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Abstract

Value premium has been well documented in the finance literature. This paper empirically examines whether the value strategy of buying value stocks and selling growth stocks is profitable after controlling for transaction costs. Using the limited dependent variable estimate of transaction costs as in Lesmond, Ogden, and Trzcinka (1999), we find that value premium disappears as implementation of a value strategy involves substantial transaction costs. Our results after controlling for size and liquidity are robust to different ways of categorizing value and growth stocks used in the existing literature (Lakonishok, Shleifer, and Vishny (1994), and Fama and French (1993, 2006)) and to different methods of measuring transaction costs.

Key words: Transaction costs, value stocks, growth stocks, value premium, liquidity

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1. Introduction

Starting from Fama and French (1992, 1993), there have been numerous studies showing that stocks with a high book-to-market (BM) ratio (value stocks) outperform stocks with a low book-to-market ratio (growth stocks). Recently, Fama and French (2006) show that the value premium exists for a longer period starting from 1926 to 2005 and that this effect is not driven by small firms. Different explanations for value premium have been proposed in the extant literature including compensation for risk (Fama and French (1996)), mispricing (Lakonishok, Shleifer, and Vishny (1994), La Porta (1996), La Porta, Lakonishok, Shleifer, and Vishny (1997), Griffin and Lemmon (2002), Skinner and Sloan (2002)), data-snooping biases (Conrad, Cooper, and Kaul (2003)), and greater divergence in investors' opinions (Doukas, Kim, and Pantzalis (2004)). Moreover, researchers have argued that value premium is concentrated in small-cap stocks (Kothari, Shanken, and Sloan (1995) and Loughran (1997)), in stocks with greater short-sales constraints (Nagel (2005)), stocks with lower institutional ownership (Phalippou (2007)), and stocks with higher idiosyncratic volatility (Ali, Hwang, and Trombley (2003)). However, there has been little attention paid to the subject of attainability of value premiums in practice. In other words, whether implementing the value strategy of buying value stocks and selling growth stocks is profitable or not after accounting for transaction costs? Our paper fills this gap in the extant literature by empirically examining the transaction costs of implementing value strategy to determine if the value premium is achievable by the investors.

The existence and persistence of value premium depend on transaction costs for several reasons. First, buying and selling stocks to implement value strategy involve non-trivial transaction costs. Second, if value stocks have high transaction costs, then investors may require high returns on value stocks to compensate for high transaction costs. Based on the modified efficient market hypothesis (Fama (1991)), prices reflect information to the point where the marginal benefits of acting on information do not exceed the marginal costs. If arbitrageurs do not trade value stocks till the costs of trading are smaller than the benefits of trading, the price adjustment of the value stocks will be delayed.[1] Consequently, the value stocks will appear to have higher returns than growth stocks when in fact the transaction-cost-adjusted returns of these two types of stocks are similar. Finally, the persistence of value premium also depends on transaction costs, because transaction costs can prevent the arbitrageurs from arbitraging away the value premium.

We use different measures of transaction costs to examine the profitability of implementing value strategy. Transaction costs have both explicit and implicit components. Amihud and Mendelson (1986) used quoted bid-ask spread as a measure of transaction costs. However, quoted bid-ask spread is a noisy proxy given the fact that many large (small) trades occur outside (inside) the spread. Furthermore, estimate of quoted spread understates the true trading cost as it ignores other related trading costs such as pricing impact, cost of immediacy, and commissions. Theoretical models of Glosten (1989) and the empirical evidence in Glosten and Harris (1988) suggest that asymmetric information effect is most likely captured in the price impact of a trade. Brennan and Subrahmanyam (1996) find a significant return premium associated with illiquidity by measuring both the fixed and variable elements of the transaction costs.

[1] Both Constantinides (1986) and Vayanos (1998) show that the effect of transaction costs on stock prices is small and is perhaps of second-order. However, the attainability of value premium after controlling for transaction costs does not rely on the argument that transaction costs will affect stock prices.

This literature indicates the multidimensional nature of transaction costs, thereby suggesting the use of a comprehensive measure to capture transaction costs. Lesmond, Ogden, and Trzcinka (1999) provide such a measure by proposing the use of limited dependent variable (LDV) procedure to estimate trading costs. We refer to it as the LOT measure. This measure is a comprehensive estimate that includes implicitly not only the components of the spread but also the implied commissions, immediacy costs, and at least some of the cost resulting from the price impact of the trades. Further, as a robustness check, we also use another measures of transaction costs, namely the sum of quoted spread and commission. Since the LOT measure yields smaller trading cost estimates than the sum of traditional quoted spread and commission, it biases us against finding the transaction costs explaining the value premium.[2]

We find that after controlling for transaction costs in these two alternative ways, the value premium disappears. This result is robust to different ways of sorting the value and growth stocks and use of different return horizons. In particular, we follow the alternative sorting procedures and holding periods in Lakonishok, Shleifer, and Vishny (1994, hereafter LSV) and Fama and French (2006) to estimate the value premium. LSV (1994) classify stocks into book-to-market (henceforth BM) deciles for the period of 1968 to 1989. They find that the average difference between the returns in value portfolio (highest BM decile) and growth portfolio (lowest BM decile) using holding periods of one to five years, is more than 10% per annum in a large number of cases. Fama and French (2006) estimate the value premium during 1926-2005 period by forming six portfolios based on two size groups and three BM groups. For robustness, they also form

[2] Lesmond, Ogden, and Trzcinka (1999) also find that their measure of transaction costs is more conservative than the often used sum of quoted spreads and commissions.

25 portfolios based on size and BM quintiles. Since the portfolios are rebalanced each year, the effective holding period is one year. Regardless of whether we use LSV (1994) or Fama and French (2006) way of categorizing value and growth stocks, we find that once we control for transaction costs, the value premium disappears.

Recently, Liu (2006) uses a new measure of liquidity and find that liquidity is an important source of priced risk. He argues that the value premium is insignificant after controlling for liquidity. We explicitly account for the differences in liquidity between value and growth stocks by forming 25 portfolios after double sorting on liquidity and book-to-market. We find that the value premium still exists even after controlling for Liu's liquidity measure but disappears once we account for transaction costs.

We believe that the value premium disappears for two reasons. On one hand, value stocks indeed have higher transaction costs than growth stocks. The higher transaction costs of value stock offset the higher returns of value stocks. On the other hand, buying of value stocks and selling of growth stocks also involve non-trivial transaction costs, which deter the arbitrageurs from exploiting the value premium.

The main contribution of this paper is to study the profitability of value strategy and if it is achievable in practice after accounting for transaction costs. Using LOT measure of transaction costs, we find a positive relation between transaction costs and stock returns. This positive relation is consistent with previous studies such as Amihud and Mendelson (1986) and Brennan and Subrahmanyam (1996). The findings of this paper help us to understand why value stocks have higher returns and that the suggested mispricing of value stocks in the literature may be due to higher transaction costs incurred in trading them. Our paper builds on the recent evidence in two related papers. First, Dimson, Nagel, and Quigley (2003), show that it is difficult to realize profits following a small-cap value strategy in the UK, since it requires substantial rebalancing resulting in high turnover and trading costs. However, due to non-availability of transaction cost data, their focus is largely on portfolio turnover and potential infeasibility of executing value strategy in non-US markets. Second, Houge and Loughran (2006), show that there is no difference between either the performance of value and growth style indexes, or between actively managed value and growth funds. They suggest that high transaction costs and price impact of trading may be driving their results. However, since their analysis uses actively managed funds, where managers may be influenced by career concerns and other incentives, it is not clear if transaction costs alone are responsible for the absence of value premium. Our paper explicitly controls for transaction costs in different ways to show that the value premium, as documented in the large academic literature, may not be achievable by the investors.

The paper is organized as follows. Section 2 briefly reviews the extant literature. Section 3 describes the sample data. Section 4 provides the details of different measures of transaction costs. Section 5 estimates the value premium and transaction costs involved in the implementation of value strategy. Section 6 shows the results of the value premium after adjusting for transaction costs. Section 7 offers concluding remarks.

2. Literature Review

Value strategy involves buying stocks that have low prices relative to earnings, dividends, historical prices, book assets, or other measures of value. For more than two decades, value strategy has attracted significant attention from both academics and practitioners. Rosenberg, Reid, and Lanstein (1985), Chan and Chen (1991), Fama and French (1992, 1993, 1996, 2006), LSV (1994), La Porta (1996), and La Porta et al. (1997) provide profound evidence that stocks with high book values of equity relative to their market values outperform the market. For example, Fama and French (2006) find that value premium exists for 1926 to 2005 and that it is not confined to small firms.

Although there is general consensus on the existence of value premium, there have been different explanations offered for why it exists. LSV (1994) and La Porta et al. (1997) argue that investors are very pessimistic about value stocks and the market slowly realize that earnings growth rates for value stocks are actually higher than it was initially expected. Rozeff and Zaman (1998) provide further evidence that insiders are taking advantage of mispricing by studying insider behavior when stocks move between value and growth categories. Piotroski (2000) use F-scores to separate value stocks into weak value and strong value. In contrast to market efficiency, Piotroski finds that strong value (healthier and less risky) firms appear to deliver stronger returns. Similarly, Mohanram (2004) uses a G-score index to separate growth stocks into winning growth and losing growth. He finds that the firms that ex-ante, appear less risky have better future returns. However, none of these papers can explain why the arbitrageurs do not take advantage of the obvious and high abnormal returns, if the value premium is a result of mispricing. Ali, Hwang, and Trombley (2003) find that book-to-market effect is greater for stocks with higher idiosyncratic return volatility. They argue that this finding is consistent with Shleifer and Vishny (1997) that the volatility will deters arbitrage activity and is an important reason for the existence of BM effect.[3]

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[3] Ali, Hwang, and Trombley (2003) use the frequency of price, volume, and zero daily returns as their measure of transaction costs. In their multivariate analysis using these measures, they do not find a

Fama and French (1996) are able to capture the value premium in their three-factor model and they argue that the value premium is a compensation for additional fundamental risk. Doukas, Kim, and Pantzalis (2002) (DKP) directly test the expectation error hypothesis and find that investors are more optimistic about value stocks than growth stocks by using forecast error and forecast revision to proxy investors' expectations. DKP's results directly reject the hypothesis that market mispricing caused by extrapolative expectation errors is the source of value premium. Recently, Liu (2006) uses a new measure of liquidity for individual stocks and find that value stocks are mostly illiquid. Using his liquidity measure as an additional factor in the CAPM, he finds that his two-factor CAPM performs better than the Fama and French three-factor models. Liu's findings provide evidence that liquidity risk might be the additional fundamental risk that can explain the value premium.

However, there has been little attention paid in the literature on the attainability of value premium in practice. There are two recent papers that have attempted to address this issue. First, using data on actively managed mutual funds and style indexes, Houge and Loughran (2006) find evidence on value funds or indexes failing to outperform their growth counterparts. Second, using UK data, Dimson, Nagel, and Quigley (2003) show that it is difficult to realize profits following a small-cap value strategy in the UK, since it requires substantial rebalancing resulting in high turnover and trading costs. Our paper contributes to this burgeoning literature by directly examining the value strategy as described in the academic literature and then adjusting for the transaction costs using a

significant relation between transaction costs and BM effect. Unlike this study, they do not study the magnitude of the transaction costs and the transaction-cost-adjusted value premium. Furthermore, given the high correlation between idiosyncratic volatility and transaction costs in their study, it is difficult to determine which one is the driving factor of the BM effect. High transaction costs can deter arbitrage activity and at the same time increase stock return volatility as well.

comprehensive measure to demonstrate that value strategy may not be profitable in practice. This, in turn, helps us understand why it persists over time and explains why the arbitrageurs are perhaps not able to exploit it.

Finally, our paper also contributes to the literature that use transaction costs to explain different asset pricing anomalies such as the small firm effect (Stoll and Whaley (1983)), January effect (Reinganum (1983) and Bhardwaj and Brooks (1992)), post-earnings announcement drift (Bhushan (1994)), closed-end fund discount (Pontiff (1996)), and momentum effect (Lesmond, Schill, and Zhou (2004)).

3. Data and sample construction

The sample consists of all New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and NASDAQ ordinary common stocks that appear on the Center for Research in Securities Prices (CRSP) and on COMPUSTAT tapes with data available for certain income statement and balance sheet items. We exclude real estate investment trusts (REITs), American Depository Receipts (ADRs), closed-end mutual funds, foreign stocks, unit investment trusts, and American trusts. The sample period is from January 1973 to December 2005.

Book-to-market (BM hereafter) is the ratio of book equity to the market value of equity. Follow Fama and French (1993) and Cohen, Polk and Vuolteenaho (2003), we define book equity as the sum of COMPUSTAT book value of stockholders' equity (data216) and balance-sheet deferred taxed and investment tax credit (if available) less the book value of preferred stock. Depending on availability, we use the redemption, liquidation, or par value, in that order to estimate the value of preferred stock. If book value of stockholders' equity is not available in COMPUSTAT, we calculate book equity as the sum of common equity (data60) and the par value of preferred stocks. If common equity is not available, we calculate the stockholder equity as the difference of total assets and total liabilities. Market equity is the product of number of shares outstanding and the closing price of the stock in December of year *t*. To be included in the sample, the common stock of a U.S. firm must have a CRSP value of equity in December of year *t-1* and June of year *t*. To mitigate the potential survivorship bias in the COMPUSTAT database, we require that a firm must have at least two years history in COMPUSTAT before it is included in portfolio construction. We exclude stocks with negative book value of stockholder's equity.

We use CRSP daily data for estimating transaction costs. We use three alternative transaction cost estimates in this paper: (1) Quoted Spread + Commission; (2) Roll's (1984) spread; and (3) LOT measure using the LDV procedure. We discuss estimation of these different types of transaction costs in greater detail in the following section.

4. Measures of Transaction Costs

There are mainly two methods of estimating transaction costs that have been used in the literature. The first method that is used traditionally is the bid-ask spread and commissions (S+C). The second method is more comprehensive, and includes price impact, immediacy costs, and short-sale constraints, etc. To demonstrate the robustness of our results, we use three transaction costs measures in this paper: (1) Quoted bid-ask spread plus commission; (2) Roll's (1984) spread; (3) the comprehensive Lesmond, Ogden, and Trzcinka (LOT) (1999) measure. We discuss each of these measures in greater details below.

4.1 Traditional measure of transaction costs

Three different types of bid-ask spread measures have been used in the existing literature. The first one is the quoted bid-ask spread. Amihud and Mendelson (1986), Stoll and Whaley (1983), and Bhardwaj and Brooks (1992) use this measure. Quoted bid-ask spread for stock *i* in year *t* is defined as:

Quoted Spread (*i, t*) = $\frac{1}{12}\sum_{m=1}^{12}\frac{(Ask(i,t,m)-Bid(i,t,m))}{\frac{1}{2}(Ask(i,t,m)+Bid(i,t,m))}$ (where *m* is month id) **(1)**

The second type of bid-ask spread used is the direct effective spread (Lee and Ready (1991)). If a trade price is greater (less) than the midpoint of a quoted bid-ask prices, then the trade is classified as a buy (sell). If the trade price equals to the midpoint, then the direct effective spread is zero.

The third type of bid-ask spread used is Roll's effective spread. In Roll (1984), Roll argues that given market efficiency, the effective bid-ask spread can be measured by Spread = $2\sqrt{-\text{cov}}$. The "cov" in the equation stands for the first-order serial covariance of price changes. Roll's model requires a negative autocovariance structure in the returns. However, positive serial correlation occurs quite frequently when using daily data (40%). Due to its restrictive assumptions, Roll's spread could be biased.

As pointed out earlier, the main limitation of each of these bid-ask spread measures is that they all understate the true costs of trading by omitting relative trading costs such as price impact, immediacy costs, commissions, or short-sale constraints. The second measure of transaction cost that we use, addresses this limitation.

4.2 Lesmond, Ogden, and Trzcinka (LOT) measure

Lesmond, Ogden, and Trzcinka (1999) present a model based on limited dependent variable (LDV) procedure. The model requires only the time series of daily security returns to endogenously estimate the effective transaction costs for a stock. The assumption of this measure is that arbitrageurs trade only if the value of accumulated information exceeds the marginal cost of trading. If trading costs are sizable, new information must accumulate longer before investors engage in trading. Therefore, frequency of the zero-return days can be a proxy for the length of information accumulation.

In the LDV model, the relation between measured returns, R^*_{jt}, and realized return, R_{jt}, is given as:

$$R^*_{jt} = \beta_j R_{mt} + e_{jt}, \qquad \textbf{(2)}$$

where

$$\begin{aligned} R_{jt} &= R^*_{jt} - \alpha_{1j} \quad \text{if} \quad R^*_{jt} < \alpha_{1j} \\ R_{jt} &= 0 \quad \text{if} \quad \alpha_{2j} < R^*_{jt} < \alpha_{1j} \\ R_{jt} &= R^*_{jt} - \alpha_{1j} \quad \text{if} \quad R^*_{jt} > \alpha_{2j} \end{aligned} \qquad \textbf{(3)}$$

α_{1j} is the seller-side trading cost and $\alpha_{2j} > 0$ is the purchase side cost for asset *i*. Assuming returns are normally distributed; estimates of α_{1j} and α_{2j} can be obtained by maximizing the following log-likelihood function:

$$\begin{aligned} \ln L = &\sum_{R1} \ln \frac{1}{\sqrt{2\pi * sqr(\sigma(i))}} - \sum_{1} \frac{sqr(R(i,t) + \alpha 1(i) - \beta(i) Rm(t))}{2 * sqr(\sigma(i))} + \sum_{R2} \ln \frac{1}{\sqrt{2\pi * sqr(\sigma(i))}} \\ &- \sum_{2} \frac{sqr(R(i,t) + \alpha 2(i) - \beta(i) Rm(t))}{2 * sqr(\sigma(i))} + \sum_{R0} \ln(\phi 2(i) - \phi 1(i)) \end{aligned} \qquad \textbf{(4)}$$

In this function, *R1* denotes the non-zero negative return region, *R2* denotes the non-zero positive return region, and *Rm(t)* is measured market return index. $\beta(i)$ and $\sigma(i)^2$ represent the estimates of market beta and the variance of the non-zero observed returns, respectively.[4] *R0* denotes the zero-return region. The parameters, $\alpha_1(i)$, $\alpha_2(i)$, $\beta(i)$, and $\sigma(i)$ are solved by maximizing the likelihood function in equation (4). The estimate of interest is $\alpha_2(i) - \alpha_1(i)$. This difference between $\alpha_1(i)$ and $\alpha_2(i)$ is the implied round trip transaction costs, i.e. LDV estimate.

LDV estimate is more conservative than using the sum of spread and commissions (S+C). In Lesmond, Ogden, and Trzcinka (1999), LDV estimate is at least 30% lower than the sum of the quoted spread and commission regardless of firm size. For robustness, we also calculate Roll's spread and quoted spread for year 1995.[5] We find the commission for stocks trading in 1995 using the commission schedule in Lesmond, Schill, and Zhou (2004, pp. 361). There are two reasons for using the same schedule. First, our sample universe is the same as theirs. Second, their schedule is valid for years from 1994 to 1997, which includes 1995 for which we conduct our robustness check. Consistent with their findings, we observe that the LDV estimate is at least 40% lower than quoted spreads plus commission for year 1995. The detailed results and the commission schedule are in Appendix A.

We use daily return data from CRSP to estimate the LOT measure of transaction costs. Because buying and holding stocks are ex-ante decisions, we calculate the LDV estimate for year *t-1*. By maximizing the likelihood function in equation (4), we estimate

[4] We use the CRSP equally-weighted market return as the market index.

[5] The results after controlling for transaction costs in this version are based only on the LDV estimate. We calculate the quoted bid-ask spread, commission and Roll's spreads for year 1995 to check the robustness of the LDV estimate. In future, we plan to report results on all these different measures of transaction costs.

the round trip transaction costs for every stock in the book-to-market portfolios from year 1973 to 2004.[6]

Now that we have our different measures of transaction costs, in the following section, we estimate the value premium with and without controlling for transaction costs.

5. Estimating the value premium and transaction costs in implementing value strategy

In this paper, we follow the different ways of constructing the value and growth portfolios. For this purpose, we employ different mechanisms to sort on book-to-market ratios as in LSV (1994) and La Porta et al. (1997), and as in Fama and French (1993, 2006). The calculation of book-to-market ratio follows the methods in Fama and French (1993) and as described on Kenneth French's website. Specifically, book-to-market ratio is the book value of stock equity at the end of fiscal year *t-1* divided by the market value of equity at December of year *t-1*. We implement a one-way sort to obtain 10 book-to-market deciles as in LSV (1994) and a two-way sort on size and book-to-market to obtain portfolios as in Fama and French (1993, 2006). Further, to account for the impact of liquidity (Liu (2006)), we also perform two-way sort on liquidity and book-to-market. We describe below in detail how we form the different types of portfolios and estimate the associated value premium.

5.1. Sorts on book-to-market ratio as in LSV (1994) and La Porta et al. (1997)

[6] We omit any estimates that are greater than 100%.

Following LSV (1994) and La Porta et al. (1997), we sort stocks into ten deciles based on book-to-market ratio (BM). Equally weighted portfolios are formed in June of each year *t* using the BM classification from December of year *t-1*. The value portfolio consists of stocks in the highest decile (BM10) and the growth portfolio consists of stocks in the lowest decile (BM1). As we report buy-and-hold returns for five years, we exclude firms with less than five years history in COMPUSTAT for this procedure of portfolio formation. Annual buy-and-hold returns are reported for five years after formation with year 1 beginning in July of year 0 and ending in June of year +1, year 2 beginning in July of year +1 and ending in June of year +2, and so on. If a stock has missing returns for any month in a year, we replace that month's return by the equally-weighted return on the remaining stocks in the portfolio. If the stock with missing returns in year *t* does not have any return data for the following year, we remove the stock from the portfolio for the following years.

Before proceeding further, we show that both the value and growth stocks as classified using LSV (1994) and La Porta et al. (1997) methodology exhibit a significant number of zero-return days suggesting that trading these stocks involves substantial transaction costs. Recall that the investors trade only if the value of accumulated information exceeds the marginal costs of trading. If these costs are sizable, new information must accumulate longer before investors engage in trading. Therefore, frequency of the zero-return days can be a proxy for the length of information accumulation.

We use the ten single-sorted BM portfolios as an example. Figures 1 and 2 show that value portfolio indeed has more zero-return days than growth portfolio. In addition to the frequency of zero-return days for value and growth portfolios, we also show the same frequency for the BM decile 4 and BM decile 7 portfolios for the sake of comparison. Figure 1 presents two interesting patterns. First, it shows that the frequency of zero return days is particularly high for the value portfolio. More than 30% of the daily return values are exactly zero. The growth portfolio has only around 17% daily returns at zero. Second, it shows that the variation of nonzero returns is greater in value portfolio than in growth portfolio. Value portfolio exhibits high frequency of zero returns, low frequency of small magnitude returns, and high frequency of large magnitude returns. We believe that sizable transaction costs associated with value stocks may have caused the prices for value stocks to be stickier than those for growth stocks. In other words, market takes more time to incorporate information into prices for values stocks than for growth stocks. Figure 2 shows that the period from 1994 to 2003 has fewer zero-return days compared to the 1984-1993 period. Zero return frequency decreases from 43% to 21% for value stocks and from 26% to 10% for growth stocks. This decline is consistent with the reduction in the trading costs during the recent period. Overall, the patterns in Figures 1 and 2 indicate significant transaction costs involved in trading value and growth stocks, with the costs being much greater for value stocks. We show more formally how the transaction costs can explain the value premium later in this section.

Continuing with the construction of the value and growth portfolios, in order to control for size effect, we use the method of LSV (1994) to adjust portfolio returns for size. First, we classify stocks in our sample into size deciles based on the stocks' market capitalization at the end of December of year *t-1*. Second, we replace every stock's return in each year with an annual buy-and-hold return on an equally-weighted portfolio of all stocks in its size decile for that year. Third, we equally weight these returns across all stocks in the original BM portfolios to get the size benchmark return. Finally, the annual size-adjusted return is then computed as the return on the BM portfolio minus the size benchmark return for that year.

We calculate the annual value premium as the difference of the annual buy-and-hold return of value portfolio and that of the growth portfolio. Table 1 presents the value premium for year t+1 to year t+5. We report the results for the annual raw returns and the size-adjusted returns in Panels A and B respectively. Panel A shows a decreasing pattern in the value premium following the portfolio formation in year *t* — from 14.2% in year t+1 to 7.9% in year t+5. The average annual value premium across the five years after the portfolio formation is 10.3%. Further, the value premium is statistically significant for each of the five years at the 5% level or better (see last column of Panel A). Results in Panel B for size-adjusted average return differences between top and bottom BM deciles (or value premium) are smaller than the raw return results in Panel A. For example, for year t+3, the size-adjusted return average difference in Panel B is 7% (t-stat=2.07) versus 9.8% (t-stat=2.86) in Panel A. Furthermore, average size-adjusted return differences in Panel B are statistically significant for only three years. This result is different from the findings in La Porta et al. (1997), where they find that the average differences between size-adjusted value and growth portfolio returns are statistically significant for all the five years. To examine the reasons for this discrepancy, we divide our sample period into three equal sub periods, 1974-1983, 1984-1993, and 1994-2003. We find that the persistence of value premium in previous studies is largely driven by the 1974-1983 subperiod (See Table 2).

The results from Table 2 are quite informative and interesting. The persistence of value premium decreased from five years in 1970s to only one year in the last decade (1994-2003) of our sample. We conjecture that one possible explanation for the lack of persistence in the value premium during the third sub period is that the transaction costs have decreased dramatically from 1974 to 2003. Hence, the additional required expected return to compensate higher transaction costs of value portfolio is much lower. We provide evidence to support this explanation in later sections.[7]

5.2. Sorts on size and book-to-market (Fama and French 1993, 2006)

Using double sorts on size and book-to-market, Fama and French (2006) find that value premium exists from 1926 to 2005 and that it is not driven by small firms. To account for size effect more explicitly, we also use double sorts to form value and growth portfolios. To check the profitability of value premium for different sorting strategies, we form 25 portfolios based on size and book-to-market quintiles and also construct 6 portfolios based on two size groups and 3 book-to-market groups.

At the end of each June from 1974 to 2005, we form 25 value-weighted portfolios as the intersection of independent sorts of NYSE, AMEX, and NASDAQ stocks into five size groups and five book-to-market groups. We use NYSE market cap and book-to-market quintile breakpoints to classify the stocks into five groups. The method of using NYSE breakpoints is common (see Fama and French (1992), Brav, Geczy, and Gompers (2000) for example) to avoid the clustering of NASDAQ stocks in portfolios with smaller

[7] Table 2 Panels C and D show the annual returns and size-adjusted returns for period 1984-1993. The average differences of size-adjusted returns for year t+1 and t+2 — 10.7% and 11.3% are higher than those for the raw returns — 9.4% and 11.0%. This result is consistent with the weakening of size effect after it was discovered in 1980s as documented in previous studies (Horowitz, Loughran, and Savin (2000), Schwert (2003)).

size or higher book-to-market values. Size for a stock in year *t* is measured by the market capitalization at the end of June, which is calculated as the product of the closing price of the stock and the number of shares outstanding at the end of June of year *t*. As in Fama and French (1992, 2006), book equity is for the fiscal year ending in year *t-1* and market equity is the market capitalization at the end of December of year *t*. Table 3 summarizes the characteristics of the 25 size-BM portfolios from 1974 to 2005. On average, the smallest size quintile contains more than half the total number of NYSE, AMEX, and NASDAQ stocks (2,212 out of 3,806) (see Panel A of Table 3). Panel B of Table 3 shows value-weighted average annual returns for the 25 portfolios. Consistent with Fama and French (1993 and 2006), within each BM quintile with the exception of lowest BM quintiles, larger is the size, lower are the returns. Within a size decile, returns are monotonically increasing with BM. For robustness, we estimate the value premium for the 25 portfolios in two different ways. The first estimate is based on the strategy of buying stocks in the highest BM quintile, H (value stocks) and shorting stocks in the lowest BM quintile, L (growth stocks), represented by H-L in Table 3 Panels B and C. The second estimate of the value premium follows the methodology in Fama and French (2006). The value premium for a size quintile is the difference between the average return on the two highest BM portfolios and the average return on the two lowest BM portfolios of the size quintile. Four portfolios are used to estimate value premium to mitigate the under-diversification problem of some portfolios. We also present the second estimate of value premium, noted as H45-L12, in Panel B of Table 3. All the value premiums for H-L and H45-L12 strategies are positive and significant except for the largest size quintile.[8]

[8] The insignificant of value premium for the largest size quintile is merely a book-to-market effect. As shown in Fama and French (2006), if the value portfolios are classified on Earnings to Price (EP) ratio, then

Similar to Fama and French (2006), we find that the value premium decreases with increase in size.

Panel C of Table 3 shows the average annual LOT measure of transaction costs of the 25 size and BM portfolios. The average transaction costs of implementing H-L value strategy for the 25 size/BM portfolios range from 9.2% in the smallest size quintile to 0.9% of the largest size quintile (see column labeled as H-L). H-L strategy involves the roundtrip costs of buying and selling value and growth stocks. So the transaction costs for H-L strategy is the sum of LDV estimates of the high BM and low BM portfolios. The results are similar if we use H45-L12 instead of H-L.

Next, we form six portfolios based on size and BM. For this purpose, we independently sort portfolios into two size groups (S, B), using NYSE median size as the breakpoint and three BM groups (V, N, G), using NYSE BM as the breakpoints. G group contains all stocks in the bottom 30% of NYSE BM, N portfolio has all stocks in the middle 40% of NYSE BM, and V group contains all stocks in the high 30% of NYSE BM. The value premium, VMG, is the simple average of the returns on the two value portfolios minus the average of the returns on the two growth portfolios: VMG = (VB+VS)/2 - (GB+GS)/2. The other value premiums are calculated as: VMGS = SV - SG, VMGB = BV - BG. Panels A and B of Table 4 present the value-weighted annual returns for the six portfolios and the different value premiums. The value premiums are positive and statistically significant for VMG, VMGS and VMGB strategies. Panels C and D provide the estimate of the average annual transaction costs for the six size-BM portfolios and for the long-short portfolios to execute the value strategy. From Panel C,

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the value premium will be positive and statistically significant even for the largest size quintile. In future, we plan to implement EP as an alternative way of classifying value and growth stocks.

we observe that the average transaction costs are higher for value portfolios compared to growth portfolios after controlling for size — 2.6% for small-value (SV) compared to 2.2% for small-growth (SG), and 0.7% for big-value (BV) compared to 0.4% for big-growth portfolio. Panel D of Table 4 provides a further confirmation of earlier results in Panel C of Table 3. We continue to observe significant roundtrip transaction costs of trading long-short portfolio for implementing value strategy. These costs are 2.9% for long all value stocks and short all growth stocks (VMG), 4.8% for long small value stocks and short small growth stocks (VMGS), and 1.0% for long large value and short large growth stocks.

Until now, we control for size to estimate the value premium and transaction costs. For robustness, we next examine if the value premium is driven by differences in liquidity.

5.3. Sorts on book-to-market and Liquidity

If value stocks are less liquid than growth stocks, then the book-to-market effect might be merely a liquidity effect. To examine whether value premium is driven by differences in liquidity, we double sort stocks into 25 portfolios based on quintiles of book-to-market and liquidity. If the value premium is due to variation in liquidity, we should not observe the existence of value premium within the same liquidity quintile. To form portfolios of year *t*, we first independently sort our universe of stocks into liquidity quintiles and BM quintiles based on the liquidity and BM information at December of year *t-1*. Then 25 liquidity-BM portfolios are formed as the intersection of the two independent sorts. For robustness, we use two different liquidity measures to classify our portfolios. First one is the commonly used Amivest measure of liquidity as in Amihud (2002):

$$L_{i,y} = \frac{1}{Ty} \sum_{t=1}^{Ty} \sqrt{\frac{Vol(i,t,y)}{|r(i,t,y)|}} \quad \textbf{(5)}$$

where *Vol(i,t,y)* and *r(i,t,y)* are, respectively, stock *i*'s dollar volume (in millions) and return on day *t* in year *y*. *Ty* is the number of non-zero return trading days. As suggested by Hasbrouck (2006), we take the square root of *Vol(i,t,y)* / |*r(i,t,y)*| to mitigate the effects of extreme values in the distribution of $L_{i,y}$.

One limitation of the Amivest measure is it is not defined when the stock return is zero. Liu (2006) obviates this limitation by proposing an alternative measure, which is essentially the standardized turnover-adjusted number of zero daily trading volumes. Liu's measure of liquidity for stock *i* in year *t* is calculated as:

$$LM12_{i,t} = \textit{Number of zero daily volumes in prior 12 months} + \frac{1/(\textit{12-month turnover})}{\textit{Deflator}} \times \frac{252}{NoTD} \quad \textbf{(6)}$$

where 12-month turnover is calculated as the sum of daily turnover over the prior 12 months. Daily turnover is the ratio of the number of shares traded on a day to the number of shares outstanding at the end of the day. *NoTD* is the total number of trading days of the market over the prior 12 months. Because the number of trading days varies from one month to another, the factor *252/NoTD* standardizes the number of trading days to 252 days. Following Liu (2006), we choose a deflator of 11000 for annual liquidity estimate.[9]

[9] Deflator is chosen such that: $0 < \frac{1/(\textit{12-month turnover})}{\textit{Deflator}} < 1$.

Table 5 (Table 6) presents the summary characteristics for the 25 portfolios formed by sorting on book-to-market and Amivest (Liu) liquidity measure. The portfolio annual returns are value-weighted returns based on December market cap of year *t-1*. Panel B of Table 5 and 6 report the average annual returns for the 25 portfolios. We observe that within each liquidity quintile, portfolio returns are monotonically increasing with BM. However, within each BM quintile, portfolio returns do not always decrease with liquidity. This finding suggests that even after controlling for liquidity, we observe a significant value premium. The value premiums H-L and H45-L12 are defined the same way as in Fama and French 25 portfolios. In most cases, the value premiums are positive and statistically significant. For Amivest liquidity measure, the value premium ranges from 2.5% to 6.3% annually (see columns H-L and H45-L12 of Table 5 Panel B). For Liu liquidity measure, the value premium ranges from 3.1% to 7.5% annually (see columns H-L and H45-L12 of Table 6 Panel B).

Panel C of Table 6 shows the average annual LOT measure of transaction costs for different liquidity-BM portfolios and long-short portfolios (H-L and H45-L12) for implementing value strategy. The average annual transaction costs are usually higher for the highest BM quintiles (value stocks) than for the lowest BM quintiles (growth stocks). For example, in Panel C of Table 6, for each liquidity quintile, the transaction costs are greater for high BM quintile compared to the low BM quintile. Further, the average transaction costs of implementing H-L value strategy for the 25 liquidity-BM portfolios range from 1.5% in the highest liquidity quintile to 4.3% in the lowest liquidity quintile. Each of these roundtrip transaction costs is statistically significant at the 1% level. The results are similar for the alternative way of defining value strategy of buying the two highest BM quintiles and selling the two lowest BM quintiles (H45-L12).

Having provided evidence on the existence of value premium in absence of transaction costs, and shown that implementing value strategy involves non-trivial transaction costs, the next logical step is to compute the value premium after adjusting for transaction costs, which we do in the following section.

6. The profitability of value strategy

Before we examine whether value premium exists after adjusting for transaction costs, we first briefly summarize different value strategies described in the previous section. We have described so far three variations of value strategies. First, based on LSV (1994), a trading strategy of buying stocks in the highest BM decile and selling stocks in the lowest BM decile and holding the portfolio for one to five years will generate value premium of about 10% per year. We refer to this strategy as the LSV value strategy. Second type of value strategy is to construct the HML factor mimicking portfolio of Fama and French (1993) using double sorts on size and book-to-market, while dividing the stock universe into two (S and B) and three (V, N, and G) groups along these two dimensions. Particularly, to obtain the value premium on the mimicking portfolio, we need to buy stocks in the two value portfolios and short the stocks in the two growth portfolios. In this case, the value premium is given by VMG=(SV+BV)/2-(SG+BG)/2, where SV represents returns on small value portfolio, BV is big value portfolio, SG is small growth portfolio, and BG is big growth portfolio. For robustness, we also study the profitability of the value strategies (H-L, H45-L12) based on 25 size-BM portfolios using size and BM quintiles. We group these two variations of sorting procedures for implementing value strategy together and refer to it as FF value strategy. The third variation of value strategy is based on the 25 liquidity-BM portfolios. We obtain the value premium within a liquidity quintile by shorting stocks in the two lowest BM quintiles and buying stocks in the two highest BM quintiles. We refer to this type of value strategy as liquidity-adjusted value strategy. Table 7 summarizes these different variations of value strategies.

6.1. Profitability of LSV strategy.

Because LSV (1994) equally weight stocks in their portfolio construction, we calculate average transaction costs for portfolios using equal weighting. We plot the LOT measure of transaction costs for value and growth stocks each year during our sample period in Figure 3. For the sake of comparison with value and growth portfolios, we also plot the transaction costs for the BM deciles 4 and 7. Figure 3 clearly shows a sharp decline in transaction costs beginning in 1991. The growth, BM4, and BM7 portfolios exhibit very similar pattern of transaction costs. However, the value portfolio's average transaction costs are much higher throughout our sample period. Table 8 compares the transaction costs between value and growth stocks year by year. The results are striking. For each and every year, the transaction costs for value stocks are higher than those for growth stocks with the difference being greater than 10% for a large number of years. The average transaction cost of value stocks across the 30-year period is 8.9% compared to 3.7% for the growth stocks (see last row of Table 8). Given this large average roundtrip transaction cost of 12.6% (= 8.9% + 3.7%), it seems that the value premium of around 10% cannot be achieved in practice. The average transaction costs are even higher during the first two sub-periods: 1973 to 1982 and 1983 to 1992. Overall, based on the evidence in Table 8, after accounting for transaction cost, the value premiums reported in LSV (1994) and La Porta et al. (1997) disappear.

6.2. Profitability of FF Strategy

Panels A and B of Table 9 present the profitability of FF value strategies. As we can see from Panel A, none of the value premiums within a size quintile is statistically significant. The average value premium for H45-L12 is also not statistically significant.[10] In Panel B, all the three value premiums (VMG, VMGS, VMGB) are again not statistically significant. Overall, these findings suggest that value strategies are no longer profitable after adjusting for transaction costs.

6.3. Profitability of liquidity-adjusted value strategy

Table 9, Panels C and D report the results for profitability of liquidity-adjusted value strategy. Regardless of the liquidity measure used, the value premiums based on liquidity and BM sorted portfolios are no longer significant for all liquidity quintiles except for one group (the 4th group in Panel C Table 9) under Amivest measure. These results suggest that even after accounting for variation in liquidity, value premium disappears when we adjust for transaction costs.

Overall, the results in this section provide strong evidence that the value premium ceases to exist after controlling for transaction costs.

[10] The average value premium for H-L still appears to be significant with a t-value of 3.07, but this might due to the fact that some portfolios of the highest BM group have fewer firms and are not well diversified. As a result, part of the value premium might be a compensation for non-diversification risk.

7. Conclusion

In his survey paper of asset pricing, Campbell (2000) states that "we have only a poor understanding of how transaction costs can affect asset prices". This paper intends to provide further insights on the subject of transaction costs and stock returns.

By comparing the transaction costs of value stocks and growth stocks, it finds that on average, value stocks have higher transaction costs than growth stocks and the value premium is not obtainable after controlling for transaction costs. There has been a huge decline in the transaction costs in the late nineties, perhaps due to the market reforms during this period. The findings of this paper can potentially explain why investors may not be able to arbitrage away the value premium and provide evidence for modified efficient market hypothesis of Fama (1991). Furthermore, our results raise questions about the attainability of value premium in some of the international markets (e.g., Arshanapalli et al. (1998), Fama and French (1998)) where transaction costs are likely to be much higher than those in the US.

Appendix A:

Table A.1: Commission Schedule used by Lesmond, Schill, and Zhou (2004).

Transaction amount	Commission
\$0 – \$2,500	\$29 + 1.70% of Principal Amount
\$2,500.01 – \$6,250	\$55 + 0.66% of Principal Amount
\$6,250.01 – \$20,000	\$75 + 0.34% of Principal Amount
\$20,000.01 – \$50,000	\$99 + 0.22% of Principal Amount
\$50,000.01 – \$500,000	\$154 + 0.11% of Principal Amount
\$500,000	\$254 + 0.09% of Principal Amount

Table A.2: Comparisons of LDV estimate and the sum of spread and commissions (S+C) (Year 1995)

	Growth			Value
	1	4	7	10
Roll's Spread	0.035	0.032	0.033	0.055
RS + Commission	0.075	0.084	0.096	0.147
Quoted Spread	0.021	0.017	0.024	0.045
QS + Commission	0.061	0.069	0.088	0.137
LDV	0.035	0.023	0.036	0.070

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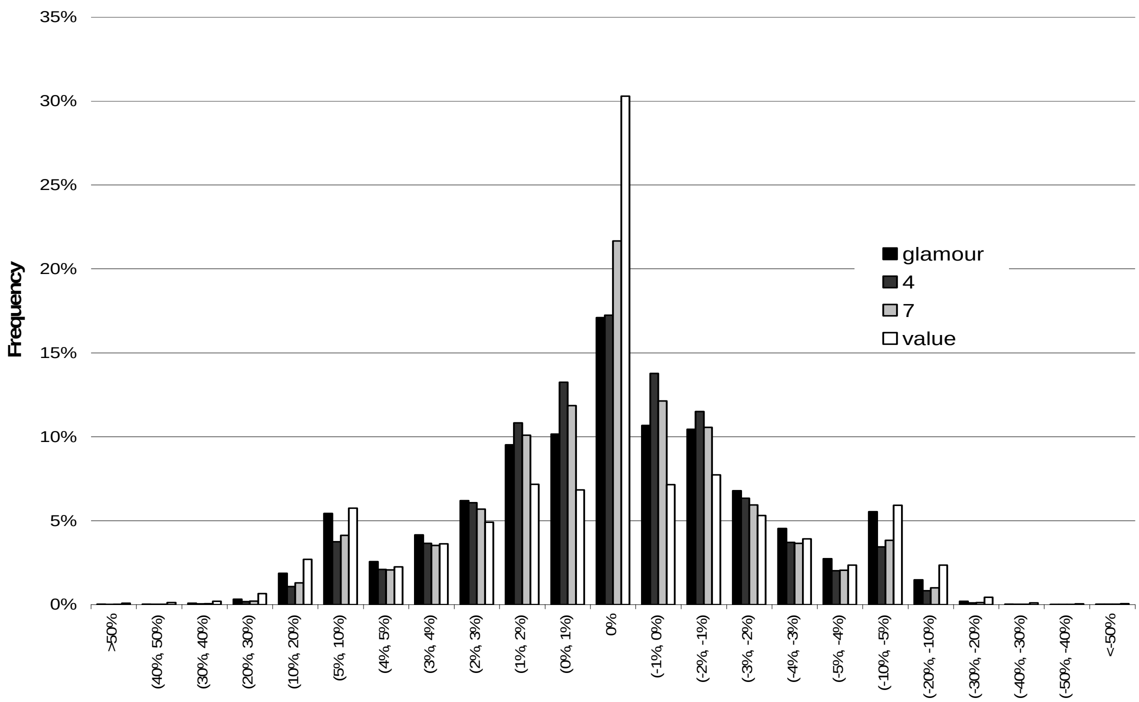

Figure 1. Histogram of mean frequency daily returns for 1973 to 2004. 4 and 7 stand for the fourth and seventh decile portfolios of the BM deciles respectively. The darkest bars stand for glamour stocks and the white bars stand for value stocks.

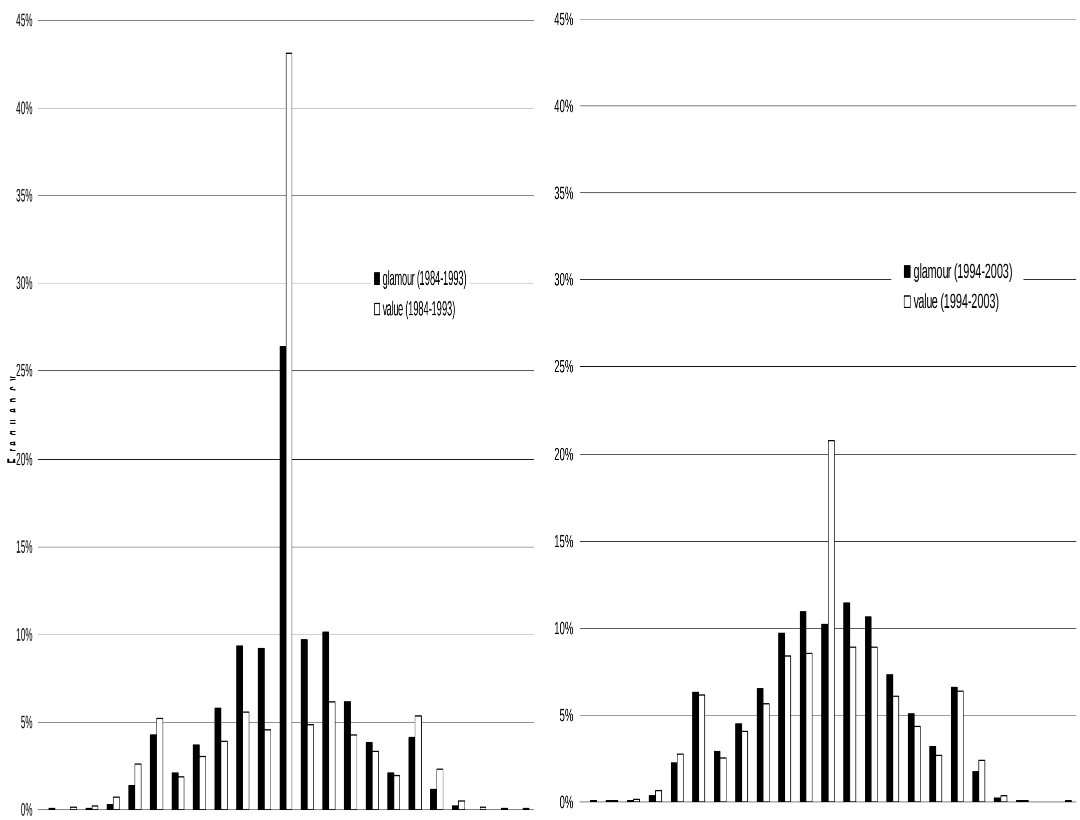

Figure 2 Histogram of mean frequency zero daily return for 1984-1993 and 1994 -2003.

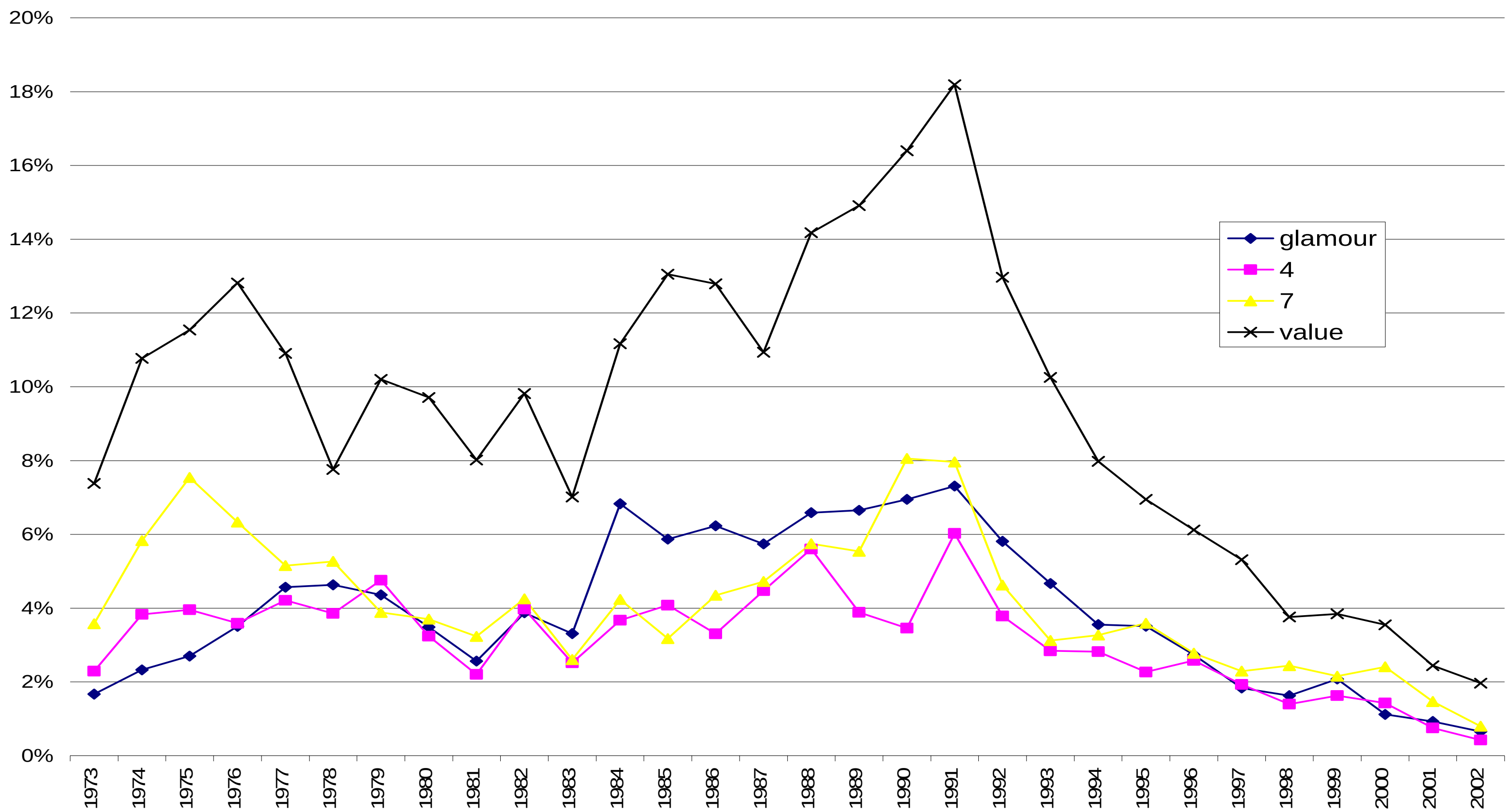

Figure 3. LOT measure of transaction costs during our sample period (1973-2004)

4 and 7 represent for the fourth and seventh decile portfolios of the BM deciles respectively. BM is the ratio of book equity to market value of equity. Market value of equity is calculated as the price multiplied by shares outstanding. At the end of each December between 1973 and 2004, 10 decile portfolios are formed in ascending order of BM. BM rank 1 represents value portfolio and 10 represents glamour (or growth) portfolio. LOT measure of transaction costs is estimated by maximizing the likelihood function in equation 4 in the paper.

Table 1: Annual Buy-and-Hold Returns on 10 Portfolios Classified by Book-to-Market Ratios, 1974-2005

BM is the ratio of book equity to market value of equity. Market value of equity is calculated as the price multiplied by shares outstanding. At the end of each December between 1973 and 2004, 10 decile portfolios are formed in ascending order of BM. BM rank 1 represents value portfolio and 10 represents glamour (or growth) portfolio. The returns of the portfolios are measured since July of the year following the portfolio formation year. The returns presented in the table are the averages of annual returns over the entire sample period. YR1-YR5 is the average return in year 1-5 after portfolio formation. AR is the average annual return over YR1 to YR5. Size-adjusted annual returns are calculated by raw annual returns less the size benchmark portfolio returns.

	Glamour									Value	Mean Difference	t-Stat for Mean
BM	1	2	3	4	5	6	7	8	9	10	10-1	Difference 10-1
						Panel A: Annual Returns						
YR1	0.117	0.163	0.186	0.196	0.210	0.220	0.225	0.243	0.265	0.259	0.142	4.36***
YR2	0.128	0.172	0.189	0.195	0.206	0.212	0.233	0.240	0.248	0.250	0.123	3.40***
YR3	0.150	0.164	0.188	0.186	0.194	0.222	0.228	0.221	0.237	0.247	0.098	2.86***
YR4	0.158	0.172	0.181	0.187	0.196	0.198	0.216	0.232	0.231	0.234	0.076	2.12**
YR5	0.152	0.175	0.180	0.173	0.181	0.200	0.232	0.224	0.236	0.230	0.079	2.36**
AR	0.141	0.169	0.185	0.187	0.198	0.210	0.227	0.232	0.244	0.244	0.103	
						Panel B: Size-Adjusted Annual Returns						
YR1	-0.073	-0.030	-0.009	-0.002	0.008	0.016	0.018	0.032	0.052	0.049	0.121	4.09***
YR2	-0.053	-0.015	0.003	0.005	0.012	0.014	0.031	0.035	0.037	0.044	0.097	3.08***
YR3	-0.020	-0.014	0.008	0.005	0.009	0.031	0.035	0.021	0.036	0.049	0.070	2.07**
YR4	-0.016	-0.006	0.002	0.004	0.011	0.008	0.019	0.033	0.026	0.035	0.051	0.92
YR5	-0.031	-0.011	-0.008	-0.016	-0.011	0.002	0.031	0.018	0.025	0.028	0.059	1.17
AR	-0.039	-0.015	-0.001	-0.001	0.006	0.014	0.027	0.028	0.035	0.041	0.080	

***: Statistically significant at 1% level **: Statistically significant at 5% level *: Statistically significant at 10% level

Table 2: Annual Buy-and-Hold Returns on 10 Portfolios Classified by Book-to-Market Ratios, 1974-1983, 1984-1993, and 1994-2003

At the end of each December, decile portfolios are formed in ascending order of BM. The table reports the average returns five years after portfolio formation (YR1-YR5 from year t+1 to t+5). AR is the average annual return over YR1 to YR5. Size-adjusted returns are calculated as raw returns less the size benchmark portfolio returns.

	Glamour									Value	Mean Difference	t-Stat for Mean Difference
BM	1	2	3	4	5	6	7	8	9	10	10-1	10-1
Panel A: Annual Returns (1974 – 1983)												
YR1	0.117	0.137	0.175	0.165	0.196	0.206	0.212	0.246	0.258	0.258	0.141	3.27***
YR2	0.174	0.216	0.237	0.248	0.272	0.271	0.302	0.313	0.333	0.334	0.159	2.81**
YR3	0.187	0.210	0.258	0.247	0.260	0.311	0.288	0.333	0.358	0.341	0.154	3.30***
YR4	0.181	0.219	0.241	0.246	0.256	0.257	0.306	0.332	0.334	0.334	0.153	3.59***
YR5	0.160	0.210	0.221	0.207	0.232	0.254	0.284	0.269	0.299	0.302	0.143	2.59**
AR	0.164	0.198	0.226	0.223	0.243	0.260	0.278	0.298	0.316	0.314	0.150	
Panel B: Size-Adjusted Annual Returns (1974 – 1983)												
YR1	-0.116	-0.105	-0.074	-0.090	-0.067	-0.060	-0.059	-0.036	-0.037	-0.041	0.075	2.65**
YR2	-0.047	-0.016	0.003	0.006	0.025	0.013	0.037	0.040	0.046	0.038	0.085	2.47**
YR3	-0.030	-0.023	0.018	0.006	0.009	0.050	0.029	0.054	0.068	0.044	0.074	2.14**
YR4	-0.044	-0.020	-0.004	-0.003	0.005	-0.004	0.033	0.047	0.037	0.031	0.074	1.89*
YR5	-0.074	-0.036	-0.029	-0.039	-0.021	-0.010	0.017	-0.007	0.011	0.009	0.084	1.00
AR	-0.062	-0.040	-0.017	-0.024	-0.010	-0.002	0.012	0.020	0.025	0.016	0.078	
Panel C: Annual Returns (1984-1993)												
YR1	0.080	0.113	0.125	0.145	0.161	0.164	0.163	0.178	0.194	0.174	0.094	2.26**
YR2	0.082	0.142	0.136	0.143	0.147	0.157	0.177	0.170	0.169	0.192	0.110	2.29**
YR3	0.087	0.072	0.121	0.109	0.116	0.129	0.141	0.104	0.115	0.175	0.089	1.76
YR4	0.079	0.091	0.103	0.100	0.137	0.108	0.119	0.121	0.113	0.136	0.058	1.11
YR5	0.123	0.118	0.123	0.135	0.129	0.146	0.149	0.135	0.143	0.141	0.018	0.24
AR	0.090	0.107	0.122	0.126	0.138	0.141	0.150	0.142	0.147	0.164	0.074	
Panel D: Size-Adjusted Annual Returns (1984-1993)												
YR1	-0.071	-0.040	-0.022	-0.003	0.015	0.016	0.013	0.031	0.053	0.036	0.107	3.08**
YR2	-0.055	0.003	0.000	0.007	0.010	0.020	0.036	0.034	0.033	0.058	0.113	2.71**
YR3	-0.025	-0.040	0.011	-0.001	0.004	0.016	0.026	-0.009	0.002	0.064	0.089	2.02*
YR4	-0.029	-0.019	-0.004	-0.008	0.028	-0.002	0.004	0.009	-0.001	0.025	0.054	1.13
YR5	-0.009	-0.017	-0.009	0.001	-0.006	0.010	0.008	-0.008	-0.003	0.003	0.011	0.17
AR	-0.038	-0.023	-0.005	-0.001	0.010	0.012	0.018	0.012	0.017	0.037	0.075	

Table 2 (Continued)

BM	Glamour 1	2	3	4	5	6	7	8	9	Value 10	Mean Difference 10-1	t-Stat for Mean Difference 10-1
Panel E: Annual Returns (1994– 2003)												
YR1	0.117	0.137	0.175	0.165	0.196	0.206	0.212	0.246	0.258	0.258	0.141	2.08*
YR2	0.127	0.156	0.196	0.194	0.196	0.207	0.219	0.237	0.242	0.222	0.096	1.11
YR3	0.163	0.191	0.171	0.187	0.192	0.208	0.238	0.204	0.215	0.212	0.049	0.66
YR4	0.191	0.181	0.177	0.188	0.178	0.200	0.194	0.209	0.209	0.203	0.013	0.16
YR5	0.161	0.176	0.174	0.162	0.162	0.178	0.230	0.232	0.230	0.212	0.051	1.03
AR	0.152	0.168	0.179	0.179	0.185	0.200	0.219	0.226	0.231	0.221	0.070	
Panel F: Size-Adjusted Annual Returns (1994 – 2003)												
YR1	-0.067	-0.047	-0.013	-0.026	0.001	0.008	0.011	0.042	0.055	0.065	0.132	1.86*
YR2	-0.057	-0.033	0.008	0.002	0.000	0.009	0.018	0.032	0.031	0.031	0.088	1.01
YR3	-0.016	0.005	-0.017	-0.003	0.000	0.010	0.036	-0.003	0.012	0.023	0.039	1.29
YR4	0.005	-0.002	-0.006	0.000	-0.013	0.006	-0.007	0.010	0.007	0.015	0.010	0.13
YR5	-0.021	-0.007	-0.011	-0.027	-0.029	-0.017	0.031	0.030	0.025	0.025	0.046	0.91
AR	-0.031	-0.017	-0.008	-0.011	-0.008	0.003	0.018	0.022	0.026	0.032	0.063	

***: Statistically significant at 1% level **: Statistically significant at 5% level *: Statistically significant at 10% level.

Table 3: Returns and Transaction Costs for 25 Portfolios Classified by Size and Book-to-Market Quintiles 1974-2005

At the end of each June from 1974 to 2004, we form 25 value-weighted portfolios as the intersection of independent sorts of NYSE, AMEX, and NASDAQ stocks into five size groups and five book-to-market groups. We use NYSE market cap and book-to-market quintile breakpoints to classify the stocks into five groups. Size for a stock in year *t* is measured by the market capitalization at the end of June, which is calculated as the closing price of the stock multiplied by the number of shares outstanding at the end of June of year *t*. Book equity in book-to-market is for the fiscal year ending in year *t-1* and market equity is market cap at the end of December of year *t*. Panel B reports the value-weighted average annual returns for each portfolio. Panel C presents the average annual LOT measure of transaction costs for each portfolio. LOT measure is estimated by maximizing the likelihood function in equation 4 in the paper. H-L in Panel B is the value premium for a size group estimated from the time series of annual differences between the average returns for the highest BM quintile within a size quintile and the average returns of for the lowest BM quintile in the same size quintile. H45-L12 in Panel B is the value premium for a size group estimated from the time series of annual differences between the average returns for the two highest BM quintiles within a size quintile and the average returns for the two lowest BM quintiles in the same size quintile. H-L in Panel C is the average transaction cost for implementing value strategy H-L and equals to the roundtrip transaction costs for the highest and lowest BM quintiles. H45-L12 in Panel C is the average transaction cost for implementing value strategy H45-L12 and equals to the average round trip transaction costs for the two highest and lowest BM quintiles within a size quintile.

Panel A: 25 Size/BM Portfolios - Number of Firms

	Low BM	2	3	4	High BM	Sum
Small Size	447	317	329	416	703	2212
2	139	117	120	108	81	564
3	113	90	85	69	45	402
4	101	78	65	55	35	334
Big Size	110	64	51	42	26	294
Sum	910	667	650	690	889	3806

Panel B: 25 Size/BM Portfolios - Average buy and hold annual returns

	Low BM	2	3	4	High BM	H-L	t(H-L)	H45-L12	t(H45-L12)
Small Size	0.119	0.188	0.188	0.194	0.210	0.091	2.76	0.048	1.90
2	0.136	0.162	0.178	0.190	0.208	0.072	2.31	0.050	2.17
3	0.140	0.168	0.173	0.176	0.202	0.062	2.07	0.035	1.66
4	0.136	0.153	0.162	0.173	0.197	0.061	2.12	0.040	2.15
Big Size	0.122	0.141	0.145	0.146	0.154	0.032	0.97	0.018	0.86

Panel C: 25 Size/BM Portfolios- Average annual transaction costs

	Low BM	2	3	4	High BM	H-L	t(H-L)	H45-L12	t(H45-L12)
Small Size	0.047	0.036	0.035	0.036	0.046	0.092	12.20	0.082	12.23
2	0.020	0.017	0.017	0.017	0.019	0.038	11.14	0.036	11.31
3	0.011	0.011	0.011	0.011	0.012	0.024	11.04	0.023	11.48
4	0.007	0.007	0.007	0.007	0.010	0.017	12.31	0.016	12.26
Big Size	0.003	0.003	0.004	0.005	0.006	0.009	11.30	0.009	11.97

Table 4: Returns and Transaction Costs for 6 Portfolios Classified by Size and Book-to-Market 1974-2005

At the end of each June from 1974 to 2004, we form 6 value-weighted portfolios as the intersection of independent sorts of NYSE, AMEX, and NASDAQ stocks into two size groups (S, B) and three book-to-market groups (V, N, G). We use median value of NYSE market cap and 30%, 40% and 70% of BM breakpoints to classify the stocks into 6 groups (SG, SN, SV, BG, BN, and BV). Size for a stock in year *t* is measured by the market capitalization at the end of June, which is calculated as the closing price of the stock multiplied by the number of shares outstanding at June of year *t*. Book equity in book-to-market is for the fiscal year ending in year *t-1* and market equity is market cap at the end of December of year *t*. Panel B presents value-weighted average annual returns for each portfolio. Panel C presents average annual LOT measure of transaction costs for each portfolio. LOT measure is estimated by maximizing the likelihood function in equation 4 in the paper. In Panel B, the value premium, VMG, is the simple average returns on the two value portfolios less the average returns on the two growth portfolios: VMG = (VB+VS)/2 - (GB+GS)/2. The other value premiums are calculated as: VMGS = SV - SG, and VMGB = BV – BG. Panel C reports the average annual transaction costs. The transaction costs of VMG is equal to (VB+VS)/2 + (GB+GS)/2. The other value premiums are calculated as: VMGS = SV + SG, and VMGB = BV + BG.

Panel A: 6 Size/BM Portfolios - Average annual buy-and-hold returns

	SG	SN	SV	BG	BN	BV
Mean	0.147	0.182	0.204	0.124	0.150	0.159
Std Dev	0.212	0.184	0.171	0.171	0.149	0.147
t-statistic	3.93	5.60	6.78	4.09	5.71	6.11

Panel B: 6 Size/BM Portfolios - Value Premiums

	SMB	VMG	VMGS	VMGB
Mean	0.034	0.046	0.057	0.035
Std Dev	0.108	0.132	0.139	0.150
t-statistic	1.76	1.97	2.33	1.31

Panel C: 6 Size/BM Portfolios - Average annual transaction costs

	SG	SN	SV	BG	BN	BV
Mean	0.022	0.020	0.026	0.004	0.005	0.007
Std Dev	0.010	0.010	0.013	0.002	0.002	0.003
t-statistic	12.43	11.26	11.61	12.66	12.03	10.99

Panel D: 6 Size/BM Portfolios - Transaction Costs for Value Strategies

	SMB	VMG	VMGS	VMGB
Mean	0.028	0.029	0.048	0.010
Std Dev	0.013	0.014	0.022	0.005
t-statistic	12.07	12.22	12.10	12.05

Table 5: Returns and Transaction Costs for 25 Portfolios Classified by Liquidity (Amivest) and Book-to-Market 1974-2005

At the end of each June from 1974 to 2004, we form 25 value-weighted portfolios as the intersection of independent sorts of NYSE, AMEX, and NASDAQ stocks into five liquidity groups and five book-to-market groups. We use NYSE liquidity and book-to-market quintile breakpoints to classify the stocks into five groups. Liquidity of stocks in this table is measured by Amivest measure. Liquidity during year *t-1* is used to form portfolios for year *t*. Book equity in book-to-market is for the fiscal year ending in year *t-1* and market equity is market cap at the end of December of year *t*. Panel B presents value-weighted average annual returns for each portfolio. Panel C reports the average annual LOT measure of transaction costs for each portfolio. LOT measure is estimated by maximizing the likelihood function in equation 4 of the paper. H-L in Panel B is the value premium for a liquidity group estimated from the time series of annual differences between the average returns for the highest BM quintile within a liquidity quintile and the average returns for the lowest BM quintile in the same liquidity quintile. H45-L12 in Panel B is the value premium for a liquidity group estimated from the time series of annual differences between the average returns for the two highest BM quintiles within a liquidity quintile and the average returns for the two lowest BM quintiles in the same liquidity quintile. H-L in Panel C is the average transaction cost for implementing value strategy H-L and equals to the roundtrip transaction costs for the highest BM quintile and those for the lowest BM quintile. H45-L12 in Panel C is the average transaction cost for implementing value strategy H45-L12 and equals to the average round trip transaction costs for the two highest BM quintiles and those for the two lowest BM quintiles within a liquidity quintile.

Panel A: Number of Firms

	Low	2	3	4	High	Sum
Liquidity-Low	314	268	308	379	608	1876
2	183	125	115	107	100	630
3	154	104	89	76	58	480
4	117	85	67	59	44	372
Liquidity-High	110	68	55	49	39	321
Sum	877	650	635	669	848	3679

Panel B: 25 Liquidity (Amivest) / BM Portfolios - Average buy and hold annual returns

	Low	2	3	4	High	H-L	t(H-L)	H45-L12	t(H45-L12)
Liquidity-Low	0.143	0.158	0.195	0.203	0.205	0.063	2.36	0.054	2.79
2	0.139	0.160	0.184	0.170	0.195	0.056	2.02	0.033	1.74
3	0.136	0.157	0.173	0.175	0.201	0.065	2.21	0.042	2.08
4	0.123	0.152	0.161	0.170	0.202	0.079	2.71	0.048	2.43
Liquidity-High	0.117	0.144	0.144	0.151	0.160	0.043	1.37	0.025	1.26

Panel C: 25 Liquidity (Amivest) / BM Portfolios - Average annual transaction costs

	Low	2.00	3.00	4.00	High	H-L	t(H-L)	H45-L12	t(H45-L12)
Liquidity-Low	0.026	0.020	0.018	0.019	0.031	0.057	11.16	0.048	11.83
2	0.012	0.011	0.011	0.012	0.016	0.028	13.27	0.025	13.14
3	0.008	0.008	0.008	0.009	0.011	0.019	11.55	0.018	12.18
4	0.005	0.006	0.006	0.007	0.009	0.015	11.45	0.013	11.58
Liquidity-High	0.003	0.003	0.004	0.005	0.007	0.009	10.95	0.009	11.60

Table 6: Returns and Transaction Costs for 25 Portfolios Classified by Liquidity (Liu 2006) and Book-to-Market 1974-2005

At the end of each June from 1974 to 2004, we form 25 value-weighted portfolios as the intersection of independent sorts of NYSE, AMEX, and NASDAQ stocks into five liquidity groups and five book-to-market groups. We use NYSE liquidity and book-to-market quintile breakpoints to classify the stocks into five groups. Liquidity of stocks in this table is measured as in Liu (2006). Liquidity during year *t-1* is used to form portfolios for year *t*. Book equity in book-to-market is for the fiscal year ending in year *t-1* and market equity is market cap at the end of December of year *t*. Panel B presents value-weighted average annual returns for each portfolio. Panel C presents average annual LOT measure of transaction costs for each portfolio. LOT measure is estimated by maximizing the likelihood function in equation 4 of the paper. H-L in Panel B is the value premium for a liquidity group estimated from the time series of annual differences between the average returns for the highest BM quintile within a liquidity quintile and the average returns for the lowest BM quintile in the same liquidity quintile. H45-L12 in Panel B is the value premium for a liquidity group estimated from the time series of annual differences between the average returns for the two highest BM quintiles within a liquidity quintile and the average returns for the two lowest BM quintiles in the same liquidity quintile. H-L in Panel C is the average transaction cost for implementing value strategy H-L and equals to the roundtrip transaction costs for the highest BM quintile and those for the lowest BM quintile. H45-L12 in Panel C is the average transaction cost for implementing value strategy H45-L12 and equals to the average roundtrip transaction costs for the two highest BM quintiles and those for the two lowest BM quintiles within a liquidity quintile.

Panel A: Number of Firms

	Low	2	3	4	High	Sum
Liquidity-High	283	152	109	93	93	730
2	109	86	76	68	67	406
3	90	75	75	69	57	367
4	81	72	79	80	68	380
Liquidity-Low	313	265	296	359	562	1796
Sum	877	650	635	669	848	3679

Panel B: 25 Liquidity (Liu) /BM Portfolios: Average buy and hold annual returns

	Low	2	3	4	High	H-L	t(H-L)	H45-L12	t(H45-L12)
Liquidity-High	0.118	0.150	0.156	0.160	0.193	0.075	1.87	0.042	1.60
2	0.129	0.161	0.161	0.158	0.194	0.065	1.79	0.031	1.24
3	0.120	0.143	0.160	0.160	0.180	0.060	1.77	0.038	1.94
4	0.118	0.139	0.146	0.168	0.181	0.064	2.09	0.047	1.87
Liquidity-Low	0.128	0.148	0.192	0.195	0.191	0.063	3.30	0.055	2.43

Panel C: 25 Liquidity (Liu)/BM Portfolios: Average annual transaction costs

	Low	2	3	4	High	H-L	t(H-L)	H45-L12	t(H45-L12)
Liquidity-High	0.005	0.006	0.007	0.007	0.010	0.015	11.69	0.014	11.93
2	0.004	0.004	0.005	0.006	0.009	0.013	11.67	0.012	12.35
3	0.003	0.004	0.005	0.006	0.008	0.011	9.61	0.011	10.60
4	0.004	0.004	0.005	0.006	0.011	0.015	7.77	0.013	8.72
Liquidity-Low	0.016	0.014	0.015	0.016	0.026	0.043	9.99	0.037	10.71

Table 7: Summary of Value Strategies

LSV value strategy is based on LSV (1994). At the end of each December between 1973 and 2004, 10 decile portfolios are formed in ascending order of BM. BM rank 1 represents value portfolio and 10 represents growth portfolio. FF value strategy is based on Fama and French (1993, 2006). At the end of each June from 1974 to 2004, 6 value-weighted portfolios are formed as the intersection of independent sorts of NYSE, AMEX, and NASDAQ stocks into two size groups (S, B) and three book-to-market groups (V, N, G). Alternatively, 25 value-weighted portfolios are formed as the intersection of independent sorts of NYSE, AMEX, and NASDAQ stocks into five size groups and five book-to-market groups. Liquidity-adjusted value strategy is based on double sorts on liquidity and BM. At the end of each June from 1974 to 2004, we form 25 value-weighted portfolios as the intersection of independent sorts of NYSE, AMEX, and NASDAQ stocks into five liquidity groups and five book-to-market groups. H stands for the highest BM quintile and L stands for the lowest BM quintile. H45 represents the two highest BM quintiles and L12 represents the two lowest BM quintiles.

	Portfolio Formation	No. of portfolios	Value Premium
LSV Value Strategy	BM deciles	10	BM10-BM1
FF Value Strategy	2 Size groups/3 BM groups	6	VMG = (VB+VS)/2 - (GB+GS)/2 VMGS=SV-SG VMGB=BV-BG
	Size quintiles/BM quintiles	25	For each size quintile: H-L=BM5-BM1 H45-L12=(BM5+BM4)/2 - (BM1+BM2)/2
Liquidity-adjusted Value Strategy	Liquidity Quintiles/ BM Quintiles	25	For each liquidity quintile: H-L=BM5-BM1 H45-L12=(BM5+BM4)/2 - (BM1+BM2)/2

Table 8: LOT measure of trading costs for LSV Strategy (1973-2004)

BM is the ratio of book equity to market value of equity. Market value of equity is calculated as the price multiplied by shares outstanding. At the end of each December between 1974 and 2003, 10 decile portfolios are formed in ascending order of BM. BM rank 1 represents value portfolio and 10 represents growth portfolio. LOT measure of transaction costs is estimated by maximizing the likelihood function in equation 4 of the paper.

	Growth			Value
BM	1	4	7	10
1973	0.017	0.023	0.036	0.074
1974	0.023	0.038	0.058	0.108
1975	0.027	0.040	0.075	0.115
1976	0.035	0.036	0.063	0.128
1977	0.046	0.042	0.052	0.109
1978	0.046	0.039	0.053	0.078
1979	0.044	0.048	0.039	0.102
1980	0.035	0.032	0.037	0.097
1981	0.026	0.022	0.032	0.080
1982	0.039	0.040	0.043	0.098
1983	0.033	0.025	0.026	0.070
1984	0.068	0.037	0.042	0.112
1985	0.059	0.041	0.032	0.131
1986	0.062	0.033	0.043	0.128
1987	0.057	0.045	0.047	0.109
1988	0.066	0.056	0.057	0.142
1989	0.067	0.039	0.055	0.149
1990	0.070	0.035	0.081	0.164
1991	0.073	0.060	0.080	0.182
1992	0.058	0.038	0.046	0.130
1993	0.047	0.028	0.031	0.103
1994	0.036	0.028	0.033	0.080
1995	0.035	0.023	0.036	0.069
1996	0.027	0.026	0.028	0.061
1997	0.018	0.019	0.023	0.053
1998	0.016	0.014	0.024	0.038
1999	0.021	0.016	0.022	0.038
2000	0.011	0.014	0.024	0.035
2001	0.009	0.008	0.015	0.024
2002	0.007	0.004	0.008	0.020
2003	0.006	0.003	0.007	0.016
2004	0.005	0.003	0.007	0.008
Average (1973-1982)	0.034	0.036	0.049	0.099
Average (1983-1992)	0.061	0.041	0.051	0.132
Average (1993-2004)	0.020	0.016	0.021	0.046
Total Average	0.037	0.030	0.039	0.089

Table 9: Profitability of Value strategy

Panel A and Panel B show the transaction-cost-adjusted premium of FF value strategy. Panel C and Panel D present the transaction-cost-adjusted premium of liquidity-adjusted value strategy. FF strategy is based on Fama and French (1993,2006). At the end of each June from 1974 to 2004, 25 value-weighted portfolios are formed as the intersection of independent sorts of NYSE, AMEX, and NASDAQ stocks into five size groups and five book-to-market groups. Alternatively, 6 value-weighted portfolios are formed as the intersection of independent sorts of NYSE, AMEX, and NASDAQ stocks into two size groups (S, B) and three book-to-market groups (V, N, G). Liquidity strategy is based on double sorts on liquidity and BM. At the end of each June from 1974 to 2004, we form 25 value-weighted portfolios as the intersection of independent sorts of NYSE, AMEX, and NASDAQ stocks into five liquidity groups and five book-to-market groups. H stands for the highest BM quintile and L stands for the lowest BM quintile. H45 represents the two highest BM quintiles and L12 represents the two lowest BM quintiles. The value premiums are as defined in Table 7. The transaction-cost-adjusted value premiums reported in this table are value premiums defined in Table 7 less the transaction costs associated with each value strategy.

Panel A: 25 Size-BM Portfolios: Transaction-cost-adjusted value premium

	H-L	t(H-L)	H45-L12	t(H45-L12)
Small	0.00	-0.05	-0.03	-1.30
2	0.03	1.08	0.01	0.60
3	0.04	1.28	0.01	0.59
4	0.04	1.55	0.02	1.33
Big	0.02	0.70	0.01	0.46

Panel B: 6 Size-BM Portfolios: Transaction-cost-adjusted value premiums

	SMB	VMG	VMGS	VMGB
Mean	12.431	11.263	11.608	12.662
Std Dev	0.108	0.132	0.141	0.150
t-statistic	0.32	0.72	0.37	0.92

Panel C: 25 Liquidity (Amivest)-BM Portfolios – Transaction-cost-adjusted value premium

	H-L	t(H-L)	H45-L12	t(H45-L12)
Liquidity-Low	0.005	0.15	0.006	0.23
2	0.029	1.02	0.008	0.40
3	0.045	1.55	0.024	1.19
4	0.064	2.22	0.035	1.76
Liquidity-High	0.034	1.07	0.016	0.80

Panel D: 25 Liquidity (Liu)-BM Portfolios – Transaction-cost-adjusted value premium

	H-L	t(H-L)	H45-L12	t(H45-L12)
Liquidity-High	0.060	1.50	0.028	1.05
2	0.052	1.43	0.020	0.76
3	0.049	1.44	0.028	1.41
4	0.049	1.63	0.034	1.38
Liquidity-Low	0.020	0.73	0.018	1.06

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