Liquidity as an Investment Style

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ABSTRACT

We first show that liquidity, as measured by stock turnover or trading volume, is an economically significant investment style that is distinct from traditional investment styles such as size, value/growth, and momentum. We then introduce and examine the performance of several portfolio strategies, including a Volume Weighted Strategy, an Earnings Weighted Strategy, an Earnings-Based Liquidity Strategy, and a Market Cap-Based Liquidity Strategy. Our backtest research shows that the Earnings-Based Liquidity Strategy offers the highest return and the best risk-return tradeoff, while the Volume Weighted Strategy does the worst. The superior performance of the liquidity strategies are due to equilibrium, macro, and micro reasons. In equilibrium, liquid stocks sell at a liquidity premium and illiquid stocks sell at a liquidity discount. Investing in less liquid stocks thus pays. Second, at the macro level, the growing level of financialization of assets in the world makes today's less liquid securities increasingly more liquid over time. Finally, at the micro level, the strategy avoids, or invests less, in popular, heavily traded glamour stocks and favors out-of-favor stocks, both of which tend to revert to more normal trading volume over time.

1. Introduction

We develop an approach to investing in less liquid stocks while under-investing in more liquid stocks. The purpose is to take advantage of the liquidity premium in U.S. publicly traded equity markets. We compare liquidity based portfolios with the three conventional investment styles: size, value/growth, and momentum. That is, since small-cap stocks are known to do better in the long-run than their large-cap counterparts Banz (1980), one can favor small-cap stocks. Since value tends to outperform growth (Fama and French 1993, 1995), an investor can bias against growth. As past winners and losers are likely to repeat their fortunes in the future (Jegadeesh and Titman 1993, 2001), an investor may load up on momentum. There is however one missing style: liquidity investing, which favors less liquid stocks at the expense of more liquid ones.

It is well known in the literature that less liquid assets are discounted in price, while more liquid assets have higher prices for the same set of expected cash flows. Correspondingly, less liquid assets have higher expected returns while more liquid assets have lower expected returns. For example, Ibbotson, Siegel and Diermeier (1984) posit that in equilibrium investors would demand a return for market risk (CAPM), other systematic risks, unsystematic risks where diversification is costly, susceptibility toward taxation, and less liquidity.

Much of the liquidity literature is in the fixed income space where yield spreads of more and less liquid securities from the same issuer can be directly compared. For example, Amihud and Mendelson (1991) and others show that on-the-run treasury yield curves trade at lower yields than comparable off-the-run yield curves. Boudoukh and Whitelaw (1991) find even larger bond treasury spreads in Japan. Liquidity is also shown to affect corporate bond spreads by Fisher (1959) which is later confirmed by many others. Bonds are an especially good place to measure liquidity premiums since bond yields and their spreads provide a direct window into expected returns.

Numerous studies in the alternative space suggest that private equity has higher returns on average than publicly traded equities. Silber (1991) estimates that restricted stock trades at an average discount of about 30% relative to publicly traded stocks. Chen and Xiong (2001) estimate restricted institutional Chinese shares traded at about an 86% discount relative to exchange traded shares for the same companies. The evidence is also quite clear that assets are priced lower, regardless of country or business culture. Thus investors are paid to hold less liquid securities. The recent growth in private equity and venture capital is indicative of the perceived extra expected returns that come with less liquid investment instruments.

There is also an emerging liquidity literature focusing on publicly traded equity markets. Amihud and Mendelson (1986) first demonstrated that less liquid stocks outperform more liquid stocks. Brennan and Subramanyan (1996) use microstructure trading data to further support the connection between stock illiquidity and returns. Datar, Naik and Radcliffe (1998) demonstrate that low turnover stocks on average earn higher future returns than high turnover stocks. Pastor and Stambaugh (2003) and others attribute the higher returns by low-volume stocks to a liquidity risk premium. That is, stocks that have low turnover are less liquid and hence present a liquidity risk for which the investors should be compensated, resulting in lower valuation for a low volume stock.

The negative relation between liquidity and stock returns is not always straight forward. Lee and Swaminathan (1998) show that the return spread between past winners and past losers (i.e., the momentum premium) is much higher among high-volume stocks. Trading volume serves as an indicator of demand for a stock. When a stock falls into disfavor, the number of sellers dominates buyers, leading to low prices and low volume. When a stock becomes popular or glamorous, buyers dominate sellers, resulting in higher prices and higher volume. Thus, relatively low turnover is indicative of a stock near the bottom of its expectation cycle, while a relatively high turnover is indicative of a firm close to the top of its expectation cycle.

While the existing literature has found strong evidence for the liquidity effect in stock returns, no methods have been proposed to form investment strategies by directly incorporating trading volume into portfolio weights so as to take advantage of these research findings. One can include a turnover or volume factor in a multifactor return forecasting model and then form portfolios based on such return forecasts, but this approach may subject the portfolio manager to model estimation risk and the possibility that the future may not turn out to be like the past. Alternatively, one can simply buy some portfolio of low-volume stocks, but such an approach may put a limit on the maximum capacity that can be accommodated as it favors small-cap stocks.

In this article, we propose to overweight less liquid stocks, and underweight more liquid ones, relative to some liquidity-neutral benchmark portfolio weights. Specifically, we use a stock's earnings weight as a reference benchmark. A stock's earnings weight is the stock's weight in the universe that is trading volume-neutral and hence market sentiment-neutral. A stock with a negative liquidity bias has less trading volume share than warranted by its earnings 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 earnings-based liquidity strategy, a stock's portfolio weight is determined by its earnings weight relative to its liquidity. As a result, the portfolio weight for a stock with a positive liquidity bias is lower than its earnings weight, whereas that for a negative liquidity-bias stock is more than its earnings weight.

Our backtests cover the top 3500 stocks in the U.S. market based on market capitalization. The results demonstrate that such a less liquidity portfolio strategy outperforms the earnings weighted, market-capitalization weighted, and volume weighted portfolio strategies as well as standard benchmark indices, 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 styles. Our research also shows that the liquidity investment style goes beyond, and is different from, the size, the value/growth, and the momentum investment styles. 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 outline the basic portfolio strategies under study in this article. Section 3 describes the data sets and stock universe used in this research. Section 4 focuses on showing that the liquidity or turnover factor is different from size, value and momentum. The main backtest results for the liquidity strategies are presented in Section 5. Explanations for why the liquidity approach works, together with a historical account of financialization and its impact on securities market liquidity in the U.S., are given in Section 6. The last section offers concluding remarks.

2. Investment Strategies

The remainder of the article is to study the characteristics of liquidity-biased portfolio strategies in comparison with other known styles. By "liquidity-biased", we mean assigning more weight to less liquid stocks and less weight to stocks that are turned over frequently. To focus our discussion, we define in this section all the portfolio weighting strategies studied in this article.

Suppose there are N stocks in our universe under consideration. For stock n and time t, let En,t be its total earnings in the recent 4 quarters, Cn,t its current market capitalization, and Vn,t the total dollar trading volume in the recent 12 months. Define

$$Et \equiv max\{E1,t, 0\} + max\{E2,t, 0\} + \ldots + max\{EN,t, 0\} ;$$

$$Ct \equiv C1,t + C2,t + \ldots + CN,t\ ;$$

$$Vt \equiv V1,t + V2,t + \ldots + VN,t,$$

where $max\{x, y\}$ means the larger of x and y. Et is thus the sum of positive earnings by all the companies in the universe, where companies with negative earnings are excluded from the calculation at time t, Ct the total market capitalization of all companies, and Et the total dollar volume traded in the recent 12 months by all the stocks in the universe.

Market-cap strategy. A common "index" strategy or "market portfolio" strategy is to assign the same weight to a stock as the stock's market capitalization divided by the total market capitalization of all stocks in the universe, that is, $Cn,t/\ Ct$ is the portfolio weight for stock n. We refer to this passive strategy as the "market-cap strategy". It is at the heart of most standard index funds at Vanguard and other mutual fund firms.

Earnings weighted strategy or fundamental index strategy. Recently, Arnott, Hsu and Moore (2005) introduced a "fundamental index" strategy in which a fundamental variable (such as earnings, sales/revenue, book value, and dividends) is used as the basis to determine how much capital is to be invested in a given stock. For example, an "earnings weighted strategy" is defined by an investment process in which the portfolio weight for any stock n is equal to $En,t\ /\ Et$. Similarly, a "sales weighted strategy", "book value weighted strategy" and a "dividend weighted strategy" can be defined. The key in a fundamental index strategy lies in its value emphasis. As Arnott, et.al. stated, traditional market-cap weighted indices have the unintended bias of buying more of past winners and less of past losers, or "buy high and sell low", which is contrary to value investing. On the other hand, when earnings are used to determine a stock's weight in a portfolio, it is a pure value strategy as the market valuation of the stock does not play any role in determining the portfolio weight.

For our purpose, we choose to stay with earnings, instead of sales, dividend or book value. First, sales or revenue have quite different meanings across industries. For example, an asset management company may not have much sales compared to a retail company or a computer assembly business, but can be more profitable than the latter. Similarly, a financial service firm may not have as much book value as a traditional brick-and-mortar manufacturing business, so book value is not comparable across industries either. Lastly, a dividend weighted strategy has even more limitations since increasingly more companies today choose to pay low or no dividends (Fama and French (2001), which unnecessarily disqualifies too many stocks. Though we exclude a company from the earnings weighted strategy at the time of portfolio formation if it has negative or no earnings in the recent 4 quarters, there are many more companies with positive earnings than with dividends. Furthermore, earnings are generally comparable across firms and industries.

Volume weighted strategy. A portfolio strategy is referred to as a volume weighted strategy if the portfolio weight for a stock n is equal to $Vn,t / Vt$. Hence, the higher a stock's trading volume, the more capital will be allocated to the stock. This approach favors popular glamor stocks that are highly traded and is biased against stocks that don't attract investor attention. It is therefore a "liquidity strategy" or glamour-biased strategy, and serves to fit investors who like to chase popular "hot" stocks. As will be shown, the volume weighted strategy differs from a traditional momentum style.

Earnings-based liquidity strategy. In this case, we assign a positive weight on earnings, but a negative volume weight relative to the earnings. For each stock, $En,t/Et$ is the earnings weight and $Vn,t /Vt$ is the volume weight. Note that Vt /Et measures the market's *volume-to-earnings ratio*, or simply the *V/E ratio*. This V/E ratio indicates how much stock trading there is for each dollar of earnings over a year. For any stock whose V/E ratio, $Vn,t /En,t$, is the same as the market's V/E ratio, Vt /Et, the stock is

given its earnings weight. On the other hand, if any stock is traded "too much", then its liquidity portfolio weight will be lower than its earnings weight. Conversely, if a stock is traded less than the market's average, the stock will be given more than its earnings weight. The liquidity strategy rewards less traded stocks with more weight and penalizes over-traded stocks.

Note that this liquidity strategy has the advantage of potentially low trading impact costs, but still has large capacity as it does not necessarily favor small-cap stocks. A key feature is that it starts with the earnings weight as the basis and adds an illiquidity bias. Therefore, large-cap companies will likely take up most of the portfolio's capital, yet the strategy has a strong bias favoring less traded stocks and thus derives illiquidity benefits.

Market cap-based liquidity strategy. In a similar way, we can also use market-cap weight as the basis to define a liquidity bias. In this case, *[Cn,t /Ct]* is the market capitalization weight. If the volume weight, *Vn,t /Vt* , is more than the stock's market-cap weight, *Cn,t /Ct*, then the stock's portfolio weight will be less than its market-cap weight. In other words, if the stock's *volume-to-market cap ratio, Vn,t /Cn,t,* is higher than the market's overall volume-to-market cap ratio, *Vt /Ct*, the stock will be assigned a lower portfolio weight than its market-cap weight. The volume-to-market cap ratio, *Vn,t /Cn,t*, is equal to the turnover rate when the latter is measured in dollar terms.

A major shortcoming with the market cap-based liquidity bias is that the market capitalization of a company may have already incorporated a liquidity premium. Put differently, if a stock is traded liquidly with much trading volume and high turnover, the stock may already be priced higher because of the high liquidity, resulting in a higher market-cap weight, *Cn,t /Ct*. Thus, the market-cap weight has incorporated at least some of the high volume information, offsetting the information in *Vn,t /Vt* and neutralizing the illiquidity bias. In contrast, any fundamental-based liquidity bias, such

as the earnings-based liquidity bias, is not subject to this shortcoming as the earnings weight is not affected by any market valuation information. Nonetheless, in what follows, we still include the market cap-based liquidity strategy as a comparison.

3. Data Description

Our 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. At each portfolio or group formation time (i.e., the end of June and/or December for each year), the following filters are applied to the databases. First, we include the top 3500 stocks based on market capitalization (which is the stock price times the number of shares outstanding). Second, the per-share price must be at least $2 and the market capitalization must be no less than $10 million. Third, Real Estate Investment Trusts (REITs), warrants, Exchange Traded Tunds (ETFs) , Americus Trust Components, and closed-end funds are all excluded from the study. Lastly, a stock must have available information on dollar trading volume and monthly returns, earnings, number of shares outstanding, and stock price, for the recent 12 months.

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.

For NASDAQ stocks, their trading volume is divided by two before 2001 because of the well known duplicated reporting practice by NASDAQ market makers. After this

adjustment to NASDAQ stock volume, the volume variable is comparable across exchanges.

After these filters are applied, there are not enough stocks remaining in the universe for the earlier years. To ensure a decent stock universe for our analyses, we choose to focus on the period from January 1972 through December 2009. This period covers the oil crisis of 1973 and the resulting "bear market" in the mid 1970's. It also covers the "bull" markets of the 1980s and 1990s, as well as the financial crisis of our current decade.

Table 1 reports summary statistics for the remaining universe, including the number of stocks remaining, the largest, average, median and minimum market capitalization, the number of stocks with positive earnings, and the number of firms with dividend payment, for each year (based on the end of December portfolio formation date). We include the constrained CRSP universe up to a maximum of 3500 stocks.

4. Turnover, size, value and momentum

Different measures of liquidity have been used in the literature. For example, bid-ask spread, market depth, trading volume, price impact per dollar traded have been employed to study the liquidity or illiquidity effect (e.g., Amihud and Mendelson (1986, 1991), Pastor and Stambaugh (2003), Chen, Stanzl and Watanabe (2003)). In general, liquidity refers to the speed at which a large quantity of a security can be traded with a minimal impact on the price and at the lowest cost. All three common measures of liquidity --- trading volume, bid-ask spread, and price impact --- are correlated with each other, and yet they are different. It is hard to come up with one function that captures all three, and each is also highly correlated with company size.

In this article, for the purpose of portfolio formation, we use dollar trading volume (as discussed in Section 2) as a direct measure of liquidity. For other purposes, annual turnover, defined as the number of shares traded divided by the stock's outstanding shares, is employed 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.

First, we contrast liquidity, or turnover, with size. In addition to the academic literature on size as a profitable investment style (Fama and French 1993), 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 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 2 reports the geometric average, arithmetic average annual returns, standard deviation and the average number of stocks in each intersection portfolio. Across the micro-cap quartile, the low-turnover group earns a geometric average return of 17.87% a year while the high-turnover group 5.92% a year. Across the large-cap quartile, the low- and high-turnover groups respectively earn 12.29% and 9.47%, producing a

liquidity effect of 2.82%. 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 turnover quartile. However, it is true that the liquidity effect is the strongest among micro-cap stocks and then declines from micro-to-small to mid- and to large-cap stocks. The micro-caps 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 (e.g., Fama and French (1993, 1995), Zhang (2005)). The recent efforts on fundamental indexation by Arnott, Hsu and Moore (2005) provide further evidence on the popularity of value investing. 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 quateriles, to construct 16 equally-weighted value-turnover portfolios.

The annual return results are reported for the 16 value-turnover portfolios in Table 3.
In this case, among the high-growth stocks, the low-turnover stock portfolio has a compounded annual return of 11.36% while the high-turnover stock portfolio 3.32%. For high value stocks, low turnover stocks have a 20.65% return, while high turnover stocks have a return of 12. 33%. Both value and liquidity are distinctly different ways of picking stocks. The best return comes from combining high-value with low-turnover stocks, while the worst return comes from high growth stocks with high turnover.

Finally, we contrast turnover with momentum. Jegadeesh and Titman (1993, 2001), followed by many other scholars (e.g., Chan, Jegadeesh and Lakonishok (1996), Griffin, Ji and Martin (2003), Grundy and Martin (2001), and Rouwenhorst (1998)), 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 4 two dimensional portfolios based on independent sorting of the stock universe according to past 12-month stock returns (momentum) and turnover. The independent sorts are done in the same way as Table 2 and 3.

The highest compound annual return, 16.85%, is achieved by buying mid-higher momentum low-turnover stocks, while the lowest return, 5.29%, is for the low-momentum high-turnover stocks. Again, momentum and liquidity are different stock-picking styles and not substitutes for one another. A better way is to combine the two investment styles and pick stocks that have high momentum but low turnover.

5. Backtest Results for Liquidity Investing

In this article, we choose to focus on "passive" investment strategies, in the sense that they are designed to take advantage of certain easily observable stock attributes. These attributes are converted into a stock's portfolio weight in a way that is as "passive" and as simple as possible. The market-cap weighted, volume weighted, earnings weighted, earnings-based liquidity, and market cap-based liquidity strategies are all in this category of "passive" investment approaches, as each of them relies on no more than the simple weighting of publicly available market cap, volume and earnings information. The ways in which these variables are weighted or used to form the various portfolio weighting strategies are of course influenced by academic findings, but this is the only

extent to which there is an element of non-passiveness in these strategies. Nonetheless, they can be viewed as "style index" strategies.

We now turn to examining the performance of these different portfolio weighting strategies. The test period is from January 1972 to December 2009 with the same universe including up to the top 3500 stocks based on market cap and after applying filtering rules such as $10 million minimum market-cap and $2 minimum per-share price. Table 5 displays past performance results when the five strategies are applied at the end of each June from 1972 to 2009.

First, the geometric annual return is the highest, 12.76%, for the Earnings-Based Liquidity Strategy, 11.42% for the Earnings Weighted Strategy, 10.25% for the Market Cap-Based Liquidity Strategy, 10.01% for the Market-Cap Weighted Strategy, and 9.48% for the Volume Weighted Strategy. Thus, the excess return is 1.34% by the Earnings-Based Liquidity over the Earnings Weighted Strategy. Adding the earnings-based illiquidity bias helps improve the performance of value investing. The Market Cap-Based Liquidity Strategy adds some excess return to the Market-Cap Weighted Strategy, but in this case the magnitude of the difference is smaller. The Volume Weighted Strategy has the worst return, implying that buying more of heavily traded stocks lowers investment returns. Popular glamour stocks that are heavily traded hurt performance.

Second, volatility or standard deviation is between 16.87% and 18.50% across the strategies, except that the Volume Weighted Strategy's volatility is 21.53%. Therefore, biasing investments to favor liquid and high-volume stocks not only gives the lowest return but also leads to the highest volatility. This can be seen by the information ratio (relative to a cash benchmark), which is 0.82 (the highest) for the Earnings-Based Liquidity Strategy, 0.69 for the Market-Cap Weighted Strategy, and 0.64 (the lowest) for the Volume Weighted Strategy. For the S&P 500, the information ratio is 0.63.

Third, the beta relative to the S&P 500 is 1.17 (the highest) for the Volume Weighted, and 0.76 (the lowest) for the Earnings-Based Liquidity Strategy. The latter strategy is least correlated with the lowest systematic risk. To further see this, Table 5 gives the adjusted R-square from regressing each strategy's monthly return on the S&P 500 monthly return. This serves as an indicator of how much a strategy's return can be explained by market-wide movements: the lower the adjusted R-square, the more different the strategy is from the market. The Earnings-Based Liquidity Strategy again has the lowest R-square of 0.70, whereas the Market-Cap Weighted Strategy's R-square is the highest at 0.98. The R-square for the Market Cap-Based Liquidity Strategy is 0.85, which supports our earlier conjecture that the market cap-based illiquidity bias is not ideal because the market-cap weight already has a liquidity premium incorporated into it.

Fourth, the Volume Weighted Strategy has a monthly alpha of –0.17% (the worst again) although the t-statistic is not significant because it is so highly correlated with the big stock universe. The Earnings-Based Liquidity Strategy has a monthly alpha of .38% (the highest) with a t-statistic of 3.58 (for an annualized alpha of 4.66%). It is interesting to note that the Market-Cap Weighted Strategy has a negative alpha as well. The Earnings-Based Liquidity Strategy adds to the alpha for the Earnings Weighted Strategy. The earnings-based illiquidity bias thus improves performance.

For the Market Cap-Based Liquidity Strategy, its monthly alpha is .11%, which is 1.69% higher than the Market-Cap Weighted Strategy's alpha when annualized. Therefore, even the market cap-based illiquidity bias adds significant value.

Finally, Figure 1 shows the cumulative returns starting with $1 at the beginning of 1972 and ending at the end of 2009, where all dividends are re-invested. Not surprisingly, the Earnings-Based Liquidity Strategy does the best, followed by the Earnings Weighted

Strategy, the Market Cap-Based Liquidity, the S&P 500 index, while the Volume Weighted has the worst cumulative performance. Going after the most popular stocks does not pay, and investing in illiquidity does.

Note that the Earnings-Based Liquidity Strategy combines two investment styles or factors: value and liquidity. The first component in a stock's portfolio weight is its earnings weight. Therefore, this strategy first favors the value style. The illiquidity bias makes the strategy favor stocks that have high earnings but a trading volume less than what its earnings would imply. The strategy bets more heavily in value stocks that have a low volume-to-earnings ratio, and it hence goes beyond fundamental value investing. And it pays to do so. As noted earlier, this way of value + liquidity investing is simple and easy to implement and free of model estimation risks.

6. Why Investing in Liquidity Pays?

Having demonstrated the superior performance by the Earnings-Based Liquidity Strategy, we are led to ask the "why" question. We would also like to know whether this superior performance will continue into the future, that is, if one applies this portfolio technology to managing investments in the future, can one expect the outperformance to continue? There are at least three reasons for the earnings-based illiquidity bias to add value. We refer to these reasons as the equilibrium, macro, and micro arguments.

First, there is the *equilibrium* argument. By investing in illiquidity, the strategy serves as a liquidity provider and hence is compensated. In a classic study, for example, Diamond and Dybvig (1983) show that depositors and consumers face intrinsic liquidity shocks and hence will need to have enough flexibility to convert their investments and other savings assets into cash on a short notice. Hence, depositors and consumers face "liquidity risk", because of which they are willing to pay more for liquid investment

vehicles. Ibbotson, Siegel and Diermeier (1984) demonstrate that a premium has to be paid for any characteristic that investors demand, and a discount must be given for any characteristic investors seek to avoid. Investors like liquidity and dislike illiquidity. The liquidity premium makes liquid securities priced higher than otherwise, which means that liquid securities have lower expected future returns. By the same logic, illiquid or less liquid securities are valued lower, resulting in a higher expected return for these securities. Therefore, when the Earnings-Based Liquidity Strategy invests more heavily in less liquid value stocks, the strategy is rewarded with higher future returns because it provides liquidity to the market by being more willing to take larger positions in illiquid stocks.

Second, there is a *macro* argument concerning aggregate trading volume. As 19th century economist Walter Bagehot and early 20th century economist John Hicks observed, the contribution by financial development to England's industrialization was that it facilitated the mobilization and liquification of capital for "immense works." Levine (1997) and the many economic studies reviewed therein state that a key role played by financial development is to make otherwise illiquid or hard-to-move assets more liquid. Once capital and assets are made more liquid, the allocation of capital can be done more efficiently and in a larger scale, which creates economic value.

As a result of the financial revolution in America and beyond, more and more assets and future cashflows have been converted into financial capital that can be used or put into new investments today. Figure 2 shows that the total value of financial claims circulated and traded in the U.S. was $64 billion in 1900, $7.6 trillion in 1975, $23.5 trillion in 1985, but $128.5 trillion in 2006! In 1975, the total value of financial claims was roughly 4.2 times the U.S. GDP. But this ratio had risen to 10 by 2006, that is, for each dollar of GDP, $10 worth of financial claims is being floated and traded. As the supply of financial capital increases in the U.S. and from abroad, the liquidity of securities of all kinds has to rise. Figure 3 illustrates the evolution of average annual

turnover rate for the New York Stock Exchange stocks: the annual turnover was 20% in 1970, 60% in 1993, and 120% in 2005. The recent turnover rates are now over 200%. Trading volume is a proxy for the demand for stocks. It is, however, the least liquid stocks that receive the biggest benefit. Such rising liquidity makes past illiquid stocks valued relatively more today.

Finally, there is a *micro* argument about what happens to the trading volume of individual stocks. Trading volume is often viewed by traders and investors as an indicator of investor demand or the degree of the stock's popularity. If there is too much demand for a stock and the stock becomes glamorous, the trading volume will be high and turnover will be extraordinary too, pushing the stock price higher than justified by fundamentals. Conversely, a low volume-to-earnings ratio implies an unjustified low demand for a stock, likely causing the stock price to be too low. Therefore, by avoiding or investing less in stocks that are popular and traded heavily and putting more capital in low volume-to-earnings stocks, the Earnings-Based Liquidity Strategy reduces its exposure to speculative fever risk and puts more weight on the "diamonds in the rough." Because the demand for stocks is not stable, the level of trading volume migrates over time. Fama and French (2009) show that a similar (but slower) migration takes place for size and value stocks. This migration causes much of the excess return for all the style categories.

The above three sources of extra return for illiquid stocks are not expected to disappear in the future. Liquidity will continue to be valued high, and illiquid stocks will still come at a discount. As the American style financial capitalism spreads to Western Europe, Eastern Europe, Asia and Latin America, the global supply of financial capital and liquidity will only grow more in the future. Furthermore, there will always be glamour stocks and overlooked value stocks, but they will migrate over time. For these reasons, the liquidity investment style is likely to continue to outperform.

7. Conclusions

We show that liquidity is a style that is different from size, value/growth or momentum. Liquidity can potentially be combined with any of the other traditional styles.

We develop a Volume Weighted Strategy, an Earnings-Based Liquidity Strategy and a Market Cap-Based Liquidity Strategy, and investigate their respective relative performance compared to traditional investment styles. A major advantage of the approach of relying on easily observable stock attributes and financials is that these strategies are easy and simple to implement. Our backtest results demonstrate that the Earnings-Based Liquidity Strategy adds significant performance to the Earnings Weighted Strategy and outperforms all the other strategies as well. It has the highest returns and information ratio (relative to cash).

Given the above findings, one can combine turnover, size, value and momentum in a model to predict future returns for individual stocks. The excess returns associated with such a strategy can be characterized as either alpha or beta. It has often been said that as alpha gets better understood it becomes beta. Thus liquidity can be considered as an investment style (which makes it more of a beta strategy) or as an undiscovered source of excess return (which makes it an alpha). One can look at liquidity strategies either way.

The equilibrium, macro, and micro reasons for the success of the liquidity strategy apply to a wide variety of financial environments. Although we only test the strategy in the U.S., it is likely to work all around the world. 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 substantial impact on their past and future returns.

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Table 1: Summary Statistics of Stock Universe by Year

This table reports summary statistics for stocks that meet our criteria for data selection, including $10 million minimum market capitalization, $2 minimum per-share price, no REITs, no ETFs, and no warrants. Market capitalization is based on the end of December information, in thousands of dollars.

Year	Number of Stocks	# of Stocks with Positive Earnings	Market Capitalization			
			Mean	Median	Max	Min
1972	1600	1532	502,031	98,906	46,700,742	10,076
1973	1407	1392	431,897	85,070	35,831,555	10,033
1974	1200	1188	351,073	85,565	24,395,952	10,074
1975	1410	1350	418,093	85,366	33,289,240	10,021
1976	1415	1360	484,405	98,124	41,999,101	10,013
1977	1672	1622	436,541	99,438	40,333,319	10,094
1978	1687	1642	450,426	109,467	43,524,285	10,001
1979	1717	1664	522,191	133,542	37,568,928	10,076
1980	1737	1649	675,804	169,442	39,625,900	10,010
1981	1529	1456	602,443	162,674	47,887,595	10,289
1982	1708	1508	730,469	192,988	57,981,578	10,007
1983	2999	2551	545,768	117,485	74,508,450	10,078
1984	2935	2661	547,308	112,113	75,436,964	10,010
1985	2960	2562	695,778	137,403	95,607,154	11,296
1986	2864	2421	794,650	140,210	72,710,760	12,649
1987	2726	2401	833,095	138,062	69,815,361	12,709
1988	2938	2572	855,124	142,760	72,165,478	13,834
1989	2829	2465	1,081,521	169,456	62,581,600	17,100
1990	2491	2200	1,117,723	174,287	64,528,989	15,211
1991	2799	2328	1,317,937	200,802	75,653,015	20,394
1992	3204	2637	1,277,451	204,306	75,884,426	22,518
1993	3500	2927	1,317,267	228,060	89,451,558	30,280
1994	3500	3085	1,315,332	240,154	87,192,660	35,856
1995	3500	3082	1,780,163	328,957	120,259,800	58,829
1996	3500	3085	2,159,952	421,136	162,789,876	78,885
1997	3500	3106	2,849,404	520,956	240,136,270	107,100
1998	3500	3001	3,498,592	478,120	342,558,125	78,948
1999	3277	2650	4,633,115	553,898	602,432,919	88,355
2000	2891	2357	5,060,045	711,380	475,003,196	80,438
2001	3093	2331	4,148,922	643,734	398,104,758	71,484
2002	2839	2352	3,584,914	584,559	276,630,832	57,830
2003	3370	2724	4,023,952	701,380	311,065,838	75,462
2004	3392	2927	4,473,351	818,295	385,882,855	85,460
2005	3331	2900	4,796,643	886,571	370,344,145	90,435
2006	3332	2918	5,348,328	998,454	446,943,539	102,655
2007	3490	2936	5,253,306	836,437	511,887,120	95,836
2008	3017	2550	3,610,997	606,571	406,067,190	56,810
2009	3217	2275	4,353,958	731,178	322,668,125	72,453
Whole Sample	102,076	88,367	2,337,821	328,511	602,432,919	10,001

Table 2: Two-Dimensional Quartile Portfolios by Size and Turnover

For this table, the top 3500 market-cap stock universe is independently and separately sorted into 4 quartiles according to each stock's market cap and trailing 12-month turnover, at the end of each December from 1972 to 2009. Then we take the 16 intersection portfolios between the size and the turnover quartiles. The stocks in each intersection cell form an equally weighted portfolio for the next 12 months. Reported for each intersection portfolio are geometric average annual return, arithmetic average annual return, return standard deviation, and average number of stocks in each cell.

Quartiles		Low Turnover	Mid-Low	Mid-High	High Turnover
Micro-Cap	Geom. Avg	17.87%	16.90%	13.32%	5.92%
	Arithm. Avg	20.34%	20.05%	17.17%	11.75%
	Std Dev	23.49%	26.01%	28.93%	36.53%
	Avg No. Stocks	234	166	135	127
Small-Mid	Geom. Avg	16.49%	14.80%	11.34%	6.07%
	Arithm. Avg	18.14%	17.21%	14.29%	10.25%
	Std Dev	19.57%	23.20%	25.37%	29.78%
	Avg No. Stocks	184	158	153	168
Large-Mid	Geom. Avg	14.82%	14.12%	12.52%	9.14%
	Arithm. Avg	16.34%	15.82%	15.11%	12.78%
	Std Dev	18.55%	19.31%	24.01%	27.97%
	Avg No. Stocks	149	155	169	190
Large-Cap	Geom. Avg	12.29%	11.37%	11.36%	9.47%
	Arithm. Avg	13.64%	12.79%	13.21%	12.74%
	Std Dev	16.87%	17.35%	19.41%	25.55%
	Avg No. Stocks	95	185	207	176

Table 3: Two-Dimensional Quartile Portfolios by Value/Growth and Turnover

For this table, the top 3500 market-cap stock universe is independently and separately sorted into 4 quartiles according to each stock's trailing earnings/price ratio (value versus growth measure) and trailing 12-month turnover, at the end of each December from 1972 to 2009. The lowest earnings/price quartiles are called high growth and mid growth, and the highest earnings to price quartiles are called high value and mid-value. Then we take the 16 intersection portfolios between the value/growth and the turnover quartiles. The stocks in each intersection cell form an equally weighted portfolio for the next 12 months. Reported for each intersection portfolio are geometric average annual return, arithmetic average annual return, return standard deviation, and average number of stocks in each cell.

Quartiles		Low Turnover	Mid-Low	Mid-High	High Turnover
High-Growth	Geom. Avg	11.36%	11.16%	7.41%	3.32%
	Arithm. Avg	14.13%	14.47%	11.52%	8.84%
	Std Dev	23.68%	26.59%	29.62%	34.67%
	Avg No. Stocks	130	148	175	211
Mid-Growth	Geom. Avg	13.60%	12.03%	10.39%	7.60%
	Arithm. Avg	15.13%	13.72%	12.71%	11.20%
	Std Dev	18.43%	18.76%	21.96%	26.98%
	Avg No. Stocks	150	174	178	162
Mid-Value	Geom. Avg	15.51%	14.75%	13.29%	12.12%
	Arithm. Avg	17.08%	16.41%	15.65%	15.45%
	Std Dev	19.12%	19.43%	22.39%	26.36%
	Avg No. Stocks	195	181	159	127
High-Value	Geom. Avg	20.65%	17.88%	16.90%	12.33%
	Arithm. Avg	22.63%	20.15%	19.48%	16.16%
	Std Dev	21.63%	22.36%	24.03%	28.34%
	Avg No. Stocks	188	161	151	160

Table 4: Two-Dimensional Quartile Portfolios by Momentum and Turnover

For this table, the top 3500 market-cap stock universe is independently and separately sorted into 4 quartiles according to each stock's trailing 12-month return (momentum measure) and trailing 12-month turnover, at the end of each December from 1972 to 2009. Then we take the 16 intersection portfolios between the momentum and the turnover quartiles. The stocks in each intersection cell form an equally weighted portfolio for the next 12 months. Reported for each intersection portfolio are geometric average annual return, arithmetic average annual return, return standard deviation, and average number of stocks in each cell.

Quartiles		Low Turnover	Mid-Low	Mid-High	High Turnover
Low Momentum	Geom. Avg	14.06%	10.38%	9.61%	5.29%
	Arithm. Avg	16.58%	13.70%	12.99%	10.09%
	Std Dev	24.22%	26.72%	27.13%	32.85%
	Avg No. Stocks	107	126	164	267
Mid-Low	Geom. Avg	15.08%	14.24%	13.50%	8.94%
	Arithm. Avg	16.98%	16.09%	15.80%	12.25%
	Std Dev	20.78%	20.29%	22.38%	26.34%
	Avg No. Stocks	190	184	167	124
Mid-High	Geom. Avg	16.85%	15.36%	12.52%	9.07%
	Arithm. Avg	18.53%	16.97%	14.65%	12.42%
	Std Dev	19.51%	18.76%	21.38%	26.03%
	Avg No. Stocks	204	189	162	109
High Momentum	Geom. Avg	16.76%	15.16%	12.67%	10.59%
	Arithm. Avg	18.84%	17.35%	15.75%	14.74%
	Std Dev	21.17%	22.08%	25.67%	29.87%
	Avg No. Stocks	161	166	169	161

Table 5: Investment Performance by Different Strategies

The period used for this table is from 1972 to 2009. The stock universe construction is as described in Table 1. The investment strategies are defined as follows. Each stock's weight in the Market-Cap Weighted Strategy is equal to its market capitalization divided by the total market capitalization value of all stocks; In the Volume Weighted Strategy, each stock's portfolio weight is equal to its trading volume divided by the total dollar trading volume of all stocks ("volume weight"); In the Earnings Weighted Strategy, each stock's portfolio weight is equal to its earnings divided by the total earnings of all stocks ("earnings weight"); In the Earnings-Based Liquidity Strategy, each stock's earnings weight is decreased by its relative trading volume ; In the Market Cap-Based Liquidity Strategy, each stock's market cap weight is decreased by its relative trading volume. Each strategy is rebalanced at the end of each June and December. The alpha and beta estimates are based on monthly returns, with the adjusted R-square from regressing each strategy's monthly return on the S&P 500. The t-statistics for alpha estimates are in given in square brackets.

Portfolio Strategies	Annual Geometric Avg.	Annual Arithm. Avg.	Std Dev.	Avg Return to Std Dev Ratio	Monthly Alpha	Beta	Adj. R^2 in mkt regression
Market Cap Weighted	10.01%	11.71%	18.50%	0.63	-0.03%	1.01	0.98
					[-0.94]		
Volume Weighted	9.48%	11.81%	21.53%	0.64	-0.17%	1.17	0.92
					[-2.34]		
Earnings Weighted	11.42%	12.98%	17.84%	0.7	0.12%	0.96	0.95
					[2.52]		
Earnings-based Liquidity	12.76%	14.15%	17.31%	0.82	0.38%	0.76	0.7
					[3.58]		
Mkt Cap-based Liquidity	10.25%	11.61%	16.87%	0.69	0.11%	0.85	0.92
					[2.08]		
S&P 500	10.02%	11.70%	18.53%	0.63	0	1	1

Figure 1: Cumulative Investment Returns across Strategies 1972 – 2009

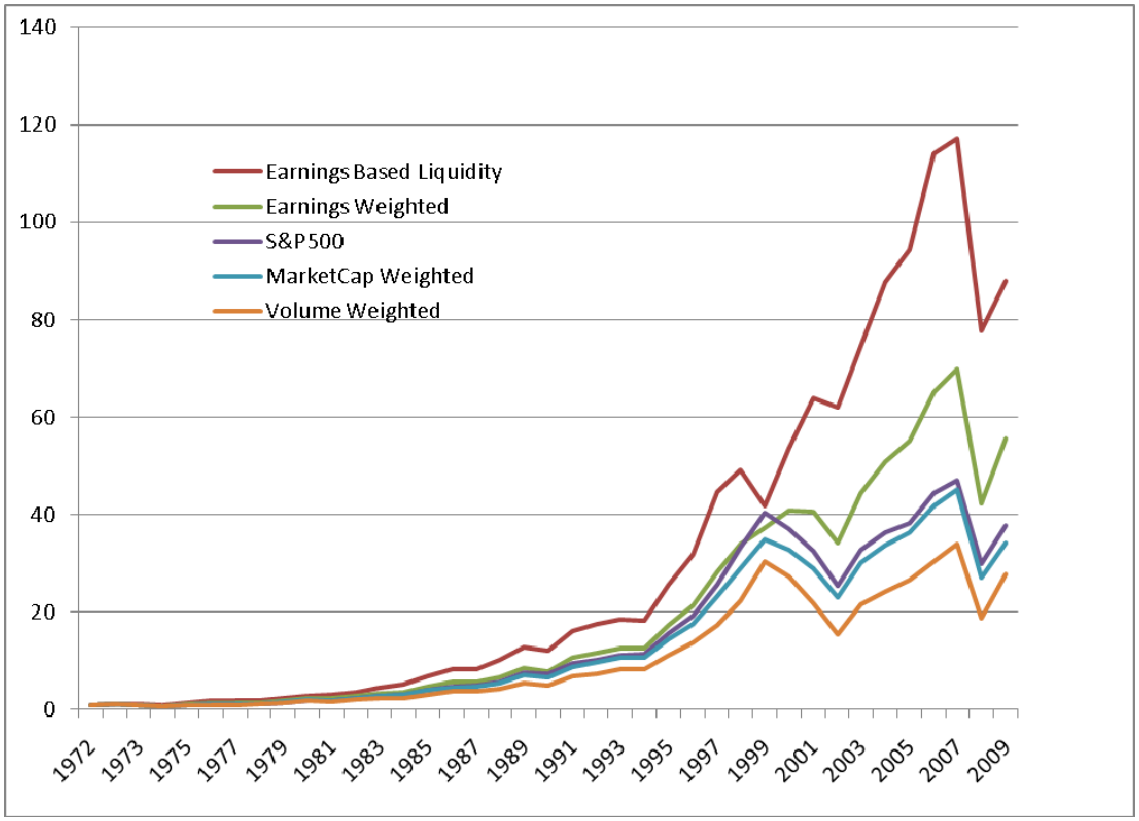
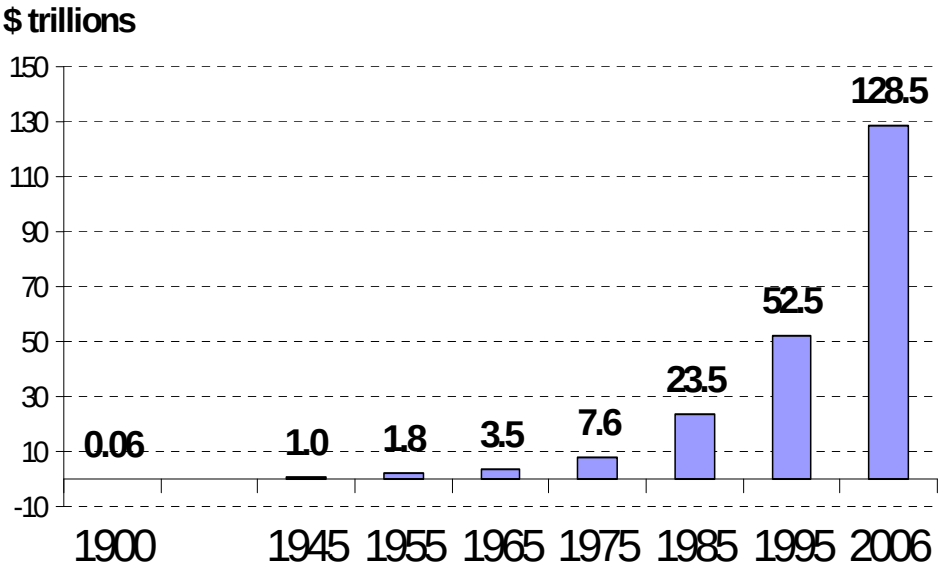
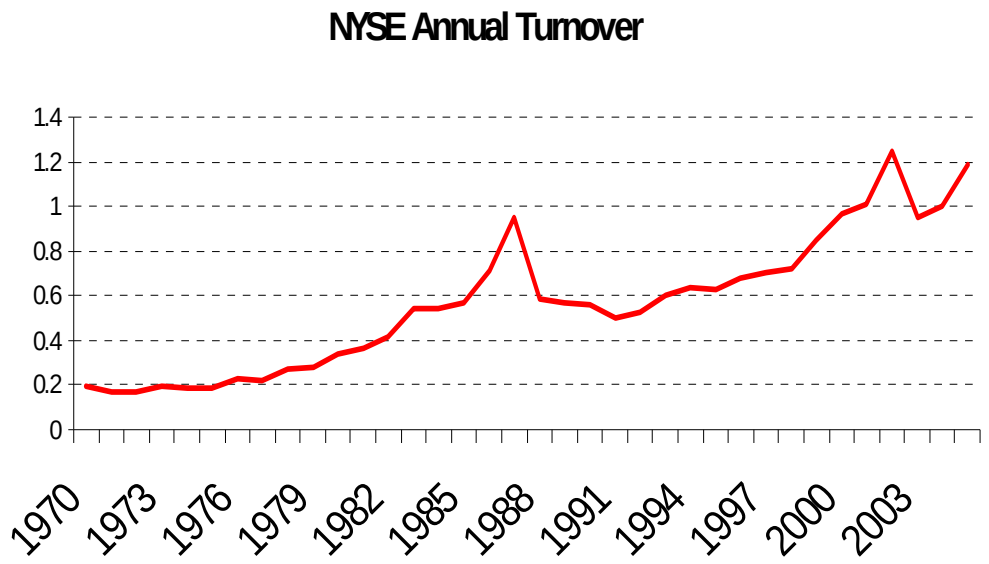


Figure 2: A Century of American Financial Revolution: Total value of all financial claims outstanding



Sources: For year 1900, Goldsmith (1969), Financial Structure and Development. For post-1945 years, the Federal Reserve Flow-of-Funds, various years.

Figure 3: Increasing Financialization Makes Markets More Liquid



Data source: University of Chicago Center for Research in Security Prices.