Liquidity as an Investment Style

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ABSTRACT

This paper develops an Earnings-Based Liquidity Strategy that invests in both value and illiquidity[2]. 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 Earnings-Based Liquidity Strategy is due to equilibrium, macro, and micro reasons. In equilibrium, liquid stocks sell at a liquidity premium and illiquid stocks sell at an illiquidity discount. Investing in illiquid stocks thus pays. Second, at the macro level, since higher supply of overall financial capital makes all stocks more liquid, the strategy benefits from the growing level of financialization of assets in the world, which increases the global supply of financial capital, making today's less liquid securities increasingly more liquid over time. Other things equal, this trend implies higher future valuations for today's illiquid stocks. 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, earnings-adjusted trading volume over time.

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[1] Both authors are Professors of Finance at the Yale School of Management and founding partners of Zebra Capital Management. We would like to thank Wendy Hu and Denis Sosyura for their wonderful research assistance. Any remaining errors are the authors' responsibility.

[2] A patent application is pending for the various versions of the liquidity strategy developed by the authors in this and other work.

1. Introduction

The purpose of this article is two-fold. First, we develop a public-equity investment approach that favors less liquid stocks at the expense of under-investing in more liquid ones. Second, we investigate the performance characteristics of such a strategy when applied to the U.S. equity market. Among investment practitioners and academics, the focus has often been on one, or a combination of, three investment styles/approaches: 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, one can favor small-cap stocks. Since value tends to outperform growth, an investor can bias against growth (Fama and French 1993, 1996). As past winners and losers are likely to repeat their fortunes in the future, an investor may load up on past winners and bias against past losers (Jegadeesh and Titman 1993, 2001). There is however one missing style: liquidity investing, that is, to favor less liquid stocks at the expense of more liquid ones.

It is well known in the literature that less liquid (i.e., less traded) stocks outperform popular and more heavily traded glamorous stocks. Conrad, Hameed and Niden (1994) use weekly data to show that past trading volume can explain some of the short-term price reversal patterns in stock price movements. Datar, Naik and Radcliffe (1998) demonstrate that low-volume stocks on average earn higher future returns than high-volume stocks, where turnover is used as a measure of a stock's trading volume that is comparable across stocks. Like a later study by Pastor and Stambaugh (2003), Datar et al (1998) attribute the higher returns by low-volume stocks to a liquidity risk premium. That is, according to the liquidity hypothesis, 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. However, in another study, Lee and Swaminathan (1998) show that the liquidity hypothesis is not totally consistent with their evidence. They study the joint interaction between past stock price momentum and trading volume. In particular, they find

that the return spread between past winners and past losers (i.e., the momentum premium) is much higher among high-volume stocks: between 1965 and 1995, a strategy of buying high-volume winners and selling short high-volume losers can outperform a similar momentum strategy using price returns alone by 1.8% to 2.7% per year. Lee and Swaminathan (1998) propose an Expectations Life Cycle Hypothesis, that is, trading volume serves as an indicator of investor interest in the stock: when a stock falls into disfavor, the number of sellers dominates buyers, leading to low trading volume, whereas 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. They find that among past losers, low volume is a particularly useful signal suggesting that the stock has "bottomed out", with upward price movement being the more likely to occur going forward. Based on their reasoning, high-volume losers still have plenty of negative price momentum and hence more downside to continue.

Not withstanding the Lee-Sawminathan (1998) Expectations Life Cycle Hypothesis, theory and empirical work on financial development have made it abundantly clear that one fundamental role played financial markets is to make otherwise illiquid assets liquid. That is, through the financialization of physical assets and otherwise non-tradable future cashflows, securities markets make such value and wealth more liquid, which in turn makes capital more productive and easier to allocate across competing projects. This process of financialization therefore creates more value out of the same amount of wealth or value. Since liquidity creation is at the center of financial development and since value creation comes with increased liquidity, liquid stocks should be priced higher than illiquid ones.[3] In

[3] See Levine (1997) and references therein for a good review of the financial development literature. The importance and contributions of financial development for economic growth and value creation have long

a relatively small literature, illiquidity discounts in security valuation have been documented. For example, Silber (1991) shows that in the U.S. Rule 144 stocks with a two-year no-trading restriction have an average price discount of 35% relative to the freely traded, otherwise identical, common shares of the same company. On the U.S. bond market, Amihud and Mendelson (1991) and Kamara (1994) document that the average yield spread between illiquid Treasury notes and liquid Treasury bills of the same maturity is more than 35 basis points. According to Boudoukh and Whitelaw (1991), the yield spread is more than 50 basis points between the designated benchmark government bond and similar but less liquid government bonds in Japan. For stocks in China, Chen and Xiong (2001) find that the average discount for restricted legal-person shares relative to their otherwise identical freely-tradable shares issued by the same company is 86%, where the legal-person shares can only be held by legal-person corporations and cannot be traded on any open market. The evidence is thus quite clear that securities of less liquidity are priced lower, regardless of country and business culture. Thus, investors are paid to hold illiquid securities. The recent growth trend in private equity and venture capital funds is also indicative of the extra returns that come with less liquid investment instruments.

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

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been at the center of economic debate. Levine (1997) reviews the theories that have been proposed and empirical evidence that has been found in support of the financial development-economic growth linkage.

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, where the earnings weight is equal to the stock's trailing four-quarters' earnings divided by the sum of earnings across all stocks in the relevant universe. A stock's earnings weight is the stock's weight in the universe that is trading volume-neutral and hence market sentiment-neutral. The volume weight is determined by the stock's total dollar trading volume in the recent 12 months divided by the sum of dollar trading volume over the same period across all stocks in the universe. A stock with a positive illiquidity 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 negative illiquidity 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 plus the illiquidity bias. As a result, the portfolio weight for a stock with a positive illiquidity bias is higher than its earnings weight, whereas that for a negative illiquidity-bias stock is less than its earnings weight. For the top 3500 stock universe based on market capitalization and for the period from 1972 to 2005, our backtest results demonstrate that such a 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 liquidity strategy offers similar 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 datasets 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 fincialization 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 illiquidity-biased portfolio strategies in comparison with other known styles. By "illiquidity-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 Vangard 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. We are the first to propose such an investment strategy.

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, $E_{n,t}/E_t$ is the earnings weight and $V_{n,t}/V_t$ is the volume weight.

Note that V_t/E_t 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, $V_{n,t}/E_{n,t}$, is the same as the market's price earnings ratio, V_t/E_t, 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 an illiquidity bias. In this case, $[C_{n,t}/C_t]$ is the market capitalization weight. If the volume weight, $V_{n,t}/V_t$, is more than the stock's market-cap weight, $C_{n,t}/C_t$, 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,* $V_{n,t}/C_{n,t}$, 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. In general, the volume-to-market cap ratio is more influenced by market valuation than the share volume-based turnover rate.

A major shortcoming with the market cap-based illiquidity 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 illiquidity bias, such as the earnings-based illiquidity 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 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 2005. 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 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).

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 spread, 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/illiquidity 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 illiquidity 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 June 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 small-cap quartile, the low-turnover group earns a geometric average return of 16.05% a year while the high-turnover group 3.26% a year, resulting in a liquidity effect of 13.79% a year. Across the large-cap quartile, the low- and high-turnover groups respectively earn 11.92% and 9.23%, producing a liquidity effect of 2.69%. 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. However, it is true that the liquidity effect is the strongest among small-cap stocks and then declines from small- to mid- and to large-cap stocks. A strategy of buying low-turnover small-cap stocks produces the highest compound annual return of 16.05%.

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, 1996), Zheng (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 low-value (or, high-growth) stocks, the low-turnover stock portfolio has a compounded annual return of 11.3% while the high-turnover stock portfolio 4.1%, resulting in a liquidity effect of 7.2% a year. The highest liquidity effect is achieved among high-value stocks: an annual return differential of 11.08% between low- and high-turnover stocks. That is, the liquidity effect is stronger as we move from low- to high-value stocks. Therefore, value and liquidity are distinctly different ways of picking stocks. The best portfolio is to combine high-value with low-turnover stocks, which yields an annual compound return of 14.18%.

Finally, we contrast turnover with momentum. Jegadeesh and Titman (1993, 2001) , followed by many other scholars (e.g., Cha, 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 for Table 2 and 3.

The highest compound annual return, 18.22%, is achieved by buying high-momentum low-turnover stocks, while the lowest return, 2.99%, is for the low-momentum high-turnover stocks. The liquidity effect (the difference between low- and high-turnover stocks) is 6.23% for the low-momentum quartile, 6.92% for the low-middle momentum, 8.25% for the high-middle momentum, and 10.69% for the high-momentum stock quartile. 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.

Given the above findings, one can combine turnover, size, value and momentum in a multivariate alpha model to predict future returns for individual stocks. One can then presumably buy high-alpha stocks and sell short low-alpha stocks for a long/short strategy, or simply buy high-alpha stocks for a long-only strategy. Such an approach would involve estimating model coefficients based on historical data and be subject to model risk and paradigm shifts. That would be an "active" quantitative investment approach, a topic not central to this study.

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 2005, and the universe includes 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 to the end of each June from 1972 to 2005.

First, the geometric annual return is the highest, 15.08%, for the Earnings-Based Liquidity Strategy, 13.98% for the Earnings Weighted Strategy, 11.81% for the Market Cap-Based Liquidity Strategy, 11.09% for the Market-Cap Weighted Strategy, and 9.36% for the Volume Weighted Strategy. Thus, the excess return is 1.11% by the Earnings-Based Liquidity over the Earnings Weighted Strategy and adding the earnings-based illiquidity bias helps improve the performance of value investing. The Market Cap-Based Liquidity Strategy adds 0.79% excess return to the Market-Cap Weighted Strategy. In this case, the return added by investing in illiquidity (defined relative to the market-cap weight) is 0.79%.

The Volume Weighted Strategy has the worst return, implying that buying more of heavily traded stocks lowers investment returns. Popular glamour stocks that are traded a lot hurt performance. Over the same period, the compound annual return is 11.32% for the S&P 500.

Second, volatility or return standard deviation is all between 16.76% and 18% across the strategies, except that the Volume Weighted Strategy's volatility is 20.82%. 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 (defined as the ratio between average annual return and volatility), which is 0.92 (the highest) for the Earnings-Based Liquidity Strategy, 0.71 for the Market-Cap Weighted Strategy, and 0.55 (the lowest) for the Volume Weighted Strategy. For the S&P 500, the information ratio is 0.73.

Third, the beta relative to the S&P 500 is 1.19 (the highest) for the Volume Weighted, and 0.89 (the lowest) for the Earnings-Based Liquidity Strategy. The latter strategy offers the lowest systematic risk as well. 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 0.78, whereas the Market-Cap Weighted Strategy's R-square is the highest at 0.96. The R-square for the Market Cap-Based Liquidity Strategy is the second highest at 0.95, 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 an annualized alpha of –3.32% (the worst again) with a t-statistic of 2.88, while the Earnings-Based Liquidity Strategy has an alpha of 4.69% (the highest) with a t-statistic of 3.86. It is interesting to note that the Market-Cap Weighted Strategy has a negative alpha as well, -0.30%. The Earnings-Based Liquidity

Strategy adds 1.59% to the alpha of 3.10% for the Earnings Weighted Strategy. The earnings-based illiquidity bias thus improves performance.

For the Market Cap-Based Liquidity Strategy, its annualized alpha is 1.2%, which is 1.5% higher than the Market-Cap Weighted Strategy's alpha. 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 2005, where all dividends are re-invested. Not surprisingly, the Earnings-Based Liquidity Strategy does the best closing the period with $119, followed by the Earnings Weighted Strategy ($85), the Market Cap-Based Liquidity ($45), the S&P 500 index ($38), and the Volume Weighted yields only $21 at the end of 2005. 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? Let us first address the first question. 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. 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. 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 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, now $10 worth of financial claims is being floated and traded! The degree of financialization is indeed unprecedented. 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! Therefore, as financial capital supply grows overtime, the high tide lifts all boats: all securities will have rising liquidity. 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 interest or the degree of the stock's popularity (see also Lee and Swaminahtan 1998). If there is too much interest in the 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 interest in the 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."

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. For these reasons, the liquidity investment style is likely to continue to outperform.

7. Conclusions

This paper is the first to develop a Volume Weighted Strategy, an Earnings-Based Liquidity Strategy and a Market Cap-Based Liquidity Strategy, and to 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 excess returns and information ratio. Liquidity as an investment style is distinct from size, value/growth and momentum.

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 Sample Stocks 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	1,545	1,464	510,943	95,981	46,700,742	10,076
1973	1,439	1,411	421,806	78,850	35,831,555	10,011
1974	1,340	1,301	314,741	66,775	24,395,952	10,005
1975	1,527	1,416	388,244	70,485	33,289,240	10,050
1976	1,553	1,474	444,322	78,900	41,999,101	10,013
1977	1,591	1,523	452,244	106,392	40,333,319	10,094
1978	1,717	1,649	440,857	104,110	43,524,285	10,006
1979	1,730	1,659	518,062	128,976	37,568,928	10,013
1980	1,739	1,620	670,822	163,696	39,625,900	10,009
1981	1,541	1,436	591,720	158,585	47,887,595	10,012
1982	1,688	1,450	732,255	185,351	57,981,578	10,007
1983	1,790	1,502	814,651	224,423	74,508,450	10,078
1984	2,888	2,501	549,530	105,278	75,436,964	10,010
1985	3,189	2,587	620,916	107,621	95,607,154	10,075
1986	3,134	2,463	727,244	106,371	72,710,760	10,014
1987	3,019	2,468	744,293	97,706	69,815,361	10,023
1988	3,293	2,677	757,609	100,649	72,165,478	10,003
1989	3,356	2,732	904,559	106,441	62,581,600	10,024
1990	3,056	2,490	913,671	101,624	64,528,989	10,013
1991	3,368	2,581	1,093,238	126,019	75,653,015	10,032
1992	3,500	2,727	1,147,462	142,592	75,884,426	13,937
1993	3,500	2,736	1,289,913	193,320	89,451,558	27,258
1994	3,500	2,866	1,267,519	201,341	87,192,660	29,526
1995	3,500	2,940	1,724,290	291,097	120,259,800	50,369
1996	3,500	2,899	2,077,825	354,235	162,789,876	62,338
1997	3,500	2,939	2,729,129	445,309	240,136,270	77,077
1998	3,500	2,815	3,415,156	412,618	342,558,125	68,367
1999	3,500	2,639	4,251,200	443,586	602,432,919	70,735
2000	3,500	2,776	3,978,508	380,644	475,003,196	40,163
2001	3,500	2,448	3,548,591	444,164	398,104,758	50,949
2002	3,500	2,535	2,876,820	375,492	276,630,832	42,810
2003	3,500	2,592	3,822,991	610,849	311,065,838	86,362
2004	3,500	2,815	4,281,451	748,933	385,882,855	98,401

2005	3,500	2,866	4,484,824	746,311	370,344,145	81,803
Whole Sample	93,503	76,997	1,855,335	225,318	602,432,919	10,003

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 June from 1972 to 2005. Then we take the 16 intersection portfolios between the size and the turnover quartiles. The stocks in each intersection cell are equally weighted to a 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
Small-Cap	Geom. Avg	16.05%	14.82%	9.24%	3.26%
	Arithm. Avg	18.12%	17.26%	12.33%	7.14%
	Std Dev	23.53%	25.44%	28.78%	29.37%
	Avg No. Stocks	303	165	152	161
Small-Mid	Geom. Avg	14.67%	13.97%	11.42%	2.94%
	Arithm. Avg	16.39%	15.54%	14.02%	6.70%
	Std Dev	21.20%	20.02%	25.50%	28.77%
	Avg No. Stocks	243	175	174	191
Large-Mid	Geom. Avg	13.71%	13.33%	13.40%	6.86%
	Arithm. Avg	14.62%	14.73%	15.44%	10.23%
	Std Dev	14.70%	18.61%	22.50%	27.29%
	Avg No. Stocks	166	224	192	214
Large-Cap	Geom. Avg	11.92%	12.52%	11.78%	9.23%
	Arithm. Avg	12.47%	13.73%	13.28%	11.86%
	Std Dev	11.51%	17.35%	18.35%	23.24%
	Avg No. Stocks	118	225	271	215

Table 3: Two-Dimensional Quartile Portfolios by Value 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 June from 1972 to 2005. Then we take the 16 intersection portfolios between the value and the turnover quartiles. The stocks in each intersection cell are equally weighted to a 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 value	Geom. Avg	11.30%	11.68%	9.94%	4.10%
	Arithm. Avg	13.92%	14.53%	14.09%	9.87%
	Std Dev	25.89%	26.77%	31.46%	34.00%
	Avg No. Stocks	196	174	187	228
Low-Mid	Geom. Avg	19.91%	15.48%	13.70%	11.27%
	Arithm. Avg	21.75%	16.99%	15.96%	14.42%
	Std Dev	23.18%	19.93%	23.34%	27.09%
	Avg No. Stocks	192	204	201	198
Mid-High	Geom. Avg	15.46%	13.38%	11.21%	6.96%
	Arithm. Avg	16.93%	14.62%	12.99%	9.41%
	Std Dev	19.24%	17.31%	20.44%	23.14%
	Avg No. Stocks	211	207	196	173
High Value	Geom. Avg	14.18%	11.54%	10.22%	3.09%
	Arithm. Avg	15.80%	12.76%	11.67%	5.11%
	Std Dev	20.58%	16.86%	18.31%	20.68%
	Avg No. Stocks	188	205	204	181

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 June from 1972 to 2005. Then we take the 16 intersection portfolios between the momentum and the turnover quartiles. The stocks in each intersection cell are equally weighted to a 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	9.22%	9.49%	7.84%	2.99%
	Arithm. Avg	11.52%	11.29%	10.35%	6.28%
	Std Dev	23.53%	20.51%	24.89%	26.14%
	Avg No. Stocks	157	145	186	299
Mid-Low	Geom. Avg	15.09%	12.60%	11.29%	8.18%
	Arithm. Avg	16.76%	13.99%	12.93%	10.59%
	Std Dev	22.00%	19.10%	20.45%	23.48%
	Avg No. Stocks	215	222	206	148
Mid-High	Geom. Avg	16.74%	14.18%	12.88%	8.49%
	Arithm. Avg	18.53%	15.68%	14.75%	11.41%
	Std Dev	22.02%	19.57%	21.33%	24.90%
	Avg No. Stocks	222	233	197	134
High Momentum	Geom. Avg	18.22%	14.55%	12.69%	7.53%
	Arithm. Avg	20.53%	16.78%	15.63%	11.41%
	Std Dev	24.61%	22.72%	24.57%	28.53%
	Avg No. Stocks	193	188	200	198

Table 5: Investment Performance by Different Strategies

The period used for this table is from 1972 to 2005. 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 weight is equal to its earnings weight plus the difference between its earnings weight and its volume weight; In the Market Cap-Based Liquidity Strategy, each stock's weight is equal to its market-cap weight plus the difference between its market-cap weight and volume weight. Each strategy is rebalanced at the end of each June. 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.

	Annual Returns						
Portfolio Strategies	Geometric Avg.	Arithm. Avg.	Std Dev.	Avg Return to Std Dev Ratio	Alpha	Beta	Adj. R^2 in mkt regression
Market Cap Weighted	11.09%	12.57%	17.77%	0.71	-0.30% [-0.55]	1.02	0.96
Volume Weighted	9.36%	11.44%	20.82%	0.55	-3.32% [-2.88]	1.19	0.89
Earnings Weighted	13.98%	15.38%	17.64%	0.87	3.10% [3.31]	0.94	0.87
Earnings-based Liquidity	15.08%	16.52%	18.00%	0.92	4.69% [3.86]	0.89	0.78
Mkt Cap-based Liquidity	11.81%	13.10%	16.76%	0.78	1.20% [2.33]	0.93	0.95
S&P 500	11.32%	12.74%	17.48%	0.73	0	1	1

Figure 1: Cumulative Investment Returns across Strategies

1972 – 2005

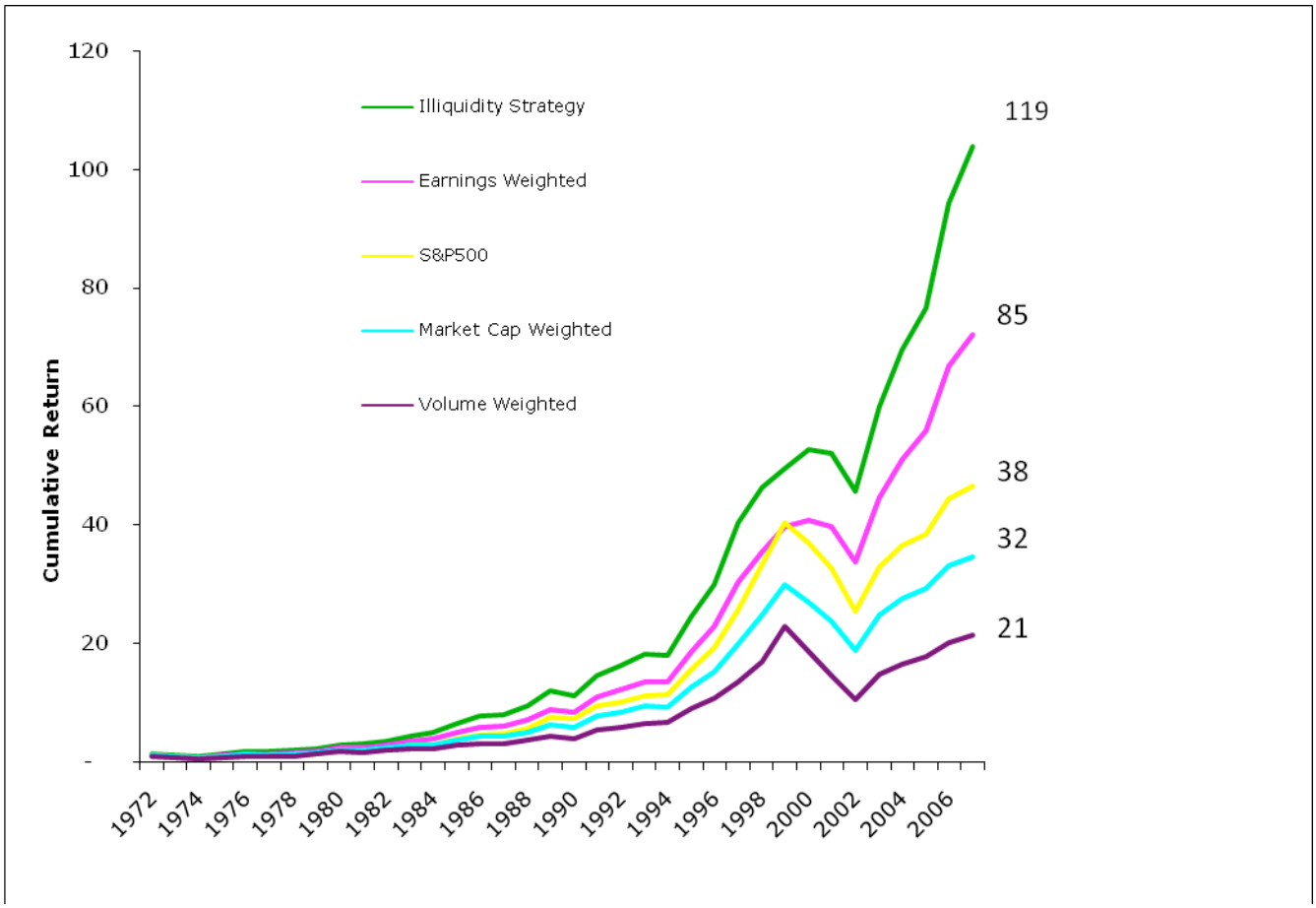
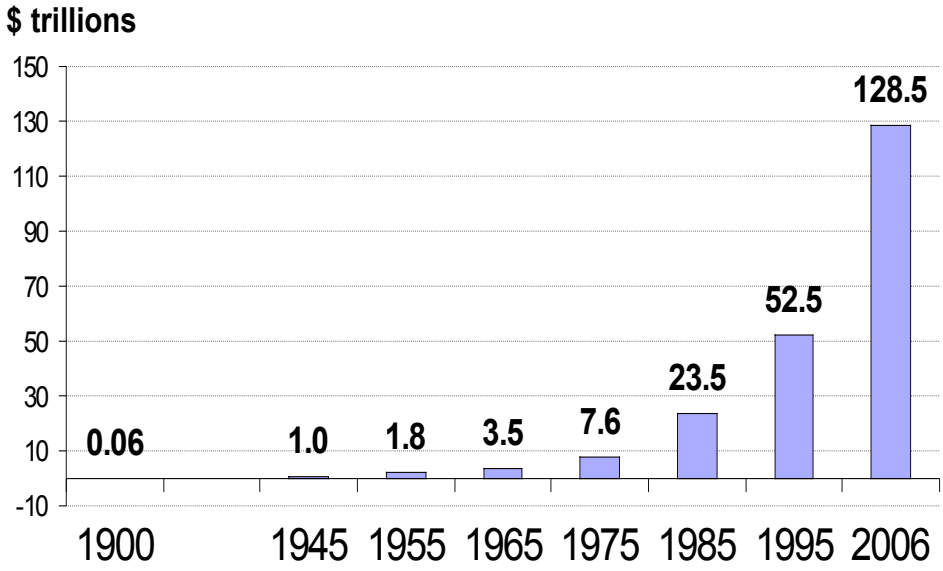
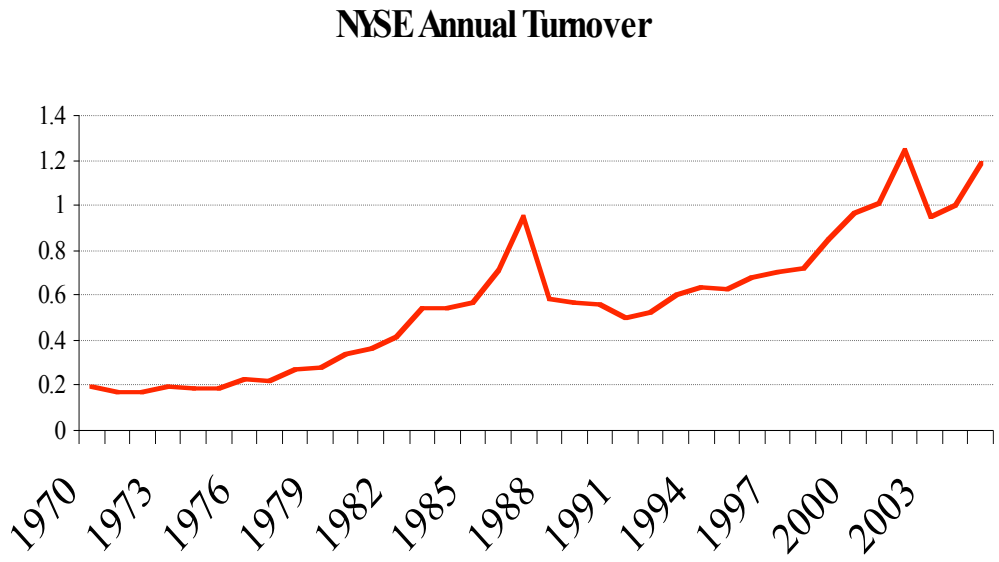


Figure 2: A Century of American Financial Revolution:
Total value of all financial claims outstanding



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: CRSP.