Liquidity Styles and Strategies in U.S., International, and Global Markets

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ABSTRACT

Liquidity is a strong predictor of future returns in U.S., International, and global markets, yet distinct from size, value, and momentum. We develop a strategy for implementing the liquidity style, creating portfolios that have positive and significant alphas, low betas, and good down-side protection geographically across all markets.

1. Introduction

Liquidity is an important characteristic of a stock or any asset. There is increasing evidence that less liquid publicly traded stocks outperform more liquid stocks, and that liquidity is a characteristic to be managed, much like risk. In this paper we extend earlier work to show that liquidity behaves as a style in U.S., international, and global markets. We also create a strategy for implementing the style in all the markets.

The conventional styles are size, value, and momentum. Small stocks have been shown to outperform large stocks by Banz (1981) and others, value has been shown to outperform growth (e.g. Basu (1977), Fama and French 1993, 1995, and others) and high momentum stocks have been shown to outperform low momentum stocks (e.g. Jegadeesh and Titman 1993, 2011, and others). Ibbotson, Chen, and Hu (2011) demonstrate that in the U.S. equity market liquidity also has all the characteristics of a style, but is distinct from size, value, and momentum.

The studies of size, value and momentum are also extended to international markets. Some previous studies show that similar to U.S. results, momentum is globally profitable. It lasts for about a year (Rouwenhorst (1998)), and the co-movement among countries is weak (Griffin, et al. (2003)). Asness et al.(2010) report that value generates abnormal returns for individual stocks within several countries. Fama and French (2011) test these styles in major developed markets, including North America, Europe, Japan, and Asia Pacific and find value premiums exists for all four regions, and momentum returns are strong except in Japan. Griffin (2002) finds that a country-specific version of Fama and French's three-factor model explains the time-series variation in returns better than the global version.

Previous research measures liquidity in different ways. The first category is the turnover measure. Datar (1998) observes that the cross section of stock returns are negatively related to stock turnover. Ibbotson, Chen, and Hu (2011) find that relatively low

turnover stocks are anti-glamour stocks, and are at the bottom of their pricing cycle. Idzorek, Xiong, and Ibbotson (2011) find that liquidity measured by turnover also works at the mutual fund level, i.e., low turnover mutual funds outperform high turnover mutual funds. Another category is the price impact of trading volume measure. Amihud (2002) defines the liquidity with the absolute value of the return divided by trading volume over a period of time. He shows that the expected stock returns are increasing with this ratio. Pastor and Stambaugh (2003) measure the stock liquidity by the sensitivity of the next day return to the signed trading volume of a given day (trading volume times the sign of return on that given day). Lower liquidity will be followed by a larger price reversal on the next day for a given trading volume. The third category studies the pricing impact of turnover ratio. Florackis, Gregoriou, and Kostakis (2010) use absolute stock return over turnover rate during a period of time to measure stock liquidity which is free of size bias, and show the level of stock price change given 1% change in turnover rate.

The studies of liquidity are also carried to global stock markets in recent years. Asness et al.(2010) report that liquidity risk is positively related to value and negatively to momentum with developed market data. Dey (2011) argues that it is only true in the emerging market that investors expect higher return from high turnover market, while in the developed market, the expected return is a function of volatility.

We create a portfolio strategy by overweighting less liquid stocks, and underweighting more liquid ones. A stock with a negative liquidity bias has less trading volume share than warranted by its earnings or market cap share, having a turnover rate lower than the market's average turnover rate. Conversely, a stock with a high liquidity bias is traded more frequently than the market as a whole, and thus it is traded "too much" relative to the average turnover of the stock universe. In our liquidity strategies, a stock's portfolio is heavily invested in fundamentals, particularly earnings. We create ratios to maximize the positive impact of fundamentals, while minimizing trading

volume. For example, stocks with a low volume to earnings ratio have less trading volume, but strong earnings fundamentals.

Our backtest covers over 6000 stocks based on market capitalization in the developed markets including U.S., U.K., Japan, and Euro-zone countries. The results demonstrate that a less liquid portfolio strategy outperforms its benchmark index globally and regionally, even on a risk-adjusted basis. This less liquid strategy offers almost as much capacity as market-capitalization weighted and earnings weighted strategies, and yet it adds value over such traditional investment strategies. Our liquidity strategy represents a particular profitable, large-capacity way to implement the liquidity style.

The remainder of the article is organized as follows. In Section 2, we describe the data sets and stock universe used in this research. Section 3 focuses on showing that the liquidity factor is universally different from size, value and momentum. The main backtest results for the liquidity strategies are presented in Section 4. Section 5 demonstrates the strong downside protection inherent in the strategies. The last section offers concluding remarks.

2. Data Description

Our U.S. stock sample is collected from the CRSP and Compustat databases, consisting of firms listed on the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and NASDAQ stock markets. We include up the top 3500 stocks based on market capitalization (which is the stock price times the number of shares outstanding).

All stock returns are total returns with dividends included, which are collected from CRSP. Earnings for each company are the earnings per share (EPS) times the number of shares outstanding at the portfolio formation date. Specifically, we use the four most recent quarterly EPS, with the most recent quarter ending two months prior to the

portfolio formation date. This is to avoid any forward-looking biases as it usually takes several weeks for a company to report its recent quarterly earnings after the end of the quarter. The earnings data are from Compustat.

Our international stock sample includes three currencies: the British Pound, the Euro, and the Japanese Yen. The data is collected from International Data Corporation (IDC) and Worldscope. The international portfolio includes the top 500 market-cap stocks in the U.K., the top 1000 Euro-zone by capitalization, along with the Tokyo Tier I stocks in Japan. The data in these international markets is available from December 1995 through 2010.

We apply a similar methodology to the international market as we do to the U.S. market. All the stocks must have the annual earnings and trading volume for each of the past 12 months in order to be included into our sample. The annual earnings must end two months prior to the portfolio formation date. The minimum price for U.K. and Euro-zone stocks is 2 dollars. The minimum market capitalization must exceed 25 million dollars for U.K. and Euro-zone stocks in today's market value. The minimum trailing 12 month trading volume must exceed 10 million dollars for U.K. and Euro-zone stocks, in today's market value. There are no minimum constraints on Japanese stocks, since Tokyo Tier 1 only includes the larger and more actively traded stocks. We also do not combine the international results into one data set since the stocks from each currency have substantially different trading characteristics. Rather we treat each currency separately and then apply fixed weight combinations of the results that we present.

Table 1 reports the summary statistics for the regions, including the number of stocks remaining, mean and median market capitalization, stock turnover ratio and EP ratios for each year based on the end of December portfolio formation date.

3. Liquidity versus size, value and momentum in the U.S., international, and global markets

Initially, we use annual turnover, defined as the number of shares traded divided by the stock's outstanding shares, as a proxy of the stock's liquidity. Trading volume favors large-size stocks, which is perhaps what any liquidity measure should do as large stocks are generally more tradable. Turnover is relatively market capitalization-neutral as small-cap and large-cap stocks can have both low and high turnover rates. High turnover stocks tend to have low bid-ask spreads, high trading volume relative to the size of the company, and low price impact per dollar traded. In this section, we focus on turnover and show that liquidity is different from such traditionally known styles as size, value, and momentum in all three markets.

First, we contrast liquidity, or turnover, with size. In addition to the academic literature on size as a profitable investment style, there are many small-cap and mid-cap mutual funds and managed accounts, indicating that size is a popular differentiating factor in investment practice. In both academic and practitioner discussions on liquidity, it is often taken as a given that less liquidity equals small cap, so betting on illiquidity must mean betting on small-cap stocks. To see whether liquidity is captured by size, we form at the end of each December independently sorted size and liquidity (turnover) quartiles and then take the intersections of the two independent sets of quartiles, to produce 16 intersection groups. Next, we form an equally weighted portfolio of the stocks in each of the 16 intersection groups and hold it for the next 12 months.

Table 2A reports the geometric average annual returns in each intersection portfolio. Across the small-size quartile, the low-liquidity group earns a geometric average return of 13.52% a year while the high-liquidity group 7.25% a year. Across the large-size quartile, the low- and high-liquidity groups respectively earn 12.18% and 8.67%, producing a liquidity effect of 3.51%. Within the two mid-size groups, the liquidity

return spread is also significant. Therefore, size does not capture liquidity, i.e. the liquidity effect holds regardless of the size group. Conversely, the size effect does not hold across all liquidity quartiles, especially in the highest liquidity quartile. However, it is true that the liquidity effect is the strongest among the smallest size stocks and then declines across the quartiles from small to large-size stocks. The small size row contains both the highest return and the lowest return cells in the matrix.

Value investing has been popularized since Graham and Dodd (1940). It has been widely supported by rigorous academic research. How different is the liquidity style from value? To answer this question, we use the earnings/price (E/P) ratio as a proxy for value, with the understanding that E/P is highly correlated with dividend/price and book/price ratios. Again, we form independently sorted value and turnover quartiles and take the intersection groups between the two independent sets of quartiles, to construct 16 equally-weighted value-turnover portfolios.

The annual return results are reported for the 16 value-liquidity portfolios in Table 2B. In this case, among the high-growth stocks, the low-liquidity stock portfolio has a compounded annual return of 10.05% while the high-liquidity stock portfolio 0.75%. For high value stocks, low liquidity stocks have a 17.56% return, while high liquidity stocks have a return of 11.97%. Both value and liquidity are distinctly different ways of picking stocks. The best return comes from combining high-value with low-liquidity stocks, while the worst return comes from high growth stocks with high liquidity.

Finally, we contrast turnover with momentum. Numerous scholars have found that buying past medium-term winners and selling past medium-term losers and holding the positions for a medium term (6 to 18 months) yields significant profits. These studies have confirmed a common practice among certain groups of investors who follow trends using charts or simple return calculations. After the research results became

known, momentum investing has received more following on a larger scale among institutional money managers.

To examine whether liquidity investing is simply another form of momentum investing, we form in Table 2C two dimensional portfolios based on independent sorting of the stock universe according to past 12-month stock returns (momentum) and liquidity.

The highest compound annual return, 14.76%, is achieved by buying mid-higher momentum low-liquidity stocks, while the lowest return, 4.56%, is for the high-momentum high-liquidity stocks. Again, momentum and liquidity are different stock-picking styles and not substitutes for one another. A better way may be to combine the two investment styles and pick stocks that have high momentum but low liquidity, as demonstrated in Idzorek, Xiong, and Ibbotson (2010).

We examine liquidity versus size, value, and momentum in both international and global developed markets. The international markets include stocks listed in the U.K., the Euro-zone, and Japan. By adding stocks in these three currencies, we are picking up most of the international capitalization, although we only have complete data starting in 1995, unlike the long period we could study in the U.S. The global results include the U.S. markets. The whole sample includes over 6000 of the largest capitalization stocks in the four developed country/region markets.

Table 3 shows just the international set of matrices, consisting of the weighted combination of 12.5% U.K., 50% Euro-zone, and 37.5% Japan. The individual currency portfolios, which equally weight the securities in each cell, are not shown. The international geometric mean results shown in Table 3 are almost as strong as the U.S. results. During the 1996-2010 period, the least liquid quartile had a return of 8.06% versus 1.67% for the most liquid quartile. The three four-by-four matrices, each with 16 cells are again aligned, but this time there are a few exceptions in the middle cells of the

size and value/growth matrices. Nevertheless, there is a clear liquidity impact on returns, even after comparing the returns across the various well recognized styles. Furthermore, there is no other style which dominates liquidity.

We present the global liquidity quartile matrix in Table 4. These set of matrices are combinations of the portfolios presented in Tables 2 and 3 in the U.S. and international markets, measuring liquidity quartiles relative to size, value/growth, and momentum quartiles. The returns in the cells are a fixed weight combination of the equally weighted returns of separate U.S., U.K., Euro-zone and Japan portfolios. The weights in global portfolio are 60% U.S., 20% Euro-zone, 5% U.K., and 15% Japan.

We report the geometric mean return of the weighted combination of each cell. Liquidity results are very strong in all categories, with the global low liquidity quartile having a return of 11.34% versus only 5.02% for the global high liquidity quartile over the period 1996-2010. The returns in every one of the 16 cells in all three matrices progressively rise as we move into adjacent less liquid quartiles. Liquidity has a substantial impact on returns in global markets.

4. U.S., International, and Global Liquidity Results

Given the analyses that liquidity is a significant independent indicator of future returns globally, we develop strategies that favor the stocks that have strong fundamentals but also with relatively less liquidity. The stocks in the portfolio are selected on the basis of favorable ratios, such as a low volume to earnings ratio, which measures the previous year's trading volume divided by the previous four quarter earnings, lagged two months. The selected stocks are then positively weighted by the earnings and negatively weighted by the trading volume.

Table 5 displays the liquidity strategy performances in U.S., international, and global markets over the period of 1996-2010. The Russell 3000, the MSCI International, and the MSCI Global are used as the benchmarks for the strategies. The portfolio characteristics are quite consistent across different strategies. The geometric annual returns for all three strategies are more than 4% higher than their own benchmarks for the testing period. The highest is 6.24% (12.20%-5.96%=6.24%) for the Global strategy. The lowest is 4.35% (11.35%-7.00%=4.35%) for the U.S. strategy. All three strategies have about 2% lower volatility than the benchmark indices. The information ratio relative to benchmark is 0.82 (the highest) for the International Liquidity Strategy, 0.76 for the Global Liquidity Strategy, and 0.44 (the lowest) for the U.S. Liquidity Strategy. The betas for three strategies are all lower than 1, with the U.S. Liquidity Strategy having the lowest beta of 0.65 and the International Liquidity Strategy having the highest beta of 0.83.

5. When Does Liquidity Work the Best?

After demonstrating that the liquidity strategies work globally, we also are interesting to figure out when liquidity works best. Because the liquidity based strategies invest in relative less liquid anti-glamour stocks, one concern might arise that the liquidity strategies might not work well when the market is volatile and has large down-side stresses. To investigate this concern, we study the performance of liquidity strategies under different market environments.

Figure 1 shows that the Liquidity Strategy beats the benchmarks by generating limited downside capture. In the U.S. market from 1996 to 2010, it outperforms the Russell 3000 in 31 out of the 36 months when equity market is down more than 3%. During this worst scenario, the Russell 3000 is down 6.5% on average, while the Liquidity Strategy is down only 4.0%. When market is up, the Liquidity Strategy performance is quite comparable to the market unless the market is up more than 3%. This is not just a small

beta effect. Liquidity Strategy outperforms the market when market is down even after adjusting for the portfolio beta. It provides more down side protections to investors than a regular low beta product can provide. The overall downside capture is 56.3% while the upside capture is 83.1%.

We also notice the international liquidity strategy and the global liquidity strategy have limited downside capture. Figure 2 gives the international results. When the market is down more than 3% in a month, the international strategy outperforms the MSCI International Index in 34 out of 37 months. When the market is down less than 3% in a month, the strategy outperforms the index 26 out of 32 months. Overall the downside capture is only 60.5% compared with upside capture of 89.8%.

The global liquidity strategy downside capture is compared to the MSCI World Index in Figure 3. The strategy outperforms the index in 33 out of 35 months when the index is down over 3%. Overall the downside capture is only 56.7%, compared with the upside capture of 90.2%.

6. Conclusions

Similar to the U.S. markets, liquidity has the characteristics of an investment style in international and global markets. It is different from size, value/growth or momentum, but just as powerful in effect. We create a strategy which selects stocks which have strong fundamentals but are less liquid. We apply this strategy in U.S., international, and global markets.

Although we only study the stock market in this paper, liquidity also affects bonds and other asset classes. We believe that liquidity is central to the valuation of securities and has a substantial impact on their past and future returns. Furthermore, rather than

provide extra risk, it provides low volatility and downside protection in the U.S., international, and global markets.

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Table 1: Summary Statistics of the Stock Universe by Regions

This table reports summary statistics for the stock universe in U.S., U.K., Euro-zone, and Japan stock markets from Dec 1995 to Dec 2009. The number of stocks, market capitalization in billions of dollars, stock turnover ratio, and EP ratios are all based on the end of December information.

A. U.S. summary statistics

		Market Capitalization		EP Ratio		Stock Turnover Ratio	
Year	N of Stocks	Mean (in $B)	Median (in $B)	Mean	Median	Mean	Median
1995	3500	1.78	0.33	0.0463	0.0546	0.85	0.60
1996	3500	2.16	0.42	0.0414	0.0510	0.92	0.68
1997	3500	2.85	0.53	0.0376	0.0466	0.96	0.71
1998	3500	3.51	0.48	0.0379	0.0502	1.02	0.76
1999	3341	4.64	0.56	0.0355	0.0459	1.20	0.84
2000	2903	5.05	0.71	0.0378	0.0503	1.32	1.00
2001	3107	4.13	0.64	0.0107	0.0405	1.27	0.93
2002	2845	3.58	0.58	0.0338	0.0526	1.31	0.97
2003	3390	4.00	0.70	0.0247	0.0414	1.33	0.99
2004	3408	4.46	0.82	0.0332	0.0438	1.45	1.08
2005	3347	4.78	0.88	0.0373	0.0475	1.47	1.15
2006	3344	5.34	1.00	0.0395	0.0466	1.66	1.27
2007	3456	5.29	0.84	0.0356	0.0478	2.78	2.11
2008	3003	3.63	0.61	0.0584	0.0745	3.36	2.57
2009	3203	4.38	0.74	-0.0144	0.0386	2.85	2.17
Whole Sample	49347	3.95	0.63	0.0331	0.0480	1.57	1.06

B. U.K. summary statistics

		Market Capitalization		EP Ratio		Stock Turnover Ratio	
Year	N of Stocks	Mean (in $B)	Median (in $B)	Mean	Median	Mean	Median
1995	330	2.42	0.71	0.0542	0.0551	0.32	0.30
1996	335	3.09	0.86	0.0488	0.0505	0.49	0.47
1997	400	3.21	0.70	0.0443	0.0483	0.51	0.47
1998	351	4.32	0.77	0.0548	0.0515	0.62	0.58
1999	463	4.69	0.81	0.0426	0.0359	0.58	0.49
2000	480	4.00	0.58	0.0371	0.0352	0.84	0.62
2001	423	3.74	0.51	0.0340	0.0418	0.82	0.67
2002	295	4.44	0.59	0.0347	0.0559	0.98	0.80
2003	401	4.45	0.62	0.0225	0.0412	0.86	0.73
2004	452	4.74	0.72	0.0377	0.0426	0.95	0.77
2005	497	4.65	0.79	0.0357	0.0338	0.97	0.79
2006	494	6.03	1.11	0.0442	0.0407	1.09	0.87
2007	479	6.09	1.04	0.0652	0.0495	1.48	1.14
2008	272	4.62	0.90	0.0865	0.0711	1.51	1.18
2009	294	6.80	1.27	0.0355	0.0537	0.68	0.63
Whole Sample	5966	4.53	0.77	0.0443	0.0456	0.86	0.63

C. Euro-zone summary statistics

		Market Capitalization		EP Ratio		Stock Turnover Ratio	
Year	N of Stocks	Mean (in $B)	Median (in $B)	Mean	Median	Mean	Median
1995	929	1.45	0.28	0.0531	0.0588	0.25	0.14
1996	976	1.75	0.32	0.0444	0.0573	0.43	0.24
1997	994	2.24	0.40	0.0515	0.0521	0.67	0.40
1998	998	3.21	0.50	0.0491	0.0429	0.73	0.49
1999	991	4.24	0.51	0.0575	0.0497	0.54	0.37
2000	998	4.13	0.57	0.0557	0.0446	0.70	0.45
2001	995	3.38	0.47	0.0618	0.0581	0.56	0.34
2002	990	2.85	0.48	0.0287	0.0563	0.52	0.26
2003	996	4.15	0.71	0.0196	0.0404	0.41	0.23
2004	999	4.98	0.88	0.0314	0.0402	0.49	0.29
2005	993	5.35	0.98	0.0504	0.0506	0.66	0.47
2006	997	7.40	1.56	0.0415	0.0400	0.73	0.50
2007	991	8.67	1.67	0.0528	0.0495	1.02	0.72
2008	993	4.40	0.67	0.1453	0.1191	1.45	0.83
2009	994	5.58	1.01	0.0145	0.0577	0.58	0.37
Whole Sample	14834	4.27	0.66	0.0505	0.0512	0.65	0.37

D. Japan summary statistics

		Market Capitalization		EP Ratio		Stock Turnover Ratio	
Year	N of Stocks	Mean (in $B)	Median (in $B)	Mean	Median	Mean	Median
1995	1414	1.92	0.65	-0.0135	-0.0211	0.23	0.14
1996	1447	1.63	0.50	-0.0171	-0.0257	0.50	0.31
1997	1547	1.16	0.21	0.0143	-0.0339	0.51	0.33
1998	1583	1.29	0.23	0.0384	-0.0253	0.31	0.19
1999	1622	2.47	0.31	0.0221	-0.0290	0.51	0.36
2000	1670	1.66	0.25	0.0040	-0.0335	0.56	0.32
2001	1707	1.24	0.20	0.0895	-0.0253	0.59	0.32
2002	1712	1.15	0.20	0.0326	-0.0423	0.72	0.32
2003	1710	1.65	0.32	-0.0350	-0.0511	0.74	0.39
2004	1744	1.93	0.42	-0.0268	-0.0523	0.95	0.53
2005	1740	2.45	0.55	-0.0330	-0.0404	1.14	0.61
2006	1744	2.53	0.48	-0.0327	-0.0494	1.32	0.82
2007	1730	2.40	0.43	-0.0271	-0.0512	1.53	0.99
2008	1709	1.75	0.35	0.1784	-0.0284	1.87	0.95
2009	1577	1.89	0.37	0.0095	-0.0460	1.00	0.59
Whole Sample	24656	1.82	0.36	0.0139	-0.0375	0.85	0.42

Table 2: Liquidity Quartile Portfolios vs. Size, Value, and Momentum Quartile Portfolios in U.S. Market 1996-2010

For this table, the top 3500 market-cap U.S. stock universe is independently and separately sorted into four quartiles according to each stock's trailing 12-month turnover ratios (liquidity measure) and size / value / momentum measures at the end of each December from 1995 to 2009. Size is ranked by the market cap of stocks. Value/Growth is ranked by the stock's trailing earnings/price ratio. The highest earnings to price quartiles are called high value, and the lowest earnings/price quartiles are called high growth. Momentum is ranked by each stock's trailing 12-month return. Each December we equally weight the 16 liquidity and size / value / momentum intersection portfolios. Reported for each intersection portfolio is geometric average annual return. The "All" columns and rows report the quartile portfolio returns on one dimension, i.e., either by liquidity or by size / value / momentum.

A. Liquidity vs. Size

		Liquidity			
Size	All	1-Low	2	3	4-High
All		13.52%	11.94%	9.57%	7.25%
1-Small	12.37%	14.71%	13.78%	9.71%	4.64%
2	9.97%	12.62%	11.62%	7.88%	5.20%
3	10.81%	12.96%	12.29%	9.64%	7.68%
4-Large	9.86%	12.18%	9.01%	9.99%	8.67%

B. Liquidity vs. Value/Growth

		Liquidity			
Value/Growth	All	1-Low	2	3	4-High
All		13.52%	11.94%	9.57%	7.25%
1-Value	14.87%	17.56%	13.69%	13.35%	11.97%
2	12.01%	12.49%	11.65%	10.88%	11.95%
3	9.21%	11.62%	10.52%	8.51%	6.99%
4-Growth	5.14%	10.05%	9.75%	3.10%	0.75%

C. Liquidity vs. Momentum

		Liquidity			
Momentum	All	1-Low	2	3	4-High
All		13.52%	11.94%	9.57%	7.25%
1-High	8.58%	11.87%	10.42%	6.46%	4.56%
2	11.84%	14.76%	12.95%	8.76%	6.90%
3	12.01%	12.91%	12.95%	12.06%	7.82%
4-Low	9.45%	13.90%	10.65%	9.77%	7.24%

Table 3: International Liquidity Quartile Portfolios vs. International Size, Value, and Momentum Quartile Portfolios 1996-2010

The International liquidity quartile portfolio is composed of the tier-1 Japan stocks on Tokyo Stock Exchange, the top 500 market-cap U.K. stocks, and the top 1000 market-cap Euro-zone stocks. They are independently and separately sorted into four quartiles according to each stock's trailing 12-month turnover (liquidity measure) and size / value / momentum measures by regions, at the end of each December from 1995 to 2009. Stocks in each cell are equally weighted by region. The "All" columns and rows report the quartile portfolio returns on one dimension, i.e., either by liquidity or by size / value / momentum. The international matrix cells are a weighted average of 12.5% U.K. stocks, 50% Euro-zone stocks, and 37.5% of Japanese stocks.

A. Liquidity vs. Size

		Liquidity			
Size	All	1-Low	2	3	4-High
All		8.06%	6.73%	6.40%	1.67%
1-Small	6.33%	9.21%	8.23%	6.03%	-8.95%
2	6.05%	7.72%	6.79%	6.01%	0.07%
3	5.84%	7.38%	5.41%	6.24%	3.12%
4-Large	4.75%	4.60%	4.49%	5.92%	4.37%

B. Liquidity vs. Value/Growth

		Liquidity			
Value/Growth	All	1-Low	2	3	4-High
All		8.06%	6.73%	6.40%	1.67%
1-Value	9.63%	12.19%	9.65%	8.82%	5.72%
2	7.35%	8.39%	6.58%	8.26%	4.83%
3	4.86%	6.55%	6.09%	5.32%	0.88%
4-Growth	0.63%	3.30%	2.80%	1.89%	-4.15%

C. Liquidity vs. Momentum

		Liquidity			
Momentum	All	1-Low	2	3	4-High
All		8.06%	6.73%	6.40%	1.67%
1-High	8.18%	9.54%	8.37%	8.96%	3.52%
2	6.78%	7.80%	7.26%	7.10%	3.53%
3	5.91%	8.34%	5.88%	5.84%	2.08%
4-Low	1.55%	6.75%	3.57%	2.04%	-3.13%

Table 4: Global Liquidity Quartile Portfolios vs. Global Size, Value, and Momentum Quartile Portfolios 1996-2010

The global liquidity quartile portfolio is composed of the top 3500 market-cap U.S. stocks, the tier-1 Japan stocks on Tokyo Stock Exchange, the top 500 market-cap U.K. stocks, and the top 1000 market-cap Euro zone stocks. They are independently and separately sorted into four quartiles according to each stock's trailing 12-month turnover (liquidity measure) and size / value / momentum measures by regions, at the end of each December from 1995 to 2009. Stocks in each cell are equally weighted by region. The "All" columns and rows report the quartile portfolio returns on one dimension, i.e., either by liquidity or by size / value / momentum. The global matrix cells are a weighted average of 60% U.S. stocks, 5% U.K. stocks, 20% Euro-zone stocks, and 15% of Japanese stocks.

A. Liquidity vs. Size

		Liquidity			
Size	All	1-Low	2	3	4-High
All		11.34%	9.86%	8.30%	5.02%
1-Small	9.95%	12.51%	11.56%	8.24%	-0.79%
2	8.40%	10.66%	9.69%	7.13%	3.15%
3	8.82%	10.73%	9.54%	8.28%	5.85%
4-Large	7.81%	9.15%	7.20%	8.36%	6.95%

B. Liquidity vs. Value/Growth

		Liquidity			
Value/Growth	All	1-Low	2	3	4-High
All		11.34%	9.86%	8.30%	5.02%
1-Value	12.77%	15.41%	12.08%	11.54%	9.47%
2	10.15%	10.85%	9.62%	9.84%	9.10%
3	7.47%	9.59%	8.75%	7.24%	4.55%
4-Growth	3.34%	7.35%	6.97%	2.62%	-1.21%

C. Liquidity vs. Momentum

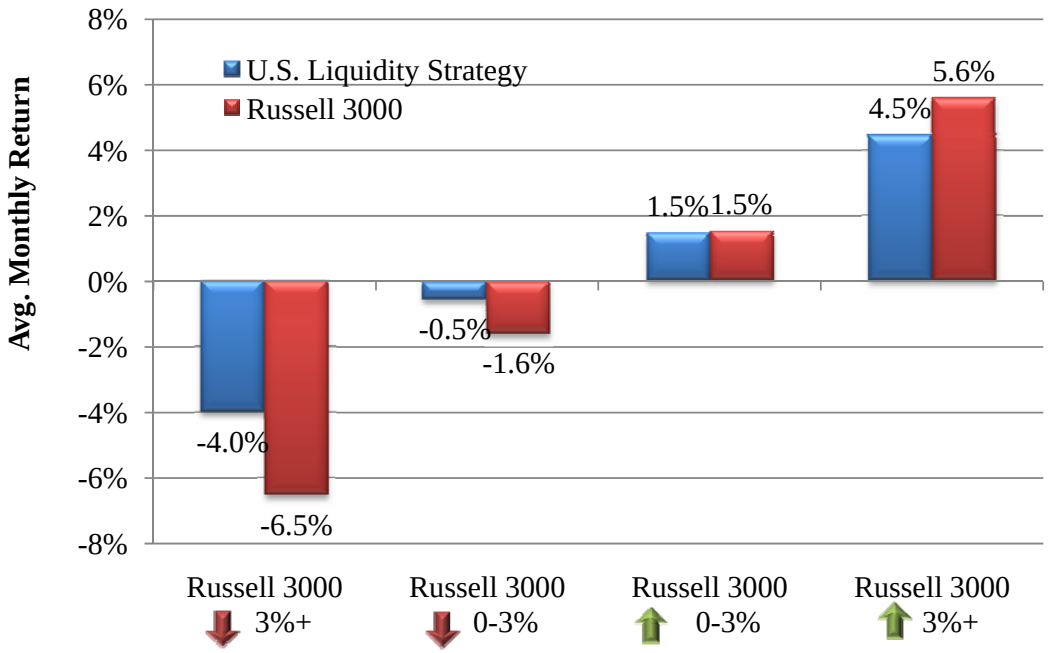
		Liquidity			
Momentum	All	1-Low	2	3	4-High
All		11.34%	9.86%	8.30%	5.02%
1-High	8.42%	10.94%	9.60%	7.46%	4.15%
2	9.81%	11.98%	10.67%	8.10%	5.55%
3	9.57%	11.08%	10.12%	9.57%	5.52%
4-Low	6.29%	11.04%	7.82%	6.68%	3.09%

Table 5: Liquidity Strategy Performances in U.S., Global, and International markets 1996-2010

The period used for this table is from 1996 to 2010. The stock universe is as described in Table 1. Each liquidity strategy is rebalanced at the end of each June and December. The standard deviation is the annualized monthly volatility. The alpha and beta estimates are based on monthly returns, with the adjusted R-square from regressing each strategy's monthly return on the benchmarks. The t-statistics for alpha estimates are in given in square brackets. The Russell 3000 is used as the benchmark of the U.S. Liquidity Strategy. The MSCI World is used as the benchmark of the Global Liquidity Strategy. The MSCI International is used as the benchmark of the International Liquidity Strategy.

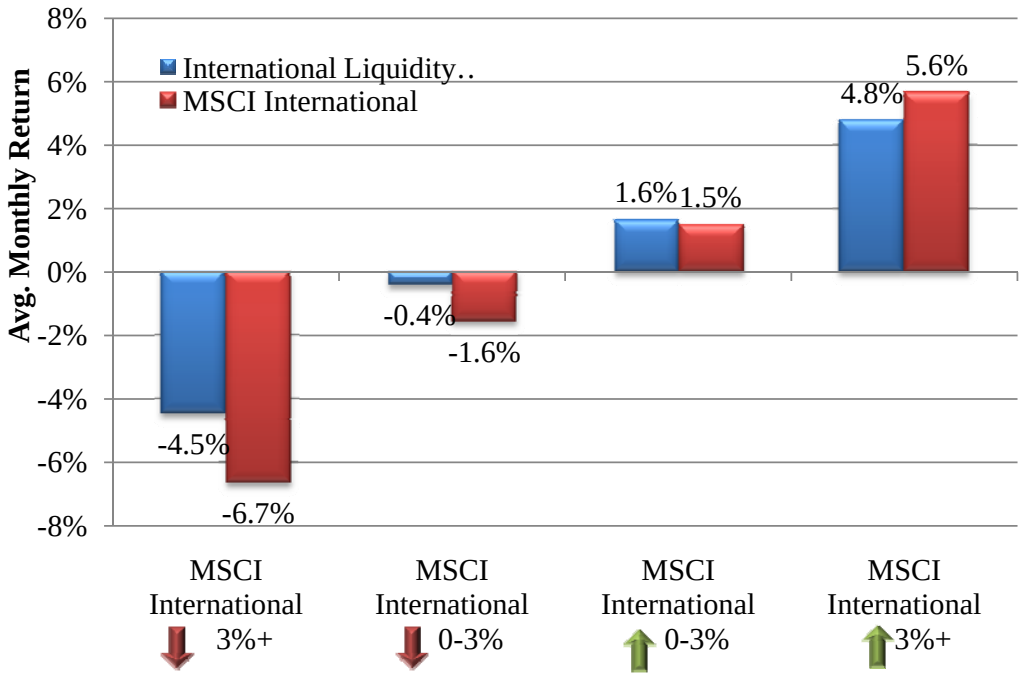
Portfolio Strategies	Annual Geometric Avg.	Annual Arithm. Avg.	Std Dev.	Info Ratio	Monthly Alpha	Beta	Adj. R^2 in mkt regression
U.S. Liquidity	11.35%	12.95%	14.84%	0.44	0.50% [2.62]	0.72	0.65
Russell 3000	7.00%	9.07%	16.64%				
Global Liquidity	12.20%	13.90%	14.15%	0.76	0.60% [3.86]	0.75	0.74
MSCI World	5.96%	8.23%	16.24%				
Intl Liquidity	11.49%	13.72%	14.87%	0.82	0.55% [4.16]	0.78	0.83
MSCI Intl	5.55%	8.19%	17.40%				

Figure 1: Liquidity Return under Different Market Environments in U.S. 1996-2010



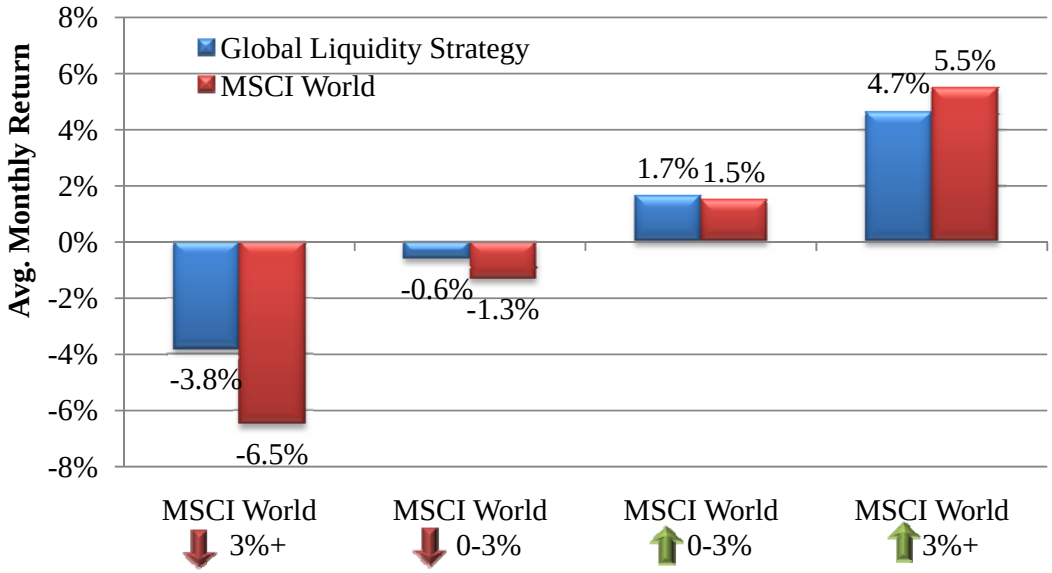
Liquidity Underperforms	5 months	7 months	23 months	41 months
Liquidity Outperforms	31 months	25 months	30 months	18 months
	Downside capture 56.3%		Upside capture 83.1%	

Figure 2: International Liquidity Strategy Return under Different Market Environments 1996-2010



Liquidity Underperforms	3 months	6 months	20 months	34 months
Liquidity Outperforms	34 months	26 months	34 months	23 months
	Downside capture 60.5%		Upside capture 89.8%	

Figure 3: Global Liquidity Returns under Different Market Environments 1996-2010



Liquidity Underperforms	2 months	12 months	18 months	38 months
Liquidity Outperforms	33 months	23 months	38 months	16 months
	Downside capture 56.7%		Upside capture 90.2%	