US and UK, which can be seen from Figure 4. The correlation of the annual (monthly) *HML* between UK and US is 0.24 (0.15). Table 3B reports the statistical comparison of the monthly *HML* in the UK and US. The zero-mean tests suggest that both of them are significantly different from zero.

3.3.3 Liquidity Sorted Portfolios

Based on the illiquidity measure of Amihud (2002), 10 decile liquidity portfolios are formed and summarized in Table 4A. The risk-return relationship suggests that illiquid stocks should earn higher expected returns than liquid stocks, because investors should be compensated for bearing the illiquidity risk. However, Table 4A indicates that this is not the case in the UK equity market. On average, the highly illiquid 30% of the stocks display a negative annual return from

[9] Fama and French (1998) find that there is a value premium of 4.62%. This is because they use a very small sample for the UK market, where on average only 185 stocks are examined.

1988 to 2004. The most illiquid-decile equity group in the UK even experienced a -13.7% annual loss. In contrast, the most liquid-decile stocks show an annual return of nearly 9 %, which results in an annual return spread of over 22 % between the liquid and illiquid stocks (ILLIQ-LIQ_d).

[TABLE 4 ABOUT HERE]

The three most illiquid portfolios include many small stocks, where the total market value of these portfolios is only 2.59%. As liquidity increases, so does the size of the firms, where the most liquid 10 percent of the stocks stand for over 72% of the total market capitalization. As expected, Amihud's illiquidity measure is affected by the size of firms, where large firm's stocks tend to be more liquid than those for small firms. From Table 2A, we see that big stocks have an average annual return of 7.05%, which is very similar to the return for the liquid stocks. Contrary to this, because the illiquid stocks (usually small) show negative returns, we can infer that small stocks with low liquidities perform much worse.

While Amihud's illiquidity measure is apparently highly correlated with size[10], as expected, our relative liquidity measure should not be. Summary statistics of the 10 portfolios made upon the relative liquidity measure are presented in Table 4B. The first row reports the percentage of each liquidity-deciles' market capitalization to the total market capitalization. Although this time the most liquid stock group shows a smaller weight than other groups, the remaining 9 deciles are much more evenly distributed in terms of size. Therefore small stocks are illiquid in absolute measure, but they could be as liquid as, or more liquid than, larger stocks according to our relative measure.

However, the return spread (ILLIQ-LIQ_d) based on this relative liquidity measure is still large (almost 18% annually) although it is smaller than that based on Amihud's measure. The standard deviation for the most liquid portfolio is larger than that of Amihud's measure. This could be a result of the fact that the liquid stocks based on Amihud's measure are usually large, and their returns are less volatile.

[10] In table 5A, we can see the correlation between the liquidity mimicking factor based on Amihud's measure and the *SMB* is 75%.

[TABLE 5 ABOUT HERE]

The monthly correlation matrix between the *RM*, *SMB*, *HML* and the two liquidity mimicking factors is displayed in Table 5A. The mimicking liquidity factor based on our relative liquidity measure barely shows any relationship with that based on Amihud's measure, and also a very low correlation with *SMB* and *RM*. Amihud's measure is however highly correlated with size. There is also almost no relationship between the *SMB* and the *HML* in the UK, a result similar to the US (Fama and French (1993)). Table 5B describes the statistical properties of these factors. Because liquid and big stocks display excess returns over illiquid and small stocks in the UK, this makes the mimicking liquidity factor (*LIQ*) and size factor (*SMB*) display negative values. The last row of Table 5B reports the Sharpe Ratios of various factors. *LIQ* and *LIQ_AMIHUD* produce the largest absolute Sharpe Ratios, which implies that investors can be significantly rewarded for perusing the liquidity strategies, specifically, buying liquid and selling illiquid stocks. Long big and short small also tends to be a good investment strategy in the UK stock market, as it has the third largest the Sharpe Ratio.

3.4 Liquidity Effects in Explaining Cross-sectional Returns

From the previous section, we can see that average returns are closely related to the stock characteristics, such as size, book-to-market and liquidity. In this section, we examine the cross-sectional effect of liquidity on stock returns.

We firstly test the CAPM on different portfolios strategies related to size, book-to-market and liquidity. The statistical properties of different hedge portfolios are reported in Table 6A. It is evident that the strategy of small minus big displays negative average returns regardless of breakpoints. However the t-tests suggest that these negative values are not statistically significant. The book-to-market strategy, by contrast, shows a significantly positive average return whatever breakpoint is employed. Liquid stocks have significant excess returns over illiquid stocks as highlighted by the right panel of the table.

[TABLE 6 ABOUT HERE]

Table 6B report the results of the CAPM on different hedge portfolios related to size, book-to-market and liquidity. It is evident that the CAPM itself is valid for the three size strategies as there is no significant alpha in these three regressions. By contrast, there are significant value and liquidity anomalies in the UK market. The alphas are all significantly different from zero, which suggests the failure of the CAPM in explaining this book-to-market and liquidity return regularities.

Table 7 describes the effect of liquidity on the size and book-to-market strategies. Although the CAPM is efficient in explaining the return regularities associated with size as shown in Table 6B, it is still of interest to note that liquidity betas are all significant at the 95% confidence level in the left panel of Table 7. This evidence implies that the liquidity risk partly explains the excess return of big over small stocks. The right panel of Table 7 shows that all the factor loadings on liquidity are statistically significant at the 99% confidence level, which suggests that liquidity plays a significant role in describing the observed value anomaly. In this liquidity-augmented CAPM, all three book-to-market strategies show insignificant intercepts. Compare with the central panel of Table 6B, the magnitude of intercepts are dramatically reduced in this liquidity-augmented model, which illustrates the success of the liquidity factor in explaining value anomalies.

[TABLE 7 ABOUT HERE]

Fama and French (1995) argue that the *HML* proxies for relative financial distress risk. Saretto (2004) provide empirical evidence that *HML* can be interpreted as distress factor. Chen and Zhang (1998) also demonstrate that the high returns from value stocks compensate for the high risks induced by the characteristics such as financial distress, earnings uncertainty or financial leverage.

A seminar work by Agarwal and Taffler (2005) uses a z-score as a proxy for distress risk, and shows that momentum is largely subsumed by their distress risk factor. We investigate whether the role of liquidity in explaining value premium is not subsumed by their distress factor.

The distress risk factor is calculated using the same method described by in Agarwal and Taffler (2005)[11]. The correlation between our mimicking liquidity factor (LIQ_t) and the distress factor is -0.09. The financial distress factor cannot explain the value premium in the UK market. Table 8A describes a distress-factor augmented CAPM, where it is clear that the CAPM intercepts remain significant and factor loadings on distress factor are all insignificantly different from zero. In Table 8B when the distress factor is added into the liquidity-augmented CAPM, the relation between liquidity and value premium continues to be significant.

[TABLE 8 ABOUT HERE]

The possible explanation for the close relationship between liquidity and value premium can be found in Campbell, Grossman and Wang (1993), where they present a model in which trading volume proxies for the aggregate demand of liquidity trading. In addition, the empirical work of Lee and Swaminathan (2000) demonstrates that low (high) volume stocks display many characteristics commonly associated with value (growth) stocks. Therefore, the return spread between value and growth could contain the difference in the liquidity risk inherited by them. Thus liquidity could help to explain this value premium.

3.5 Robustness of Liquidity Effects

In this section, we firstly demonstrate that the result of liquidity can be employed to explain value premium in the UK is robust to a variety of macroeconomic variables. Secondly, we argue that our liquidity factor is robust in the sense that the cross-sectional return difference related to liquidity is unexplainable by other well known factors, such as, *SMB*, *HML* and Momentum.

Zhang (2005) proposes that the value premium is linked to macroeconomic conditions. He explains that value firms are burdened with more unproductive capital when the economy is bad, and find it more difficult to reduce their capital stock than growth firms do. The dividends and returns of value stocks will hence co-vary more with economic downturns. We demonstrate that the ability of liquidity to explain the value premium is robust in the presence of a battery of

[11] Here we are grateful to Vineet Agarwal for the generous provision of their UK financial distress factor.

macroeconomic variables[12], such as industrial production, CPI, money supply, term spread (i.e., yield difference between 10 year government bond and one month T-bill), and corporate spread (i.e., the yield difference between BBB and AAA bonds). Such results are displayed in Table 9.

[TABLE 9 ABOUT HERE]

Table 10 suggests that the liquidity premium remains pronounced in different models such as, the CAPM, the Fama and French Model, the Fama and French model augmented with a distress factor and the Fama and French model augmented with a momentum factor (Winners minus Losers)[13].

[TABLE 10 ABOUT HERE]

In short, the finding that the value premium is related to liquidity is robust to a number of macroeconomic variables. The premium of liquid over illiquid stocks is robust even after adjusted by *SMB*, *HML* distress and Momentum factors.

4. Conclusions

In this study, we find that British small stocks, on average, display a poor performance compared to big stocks in the last two decades. The US however shows a slight positive *SMB* over the same period, but the t-test conducted illustrates that *SMB* is statistically indifferent from zero. Similar results can also be found in Dimson and Marsh (1999), and Ang and Chen (2005). Consistent with the majority of the literature on the value premium, there is a statistically significant value premium in the UK stock market. The return spread between high and low book-to-market decile portfolios (HML_d) is over 10 percent annually. This *HML* is also pronounced and comparable with the US results.

We compare Amihud's absolute illiquidity measure and our relative liquidity measure in this

[12] The data for these macroeconomic variables is from OECD. Please refer the footnote of Table 9 for details.
[13] We only report the case of decile breakpoints for the reason of simple presentation. However the results are similar regardless of different strategies such as ILLIQ-LIQ_q or ILLIQ-LIQ_p.

study. According to Amihud's measure, small stocks are illiquid where illiquid stocks, on average, show negative returns over time, and liquid stocks have high positive expected returns. The return difference between liquid and illiquid is over 22% annually; however as expected, Amihud's measure is highly correlated with stock size. Our relative liquidity measure produces little correlation with stock size and any other pervasive risk factors. Nevertheless, the return spread between liquid and illiquid decile portfolios still striking, 18% annually.

Cross-sectional analysis shows that there is no size anomaly in the UK from 1991 to 2004, because the CAPM can efficiently explain the excess return of small over big stocks. There is, however, a pronounced value anomaly within this period. The CAPM fails to explain this return difference. A liquidity-augmented CAPM can successfully explain the observed value anomaly.

Finally, the ability of liquidity in explaining value premium is robust to the financial distress factor and a number of macroeconomic variables. The liquidity premium of liquid over illiquid stocks is statistically significant even after being adjusted by the *SMB*, *HML*, *Distress factor* and *Momentum*. Some natural questions that arise: what are the underlying risk factors that are responsible for this pronounced liquidity premium? Is liquidity a systematic risk? Is there any connection between liquidity and beta? An unreported result shows that the beta of the most liquid (illiquid) decile portfolio is 1.36 (0.90), and the wald test highly rejects the equality of these two betas.

The interaction between liquidity and other stock characteristics remains an unexplored area in empirical finance. In modern finance, some of the observed return regularities cannot be explained by the rational asset pricing model, for example, the short-term momentum, the cross-sectional difference related to volatility, etc. This could be the result of the incompetence of the models themselves. The success of the liquidity in explaining value anomaly in this study gives us much more momentum to pursue further research in this area.

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Table 1: Liquidity Properties of the UK Stock Market over Time (Annual Average)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
$\gamma_{i,m}$ **(Value weighted)**	-0.16	-0.38	-0.13	-0.29	-0.65	-0.62	-0.39	-0.56	-0.43	-0.42	-0.50	-0.75	-0.46	-0.67	-1.46	-0.51	-0.38	-0.38
$\gamma_{i,m}$ **(Equally weighted)**	-0.18	-0.43	-0.18	-2.06	-2.01	-1.88	-1.06	-1.18	-0.67	-0.47	-0.91	-1.22	-0.88	-0.87	-1.81	-1.56	-1.13	-0.68
$\psi_{i,m}$	-2.79	-2.90	-2.81	-3.06	-3.11	-3.04	-2.83	-3.16	-3.12	-3.18	-3.28	-3.44	-3.22	-3.31	-3.22	-3.06	-2.57	-2.45
No. of Stocks	96	179	183	184	576	577	712	826	832	798	974	1003	1060	1118	1325	1367	1382	1459

The market liquidity is the average of individual stock's illiquditiy. The first two rows are aggregate market liquidity based on Amihud's (2002) measure.The third row is the aggregate market liquidity based on our new relative liquidity measure.

Table 2A Properties for 10 Decile Size Portfolios (in percentage) January 1988 to December 2004

	Small	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Big**	***SMB***
Average MV/Total MV (%)	0.06	0.16	0.30	0.49	0.81	1.32	2.24	4.05	9.29	81.29	
Average Annual Return	1.31	0.89	0.50	0.81	2.60	2.50	2.34	2.79	4.00	7.05	**-4.08**
Average Monthly Return	0.11	0.07	0.04	0.07	0.21	0.21	0.19	0.23	0.33	0.57	**-0.35**
Monthly Return SD	3.32	3.52	3.51	3.81	4.07	3.89	4.00	3.91	4.04	3.90	**2.72**

At the end of June in year t, 10 size decile portfolios are formed on stocks' ranked market value and hold for the next 12 months. Every portfolio represents 10 percentile of the ranked ME. Portfolios are rebalanced every year. *SMB* is the mimicking factor for size.The breakpoint is the 70th percentile of the ranked market equity.

Table 2B: Statistical Properties for Monthly SMB in the UK and US

	SMB_US	***SMB_UK***
Mean	0.20%	-0.35%
Median	0.20%	-0.40%
Std. Dev.	3.70%	2.70%
t-test	0.66	-0.25

The data for the US is from Kenneth French's Website.

Table 3A: Properties for 10 Decile Book-to-Market Portfolios (in percentage) January 1988 to December 2004

	Low	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**High**	***HML***
Average MV/Total MV (%)	17.28	14.56	17.30	16.53	9.96	7.74	5.53	4.07	3.13	3.90	
Average Annual Return	2.08	1.34	6.08	7.49	4.22	6.93	6.12	8.02	9.62	12.27	**3.87**
Average Monthly Return	0.17	0.11	0.49	0.60	0.34	0.56	0.50	0.64	0.77	0.96	**0.32**
Monthly Return SD	3.83	4.48	3.93	4.21	4.36	4.68	5.46	5.03	4.83	4.94	**2.50**

At the end of December in year t, 10 value decile portfolios are formed on stocks' ranked book-to-market value and hold for the next 12 months. Every portfolio represents 10 percentile of the ranked book-to-market stocks. Portfolios are rebalanced every year. *HML* is the mimicking factor for value.The breakpoints are the 40th and 60th percentile of the ranked book-to-market equity.

Table 3B: Statistical Properties for Monthly HML in the UK and US

	HML_US	***HML_UK***
Mean	0.30%	0.32%
Median	0.30%	0.20%
Std. Dev.	3.40%	2.50%
t-test	4.42	4.52

The data for the US is from Kenneth French's Website.

Table 4A: Properties for 10 Decile Liquidity Portfolios Sorted by $\gamma_{i,m}$ *1988 to 2004 (in percentage)*

	Illiquid	2	3	4	5	6	7	8	9	Liquid	*LIQ*
Average MV/Total MV (%)	0.74	0.78	1.07	1.36	1.73	2.34	3.17	5.15	11.19	72.47	
Average Annual Return	-13.74	-2.67	-3.44	1.76	1.75	-0.03	1.88	7.03	3.64	8.74	**-7.85**
Average Monthly Return	-1.23	-0.23	-0.29	0.15	0.14	0.00	0.16	0.57	0.30	0.70	**-0.68**
Monthly Return SD	6.86	5.65	5.45	5.23	5.36	5.20	5.19	5.03	5.29	4.45	**2.92**

At the end of December in year t, 10 liquidity decile portfolios are formed on stocks' ranked Amihud's illiquidity measureand hold for the next 12 months. Every portfolio represents 10 percentile of the ranked stocks. Portfolios are rebalanced every year. *LIQ* is the mimicking liquidity factor, which is the average return difference between the portfolios of the most illiquid 50 percent and the most liquid 50 percent of stocks.

Table 4B: Properties for 10 Decile Liquidity Portfolios Sorted by $\psi_{i,m}$ *1988 to 2004 (in percentage)*

	Illiquid	2	3	4	5	6	7	8	9	Liquid	*LIQ*
Average MV/Total MV (%)	9.01	6.57	9.26	10.79	13.48	15.80	13.08	10.87	8.59	2.56	
Average Annual Return	-6.55	-0.98	3.58	4.11	6.01	9.10	7.27	6.80	11.96	11.37	**-7.53**
Average Monthly Return	-0.56	-0.08	0.29	0.34	0.49	0.73	0.59	0.55	0.94	0.90	**-0.65**
Monthly Return SD	6.09	4.98	4.69	5.16	4.85	4.63	4.37	5.07	5.18	7.03	**2.02**

At the end of December in year t, 10 liquidity decile portfolios are formed on our ranked relative liquidity measure and hold for the next 12 months. Every portfolio represents 10 percentile of the ranked stocks. Portfolios are rebalanced every year. *LIQ* is the mimicking liquidity factor, which is the average return difference between the portfolios of the most illiquid 50 percent and the most liquid 50 percent of stocks.

Table 5A: Correlation Matrix (204 Monthly Obersevations)

	LIQ	***LIQ_AMIHUD***	***RM***	***HML***	***SMB***
LIQ	1				
LIQ_AMIHUD	0.01	1			
RM	-0.08	-0.12	1		
HML	-0.24	0.03	0.20	1	
SMB	-0.08	0.75	-0.33	0.02	1

Table 5B: Statistical Properties for All Factors in the UK

	LIQ	***LIQ_AMIHUD***	***RM***	***HML***	***SMB***
Monthly Mean	-0.65%	-0.68%	0.80%	0.32%	-0.35%
Monthly Std. Dev.	2.02%	2.92%	4.20%	2.50%	2.72%
Historical Sharpe Ratio	-0.65	-0.46	0.03	0.01	-0.31

RM is the market return on the FTSE-all share index. *SMB* is the return difference between the 70^{th} percentile of the ranked ME at the end of June each year *t*, and *HML* is the return spread between 40^{th} and 60^{th} percentiles of (BE/ME) at the end of December each year *t*. At the end of each year, Amihud's illiquidity measure and our relative liquidity mearsure are calculated for all stocks. The two portfolios are created based on these ranked measures. The breakpoint is the median of each liquidity measure. The return difference of these two portfolios in the next 12 months is the mimicking liquidity factor (*LIQ* and *LIQ_AMIHUD).*

Table 6A: Monthly Statistical Properties of Different Hedge Portfolios

	S-B				***H-L***				***ILLIQ-LIQ***		
	S-B_D	**S-B_Q**	**S-B_P**		**H-L_D**	**H-L_Q**	**H-L_P**		**ILLIQ-LIQ_D**	**ILLIQ-LIQ_Q**	**ILLIQ-LIQ_P**
Mean	-0.271%	-0.257%	-0.251%		0.819%	0.756%	0.544%		-0.914%	-1.243%	-1.462%
Std. Dev.	3.809%	3.397%	3.108%		4.366%	3.266%	2.670%		3.223%	4.082%	6.408%
t-test	-0.922	-0.980	-1.046		2.431	3.001	2.641		-3.259	-4.349	-4.048

S-B (H-L) is the hedge portfolio for long the smallest (highest book-to-market) and short the biggest (lowest book-to-market). ILLIQ-LIQ is the hedge portfolio for long the most illiquid and short most liquid. _D, _Q and _P stand for decile, quintile and 30%/40%/30% breakpoints

Table 6B: CAPM of SMB, HML and ILLIQ-LIQ from 1991 to 2004

	S-B				***H-L***				***ILLIQ-LIQ***		
	S-B_D	**S-B_Q**	**S-B_P**		**H-L_D**	**H-L_Q**	**H-L_P**		**ILLIQ-LIQ_D**	**ILLIQ-LIQ_Q**	**ILLIQ-LIQ_P**
C	-0.001	-0.001	-0.001		0.008	0.008	0.005		-0.010	-0.010	-0.007
	-0.346	*-0.443*	*-0.508*		*2.028*	*2.402*	*1.956*		*-2.183*	*-3.405*	*-3.123*
RM-Tbill	-0.546	-0.439	-0.395		0.047	0.004	0.068		-0.461	-0.330	-0.276
	-7.988	*-6.807*	*-6.659*		*0.382*	*0.036*	*0.862*		*-3.446*	*-3.567*	*-3.981*
R-squared	0.348	0.282	0.273		0.002	0.000	0.011		0.114	0.126	0.135

RM is the market return on the FTSE-all share index. *T-bill* is the monthly rate for UK one month Treasury bill.S-B (H-L) is the hedge portfolio for long the smallest (highest book-to-market) and short the biggest (lowest book-to-market).ILLIQ-LIQ is the hedge portfolio for long the most illiquid and short the most liquid. _D, _Q and _P stand for the decile, quintile and 30%/40%/30% breakpoints. The numbers in italic are t-statistics. Portfolios are rebalanced every year. The estimations are justified in the presence of both heteroskedasticity and autocorrelation of unknown forms according to Newey and West (1987).

Table 7: Liquidity Effects over Size (SMB) and Book-to-Market Strategy (HML)

	S-B				***H-L***		
	S-B_D	**S-B_Q**	**S-B_P**		**H-L_D**	**H-L_Q**	**H-L_P**
C	-0.003	-0.003	-0.003		0.005	0.005	0.003
	-1.146	*-1.151*	*-1.307*		*1.503*	*1.609*	*1.083*
Rm-Tbill	-0.586	-0.474	-0.432		-0.006	-0.053	0.014
	-8.315	*-6.957*	*-7.170*		*-0.051*	*-0.498*	*0.184*
LIQ	-0.358	-0.321	-0.343		-0.489	-0.511	-0.488
	-2.502	*-2.061*	*-2.664*		*-2.859*	*-4.073*	*-4.994*
Wald test of LIQ (F-stats)	6.261	4.246	7.095		8.176	16.591	24.937
R-squared	0.381	0.315	0.318		0.049	0.091	0.136

RM is the market return on the FTSE-all share index. *T-bill* is the monthly rate for the UK one month Treasury bill. S-B(H-L) is the hedge portfolio for long the smallest (highest book-to-market) and short the biggest (lowest book-to-market). _D, _Q and _P stand for the decile, quintile and 30%/40%/30% breakpoints. *LIQ is* the liquidity mimicking factor based on our size-adjusted liquidity measure. The numbers in italic are t-statistics. Portfolios are rebalanced every year. The estimations are justified in the presence of both heteroskedasticity and autocorrelation of unknown forms according to Newey and West (1987).

Table 8A: Financial Distress Factor over Book-to-Market Strategy

H-L	**H-L_D**	**H-L_Q**	**H-L_P**
C	0.009	0.008	0.006
	1.954	*2.349*	*2.026*
Rm-Tbill	*0.074*	-0.012	0.039
	0.566	*-0.108*	*0.511*
Distress_Factor	-0.096	0.137	0.184
	-0.468	*0.871*	*1.451*
R-squared	0.005	0.007	0.028

Table 8B: Robustness of Liquidity effects over Book-to-Market Strategy

H-L	**H-L_D**	**H-L_Q**	**H-L_P**
C	0.006	0.005	0.003
	1.369	*1.563*	*1.193*
Rm-Tbill	0.027	-0.056	-0.002
	0.206	*-0.524*	*-0.029*
LIQ	-0.543	-0.520	-0.480
	-3.150	*-3.970*	*-4.791*
Distress_Factor	-0.173	0.064	0.117
	-0.914	*0.477*	*1.109*
Wald test of LIQ(F-stats)	9.922	15.761	22.952
R-squared	0.059	0.094	0.143

RM is the market return on the FTSE-all share index. *T-bill* is the monthly rate for the UK one month Treasury bill. H-L is the hedge portfolio for long the highest book-to-market and short the lowest book-to-market. _D, _Q and _P stand for the decile, quintile and 30%/40%/30% breakpoints. *LIQ* is the liquidity mimicking factor based on our size-adjusted liquidity measure. The distress factor is a mimicking factor for distress risk, obtained from Agarwal and Taffler (2005). The numbers in italic are t-statistics. Portfolios are rebalanced every year. The estimations are justified in the presence of both heteroskedasticity and autocorrelation of unknown forms according to Newey and West (1987).

Table 9: Robustness of Liquidity Effects over Macroeconomic Variables

HML	H-L_D	H-L_Q	H-L_P
C	*0.013*	0.015	0.005
	1.664	*2.753*	*1.051*
Rm-Tbill	-0.027	-0.140	-0.088
	-0.131	*-0.863*	*-0.784*
LIQ	-0.343	-0.332	-0.389
	-1.878	*-2.440*	*-3.580*
Industrial Production	-0.191	0.260	0.116
	-0.382	*0.743*	*0.412*
CPI	1.225	0.582	0.400
	0.782	*0.495*	*0.444*
Term Spread	7.261	3.514	2.147
	1.113	*0.645*	*0.440*
Corporate Spread	-0.538	-0.186	0.271
	-0.612	*-0.296*	*0.590*
Momey Supply (M2)	-1.084	-1.206	-0.358
	-1.344	*-1.964*	*-0.613*
Wald test of LIQ(F-stats)	3.527	5.953	12.816
R-squared	0.051	0.106	0.118

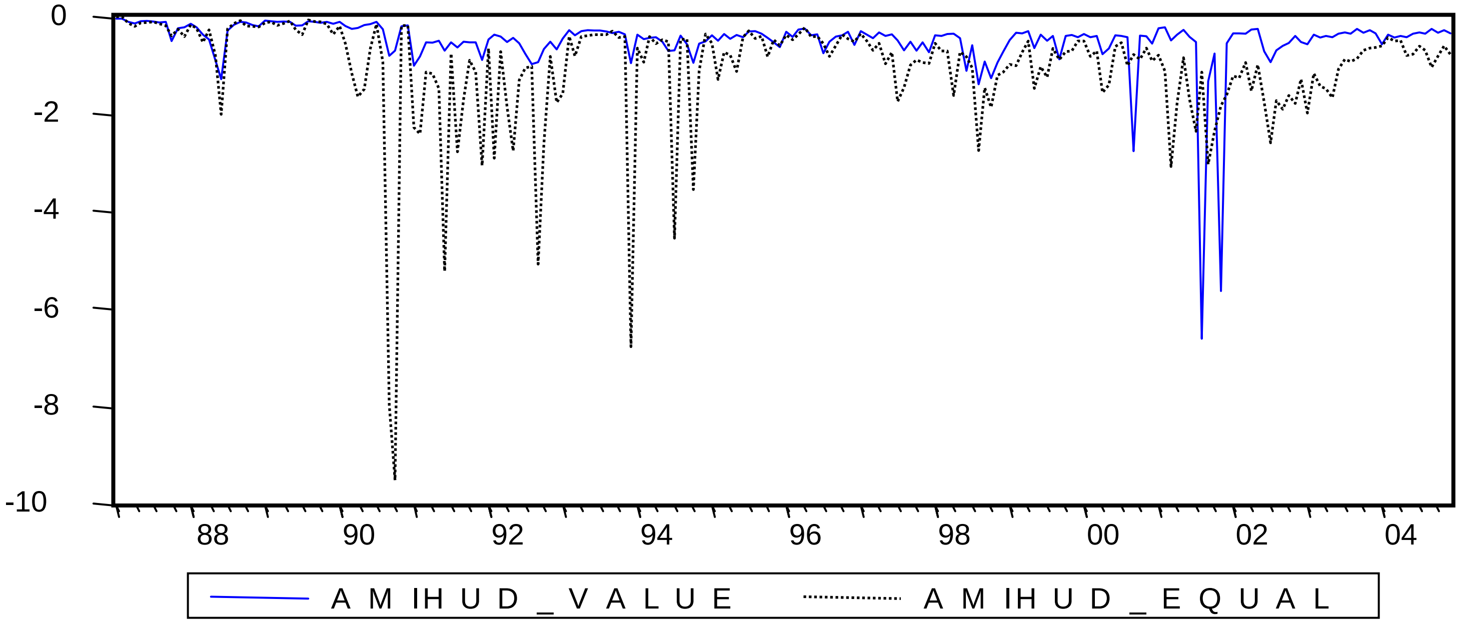
RM is the market return on the FTSE-all share index. *T-bill* is the monthly rate for the UK one month Treasury bill. H-L is the hedge portfolio for long the highest book-to-market and short the lowest book-to-market. _D, _Q and _P stand for the decile, quintile and 30%/40%/30% breakpoints. *LIQ* is the liquidity mimicking factor based on our size-adjusted liquidity measure. The macroeconomic variables are all downloaded from Datastream. Among these macroeconomic variables, the industrial production is the increase rate of the seasonally adjusted UK industrial production volume index. CPI is the changes of the UK comsumer price index. Term spread is the yield difference between the 10-year government bond and one month T-bill. Corporate spread is the return difference between the Merrill Lynch UK BBB and AAA bond index. Money supply is the increase rate of the broad money supply.The numbers in italic are t-statistics. Portfolios are rebalanced every year. The estimations are justified in the presence of both heteroskedasticity and autocorrelation of unknown forms according to Newey and West (1987).

Table 10: Different Factor Models for Illiquid minus Liquid Portfolios

Dependent variables: ILLIQ-LIQ_D					
C	-0.010	-0.012	-0.014	-0.0147	-0.016
	-2.183	*-2.543*	*-2.622*	*-2.702*	*-2.846*
RM-TBILL	-0.461	-0.614	-0.552	-0.5595	-0.504
	-3.446	*-4.845*	*-4.506*	*-3.844*	*-3.730*
SMB		-0.478	-0.361	-0.4354	-0.338
		-3.776	*-2.499*	*-2.933*	*-2.109*
HML		0.401	0.444	0.4119	0.452
		2.216	*2.443*	*2.2824*	*2.497*
Distress_Factor			-0.227		-0.145
			-0.973		*-0.583*
WML				0.1566	0.179
				1.091	*1.134*
R-squared	0.114	0.190	0.198	0.197	0.207

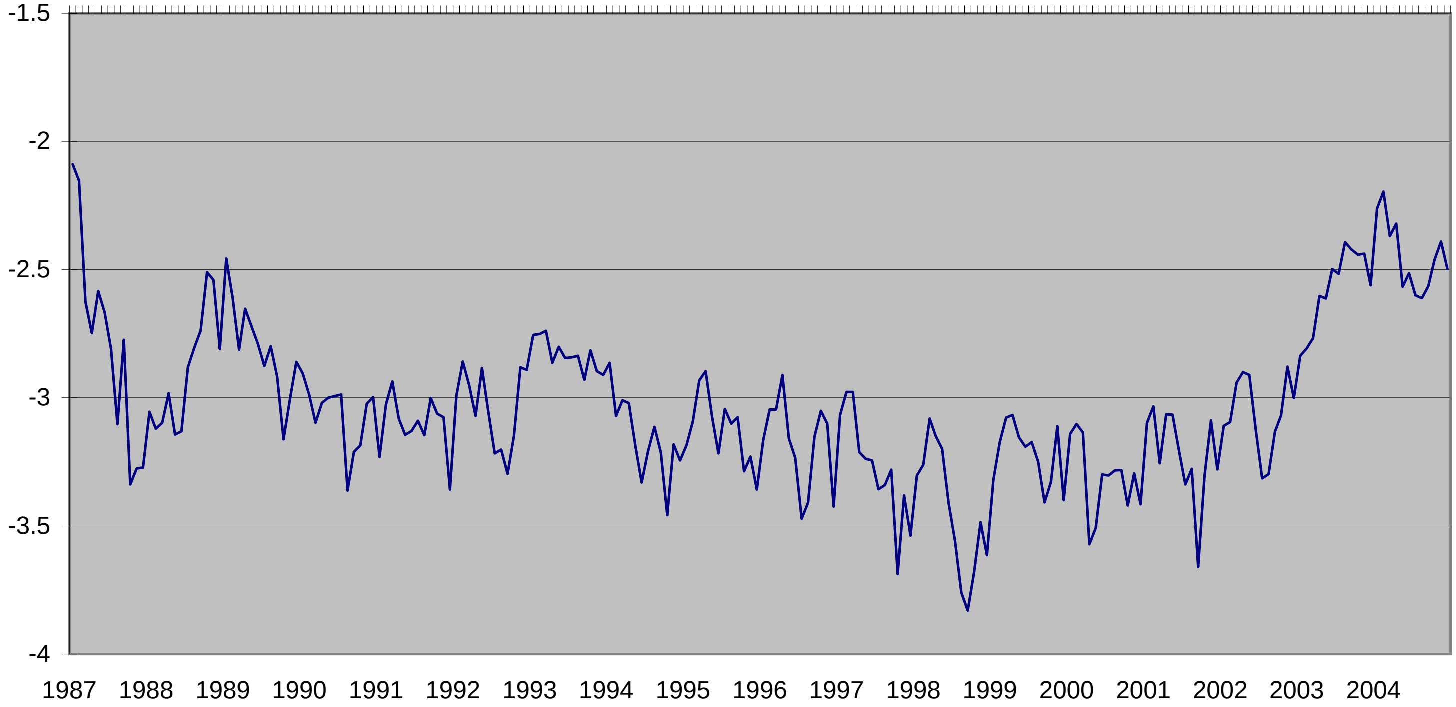
RM is the market return on the FTSE-all share index. *T-bill* is the monthly rate for the UK one month Treasury bill. ILLIQ-lLIQ_d is the return difference between the most illiquid and liquid decile portfolios. *SMB* and *HML* are mimicking factors for size and value. The distress factor is a mimicking factor for distress risk, obtained from Agarwal and Taffler (2005). WML is a 6 by 6 momentum factor as in Jegadeesh and Titman (1993). The numbers in italic are t-statistics. Portfolios are rebalanced every year. The estimations are justified in the presence of both heteroskedasticity and autocorrelation of unknown forms according to Newey and West (1987).

Figure 1: Monthly Average Amihud's Illiquidity Level in the UK



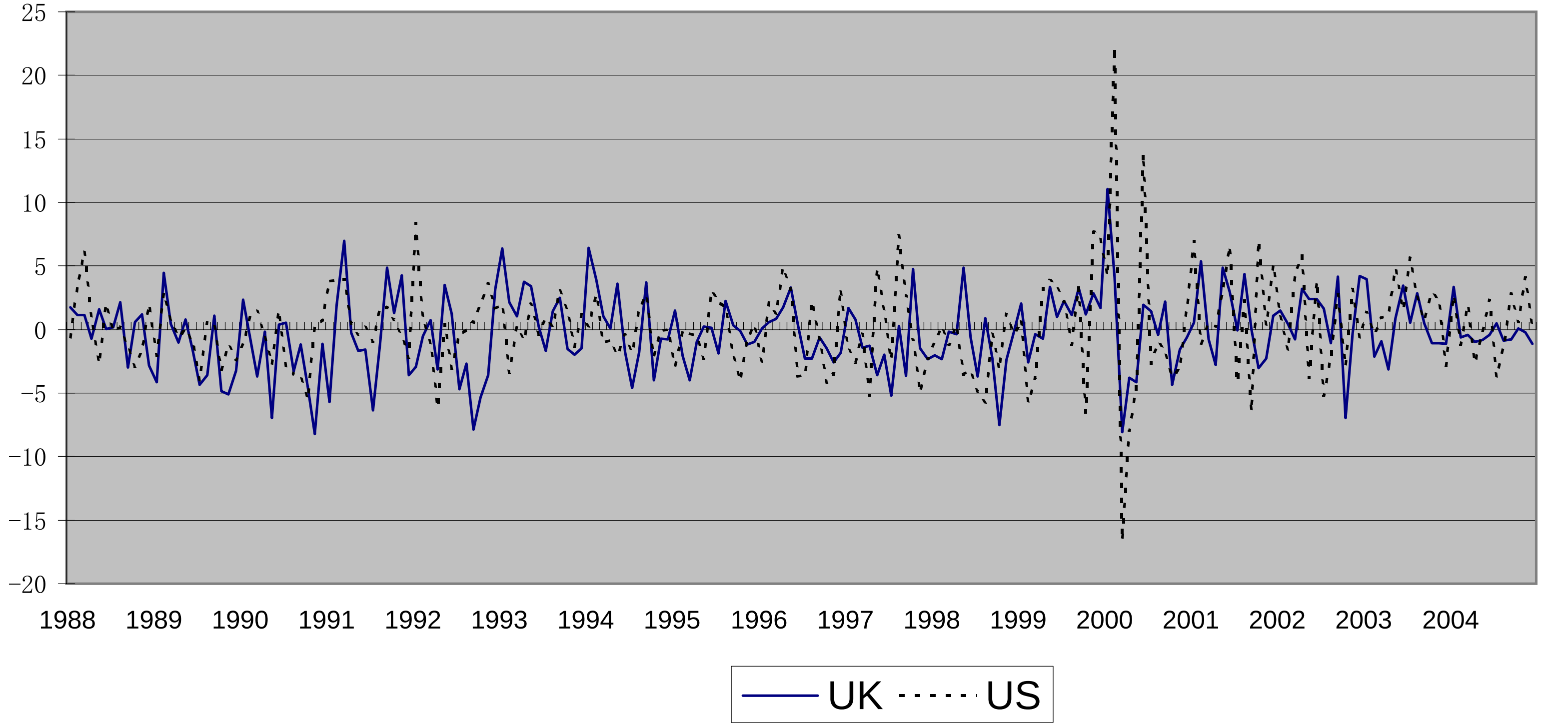
Note: The market liquidity is the average of individual stock's illiquditiy, where the illiquidity measure is based on Amihud's (2002) measure.

Figure 2: Monthly Average Relative Illiquidity Level in the UK 1987 to 2004



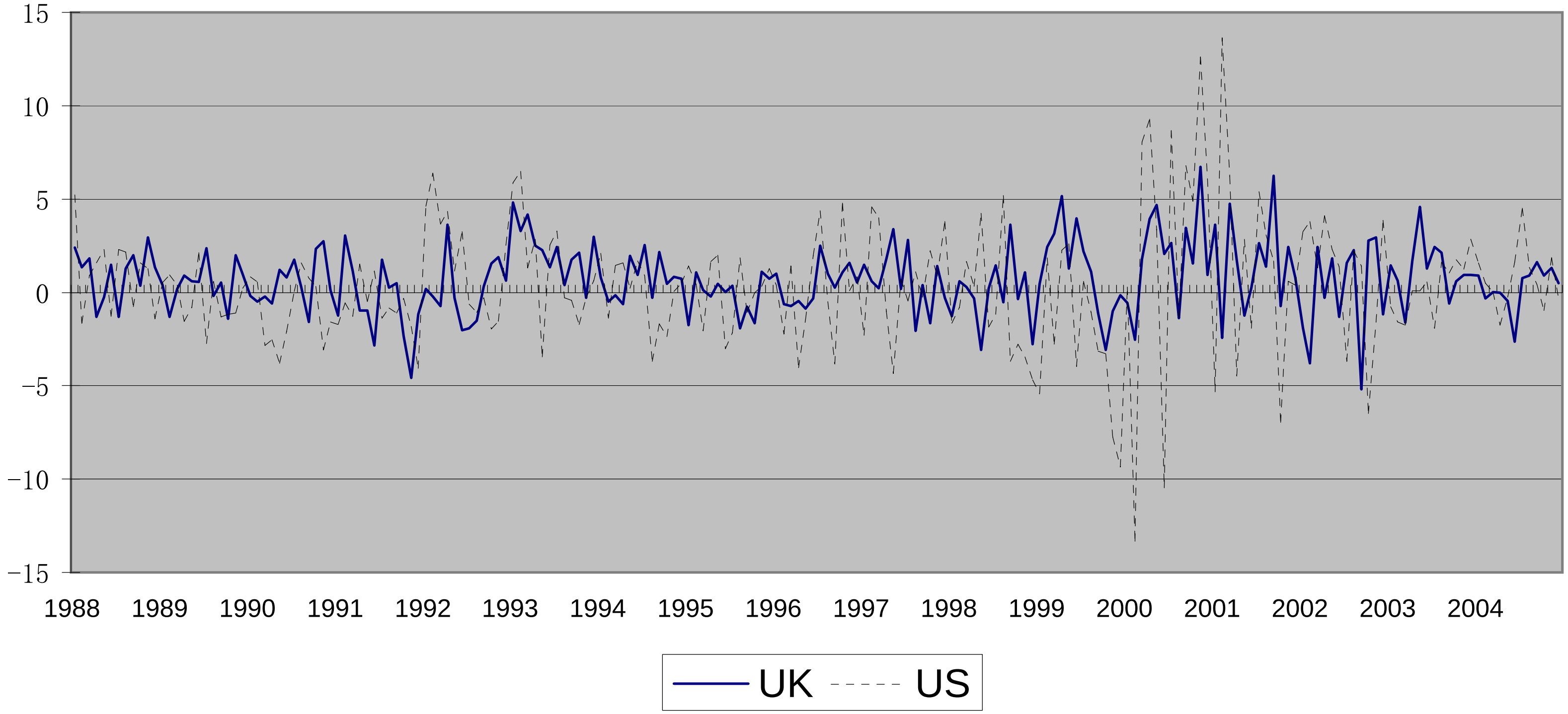
Note: The market liquidity is the average of individual stock's illiquditiy, where the liquidity measure is based on our new relative measure.

Figure 3: Monthly SMB in the UK and US from 1988 to 2004 (Percentage)



The UK *SMB* is calculated as follows: at the end of June in year *t*, two portfolios are formed on stocks' ranked market value and hold for the next 12 months. The breakpoint is the 70th percentile of the ranked market equity.The return difference of these two portfolios is *SMB*. Portfolios are rebalanced every year. The US *SMB* is downloaded from Kenneth French Website.

Figure 4: Monthly HML in the UK an US 1988 to 2004 (Percentage)



The UK *HML* is calculated as follows. At the end of December in year *t*, two portfolios are formed on stocks' ranked book-to-market value and hold for the next 12 months. The breakpoints are the 40th and 60th percentile of the ranked book-to-market equity. The return difference of these two portfolios is the *HML*. Portfolios are rebalanced every year. The US *HML* is downloaded from Kenneth French Website.