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A Time-Series Approach to Liquidity in Asset Pricing

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**THE FLORIDA STATE UNIVERSITY
COLLEGE OF BUSINESS**

**A TIME-SERIES APPROACH TO
LIQUIDITY IN ASSET PRICING**

By

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This dissertation is dedicated to my family for their loving support and guidance in this endeavor. I especially want to thank my mother, Carmen Fowler, and wife, Carmaletia Keene, for their daily commitment to my success in the process of completing my dissertation. Without my wife and mother I am not sure this would be possible.

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ABSTRACT

The main focus of this dissertation is to examine liquidity determinants of stock returns in a time-series asset-pricing model. The main questions I address are if the effects of liquidity on asset returns have significant time-variation and is there a well specified time-series model that can capture this relationship. In addition, I test whether the effect of liquidity is stronger in bear markets than in bull markets, whether liquidity has a reducing effect on other variables that are commonly significant in predicting asset returns, and if there exists some specific liquidity proxies that have greater explanatory power than other comparable proxies.

CHAPTER 1- INTRODUCTION

Several asset-pricing models have been introduced to the finance literature in order to explain how investors measure risk and value risky assets. At the forefront are the Capital Asset Pricing Model (CAPM) and the subsequent extensions of the CAPM, as well as the Arbitrage Pricing Theory (APT). According to these models expected returns can be predicted given specific related variables. Empirical tests of the unconditional CAPM use the risk of the market as measured by beta, which is defined as a measure of the relative variability of a security's return as compared to the variability of the entire market's return. The CAPM uses the beta of a security in conjunction with the risk premium on the market to account for the expected risk premium on a specific security, where it attempts to account for the market's perception of risk and return. However, skeptics of the CAPM posit that in this state the model, by use of beta, does not accurately capture the risk that investors face.

In general, it has been shown that the beta of a security is an incomplete variable in the measuring of risk. For example, Hansen and Jagannathan (1997) show that there exists portfolios comprised of stocks with small capitalization that earn higher returns on average than those predicted by the CAPM. This implies that there may be something missing from the model, namely some component of risk. From shortcomings such as this, the extensions of the CAPM and the APT have evolved to bridge this gap and try to account for the missing risk. The majority of the more recent models either remove beta from the model and replace it with a more complete proxy of risk faced by investors or add other variables that may aid beta in capturing the true risk an investor encounters.

In recent years the trend in this literature is toward uncovering factors that accurately predict returns. Studies by Banz (1981), Rosenberg, Reid and Lanstein (1985), and Fama and French (1992) show that factors other than a stock's beta can predict returns. One such factor is liquidity where, in this framework, it is defined as the risk that investors face for not being able

to readily transfer ownership of a security. Therefore, the returns earned on the small capitalization stock portfolio of Hansen and Jagannathan (1997) above that of the CAPM may be explained by a missing risk measure. In recent years an increased amount of attention has been given to liquidity as a component of extensions on the CAPM and other asset pricing models [Chordia, Roll and Subrahmanyam (2002)].

Liquidity is one of the main characteristics used by the financial services industry in many mutual fund investment portfolios and similar financial securities¹. Mutual fund and portfolio managers, as well as investment analysts, create portfolios to fit specific liquidity needs and concerns. Financial companies such as Merrill Lynch try to build their client base with slogans such as “Realize your financial goals with solutions customized to your needs.” They then claim to be able to create an investment strategy to manage a portfolio to suit the investor, whether the investor has short-term liquidity needs or medium- and longer-term fixed income needs. Through this importance in the financial markets the investigation of liquidity has seen a tremendous growth in academic research stemming from Amihud and Mendelson (1986).

The importance of liquidity comes from the desire of investors to reap more reward for the greater risk they incur. Investors require a certain level of liquidity in order to be able to move in and out of securities without being subject to losses. Given that desire, investors require a risk premium for securities that do not meet their liquidity needs. Specifically, liquidity and asset returns have an inverse relationship, where investors are willing to accept a lower return from securities with a higher level of liquidity.

Since Amihud and Mendelson (1986) the literature has extensively looked at the idea that liquidity can influence asset returns and found strong evidence that a relationship exists. However, empirical evidence of this liquidity relationship is mixed. Amihud and Mendelson (1986) find that there is a significant positive relationship between returns and illiquidity. Eleswarapu and Reinganum (1993) look at the liquidity relationship using the same measures as Amihud and Mendelson (1986), but with an updated time period, and find that the relationship between liquidity and stock returns is mainly limited to the January effect. Later articles such as

¹ See Demsetz (1968), Bagehot (1971), Tinic (1972), Tinic and West (1972), Benston and Hagerman (1974), Garman (1976), Branch and Freed (1977), Stoll (1978), Amihud and Mendelson (1980), Ho and Stoll (1981, 1983), Copeland and Galai (1983), Glosten and Milgrom (1985), Constantinides (1986), Marsh and Rock (1986), O’hara and Oldfield (1986), Easley and O’Hara (1987), Glosten and Harris (1988), Glosten (1989) and Chen and Kan (1989).

Brennan and Subrahmanyam (1996) refute the findings of Eleswarapu and Reinganum (1993) and find some support for the Amihud and Mendelson (1986) study. The liquidity-return relationship is further explored by numerous studies such as Eleswarapu (1997), Brennan, Chordia and Subrahmanyam (1998), Chalmers and Kadlec (1998), Datar, Naik and Radcliffe (1998), Chordia, Subrahmanyam and Anshuman (2001), Chordia, Roll and Subrahmanyam (2002) and Pastor and Stambaugh (2003). In general these papers look at liquidity through some of its unexplored determinants and find that, in fact, there is a statistically significant relationship between liquidity, its determinants, and returns.

Fama and French (1992) argue that liquidity is an important issue but it does not need to be specifically measured and accounted for because it is subsumed by the combination of size and book-to-market factors. However, other cross-sectional studies such as Chordia, Subrahmanyam and Anshuman (2001) show that liquidity needs to be accounted for individually and that after controlling for size, book-to-market and other variables, liquidity is still very much an important factor in returns. Specifically, they document a significant negative relationship between average stock returns and liquidity. They show that liquidity plays an integral role in the calculation of expected returns in the face of other risk factors such as size, book-to-market, and momentum.

Because of contrary studies Amihud and Menedelson (1989) revisit their liquidity-return relationship and provide a joint test of risk factors that are thought to be important to expected returns. They look at beta, residual risk, size and liquidity. Their results indicate that expected returns are a function of beta and liquidity and, in the presence of liquidity, returns are not significantly related to residual risk and firm size.

Additionally, Brennan and Subrahmanyam (1996) investigate the relationship between monthly stock returns and liquidity. They conclude that there is a statistically significant positive relationship between expected returns and illiquidity, even after taking price and the Fama and French (1993) risk factors of size and book-to-market into account. However when using the proportional spread they find a negative relationship between illiquidity and asset returns, which they attribute to some misspecification in their regressions.

In contrast to the majority of the literature, which examines the liquidity-return relationship in cross-sectional studies, Amihud (2002) adds to the importance of liquidity by showing the existence of a statistically significant time-varying relationship between liquidity

and expected returns. Specifically, he looks at the ratio of the daily absolute return to the dollar trading volume as a proxy for liquidity. Over a 34-year period he documents that liquidity has a significant negative effect on expected returns, even in the presence of size, beta and momentum. However, Amihud (2002) falls short on a few key items. Namely, he uses only a return-volume ratio as a measure of liquidity and does not account for many of the more prominent variables in the literature that are considered to encompass a more complete picture of liquidity. For instance, Chordia, Subrahmanyam and Anshuman (2001) use the natural log of dollar volume traded, the standard deviation of dollar volume traded, the coefficient of variation of dollar volume traded, share turnover, the standard deviation of share turnover, the coefficient of variation of share turnover and the reciprocal of the share price as measures of liquidity. In addition, Brennan and Subrahmanyam (1995) use the log of the daily return variance and the log of the number of analysts following a stock. In the microstructure section of the literature Chordia, Roll and Subrahmanyam (2000) use the quoted spread, proportional quoted spread, quoted depth², effective spread and proportional effective spread as liquidity measures. These variables are the more prominent proxies of liquidity witnessed in the literature and may serve as more complete proxies of liquidity.

Also, Amihud (2002) fails to account for the interaction between liquidity and other variables that are important in predicting asset returns, such as the book-to-market ratio used by Rosenberg, Reid and Lanstein (1985) and Fama and French (1992), the earnings' yield explored by Basu (1983) and the cash flow/price relationship examined by Chan, Hamao and Lakonishok (1991).

Liquidity is typically viewed as a risk measure with respect to asset pricing and expected returns, therefore the return associated with this risk measure is a risk premium, or return associated with taking on the specific amount of risk. There are varying perceptions on the true status of risk premiums, however, including both static and dynamic risk premium models. More recently, the argument can be made that there has been a shift toward a time-varying risk-premium model.

² Depth is defined as one-half of the sum of the shares available at the bid and ask prices.

Ferson and Harvey (1991) analyze the predictability of monthly stock returns by studying the behavior of economic risk premiums over time. They find supporting evidence that the predictability of returns is directly attributable to the time-variation of expected returns.

Jagannathan and Wang (1996) argue that the static CAPM leads to the presence of numerous anomalies, such as the size effect. They relax the static assumption of the CAPM and allow betas and expected returns to vary over time by presuming the CAPM holds period to period. They show that this cross-sectional conditional CAPM accounts for a greater portion of expected returns and alleviates many common anomalies.

Ghysels (1998) analyzes the accuracy of models with time-varying risk parameters and discusses evidence that suggests that the variables used in static CAPM models actually have significant time variation. He shows that dynamic variables in a conditional CAPM may prove to be a better model than that of CAPM models with constant betas. However, if the dynamic risk variables are misspecified, the measurement errors in these models may be larger than the errors faced with using a static CAPM. Ghysels (1998) provides evidence that the pricing errors in conditional CAPMs are large due to the inherent misspecification of beta risk, and that these errors are larger than those with constant beta models.

In summary, empirical evidence suggests that CAPM betas vary through time but models are misspecified when this time variation is incorporated. Liquidity may be an important factor both in static models, and most importantly, in models with time-varying risk. The role of liquidity in time-varying models has not been adequately addressed both due to the potential omission of variables and because of alternative proxies for liquidity that are not examined.

This argument shows that a company's beta is expected to change through time as markets change. One way that this time-varying behavior can be modeled is by separately examining rising and falling markets. Articles by Bhardwaj and Brooks (1993), Howton and Peterson (1998) and Howton and Peterson (1999) show the importance of changing systematic risk over bull and bear markets. Bhardwaj and Brooks (1993) show significant differences between systematic risk in bull and bear markets. Therefore it is plausible that other factor betas should also vary through time. Additionally, liquidity affects various aspects of investor behavior that may have a different impact on stock returns during a bull market than in a bear market.

Intuitively, liquidity and return have an inverse relationship where asset returns increase as illiquidity increases, as documented by Amihud and Mendelson (1986). This relationship may

be different during bull and bear markets. During a bull market an investor may require a modest level of liquidity. This modest level of liquidity is due to an investors' desire to hold winners and dump losers³, so that since the entire market is "winning" investors will tend to decrease their portfolio activity. In the case of bear markets the opposite holds true since investors may be less confident due to the unstable environment. In the midst of a bear market the demand for more liquid stocks may be at its highest levels, leading to an increased impact of liquidity on asset returns. In bear markets investors may want to quickly move in and out of losing or winning stocks, leading them to require a premium from stocks that don't meet liquidity expectations. This may lead to a weaker impact of liquidity on asset returns during bull markets than in bear markets. On the other hand, investors in a bull market may also demand higher liquidity for securities because of more frequent trading. For instance, day trading may be more prevalent during bull markets, leading to a greater emphasis on liquidity and a greater affect on asset returns.

Overall, in a bull market the liquidity-return relationship may be either strengthened or weakened depending on market conditions or investor attitudes. This is because in some cases buy and hold strategies may be more prevalent and in others day trading may be more prevalent. However, it is possible that during a bull market there may be a weaker relationship than in a bear market. Therefore, in a bear market the relationship between liquidity and returns would be at its strongest.

Under changing market climates the proxies of liquidity themselves may be elusive and possibly misspecified. This is especially of concern for liquidity proxies calculated in a time-varying framework (Ghysels (1998)). Given these changing components there may be liquidity proxies that are more accurate and well-specified in certain market conditions. There may also be some liquidity measures that behave differently in alternative market climates. Given these possible differences between market climates it is beneficial to look at the effects of liquidity under different market conditions. In addition it is useful to examine different variables that proxy for liquidity and examine their explanatory power in specific market climates.

This study looks at the role of liquidity in asset pricing using a time-series asset-pricing model. Contributions include a more extensive look at the role of liquidity including time

³ The tendency for investors to hold winners and sell losers is shown by Jegadeesh and Titman (1993), Constantinides (1984) and Constantinides (1983).

variation in risk measures and a more complete examination of the interaction between liquidity and other important asset pricing variables. This should provide a more accurate and complete model of asset pricing. This study incorporates new time-varying liquidity variables into a time-series asset-pricing model and examines the specification and predictability of the model.

Previous literature has failed to adequately document the interaction between liquidity and other important asset pricing variables. I examine the interaction between liquidity variables and a full range of other important asset pricing variables. My hypothesis is that liquidity is able to account for some of the importance of other asset pricing variables such as size and book-to-market equity.

Amihud (2002) looks at liquidity in a time-varying framework. However, he looks at only one liquidity proxy and that may not be the best or most complete proxy for liquidity. Therefore I compare and contrast the main cross-sectional liquidity variables seen in the literature in a time-varying framework in order to capture a liquidity risk premium that adequately accounts for the liquidity risk throughout time.

Specifically the contribution of this paper will be most beneficial in the conditional CAPM literature. Given the overwhelming importance of liquidity in the evaluation of investors' perceptions and, subsequently, asset pricing, my conjecture is that a well specified dynamic liquidity risk measure may be one of the keys in opening the door to an accurate and dominant asset pricing model. My goal is to add one of the components of a complete asset-pricing model, that being a liquidity risk component, with the result being a more effective and accurate asset-pricing model.

This dissertation proceeds as follows. In the next chapter I will give an in-depth literature review of the articles that most closely relate to the subject of this dissertation and develop my testable hypotheses. In the third chapter the methodology and data will be presented. The fourth chapter contains the empirical results. The fifth chapter discusses the interpretation of the results and concludes.

CHAPTER 2- LITERATURE REVIEW AND STATEMENT OF HYPOTHESES

In this chapter I review and discuss the most relevant articles in the areas of liquidity, asset pricing and time variation in relation to this dissertation. To start, I discuss the literature that documents liquidity used in asset pricing in a cross-sectional framework as well as the most relevant variables that may proxy for liquidity. I then provide a discussion of the literature that explores the use of the conditional CAPM and other time-varying asset pricing models. This is followed by an in depth review of articles that incorporate liquidity, asset pricing and time-variation. Then I address the evidence that bull and bear markets may have differing factor-return relationships. Lastly, I explore articles that examine the most relevant non-liquidity variables important to asset pricing.

2A. Cross-Sectional Liquidity

Amihud and Mendelson (1986) provide a seminal paper in introducing liquidity to academic research, even though liquidity had long been an issue looked at by practitioners. They look at the cross-sectional relationship between asset returns and illiquidity and find a significant positive relationship between the two. Since the Amihud and Mendelson (1986) paper, studies have looked at a wide range of variables that proxy for liquidity, nearly all of which look at liquidity in asset pricing in a cross-sectional framework. Thus the literature is primarily comprised of cross-sectional studies including, for example, articles by Brennan and Subrahmanyam (1995), Chordia, Roll and Subrahmanyam (2000) and Chordia, Subrahmanyam and Anshuman (2001).

Brennan and Subrahmanyam (1995) look at important models of price formation in financial markets introduced by Admati and Pfleiderer (1988) and Kyle (1985). These models

suggest that investors with superior or asymmetric information cause considerable liquidity costs to other investors due to the adverse selection cost of transacting.

The Admati and Pfleiderer (1988) model assumes that information asymmetry is short-lived and predicts that either a positive or nonmonotonic relationship between the number of informed traders and market depth exists. On the other hand, when information is not short-lived an increase in the number of informed traders will increase the rate that private information is reflected in the price. Therefore, market depth will be lower in the beginning, while market makers are at a disadvantage, but higher in later stages when market makers have had a chance to gain information from the order flow.

The Admati and Pfleiderer (1988) model shows that the inverse of market depth, λ , is characterized by the following:

$$\lambda = \frac{\sqrt{n}}{n+1} \sqrt{\frac{\text{var}(u)}{\text{var}(z)}} \quad (1)$$

where $\text{var}(z)$ is the variance of the orders from noise traders, $\text{var}(u)$ is the variance of the final payoff, and n is the number of risk-neutral traders.

This equation implies that λ is decreasing in the number of informed traders, n , so that market depth, the inverse of λ , is increasing in the number of informed traders.

Brennan and Subrahmanyam (1995) provide empirical evidence on the cross-sectional determinants of the size of these costs. They further explore the effect of information-based trading on liquidity costs by analyzing the empirical association between the number of investment analysts following a security and the estimated adverse selection cost of transacting in the security⁴, after controlling for the effects of trading volume, price and return variability. Given the predictions of the Admati and Pfleiderer (1988) model, Brennan and Subrahmanyam (1995) expect that a negative and statistically significant relationship between the adverse selection cost of transacting in a security and the number of investment analysts following the security exists. Overall, they find that an increase in the number of investment analysts tends to be related to a decrease in adverse selection costs of transacting, as suggested by Admati and Pfleiderer (1988).

⁴ The adverse selection cost is the proxy for liquidity cost. They measure the adverse selection cost as the log of the ratio of the inverse of market depth (λ) to price.

Brennan and Subrahmanyam (1995) focus on the relationship between the number of analysts following a firm and the estimates of the inverse of market depth, or the adverse selection cost. Their data comes from the Institute for the Study of Security Markets (ISSM) and is made up of intraday quotes in addition to transaction prices and number of transactions for approximately 1500 New York Stock Exchange (NYSE) securities. For each stock, the number of investment analysts following the company is defined as the number of analysts making annual forecasts for that company as reported by the Institutional Brokerage Earnings Estimates tape (IBES). The daily return variance, the average daily trading volume and the average daily closing price are computed from the Center for Research in Security Prices' (CRSP) database in order to assess the relationship between the number of investment analysts and the adverse selection cost of transacting, in the presence of these variables.

Brennan and Subrahmanyam (1995) estimate market depth by using two popular methods. First, they look at Glosten and Harris (1988), whose analysis assumes that investors can only place unconditional orders, so that limit orders do not exist. Brennan and Subrahmanyam (1995) estimate the Glosten and Harris (1988) measure of market depth by using the following equation:

$$\Delta p_t = \lambda q_t + \Psi [D_t - D_{t-1}] + y_t \quad (2)$$

where p_t is price, q_t is the order flow, Ψ is the fixed cost component of price, D is the sign of the incoming order, where D is 1 if the order is buyer-initiated and -1 if seller-initiated, y_t is the public information innovation, and the δ is the estimate of the inverse of market depth.

Secondly, they explore the analysis of Madhavan and Smidt (1991) that assumes that informed investors condition their order flow on price, so that limit orders are the only orders placed by informed traders. Brennan and Subrahmanyam (1995) estimate the Madhavan and Smidt (1991) measure of depth by using the following equation:

$$\Delta p_t = \lambda q_t + \frac{\Psi}{\pi} D_t - \Psi D_{t-1} + \eta_t \quad (3)$$

where δ is the Bayesian weight placed on the prior observation, and ζ_t is the difference between the public information innovation (y_t) and the previous periods expected value of the security, given the market maker's information set.

Given that the NYSE allows both market and limit orders, neither measure of depth is complete, and by using both measures in their regressions Brennan and Subrahmanyam (1995) are able to measure the sensitivity to model specification.

Brennan and Subrahmanyam (1995) use a simultaneous equations approach as described by the following:

$$LTC = a_{s0} + a_{s1}LANAL + a_{s2}LVOL + a_{s3}LPRI + a_{s4}LVAR + e_{TC} \quad (4)$$

$$LANAL = a_{A0} + a_{A1}LTC + a_{A2}LVAR + a_{A3}LSIZE + a_{A4}LPRI + \sum_{i=1}^5 a_{Ai+4}IND_i + a_{A10}LNINST + a_{A11}LPINST + e_{ANAL} \quad (5)$$

$$LVOL = a_{v0} + a_{v1}LTC + a_{v2}LANAL + a_{v3}LSIZE + e_{VOL} \quad (6)$$

where LTC is the log of the adverse selection cost, measured as the log of the ratio of the inverse of market depth (δ) to the price, LANAL is the log of one plus the number of analysts following the security, LVOL is the log of the average daily trading volume, LPRI is the log of the average daily closing price, LVAR is the log of the daily return variance, LSIZE is the log of the average daily market value of equity, LNINST is the log of the number of institutions holding the stock, LPINST is the log of the percentage of shares held by institutions, and IND_i is a dummy variable for the five industry classes. The coefficients to be estimated are the intercept coefficients (a_{s0} , a_{A0} , and a_{v0}) and the slope coefficients (a_{s_i} , a_{A_j} , and a_{v_k} ; $i=1$ through 5, $j=1$ through 11, and $k=1$ through 3).

In this system of equations, equation (4) explains the log of the adverse selection cost (LTC) as a linear function of the log of one plus the number of analysts following the security (LANAL), the log of the volume of trading (LVOL), the log of the stock price (LPRI) and the log of the daily return variance (LVAR). Equation (5) explains the log of the number of analysts (LANAL) in terms of the log of the adverse selection costs (LTC), the log of variance (LVAR), the log of size (LSIZE), the log of price (LPRI), five industry dummy variables (IND_i), the log of the number of institutions holding shares (LNINST) and the log of the percentage of shares institutions hold (LPINST). Equation (6) explains the log of trading volume (LVOL) as predicted by the log of the adverse selection costs (LTC), the log of the number of analysts (LANAL) and the log of size (LSIZE).

Brennan and Subrahmanyam (1995) use two-stage least squares to estimate the system of equations, where the first and third equations are identified and the second is unidentified. The results of the two-stage least squares parameter estimates for the two identified equations are reported for both estimates of market depth (δ) [Glosten and Harris (1988) and Madhavan and Smidt (1991)]. The results for both measures of market depth are fairly similar. The regressions for the log of the adverse selection costs (LTC) produce negative and significant coefficients for the number of analysts (LANAL). This implies that the market depth (δ) increases with the number of analysts coverage and therefore with the number of informed traders. The effect of trading volume (LVOL) on the log of the adverse selection costs (LTC) is negative for both measures, which is consistent with the idea that active markets are deep. Also both coefficients of the log of the daily return variance (LVAR) are positive and significant, which confirms the intuition that adverse selection costs will tend to be greater for stocks for which the flow of new information is higher.

In the log of trading volume (LVOL) regressions, the variable is significantly and positively related to both the log of the number of analysts (LANAL) and the log of size (LSIZE). The volume-analysts relationship suggests that security analysts are able to generate trading volume by their actions. The volume-size relationship is consistent with the notion that the greater the size of the firm the larger the number of investors and, subsequently, the larger the volume.

Overall, Brennan and Subrahmanyam (1995) find that the Admati and Pfleiderer (1988) model does well as a model of the adverse selection cost of trading. Specifically, models of price formation predict that an important component of market depth is the number of informed investors following the stock. The Admati and Pfleiderer (1988) model assumes short-lived information, which suggests that market depth will improve with an increase in the number of informed traders. In this study Brennan and Subrahmanyam examine the determinants of market depth by using intraday data to explore the relationship between the number of analysts and the adverse selection costs of transacting. In support of the Admati and Pfleiderer (1988) study they find that the estimated adverse selection costs decrease with the number of analysts following the security. The results support the idea that an increase in analyst coverage leads to deeper markets because of greater competition between informed investors. However, when the institutional variables (LNINST and LPINST) are included in the regression of the number of analysts in

terms of the adverse selection costs, the coefficients are positive and significant. When included, the institutional variables also increase the R^2 of the regression. This implies that the Admati and Pfleiderer (1988) model may be too simple to adequately capture all the institutional features of the market for information that affect the number of analysts following the security.

Brennan and Subrahmanyam (1995) document that the number of informed investors following a stock is an important component of market depth and, consequently, liquidity. They also document the importance of other popular liquidity variables as components of market depth. In general this paper shows the importance of a number of liquidity proxies (LANAL and LVOL) to the precise estimation of market depth and liquidity. These contributions have a significant influence on issues of liquidity and, subsequently, asset pricing and other areas of finance literature. Particularly, Brennan and Subrahmanyam (1995) play an integral role in the analysis of liquidity and the proxies of liquidity in this dissertation.

Chordia, Roll and Subrahmanyam (2000) explore the prospect that liquidity, trading costs and other specific microstructure components have common determinants. Their work comes from the foundational evidence that suggests some portion of transaction costs covary through time. The issue of commonality in liquidity raises a subsequent question of whether shocks in trading costs represent a cause of non-diversifiable priced risk. The relationship between asset return and these shocks is characterized by the level of sensitivity an asset has to these shocks. If trading costs have a changing impact across individual securities due to the inability to completely anticipate the covariation in trading costs, the resulting effect is that the greater the sensitivity of an asset to the shocks the greater the asset's expected return.

Chordia, Roll and Subrahmanyam (2000) use transactions data for NYSE securities from the ISSM database. The data include every transaction, including the transaction price, the shares traded, the closest preceding bid and ask prices quoted by the NYSE specialist, and the guaranteed number of shares at the bid and ask quotes. For every transaction there are five measures of liquidity⁵ calculated: the quoted bid-ask spread, defined as the difference between the bid and ask prices ($P_A - P_B$); the effective bid-ask spread, defined as two times the absolute difference between the actual transaction price and the midpoint of the bid and ask prices ($2|P_t - P_M|$); the proportional quoted bid-ask spread, the ratio of the quoted spread to the bid and

⁵ For a complete definition of variables and exact calculations see Chordia, Roll and Subrahmanyam (2000) table 1, page 8.

ask midpoint price $([P_A - P_B]/P_M)$; the proportional effective bid-ask spread, the ratio of the effective spread to the actual transaction price $([2|P_t - P_M|]/P_t)$; and the quoted depth, defined as one half the sum of the guaranteed quantity at the bid and ask quotes $(\frac{1}{2}[Q_A + Q_B])$.

Chordia, Roll and Subrahmanyam (2000) first look at the covariation between individual stock liquidity and market and industry liquidity. They use a market model time series regression to explain the daily percentage change in the liquidity variable of a specific stock in terms of the concurrent cross-sectional average daily percentage change in the same variable for the market⁶. The results of the regressions show strong support for the existence of covariation between individual and market-wide liquidity. The coefficients on all of the contemporaneous liquidity variables are positive and significant which shows that there is ample evidence of co-movement.

In addition, Chordia, Roll and Subrahmanyam (2000) look at time-series regressions using both market and industry liquidity measures. They regress a stock's liquidity measures, the quoted or effective spreads, in terms of the concurrent cross-sectional average daily percentage changes in the market or its industry⁷. With the exception of the change in the proportional effective spread, the liquidity measures are positively and significantly related to both the market and industry component.

Overall, Chordia, Roll and Subrahmanyam (2000) show that there is significant evidence of common influences on variations in liquidity and that commonality is a significant characteristic of liquidity. As in Brennan and Subrahmanyam (1995), Chordia, Roll and Subrahmanyam (2000) plays a significant role in the analysis of liquidity and the proxies of liquidity in this dissertation. Specifically, I make use of the liquidity measures used by these articles.

Chordia, Subrahmanyam and Anshuman (2001) document a negative and significant relationship between average returns and trading activity as well as between returns and the variability of trading activity, even after controlling for the most common variables thought to be important to the prediction of returns: size, book-to-market, momentum, dividend yield and the price level. Theoretically the relationship between expected returns and liquidity, and more importantly the relationship between expected returns and the variability of liquidity, is

⁶ The cross-sectional average is calculated with the omission of the spread data of the specific stock.

⁷ Again the cross-sectional average is calculated with the omission of the spread data of the specific stock.

motivated by the idea that agents are risk averse and have an aversion to variability in liquidity. Consequently, securities with higher variability should yield higher expected returns. They empirically investigate the relationship between expected returns and the volatility of liquidity using the Brennan, Chordia and Subrahmanyam (1998) methodology. They capture liquidity by using two underlying measures of trading activity, the dollar volume and the share turnover. In addition, they make use of the Fama and French (1993) factors as a risk-adjustment. The risk-adjusted returns are used as the dependent variable in the following regression:

$$\tilde{R}_{jt}^* = c_0 + \sum_{m=1}^M c_m Z_{mjt} + \tilde{\epsilon}_{jt}' \quad (7)$$

where \tilde{R}_{jt}^* is the risk-adjusted⁸ excess return, c_0 is the intercept term for the regression, c_m is the coefficient on each stock characteristic⁹, Z_{mjt} is the value of the specific stock characteristic and $\tilde{\epsilon}_{jt}'$ is the error term.

Chordia, Subrahmanyam and Anshuman (2001) model the relationship between returns and liquidity using equation (7). Explicitly, they regress the monthly risk-adjusted excess return in terms of various stock characteristics (Z_{mjt}), namely the market value of equity (size), the ratio of book value of equity to market value of equity (book-to-market ratio), liquidity¹⁰, the price level, dividend yield, and momentum. The purpose of this model is to explore the relationship between returns and liquidity in the presence of the other firm characteristics. They hypothesize that a significant negative relationship exists between returns and liquidity even after controlling for the other characteristics.

Chordia, Subrahmanyam and Anshuman (2001) make use of the Brennan, Chordia and Subrahmanyam (1998) methodology of calculating two estimates of the coefficients on the stock characteristics (c_m). The first estimate comes from the standard Fama and MacBeth (1973) estimator of the coefficients on the stock characteristics, where the estimates are time-series averages of the stock characteristic coefficients. The second estimate is the intercept term from an ordinary least squares (OLS) regression of monthly Fama and MacBeth (1973) coefficient estimates on the Fama and French (1993) factor realizations, denoted “purged estimates”.

⁸ The risk-adjustment procedure uses the Fama and French (1993) three-factor model.

⁹ The estimates of the coefficients, c_m , are reported as the “raw” estimates.

¹⁰ Liquidity is measured using the dollar volume of trading, the standard deviation of dollar volume, the coefficient of variation of dollar volume, share turnover, the standard deviation of share turnover and the coefficient of variation of share turnover.

Chordia, Subrahmanyam and Anshuman (2001) use monthly return data and other characteristic data for a sample of NYSE and American Stock Exchange (AMEX) common stocks. For each stock the liquidity variables that were calculated every month are the log of dollar volume, the log of the standard deviation of dollar volume, the log of the coefficient of variation of dollar volume, the log of share turnover, the log of the standard deviation of share turnover, and the log of the coefficient of variation of share turnover.

Thus, Chordia, Subrahmanyam and Anshuman (2001) use Fama and Macbeth (1973) regressions of excess returns on size, book-to-market ratio, momentum, dollar volume, dividend yield and price. Their Fama and Macbeth (1973) regressions use the excess return as well as the risk-adjusted return as the dependent variable. They calculate the independent variables by using the standard Fama and Macbeth (1973) estimates in addition to the “purged” estimates obtained from the intercept term on regressing the time-series of regression coefficients on the Fama and French (1993) factors. The results are positive and significant for the book-to-market ratio-return relationship and momentum-return relationship and negative and significant for the dollar volume-return relationship. They then add the variability in liquidity measures for dollar volume to the regression and document that the book-to-market, liquidity and momentum effects persist with very little change in the presence of these variables. The coefficients on the variability in liquidity measures are all negative and significant. They then repeat the regression with share turnover in the place of dollar volume. They find similar results that average returns are negatively and significantly related to both the level and variability of turnover and liquidity.

Chordia, Subrahmanyam and Anshuman (2001) bolster their findings with a robustness check that uses alternative measures of variability of liquidity. They calculate these measures by fitting a GARCH(1,1) model of the ratio of the liquidity variables to their time-series means and attain conditional volatilities. The conditional volatilities are then used in the cross-sectional regressions in place of the previous variability in liquidity measures. The results show that the coefficients of the level as well as the conditional volatilities continue to exhibit a negative and significant relationship to returns.

Overall, Chordia, Subrahmanyam and Anshuman (2001) document a significant negative cross-sectional relation between average returns and liquidity as well as between average returns and the variability in liquidity. The proxies of trading activity and liquidity play a significant role

in the cross-section of expected returns even in the presence of size, book-to-market ratio, and momentum.

2B. Time-Varying Asset-Pricing Models

In recent years there has been a trend in the asset pricing literature to uncover a well-specified time-varying asset pricing model. A number of articles have shown that a time-varying model may be the best tool in the pricing of assets. Articles by Ferson and Harvey (1991), Jagannathan and Wang (1996) and Ghysels (1998) not only provide evidence of this but also provide a strong foundation for the uncovering of an efficient and effective time-varying asset pricing model.

Ferson and Harvey (1991) extend the literature on the predictability over time of stock and bond rates of return. In this literature there are opposing views of the true source of predictability. Some studies claim that predictability is due to market inefficiencies, others find that changes in the required rates of return are the source of predictability. Ferson and Harvey (1991) attempt to sort out the controversy in the literature. They provide evidence that suggests that a rational risk-based asset-pricing model can adequately explain a large portion of the predictability.

Specifically, Ferson and Harvey (1991) study the time-varying behavior of economic risk premiums. They use a cross-sectional regression method to decompose the predictability of portfolio returns in order to examine the part “explained” by the model and to assess the importance of time-varying risk and risk premiums. Using monthly common stock and bond returns from the CRSP database they study models that credit predictability of rates of return to changes in expected risk premiums. In addition, they look at time-series regressions that explain risk premiums as a function of predetermined information variables¹¹ as well as analyze the predictable variability of returns.

Overall, Ferson and Harvey (1991) find that a majority of the predictable variation in portfolio returns is due to changes in the pricing of beta risk, which has a strong influence on the foundations of an adequate time-varying asset pricing model. They show that time-variation in

¹¹ The information variables used are an excess return on the equally weighted NYSE index, excess return on the 3-month Treasury bill, yield spread between Baa and Aaa corporate bonds, dividend yield on the S&P 500, 1-month Treasury bill rate and a January dummy.

beta risk premiums and not the time-variation in betas themselves capture the predictability of returns at the portfolio level. They bolster the evidence that the predicted variation in returns is due to time-varying expected returns.

Jagannathan and Wang (1996) study the ability of the conditional CAPM to account for the cross-sectional variation in average stock returns. They argue that the unconditional CAPM leads to the presence of numerous anomalies, such as the size effect. They relax the static assumption of the unconditional CAPM and allow betas and expected returns to vary over time by presuming the CAPM holds period to period. They show that the conditional CAPM accounts for a greater portion of expected returns and alleviates many common anomalies.

Harvey (1991) examines whether the conditional version of the CAPM is consistent with the economic behavior of various countries. The importance of the study lies in the potential persistence and specification of the conditional CAPM. The risk associated with individual countries is the time-varying covariance of the country's returns with a world return. The findings of the study imply that the time-varying conditional covariances are capable of capturing a large portion of the behavior of country returns.

Harvey (1991) models the time-varying conditional covariances using the following model:

$$E[r_{jt}|\Omega_{t-1}] = \frac{E[r_{mt}|\Omega_{t-1}]}{\text{Var}[r_{mt}|\Omega_{t-1}]} \text{Cov}[r_{jt}, r_{mt}|\Omega_{t-1}] \quad (8)$$

where r_{jt} is the excess return on a country's portfolio, r_{mt} is the excess return on the world's portfolio and Ω_{t-1} is the investors' information set. The ratio of the conditional expectation of the world return to the conditional variance of the world return is the world price of covariance risk.

Overall, Harvey (1991) uses tests of the conditional CAPM on "country-specific" stock portfolios. By allowing time-variation in the conditional moments the tests adequately capture the cross-sectional variation in returns for the "country-specific" portfolios.

Ferson and Korajczyk (1995) study the predictability of economic risk factors for stock returns in a time-varying framework. They use estimates of economic factors similar to those used by Ferson and Harvey (1991) as well as the principal components used by Connor and Korajczyk (1986).

Ferson and Korajczyk (1995) use a multi-beta asset pricing model shown by the following equation:

$$E(R_{i,t+1}|Z_t) = \lambda_0(Z_t) + \sum_{j=1}^K b_{ijt} \lambda_j(Z_t) \quad (9)$$

where $R_{i,t+1}$ is the asset return, Z_t is a vector of information instruments and the b_{ijt} is the set of conditional betas or factor loadings which are captured using the following equation:

$$R_{i,t+1} = a_{it} + \sum_{j=1}^K b_{ijt} F_{j,t+1} + u_{i,t+1} \quad (10)$$

where $F_{j,t+1}$ is the set of risk factors that serve to predict returns. The $\lambda_j(Z_t)$ is the set of expected risk premiums.

The time-series tests used are regressions of returns on the factor mimicking portfolios and instrumental variables as defined by the following equation:

$$r_{it} = \alpha_{i0} + \sum_{p=1}^L \alpha_{ip} Z_{p,t-1} + \sum_{j=1}^K \beta_{ij} F_{jt} + u_{it} \quad (11)$$

where r_{it} is the excess return defined as the difference between the stock return, R_{it} and the risk-free return, R_{ft} , the 1-month Treasury bill.

Overall, Ferson and Korajczyk (1995) examine the level to which an asset pricing model can measure the predictability in security returns. Specifically, they evaluate conditional models for multiple return horizons. They find that a large portion of the predictability in stock returns can be explained by a conditional APT model.

Ghysels (1998) analyzes the accuracy of models with time-varying risk parameters and discusses evidence that suggests that the variables used in static CAPM models actually have significant time variation. He shows that a conditional CAPM with dynamic variables may prove to be a better model than that of CAPM models with constant betas. However, if the dynamic risk variables are misspecified, the measurement errors in these models may be larger than the errors faced with using a static CAPM. Ghysels (1998) provides evidence that the pricing errors in conditional CAPMs are large due to the inherent misspecification of beta risk, and that these errors are larger than with constant beta models.

Given the general acceptance that the unconditional static CAPM is inadequate in capturing the variation in expected returns on stocks, Ghysels (1998) looks at several “APT-type” models that have time-varying aspects for the beta/factor-return relationship. Ghysels (1998) provides empirical evidence of the accuracy of three dynamic asset-pricing models. He looks at the conditional CAPM of Harvey (1991), the conditional multifactor APT model of

Ferson and Korajczyk (1995), and the nonlinear APT model of Bansal, Hsieh and Viswanathan (1993). The empirical results show that the conditional CAPM and the conditional multifactor APT models do not appear to accurately capture the time-varying aspects of betas. These models misprice risk and make larger errors than static beta models. The nonlinear APT model does exceptionally better than either of the other two models. The nonlinear APT model explains the returns for all the portfolios tested except for the portfolio comprised of very small firms.

2C. Liquidity in Time-Varying Asset-Pricing

There has not been a large amount of research done in the area of liquidity in time-varying asset pricing. Amihud (2002) looks at this area of the literature and examines the relationship between stock returns and liquidity over time. He suggests that over time excess returns are an increasing function of expected illiquidity of the stock market.

Amihud (2002) uses the average daily ratio of the absolute value of a stock return to its dollar volume as a proxy for illiquidity. He explores the effect of illiquidity on stock returns for NYSE stocks over the period between 1963 and 1997 by using the CRSP database. The methodology used is similar to that of Fama and MacBeth (1973). He estimates a cross-sectional model for each month for every year, where the monthly returns are a function of the given stock characteristics¹². The monthly regressions over the period generate 408 estimates of every characteristic coefficient, which are then averaged and tested for statistical significance. The mean and standard error for the average estimates are calculated for each variable so that a Student's t-test of a zero mean can be performed. The results of the test show significant evidence that illiquidity is a priced variable and that there is a significant positive relationship between returns and illiquidity. Also the results show that there is a significantly positive relationship between beta and returns and a significant positive relation between momentum and returns. The relation between size and returns is shown to be significant and negative, excluding the period between 1981-1997. There is a significant negative relationship between the standard deviation of returns and returns in the absence of January data. The dividend yield has a significant negative relationship for the entire sample.

¹² The variables used are the illiquidity measure, size, beta, standard deviation of the return, dividend yield and two momentum variables.

In general, Amihud (2002) proposes that there is a positive time-series relationship between expected market illiquidity and expected stock excess return. He tests this proposition by using the methodology of French, Schwert and Stambaugh (1987) who test the relationship between risk and stock excess return, as explained below.

French, Schwert and Stambaugh (1987) examine the time-series relationship between risk and expected returns. Specifically, they test for a positive relationship between risk, defined as the volatility of the stock market, and the expected market risk premium calculated by subtracting the risk-free rate from the expected return on a market portfolio. They examine this relationship using the following model:

$$E(R_{mt} - R_{ft} | \hat{\sigma}_{mt}) = \alpha + \beta \hat{\sigma}_{mt}^p, \quad p=1, 2 \quad (12)$$

where R_{mt} is the market return, R_{ft} is the risk-free rate, $\hat{\sigma}_{mt}$ is the market portfolio's standard deviation, and $\hat{\sigma}_{mt}^2$ is the market portfolio's variance.

If the estimation results of the model yield an estimate of $\beta=0$ the risk and expected risk premium relationship is non-existent. On the other hand, if they indicate that $\alpha=0$ and $\beta>0$ the variation in expected risk premiums is fully captured by the standard deviation or the variance.

French, Schwert and Stambaugh (1987) use two statistical methods to estimate equation (12). They first calculate monthly estimates of volatility decomposed into predictable and unpredictable components using univariate autoregressive-integrated-moving average (ARIMA) models. Secondly, they estimate the measures of volatility using a generalized autoregressive conditional heteroskedasticity (GARCH) model. Specifically, they use the GARCH-in-mean model of Engle, Lilien and Robins (1987) to estimate the relationship in equation (12).

In their ARIMA estimations they examine the relationship between expected risk premiums and both the predictable and unpredictable components of volatility. They first model the predictable relationship using the following equation:

$$(R_{mt} - R_{ft}) = \alpha + \beta \hat{\sigma}_{mt}^p + \varepsilon_t \quad (13)$$

where $\hat{\sigma}_{mt}^p$ represents the predictable portion of the standard deviation or variance, and ε_t the error term.

When taking both the predictable and unpredictable components into consideration the model¹³ is altered using the following equation:

$$(R_{mt} - R_{ft}) = \alpha + \beta \hat{\sigma}_{mt}^p + \gamma \sigma_{mt}^{pu} + \varepsilon_t \quad (14)$$

where the unpredictable component, σ_{mt}^{pu} , is calculated by $\sigma_{mt}^{pu} = \sigma_{mt}^p - \hat{\sigma}_{mt}^p$.

French, Schwert and Stambaugh (1987) find that the regressions of expected risk premiums on the predictable component of volatility yield little to no support of a positive or significant relationship between the two. In the regressions of expected risk premiums on both the predictable and unpredictable components they find a significant and negative relationship between the expected risk premiums and the unpredictable component of volatility. They interpret this as a positive relation between expected risk premiums and volatility.

When estimating the model in equation (12), French, Schwert and Stambaugh (1987) use the GARCH-in-mean model of Engle, Lilien and Robins (1987), shown by the following equations:

$$(R_{mt} - R_{ft}) = \alpha + \beta \sigma_t + \varepsilon_t - \theta \varepsilon_{t-1} \quad (15)$$

and

$$(R_{mt} - R_{ft}) = \alpha + \beta \sigma_t^2 + \varepsilon_t - \theta \varepsilon_{t-1} \quad (15a)$$

The results using the GARCH-in-mean model show a significantly positive relationship between expected risk premiums and volatility. They also show that the estimates of the standard deviation fit the data better than the variance estimates.

Overall, French, Schwert and Stambaugh (1987) find that by using an ARIMA model the relationship between expected risk premiums and volatility is only captured by the unpredictable component of volatility. There is a negative relationship between expected risk premiums and unpredictable volatility, which they suggest implies a positive relation between expected risk premiums and volatility. In the GARCH-in-mean model the relationship between expected risk premiums and volatility is significantly captured and is positive as hypothesized.

Amihud (2002) estimates expected liquidity using an autoregressive model, which he utilizes to test his hypotheses. Amihud (2002) hypothesizes that (1) “ex ante stock excess return is an increasing function of expected illiquidity” and (2) “unexpected illiquidity has a negative

¹³ The model includes both measures of volatility since they are uncorrelated.

effect on contemporaneous unexpected stock return.” He defines the effect of the first hypothesis using the following equation:

$$E(RM_y - Rf_y | \ln AILLIQ_y^E) = f_0 + f_1 \ln AILLIQ_y^E \quad (16)$$

where RM_y is the annual market return, Rf_y is the annual risk-free yield, and $AILLIQ_y^E$ is the expected average market illiquidity. The hypothesis implies that the coefficient f_1 is positive.

Both hypotheses are further explored in the following equation:

$$(RM_y - Rf_y) = g_0 + g_1 \ln AILLIQ_{y-1} + g_2 \ln AILLIQ_y^U + w_y \quad (17)$$

where $AILLIQ_{y-1}$ is the lagged average market illiquidity and $AILLIQ_y^U$ is the unexpected average market illiquidity. The first hypothesis implies that the coefficient g_1 is positive and the second hypothesis implies that the coefficient g_2 is negative.

The results of the tests are that there is significant support for both hypotheses. For the test of the first hypothesis, that there is a positive relation between return and illiquidity; the coefficient on the lagged annual market illiquidity is significantly positive, implying that expected excess returns are an increasing function of expected market illiquidity. The test of the second hypothesis, that there exist a negative relationship between unexpected illiquidity and unexpected return, results in a coefficient on the annual unexpected illiquidity that is negative and significant, implying that unexpected illiquidity does have a negative effect on returns. Amihud (2002) finds similar results when he uses monthly data in place of annual data.

In summary, Amihud (2002) presents new tests of the liquidity-return relationship over time. The tests show that the effects of illiquidity over time are such that the expected market illiquidity is significantly and positively related to ex ante stock excess return. Also, unexpected illiquidity has a significant negative relationship with contemporaneous unexpected stock return. The results overall indicate that risk premiums are in part explained by stock illiquidity.

2D. Dual Betas

Bhardwaj and Brooks (1993) build on the Ferson and Harvey (1991) study that provides evidence of time-variation in equity risk premiums. Specifically, Bhardwaj and Brooks (1993) examine the size effect using differing stock risk, given bull and bear markets. The implication of this study is that if there is reliable evidence that a varying-risk market model, or dual-beta

model, exists, then static risk models may not accurately account for returns. In general, their findings support time-varying risk models rather than constant or static risk models. They find statistically significant differences for systematic risk and abnormal returns between bull and bear markets.

Bhardwaj and Brooks (1993) calculate monthly returns for twenty size ranked portfolios of NYSE and AMEX stocks. The monthly returns are computed using the average stock return across stocks in each portfolio. All months are then classified as either a bull or a bear month. If the return in a month is higher than the median return it is classified as a bull month and if its lower than the median it is classified as a bear month. The abnormal returns for each of the twenty size portfolios are calculated using both the constant risk method and the varying risk method. The constant risk abnormal returns are estimated using the following market model:

$$R_t = a_1 + b_1 R_{mt} + e_{1t} \quad (18)$$

and the following equations estimate the varying risk abnormal returns:

$$R_t = a_2 + a_3 D_1 + b_2 R_{mt} + b_3 R_{mt} D_1 + e_{2t} \quad (19)$$

or

$$R_t = a_{bull} + (a_{bear} - a_{bull}) D_1 + b_{bull} R_{mt} + (b_{bear} - b_{bull}) R_{mt} D_1 + e_{2t} \quad (19a)$$

where R_t is the excess return on a size portfolio, R_{mt} is the excess return on the market and D_1 is an indicator that equals one for bear months and zero otherwise. The intercept coefficient from equation (18) represents the average abnormal return of a given size portfolio while the slope coefficient denotes the systematic risk of the size portfolio. Similarly, the intercepts from equation (19), a_2 and $(a_2 + a_3)$ represent the average abnormal returns of a given size portfolio for bull and bear markets, respectively. The slope coefficients, b_2 and $(b_2 + b_3)$, correspond to the systematic risk of a given size portfolio for bull and bear markets, respectively. The estimates of a_3 , $(a_{bear} - a_{bull})$, and b_3 , $(b_{bear} - b_{bull})$, show the difference in abnormal returns and systematic risk, respectively, between bull and bear months.

Bhardwaj and Brooks (1993) find that the estimates for the systematic risk of the constant risk model are 1.47 for the smallest size portfolio and 0.62 for the largest size portfolio. In comparison, when they estimate the varying risk model the systematic risk of the smallest size portfolio is 1.81 in bull months and 1.04 in bear months. For the largest size portfolio the systematic risk is 0.49 for bull months and 0.75 for bear months. Thus the systematic risk is higher in bull months than in bear months for the smallest size portfolio and lower in bull months

relative to bear months for the largest size portfolio. They find that the systematic risks in bull months versus bear months is statistically different for both the smallest and largest size portfolios. Given these findings, previous research that uses constant risk models may overstate abnormal returns for small stocks and understate abnormal returns for large stocks.

Howton and Peterson (1998) utilize the methodology of Bhardwaj and Brooks (1993) and focus on the process by which systematic risk, beta, is estimated, as well as the cross-sectional relationship between beta and stock returns. They also build on the Jagannathan and Wang (1996) study that documents the increased significance of beta when the beta is allowed to vary through time. Overall, they use a dual-beta asset-pricing model that incorporates changes in risk with respect to bull and bear markets. They empirically test the significance of beta as a sole determinant of returns as well as the significance of beta in the presence of common asset pricing variables such as size and the book-to-market ratio of Fama and French (1992).

As in Bhardwaj and Brooks (1993), Howton and Peterson (1998) model varying risk using a dual-beta market model, described in equations (19) and (19a). They form portfolios based on size and beta so that they can capture variation in beta that cannot be accredited to size. Using the size-beta portfolios, monthly returns are calculated for each portfolio and bull and bear month classifications are made. Bull months are months in which the return is higher than the median monthly return, while bear months have lower monthly returns than the median of the monthly returns. Each size-beta portfolio has two estimates of beta, a bull-market beta and a bear-market beta. For the monthly cross-sectional regressions each security is assigned a beta given the current month and portfolio that they are in. Therefore a stock may have a different beta due to a bull or bear month or due to portfolio shifts. For comparison, betas are also calculated using a constant risk model similar to equation (18).

The cross-sectional regressions use monthly returns as the dependent variable while the independent variables are beta, size, the book-to-market ratio, the earnings-price ratio¹⁴, and an earnings-price indicator variable that equals one when earnings are negative and zero otherwise. The model is depicted by the following equation:

$$R_{it} = \gamma_{0t} + \gamma_{1t} \beta_{it} + \gamma_{2t} \ln(ME_{it}) + \gamma_{3t} \ln(BE_{it} / ME_{it}) + \gamma_{4t} E_{it}(+) / P_{it} + \gamma_{5t} EPDUM_{it} + \epsilon_{it} \quad (20)$$

¹⁴ The earnings-price ratio is only computed for positive earnings.

where R_{it} denotes the return on the stock, β_{it} is the assigned beta for a given stock for the month for either the varying risk or constant risk model, ME_{it} is the market value of equity for a stock, BE_{it} is the book value of equity for a stock, $E_{it}(+)/P_{it}$ is the earnings-price ratio given positive earnings and $EPDUM$ is the earnings-price dummy variable that takes on a value of one when earnings are negative and zero otherwise.

Additionally, the following three constrained regressions are estimated:

$$R_{it} = \gamma_{0t} + \gamma_{1t}\beta_{it} + \gamma_{3t} \ln(BE_{it} / ME_{it}) + \gamma_{4t}E_{it}(+)/P_{it} + \gamma_{5t}EPDUM_{it} + \epsilon_{it} \quad (21)$$

$$R_{it} = \gamma_{0t} + \gamma_{1t}\beta_{it} + \gamma_{2t} \ln(ME_{it}) + \gamma_{4t}E_{it}(+)/P_{it} + \gamma_{5t}EPDUM_{it} + \epsilon_{it} \quad (22)$$

$$R_{it} = \gamma_{0t} + \gamma_{1t}\beta_{it} + \epsilon_{it} \quad (23)$$

Howton and Peterson (1998) show that when a constant-risk model is used and only beta is estimated, beta is an insignificant determinant of returns. Additionally, when all independent variables are used in the constant-risk model, beta retains its insignificance. In the varying-risk model the results are quite different. For bull months, when the only independent variable is the bull-beta the coefficient is significant and positive. This indicates that during bull markets riskier stocks earn higher returns than less risky stocks. In the presence of other independent variables the bull-beta retains its significance. In bear months the regressions with only the bear-beta result in a significant and negative coefficient. This implies that in bear markets riskier stocks tend to do worse than less risky stocks. When the bear-beta is estimated with other independent variables it also retains its significance.

Overall, Howton and Peterson (1998) show that when betas are allowed to vary using a bull and bear market division, the importance of beta is significant in affecting the cross-section of average stock returns.

2E. Non-Liquidity Variables

Fama and French (1993) examine time-series regressions of monthly stock and bond returns on the returns to a market portfolio of stocks and mimicking portfolios for size, book-to-market equity, and term-structure risk factors. Overall, they find that the mimicking portfolios for size and book-to-market significantly account for the variation in returns. However, these

measures can not fully account for the variation in stock excess returns. To address this shortcoming a market factor is added to the model. In general, their findings indicate that these three stock market factors and two term-structure factors can adequately account for variation in stock returns. Specifically, they show that when the stock market factors are regressed separately from the bond market factors they capture variation in both stock and bond returns. Similarly, when the bond market factors are separate from the stock market factors they also captures the variation in both stock and bond returns. However, when all five factors are regressed together only the stock market factor significantly capture the variation in stock returns and only the bond factors capture significant variation in the bond returns.

Overall, Fama and French (1993) provide evidence that the variation in stock returns can be significantly captured by the market, size, and book-to-market factors. Additionally, the variation in bond returns is captured by the term and default spreads. Also the three stock factors adequately capture the variation in bond returns and the two bond factors can capture the variation in stock returns, when regressed separately.

Carhart (1997) explores the momentum effect documented by Jegadeesh and Titman (1993) and indicates that the one-year momentum effect of stock returns can account for mutual fund persistence. He examines this relationship using three asset pricing models: the CAPM, the three-factor model of Fama and French (1993), and his own four-factor model. The models are estimated using the following three equations, respectively:

$$r_{it} = \alpha_{iT} + \beta_{iT}VWRF_t + e_{it} \quad (24)$$

$$r_{it} = \alpha_{iT} + b_{iT}RMRF_t + s_{iT}SMB_t + h_{iT}HML_t + e_{it} \quad (25)$$

$$r_{it} = \alpha_{iT} + b_{iT}RMRF_t + s_{iT}SMB_t + h_{iT}HML_t + p_{iT}PR1YR_t + e_{it} \quad (26)$$

where r_{it} is the excess return, VWRF is the CRSP value-weighted excess return, RMRF is the value-weighted excess return on the market portfolio, SMB and HML are the return from the value-weighted factor-mimicking portfolios for size and book-to-market equity, respectively, and PR1YR is the return on the value-weighted factor mimicking portfolio for one-year momentum in stock returns. This momentum factor is estimated using the returns from the portfolio of the highest performing stocks over the past year minus the returns from the portfolio of the lowest

performing stocks over the past year. The four-factor model (26) is constructed by adding a momentum factor to the three-factor model of Fama and French (1993).

Carhart (1997) finds that the CAPM model is incapable of explaining the patterns of mutual fund persistence. Unlike the CAPM, the four-factor model is able to assess a large portion of the persistence in mutual fund performance. The bulk of the explanatory power comes from the size (SMB) and momentum (PR1YR) factors. He also finds that the returns for the top decile funds, ranked by one-year return performance, are significantly and positively related to the momentum factor. On the other hand, the returns for the bottom decile funds are significantly and negatively related to momentum. Overall, except for the apparent underperformance of the previous year's lowest performing funds, the four-factor model adequately captures the variation in expected returns for portfolios sorted on lagged performance.

The three factors used in Fama and French (1992,1993) and the fourth factor used in Carhart (1997) play a significant role in this dissertation. Particularly, I use similar non-liquidity factors along with the liquidity factors, discussed in the next chapter, in a time-series regression of returns.

2F. Hypotheses

Considerable research has been accomplished in investigating the relationship between liquidity and asset returns. The bulk of research in this area uses some form of cross-sectional methodology and finds that there is a statistically significant relationship between liquidity and returns. The literature shows that this relationship exists with a variety of liquidity variables, where some have stronger relationships than others. Since Amihud and Mendelson (1986) the literature extensively looks at the idea that liquidity can influence asset returns and finds strong evidence that an inverse relationship exists. Amihud and Mendelson (1986) find that there is a significant positive relationship between returns and illiquidity. Eleswarapu and Reinganum (1993) look at the liquidity relationship using the same measures as Amihud and Mendelson (1986), but with an updated time period, and find that the relationship between liquidity and stock returns is mainly limited to the January effect. Later articles such as Brennan and Subrahmanyam (1996) refute the findings of Eleswarapu and Reinganum (1993) and find some support for the Amihud and Mendelson (1986) study. The liquidity-return relationship is further

explored by numerous studies such as Eleswarapu (1997), Brennan, Chordia and Subrahmanyam (1998), Chalmers and Kadlec (1998), Datar, Naik and Radcliffe (1998), Chordia, Subrahmanyam and Anshuman (2001), Pastor and Stambaugh (2001) and Chordia, Roll and Subrahmanyam (2002). In general, there is a statistically significant relationship between liquidity and returns.

The recent trend in the asset pricing literature has been away from static models and toward some form of time-varying model, shown by the empirical evidence documented in Ferson and Harvey (1991) and Jagannathan and Wang (1996). Ferson and Harvey (1991) analyze the predictability of monthly stock returns by studying the behavior of economic risk premiums over time. They find supporting evidence that the predictability of returns is directly attributable to the time-variation of expected returns. Jagannathan and Wang (1996) argue that the static CAPM leads to the presence of numerous anomalies, such as the size effect. They relax the static assumption of the CAPM and allow betas and expected returns to vary over time by presuming the CAPM holds period to period. They show that this conditional CAPM accounts for a greater portion of expected returns and alleviates many common anomalies.

Taken collectively there should be substantial effort in the research of exploring the relationship between liquidity and asset returns in a time-varying framework. However, to date there has been little to no work in this area, with the notable exception of Amihud (2002). Amihud (2002) looks at liquidity in a time-varying framework and adds to the importance of liquidity by showing the existence of a statistically significant time-varying relationship between liquidity and expected returns. However, he fails to adequately document the interaction between liquidity and other important asset pricing variables. Also, he looks at only one liquidity variable, and this liquidity measure may not be the best or most complete proxy for liquidity.

This study looks at the role of liquidity in asset pricing using a time-series asset-pricing model. Contributions include a more extensive look at the role of liquidity including time variation in risk measures and a more complete examination of the interaction between liquidity and other important asset pricing variables. This should provide a more accurate and complete model of asset pricing. I incorporate new time-varying liquidity variables into a time-series asset-pricing model and examine the specification and predictability of the model. I also examine the interaction between liquidity variables and a full range of other important asset pricing variables. I further compare and contrast the main cross-sectional liquidity variables seen in the literature in a time-varying framework.

I examine and test models of asset pricing given four main hypotheses. My four hypotheses are as follows: (1) there exists a statistically significant time-series relationship between liquidity and asset returns; (2) the effect of liquidity is stronger in bear markets than in bull markets; (3) liquidity has a mitigating effect on other variables that are commonly significant in predicting asset returns; (4) and there exists some specific liquidity proxies that outperform other comparable proxies.

A considerable amount of research explores the dynamic attributes of asset returns, betas and characteristic factors. The consensus seems to be that there are significant time-varying attributes to asset returns and betas [see Ferson and Harvey (1991), Jagannathan and Wang (1996), Ghysels (1998) and Chordia and Shivakumar (2002)]. Given this evidence and the evidence from the liquidity literature, which documents a significant inverse relationship between asset returns and liquidity, I investigate the time-series relationship between liquidity and asset returns. Specifically, I test a time-series model of asset pricing that incorporates liquidity and other important factors in predicting asset returns. My first hypothesis is that there is a statistically significant time-series relationship between liquidity and asset returns.

Bhardwaj and Brooks (1993) show significant differences between systematic risk in bull and bear markets. Therefore, it is plausible that other factor betas should also vary through time. Additionally, liquidity affects various aspects of investor behavior that may have a different impact on stock returns during a bull market than in a bear market. Therefore, I separately test the effects of liquidity on asset returns in prior bull and bear markets. My second hypothesis is that there is a significant difference between the impact of liquidity on asset returns in a bear market over that of the impact of liquidity on asset returns in a bull market.

The time-series relationship between liquidity and other variables important to the prediction of asset returns has largely been ignored in the literature. The studies that do look at this relationship fail to adequately document the interaction between liquidity and other important asset pricing variables. I examine the interaction between liquidity variables and a market factor, size factor, book-to-market equity factor, and momentum factor. My third hypothesis is that liquidity is able to account for some of the importance of other asset pricing variables such as size and book-to-market equity. An intuitive relationship exists between liquidity and size, where large firms may intuitively be more liquid and vice versa for small

firms. This relationship may serve as a reason why, in the absence of a liquidity proxy, size is found to be an important asset-pricing measure.

Amihud (2002) looks at liquidity in a time-varying framework; however, he looks at only one liquidity proxy which may not be the best or most complete proxy for liquidity. Therefore, I compare and contrast the main cross-sectional liquidity variables seen in the literature in a time-varying framework in order to capture a liquidity risk premium that adequately accounts for the liquidity risk throughout time. My fourth hypothesis is that there exist one or two liquidity variables that outperform the rest.

The literature reviewed in this chapter shows the importance of liquidity in a cross-sectional framework as well as the importance and movement from static models to dynamic models. I also review studies that connect the literature on liquidity in asset pricing and the literature on time-varying models. I then describe and outline my hypotheses for this dissertation.

CHAPTER 3- DATA AND METHODOLOGY

In this chapter I first describe the data used in this dissertation to address the questions of my hypotheses. I then detail the models used to test the questions I raise in this dissertation. I test four main questions: can liquidity determinants capture return time variation, are the results sensitive to the liquidity variable used, are the results sensitive to the presence of beta, size, book-to-market, and momentum, and finally is there a difference in the relationship given the market condition.

3A. Data

3A1. Returns

The returns used in the time-series regressions are formed similar to the 25 size-book-to-market portfolio returns used in Fama and French (1993). I calculate excess returns on 54 stock portfolios, using CRSP, formed on size, book-to-market equity, liquidity, and momentum. The excess returns are the dependent variables in the time-series regressions. I use these 54 portfolios because I want to examine the interaction between liquidity, size, book-to-market, and momentum.

For comparison the 54 size-book-to-market-liquidity-momentum portfolios are formed much like those used in Fama and French (1993), using the momentum factor from Jegadeesh and Titman (1993) and Carhart (1997) and a liquidity factor. In June of each year I independently sort all stocks by size, book-to-market, liquidity, and momentum. Using CRSP, in the size groupings the market equity (ME) is measured at the end of June while in the book-to-market groupings the ME is measured at the end of December of the prior year. The book value of common equity used in the book-to-market ratio is measured at the fiscal year end in the prior calendar year. As done by Fama and French (1993), the book equity is computed using the

Standard & Poor's COMPUSTAT book value of shareholder's equity, plus deferred taxes and investment tax credit, minus the book value of preferred stock. In June of each year the liquidity groupings are formed, using CRSP for the various liquidity measures, based on the prior calendar year's liquidity, where an average of the monthly liquidity is calculated¹⁵. The momentum groupings are formed at the end of June, where the CRSP returns are calculated over an eleven-month period beginning in June of the prior year and ending in May of the current year. This eleven-month return is similar to that used by Carhart (1997). I use these measures to sort all stocks into two size bisects, three book-to-market trisects, three liquidity trisects, and three momentum trisects. I then make 54 size-book-to-market-liquidity-momentum portfolios from the matrix of the size, book-to-market, liquidity, and momentum groupings. I subsequently calculate the value-weighted monthly returns of the 54 portfolios for the following year from July through June of the next year. In June of the next year I reform the portfolios and calculate returns for the following year¹⁵. The monthly returns for the 54 portfolios, less the risk-free rate, are the dependent variables used in the regressions.

3A2. Liquidity Measures

In order to capture liquidity, without the effects of the other variables, I use a residual effect of liquidity. This is done by first forming a liquidity factor-mimicking portfolio using sorts on size and liquidity. I create this factor-mimicking portfolio by forming four portfolios from the intersection of two size and two liquidity portfolios. I then use the difference between the simple average of returns from the two illiquid portfolios and the simple average of returns from the two liquid portfolios as my factor-mimicking portfolio. Once this factor-mimicking portfolio (FM_{LIQ}) is created I purge the effects associated with beta, size, book-to-market, and momentum by regressing FM_{LIQ} on the market excess return (MKT) and the factor-mimicking portfolios of other the variables (FM_{SIZE} , FM_{BM} , and $FM_{MOMENTUM}$), obtained from Kenneth French's website¹⁶. The residuals from this regression are used as my measure of liquidity, free of any influence from the market, size, book-to-market and momentum. The regression is characterized by the following equation:

¹⁵ This process is similar to that used by Amihud (2002), where he uses an average annual illiquidity measure.

¹⁵ The use of value-weighted returns beginning in July is consistent with Fama and French (1993).

¹⁶ <http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/>

$$FM_{LIQ} = \eta_0 + \eta_1 MKT + \eta_2 FM_{SIZE} + \eta_3 FM_{BM} + \eta_4 FM_{MOMENTUM} + e_m \quad (27)$$

where the residual, e_m , is the alternative liquidity factor-mimicking portfolio used in the asset-pricing tests.

The liquidity portfolios that I employ to calculate the above liquidity factor-mimicking portfolio are computed using various underlying proxies of liquidity. Overall, the proxies can be classified as liquidity levels and variability in liquidity. The portfolios are denoted LIQ_m or $VLIQ_m$ for each of the overall classifications. LIQ_m represents the proxies for liquidity levels, dollar volume traded (VOL) or share turnover (TUR). $VLIQ_m$ symbolizes the variability in liquidity measures, the standard deviation or coefficient of variation of the dollar volume traded or share turnover.

The liquidity levels used are the dollar volume of trading and the share turnover. The dollar volume (VOL) is calculated by multiplying the number of shares traded by the concurrent stock price. The share turnover (TUR) is measured by dividing the number of shares traded by the number of shares outstanding.

The variability in liquidity measures are the standard deviation or the coefficient of variation of the dollar volume traded or the share turnover measures.

3A3. Non-Liquidity Measures

The four non-liquidity measures, the market return measure (RM_m), size ($SIZE_m$), book-to-market (BM_m), and momentum (RP_{m-1}) are the same as those used to calculate the residual liquidity factor. The four measures are obtained from Kenneth French's website. The market return is defined as the value-weighted return on all NYSE, AMEX, and NASDAQ stocks (from CRSP) minus the one-month Treasury bill rate. The size, book-to-market, and momentum measures are returns on zero-investment, factor-mimicking portfolios as defined in Fama and French (1993) and Carhart (1997).

3B. Methodology

3B1. Liquidity and Returns

In this section I present the methodology that answers the questions of whether liquidity determinants can capture return time variation and are the results sensitive to the liquidity variable used? Specifically, I lay out the regressions used in each case of the overall liquidity classifications. These regression equations are:

$$RP_m - Rf_m = A + L(FM_{LIQ}) + e_m \quad (28)$$

$$RP_m - Rf_m = A + L(FM_{VLIQ}) + e_m \quad (29)$$

where RP_m is the monthly return on the size-book-to-market-liquidity-momentum portfolios, Rf_m is the risk-free rate calculated using the 30-day Treasury bill, FM_{LIQ} is the residual liquidity factor, calculated using dollar volume traded or share turnover. The variable FM_{VLIQ} is the residual liquidity factor, calculated using the standard deviation or coefficient of variation for dollar volume or share turnover. The coefficients to be estimated are A and L, where L is hypothesized to be significant for FM_{LIQ} and FM_{VLIQ} . Depending on the portfolio, the sign of the liquidity coefficient can be positive or negative. Since the construct of the liquidity variable is based on the returns from the most illiquid portfolios minus the returns from the most liquid portfolios, there may be different signs on the coefficients at the different extremes. In the portfolios with stocks that have low liquidity the natural relationship between the returns for those stocks and the liquidity variable is positive. At the opposite end, the portfolios of stocks with high liquidity may have a negative relationship with this variable. The key aspect of this relationship that I am looking for is the significant ability of liquidity to capture time-variation in returns, and not necessarily the sign of the coefficient.

3B2. Liquidity, Size, Book-to-Market, Momentum and Returns

In this section I re-examine the liquidity-return relationship in the presence of a market factor, size, book-to-market, and momentum. Since the liquidity variable is a residual from the regression of liquidity on the other variables, it is therefore uncorrelated with those variables. Furthermore, given this orthogonal relationship the coefficients on the liquidity variable should not change in the multivariate regressions from the respective univariate liquidity regressions. Additionally, the coefficients on the other variables should be independent of liquidity and so unaffected by it. The purpose of these regressions is to test whether the combination of variables can adequately capture shared variation in returns. I repeat the regressions of all of the overall liquidity classifications in the presence of these additional four factors. The regression equations are:

$$RP_m - Rf_m = A + L(FM_{LIQ}) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m \quad (30)$$

$$RP_m - Rf_m = A + L(FM_{VLIQ}) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m \quad (31)$$

where $SIZE_m$ is the monthly returns on the zero-investment, size factor-mimicking portfolio, BM_m is the monthly returns on the zero-investment, book-to-market factor-mimicking portfolio, RP_{m-1} is the monthly returns on the zero-investment, momentum factor-mimicking portfolio, and the RM_m is the value-weighted monthly return of the market portfolio. The coefficients to be estimated are A, L, B, S, H, and M, where L is hypothesized to be significant for FM_{LIQ} and FM_{VLIQ} .

Since the residual liquidity variable has no effect on the other variables, given its residual construction, there is a question left untested. The effect of liquidity on the other variables is not adequately explored by this residual variable. Namely, there may be a mitigating relationship between liquidity and size when regressed together. In order to test the liquidity-size relationship as well as the relationships between liquidity and the other variable employed, I take a step back and use the liquidity return difference portfolio from equation (27).

In using this return difference variable I am better able to study the nominal relationship between the various measures. In particular, I examine how the coefficients on the other four factors change in the presence of liquidity. I test the relationships using the following regression equations:

$$RP_m - Rf_m = A + L(LIQDIFF_m) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m \quad (32)$$

$$RP_m - Rf_m = A + L(VLIQDIFF_m) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m \quad (33)$$

where $LIQDIFF_m$ is the monthly returns on zero-investment, liquidity factor-mimicking portfolios, calculated using dollar volume traded or share turnover. The variable $VLIQDIFF_m$ is the monthly returns on zero-investment, liquidity factor-mimicking portfolios, calculated using the standard deviation or coefficient of variation for dollar volume or share turnover.

3B3. Bull versus Bear Markets

In this section I decompose my sample into groups based on up and down months, as characterized by Bhardwaj and Brooks (1993). Once I have these two groups of up and down, or bull and bear months, I re-test the dollar volume and share turnover regressions, equation (28) and equation (30), to account for differences between bull and bear months. Explicitly, I test the sensitivity of the results to the specific market condition. In addition, I am able to make a direct comparison of the bull and bear effects of the various factors. The regression equations are:

$$RP_m - Rf_m = A + A1(D) + L(FM_{LIQ}) + L1(FM_{LIQ} * D) + e_m \quad (34)$$

$$RP_m - Rf_m = A + A1(D) + L(FM_{LIQ}) + L1(FM_{LIQ} * D) + B(RM_m) + B1(RM_m * D) + S(SIZE_m) + S1(SIZE_m * D) + H(BM_m) + H1(BM_m * D) + M(RP_{m-1}) + M1(RP_{m-1} * D) + e_m \quad (35)$$

where D is a dummy variable that equals one for bear months and zero for bull months. The coefficients to be estimated are A, A1, L, L1, B, B1, S, S1, H, H1, M and M1, where L and

(L+L1) represent the liquidity effect for bull and bear months, respectively. My hypotheses dictate that these coefficients, L and (L+L1), should both be significant for FM_{LIQ} . Also, I predict that the coefficient for bear months, (L+L1), has a stronger significance than the coefficient for bull months, L. Thus, my hypothesis also states that L1 should be significant for FM_{LIQ} , showing that bear months are more sensitive to liquidity effects. I predict that in bear months there will be a stronger effect of $SIZE_m$, BM_m , and RP_{m-1} on returns, so that S1, H1, and M1 are significant. In a weak or bearish market versus a “regular” market investors may have a higher penalty on stocks that don’t measure up to liquidity expectations because of the dire nature of the environment. For completeness of the model, I also include interaction terms for size, book-to-market, momentum, and the market factor.

CHAPTER 4- EMPIRICAL RESULTS

In this chapter I present the empirical results from the tests described in Chapter 3. I first look at the univariate regressions of liquidity and show the pricing relationship between liquidity and returns. I then compare the results of the various liquidity measures to account for any differences in using one measure or another. The results from the multivariate regressions with liquidity and the other popular asset-pricing measures are studied to look for any mitigating effects on the ability of any of these five measures (liquidity, the market factor, size, book-to-market, and momentum) to capture the time variation in returns. I also examine the intercepts of the regressions to account for any changes due to the presence of liquidity. The last part of this chapter describes the results from the decomposition of the sample into bull and bear months and states the outcome of the differences in the relationships between returns and various asset-pricing variables across these market conditions.

4A. Descriptive and Summary Statistics

Before I start my discussion of the results for the various regressions, I describe and report descriptive and summary statistics for the data used in the regressions. The descriptive statistics are for the 54 portfolios of dependent returns. The summary statistics are reported for the explanatory returns used in the time-series regressions. The descriptive statistics for the 54 portfolios are reported in Table 1A, while the summary statistics of the explanatory returns are reported in Table 1B. In addition to the summary statistics the correlations for the explanatory returns are reported, in Table 1C.

4A1. Descriptive Statistics

The 54 portfolios of dependent returns are formed from the intersection of two size groups, three liquidity groups, three book-to-market equity groups, and three momentum groups. In Table 1A the averages of these various sorting measures are reported for the 54 portfolios. The size variable is the market value of equity reported in millions of dollars. The liquidity

variable is the ratio of the monthly shares traded and the number of shares outstanding. The book-to-market equity is calculated by using COMPUSTAT's book value of common stock, plus deferred taxes and investment credits, minus the book value of preferred stock. The total book value of equity is then divided by the market value of equity. The momentum variable is the eleven-month return calculated in June of each year lagged one month. The values reported in Table 1A are the averages of the annual values for the averages of the respective measures for the stocks in the portfolio. In addition I report the annual average number of stocks for each portfolio.

The patterns are clear and consistent with sorting procedures used. In the size averages it is clear that the average market value of equity for big firms is larger than that for small firms. It is also interesting to note that there is an apparent relationship between size and liquidity. Looking at the size averages for small firms, the average size of the firm increases moving from low liquidity to high liquidity, holding book-to-market and momentum constant. However, that pattern does not exist for big firms. In the book-to-market ratio averages there is a clear increase moving from low to high book-to-market portfolios. For liquidity, again, the obvious pattern exists with an increase from low to high liquidity. There is also a size pattern in the liquidity averages. Moving from small to big firms and holding liquidity, book-to-market, and momentum constant, the liquidity value increases. This suggests that on average big firms are more liquid than small firms. Momentum exhibits the natural increase in moving from loser to winner portfolios. In fact, on average, the loser portfolios suffer losses while the winners gain. The averages of the annual number of stocks in the portfolios show intuitive relationships between some of the measures. Specifically, when considering the extreme cases, it is intuitive to think that big firms are more liquid, have a low book-to-market, and are winners. At the other extreme big firms with low liquidity, high book-to-market and losing returns may be counterintuitive. These extreme cases are implied by the values of the average number of stocks, where in the portfolios with big, highly liquid, low book-to-market winner stocks the average number of stocks is at its highest value of 300 stocks. The other extreme of big, low liquid, high book-to-market loser stocks yields the lowest value of the average number of stocks of 27.

4A2. Summary Statistics

As noted by prior studies, when considering time-series analysis the average values of the explanatory variables are, in fact, the average risk premiums for the underlying factors in returns. The average values for the market, size, and book-to-market factors can be weighed against prior studies such as Fama and French (1993). However, since the time period is different, the results are not directly comparable. Fama and French (1993) extends over the period between July 1963 to December 1991, whereas this study uses the time period between July 1983 to December 2002. The average value for the market (RM) can be defined as the average premium per unit of market beta¹⁷. I find the average value of RM to be 0.51% per month. Fama and French (1993) report a similar finding (Table 2, page 14) of 0.43%. Likewise, my result for the average premium for the book-to-market factor (BM) is similar to the finding of Fama and French (1993). I find that the average value of BM is 0.44% per month while Fama and French report a finding of 0.40% per month. The effect of the different time period is most evident in the average premiums for the size factor (SIZE). For SIZE I find a reversal of the size effect with an average premium of -0.10%. This is in stark contrast to Fama and French's finding of an average premium for SIZE of 0.27%. The explanation for this reversal is that in recent years small firms tend to under-perform big firms. This leads to, on average, a negative SIZE (small minus big) factor.

Given that the liquidity factors are constructed as residuals, the average values of the liquidity factors are zero. For comparative reasons the average values of the return differences used to compute the liquidity residuals are also reported. The return differences are the differences between the illiquid and liquid portfolios used as the dependent variable to calculate the liquidity residuals. For the average values of these return differences I find very similar results for the liquidity levels, dollar volume, and share turnover. The average value for dollar volume is 0.31% per month with a t-statistic for zero mean of 1.26. Turnover has the exact same average value of 0.31% per month with a reduced t-statistic of 1.10. The standard deviation variables are also similar to each other where the standard deviation of dollar volume has an average value of 0.27% (t=1.12) as compared to the average value for the standard deviation of share turnover of 0.22% (t=0.83). The coefficient of variation variables are also similar to each other where the coefficient of variation of dollar volume has an average value of 0.25% (t=2.50)

¹⁷ A similar discussion is presented in Fama and French (1993) page 13.

Table 1A
Descriptive statistics for 54 portfolios formed on size, liquidity, book-to-market equity, and momentum: 1983-2002.

SIZE	LIQUIDITY	BOOK-TO-MARKET	MOMENTUM											
			LOSER			NEUTRAL			WINNER					
			Avg. of Ann. Avgs. of size			Avg. of Ann. Avgs. of BE/ME			Avg. of Annual Avgs. of liquidity			Avg. of Ann. Avgs. of momentum		
SMALL	LOW	LOW	24.20	32.63	31.90	0.2433	0.2755	0.2675	0.0183	0.0184	0.0203	-0.0416	0.0131	0.0774
		MEDIUM	28.03	35.67	33.10	0.6786	0.6935	0.6703	0.0174	0.0170	0.0189	-0.0289	0.0132	0.0578
		HIGH	21.79	26.65	23.91	2.0257	1.6062	1.6541	0.0175	0.0175	0.0188	-0.0276	0.0119	0.0545
	MEDIUM	LOW	31.48	37.36	38.28	0.2411	0.2566	0.2435	0.0550	0.0544	0.0564	-0.0403	0.0137	0.0797
		MEDIUM	32.85	39.50	37.41	0.6759	0.6790	0.6609	0.0546	0.0537	0.0546	-0.0343	0.0133	0.0635
		HIGH	27.16	33.04	28.29	1.9564	1.6125	1.5759	0.0536	0.0516	0.0536	-0.0360	0.0125	0.0569
	HIGH	LOW	37.84	43.91	44.82	0.2512	0.2583	0.2386	0.1580	0.1471	0.1763	-0.0506	0.0135	0.1024
		MEDIUM	41.81	47.64	42.08	0.6652	0.6493	0.6408	0.1607	0.1491	0.1749	-0.0450	0.0125	0.0811
		HIGH	35.83	40.08	36.67	2.1389	1.6656	1.5917	0.1578	0.1482	0.1650	-0.0495	0.0130	0.0722
BIG	LOW	LOW	3695.37	5247.34	3991.44	0.2879	0.3100	0.2808	0.0200	0.0218	0.0209	-0.0184	0.0146	0.0519
		MEDIUM	650.57	1337.90	964.30	0.6761	0.6696	0.6496	0.0192	0.0199	0.0198	-0.0141	0.0133	0.0435
		HIGH	657.56	894.16	880.60	1.4658	1.3158	1.2587	0.0188	0.0205	0.0198	-0.0171	0.0122	0.0436
	MEDIUM	LOW	4236.70	5436.94	3443.56	0.2977	0.3013	0.2756	0.0574	0.0546	0.0580	-0.0210	0.0146	0.0563
		MEDIUM	1568.81	2438.15	1801.64	0.6667	0.6609	0.6418	0.0557	0.0541	0.0558	-0.0168	0.0138	0.0465
		HIGH	1313.97	1761.63	1285.81	1.4574	1.2829	1.2308	0.0559	0.0534	0.0578	-0.0199	0.0127	0.0457
	HIGH	LOW	1484.50	2703.19	2088.99	0.2973	0.2917	0.2516	0.1911	0.1795	0.2010	-0.0335	0.0148	0.0778
		MEDIUM	1043.83	1562.80	1165.80	0.6525	0.6517	0.6355	0.1852	0.1537	0.1769	-0.0284	0.0139	0.0629
		HIGH	806.53	1155.23	907.08	1.6001	1.3287	1.3333	0.1703	0.1481	0.1780	-0.0328	0.0127	0.0582
			Avg. of Ann. number of firms in portfolio											
SMALL	LOW	LOW	81	49	70									
		MEDIUM	102	114	90									
		HIGH	260	191	100									
	MEDIUM	LOW	87	49	93									
		MEDIUM	89	62	74									
		HIGH	172	91	73									
	HIGH	LOW	81	39	132									
		MEDIUM	78	37	71									
		HIGH	118	42	51									
BIG	LOW	LOW	27	74	57									
		MEDIUM	56	155	65									
		HIGH	58	88	27									
	MEDIUM	LOW	52	129	139									
		MEDIUM	73	177	102									
		HIGH	70	94	40									
	HIGH	LOW	92	115	300									
		MEDIUM	93	101	127									
		HIGH	77	59	52									

The 54 size/liquidity/book-to-market equity/momentum portfolios are formed using two size, three liquidity, three book-to-market equity, and three momentum groups. Size is calculated using the market value of equity from CRSP, reported in millions of dollars. Book-to-market (BE/ME) is the ratio of the book value of equity and the market value of equity. The book value of equity is calculated as the COMPUSTAT book value of common stock, plus deferred taxes and investment credits, minus the book value of preferred stock. Liquidity is proxied for by turnover, which is calculated as the ratio of the CRSP values for shares traded and shares outstanding. Momentum is calculated as the eleven-month CRSP returns lagged one month. The descriptive statistics are calculated in June of each year, 1983-2002, and are then averaged across the 20 years.

Table 1B
Summary statistics for the monthly explanatory returns (in percent) in the time-series regressions:
July 1983 to December 2002, 234 observations.

Name	Mean	Std.	t(mean)	Min	Max
VOLDIFF	0.31	3.75	1.26	-22.43	14.64
TURDIFF	0.31	4.29	1.10	-24.32	15.33
FM_VOL	0.00	1.84	0.00	-10.58	4.71
FM_TUR	0.00	1.97	0.00	-10.46	6.19
STDVOLDIFF	0.27	3.74	1.12	-22.07	15.15
STDTURDIFF	0.22	4.02	0.83	-20.31	15.07
FM_STDVOL	0.00	1.84	0.00	-10.75	5.39
FM_STDTUR	0.00	1.82	0.00	-7.75	5.27
CVVOLDIFF	0.25	2.50	1.53	-11.29	13.54
CVTURDIFF	0.17	1.21	2.09	-4.43	4.69
FM_CVVOL	0.00	1.82	0.00	-7.22	8.40
FM_CVTUR	0.00	1.06	0.00	-4.03	3.63
RM	0.51	4.56	1.71	-23.09	12.42
SIZE	-0.10	3.47	-0.46	-16.26	21.38
BM	0.44	3.39	1.98	-12.05	13.67
RP _{m-1}	0.90	4.49	3.07	-25.13	18.21

VOLDIFF, TURDIFF, STDVOLDIFF, STDTURDIFF, CVVOLDIFF, and CVTURDIFF are the differences between illiquid stock portfolios and liquid stock portfolios using dollar volume, share turnover, the standard deviation of dollar volume, the standard deviation of share turnover, the coefficient of variation of dollar volume, and the coefficient of variation of share turnover, respectively. FM_VOL, FM_TUR, FM_STDVOL, FM_STDTUR, FM_CVVOL, and FM_CVTUR are the residuals from the regressions of the volume differences versus the three factors from Fama and French (1993) and the momentum factor from Carhart (1997). RM, SIZE, and BM are the three factors from Fama and French (1993) and RP_{m-1} is the momentum factor. All four factors were obtained from Kenneth French's website.

Table 1C
Correlations for the monthly explanatory returns in the time-series regressions
using dollar volume and share turnover.

	VOLDIFF	FM_VOL	TURDIFF	FM_TUR	RM	SIZE	BM	RP _{m-1}
VOLDIFF	1.00	0.49	0.86	0.39	-0.65	-0.21	0.74	0.31
FM_VOL	0.49	1.00	0.36	0.80	0.00	0.00	0.00	0.00
TURDIFF	0.86	0.36	1.00	0.45	-0.60	-0.60	0.77	0.18
FM_TUR	0.39	0.80	0.45	1.00	0.00	0.00	0.00	0.00
RM	-0.65	0.00	-0.60	0.00	1.00	0.16	-0.53	-0.08
SIZE	-0.21	0.00	-0.60	0.00	0.16	1.00	-0.44	0.10
BM	0.74	0.00	0.77	0.00	-0.53	-0.44	1.00	-0.08
RP _{m-1}	0.31	0.00	0.18	0.00	-0.08	0.10	-0.08	1.00

VOLDIFF and TURDIFF are the differences in the averages of the illiquid and liquid portfolios for dollar volume and share turnover, respectively. FM_VOL and FM_TUR are the residual liquidity factors obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997), for dollar volume and share turnover, respectively.

RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for size. BM is the return on the zero investment, factor mimicking portfolio for book-to-market. RP_{m-1} is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and RP_{m-1} are all obtained from Kenneth French's website.

as compared to the average value for the coefficient of variation of share turnover of 0.17% ($t = 1.21$). Overall, the measures of liquidity have very similar results with average premiums ranging from 0.17% to 0.31% per month or roughly between two and three and three-quarters percent per year.

4A3. Correlations

The correlation matrix for the explanatory returns are reported in Table 1C. I report the correlations between the liquidity level data, dollar volume and share turnover, and the other four asset pricing variables. The residuals factors show the orthogonal relationship to the other variables with the zero correlation values. The high level of correlation between the various liquidity measures is also shown in Table 1C.

4B. Univariate Liquidity Regressions

4B1. The Pricing of Liquidity

The univariate time-series regressions are estimated using various measures of liquidity. There are six underlying liquidity proxies used in the calculation of the residual liquidity factor. The six measures can be classified into two main categories, liquidity levels and the variability of the levels. The liquidity levels are the dollar volume of shares traded and the share turnover values. The variability figures are the standard deviation of the dollar volume, the standard deviation of share turnover, the coefficient of variation of dollar volume, and the coefficient of variation of share turnover. The residual liquidity factors generated from these measures are then used in the univariate regressions discussed.

4B1.1 Dollar Volume

The time-series regressions are estimated using all of the various underlying liquidity proxies, using monthly data, over the period between July 1983 and December 2002. The first regression results I report are for the time-series univariate regression using dollar volume as the underlying liquidity proxy. Table 2 presents the results generated from this time-series univariate regression.

In total, 54 portfolios of stocks are examined. These 54 portfolios are based on sorts on liquidity, size, book-to-market, and momentum. Table 2 is separated into six panels, each panel is comprised of the three by three cross-section of book-to-market and momentum. Given the intuitive relationship between size and liquidity, I use these factors as the distinguishing characteristics of the six panels. I start by looking at the small stock portfolios with varying liquidity and then the big stock portfolios with varying liquidity. For example, Panel A represents the intersection of small stocks and low liquidity stocks.

The main finding in the 54 time-series regressions, using dollar volume, is that liquidity is priced and that liquidity explains a portion of the shared variation in returns. This is shown by the significance on the liquidity terms from Table 2, the regression results of returns versus liquidity. In the low liquidity portfolios there is a tendency for the coefficients to have a positive relationship with returns and in the high liquidity portfolios the opposite tends to be the case, a negative relationship with returns. These relationships exist because of the manner in which the liquidity factor is formed. The liquidity factor is formed using the difference in the returns of illiquid and liquid portfolios, illiquid minus liquid. Given this formation technique the underlying relationship between the factor and liquidity, as a characteristic, is shown by these relationships. Therefore, in the high liquidity portfolios the negative coefficient is a product of this formation technique. Intuitively when looking solely at stocks with high liquidity, the relationship to the liquidity factor, formed using an illiquid minus liquid calculation, is negative. The opposite is true when looking at portfolios of illiquid stocks: a positive relationship between the returns and the liquidity factor.

Additionally, there are a couple of clear patterns in the liquidity-return relationship shown in Table 2. First, there is an evident pattern to the coefficients on the liquidity factors. When examining the coefficients across the three groups of liquidity, holding the other measures constant, there is an apparent monotonically decreasing pattern. This pattern is consistent with my hypothesis on the relationship between the underlying liquidity characteristic and my liquidity factor. This pattern is also consistent with the effects found by prior studies using other asset pricing measures. For example, Fama and French (1993) find similar patterns for size versus SMB and book-to-market versus HML.

Second, in all panels there is statistical significance for the liquidity-return relationship. In addition, there are two of the six panels that notably stand out. In Panel C, small firms with

high liquidity, and Panel D, big firms with low liquidity, there is a clear dominance over the other panels. This dominance is shown by the fact that the other four panels have one or two portfolios that are clearly significant while all the portfolios in Panel C are significant and five of the nine in Panel D show significance.

It is very interesting that the relationship between returns and liquidity is so concentrated in these two groups of characteristics. The interest comes from the intuitive reason that investors have set expectations about certain types of firms where they feel that big firms with high liquidity should provide a guaranteed level of liquidity while small firms with low liquidity have an understood or expected level of illiquidity. The results here imply that the more pronounced relationship between liquidity and returns is centered in the divergence from these two extremes. The rationale in the overwhelming significance for these two groups of characteristics is found in the basic concepts of asset pricing, where investors tend to seek more returns for more risk. In the small-high liquidity group, since investors tend to assume that small firms are illiquid, they don't know what to make of these types of firms that are small but are very liquid. Therefore investors assign some instability risk level with the expectation that these firms will revert to their illiquid nature. For the big-low liquidity group the effect stems from the penalty for not providing the expected level of liquidity assumed to be present in all big firms. Thus, the liquidity return relationship is magnified in these firms.

4B1.2 Share Turnover

The time-series univariate regression results using share turnover are reported in Table 3. The format of Table 3 is the same as Table 2. The results in Table 3 show that liquidity is priced, in this case using share turnover as its proxy. There are, again, clear patterns in the liquidity-return relationship evident in the results in Table 3. The monotonically decreasing pattern in the coefficients across liquidity groups from low to high liquidity shown in Table 2 for dollar volume is again present for share turnover. Once again the statistical significance is present in all panels of the table and is more pronounced in Panel C, small firms with high liquidity, and Panel D, big firms with low liquidity. The exact same portfolios are significant, all nine in Panel C and five of nine in Panel D (all three low book-to-market groups and the loser and neutral medium book-to-market groups).

4B1.3 Standard Deviation of Dollar Volume

The time-series univariate regression results using the standard deviation of dollar volume are reported in Table 4. As is the case for both dollar volume and share turnover, Table 4 shows that liquidity is also priced when using the standard deviation of dollar volume. There are clear patterns in the liquidity-return relationship evident in the results in Table 4. The monotonically decreasing pattern in the coefficients across liquidity groups from low to high liquidity shown in Tables 2 and 3 for dollar volume and share turnover is again present for the standard deviation of dollar volume. Once again the statistical significance is present in all panels of the table and is more pronounced in Panel C, small firms with high liquidity, and Panel D, big firms with low liquidity. The exact same portfolios are significant, all nine in Panel C and five of nine in Panel D (all three low book-to-market groups and the loser and neutral medium book-to-market groups).

4B1.4 Standard Deviation of Share Turnover

The time-series univariate regression results using the standard deviation of share turnover are reported in Table 5. The significance on the liquidity coefficients provides evidence that liquidity is priced when using the standard deviation of share turnover as a proxy. There are clear patterns in the liquidity-return relationship evident in the results in Table 5. The monotonically decreasing pattern in the coefficients across liquidity groups from low to high liquidity shown in Tables 2, 3, and 4 for dollar volume, share turnover, and the standard deviation of dollar volume is again present for the standard deviation of share turnover. Once again the statistical significance is present in all panels of the table and is more pronounced in Panel C, small firms with high liquidity, and Panel D, big firms with low liquidity. Of the nine portfolios, all nine in Panel C are significant and four of nine in Panel D are significant (the loser and neutral low book-to-market groups and the loser and neutral medium book-to-market groups).

4B1.5 Coefficient of Variation of Dollar Volume

The time-series univariate regression results using the coefficient of variation of dollar volume are reported in Table 6. Unlike the previous measures, the coefficient of variation of dollar volume produces very erratic results in the pricing of liquidity. The obvious patterns found

by the other measures are not evident in the results of the coefficient of variation of dollar volume regressions. There is a general lack of statistical significance across the panels of Table 6. Consequently, the significance patterns shown in prior tables for the other measures of liquidity are not present. This may indicate that the coefficient of variation of dollar volume may be a weaker proxy for liquidity than the previously presented measures.

4B1.6 Coefficient of Variation of Share Turnover

The time-series univariate regression results using the coefficient of variation of share turnover are reported in Table 7. As in the regression for the coefficient of variation of dollar volume and unlike the level and standard deviation measures, the coefficient of variation of share turnover produces very erratic results in the pricing of liquidity. The obvious patterns found by the level and standard deviation measures are not evident in the results of the coefficient of variation of share turnover regression. As in Table 6, there is a general lack of statistical significance across the panels of Table 7. Consequently, the significance patterns shown in Tables 2 through 5 for the level and standard deviation measures of liquidity are not present. As is the case for the coefficient of variation of dollar volume, the coefficient of variation of share turnover may be a weaker proxy for liquidity than the level and standard deviation measures.

4B1.7 Overall Comparison

In general, with the exception of the coefficient of variation measures, the results of the univariate regressions of returns versus liquidity provide strong evidence that liquidity is priced. Additionally, the measures of liquidity portray clear patterns of the characteristics of liquidity. First, there is a monotonically decreasing pattern in the coefficients on liquidity from low to high liquidity, consistent with the given hypotheses on the relationship between liquidity and my liquidity factor, as well as similar patterns found by prior studies. Secondly, there is an evident concentration of significance of the relationship between returns and liquidity in small, high liquid firms and big, low liquid firms.

4B2. The Difference between Liquidity Measures

In comparing the various measures of liquidity there does not seem to be vast differences in the six measures, as evident by the similar means of the measures reported in Table 1. When

Table 2
Regressions of excess stock returns on the excess market return and the mimicking returns for
liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months
 $RP_m - Rf_m = A + L(FM - VOL_M) + e_m$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner			Loser	Neutral	Winner			
	A			t(A)			L			t(L)			R ²		
Low	0.011	0.016	0.018	2.48	4.21	4.33	-0.21	-0.01	-0.14	-0.87	-0.06	-0.60	0.00	0.00	0.00
Medium	0.006	0.011	0.010	2.02	4.86	3.50	0.26	0.36	0.23	1.56	2.92	1.45	0.01	0.04	0.01
High	0.001	0.004	0.002	0.36	1.47	0.44	0.32	0.30	-0.10	1.64	2.02	-0.53	0.01	0.02	0.00

Panel B: Small - Medium Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner			Loser	Neutral	Winner			
	A			t(A)			L			t(L)			R ²		
Low	0.016	0.018	0.015	2.42	3.21	3.02	-1.11	-0.10	-0.44	-3.05	-0.32	-1.64	0.04	0.00	0.01
Medium	0.006	0.008	0.006	1.31	2.10	1.54	-0.28	0.01	-0.17	-1.15	0.07	-0.78	0.01	0.00	0.00
High	-0.003	0.000	-0.001	-0.63	0.00	-0.14	-0.14	-0.01	-0.39	-0.55	-0.06	-1.57	0.00	0.00	0.01

Panel C: Small - High Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner			Loser	Neutral	Winner			
	A			t(A)			L			t(L)			R ²		
Low	0.011	0.014	0.008	1.56	2.14	1.35	-1.50	-1.02	-1.20	-3.95	-2.80	-3.51	0.06	0.03	0.05
Medium	0.002	0.002	-0.007	0.30	0.28	-1.15	-1.12	-0.97	-1.07	-3.55	-3.29	-3.37	0.05	0.04	0.05
High	-0.009	-0.010	-0.016	-1.38	-1.66	-2.62	-1.31	-1.02	-0.96	-3.71	-3.15	-2.94	0.06	0.04	0.04

Panel D: Big - Low Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner			Loser	Neutral	Winner			
	A			t(A)			L			t(L)			R ²		
Low	0.004	0.006	0.009	1.11	2.23	2.73	0.57	0.59	0.39	2.99	3.70	2.26	0.04	0.06	0.02
Medium	0.004	0.006	0.004	1.31	2.40	1.52	0.38	0.56	0.05	2.26	4.19	0.29	0.02	0.07	0.00
High	-0.003	0.001	-0.001	-0.86	0.29	-0.38	0.04	0.24	-0.06	0.20	1.42	-0.31	0.00	0.01	0.00

Panel E: Big - Medium Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner			Loser	Neutral	Winner			
	A			t(A)			L			t(L)			R ²		
Low	0.007	0.008	0.009	1.78	2.58	2.43	0.15	0.38	0.23	0.70	2.38	1.16	0.00	0.02	0.01
Medium	0.004	0.003	0.006	0.99	0.84	1.74	0.39	0.06	-0.04	1.92	0.36	-0.23	0.02	0.00	0.00
High	-0.004	-0.001	-0.001	-0.99	-0.24	-0.18	-0.10	-0.08	-0.08	-0.44	-0.45	-0.44	0.00	0.00	0.00

Panel F: Big - High Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner			Loser	Neutral	Winner			
	A			t(A)			L			t(L)			R ²		
Low	0.010	0.011	0.009	1.91	2.32	1.72	-0.37	-0.35	-0.35	-1.30	-1.41	-1.22	0.01	0.01	0.01
Medium	0.000	0.001	-0.006	0.02	0.19	-1.14	-0.25	-0.37	-0.41	-0.83	-1.71	-1.55	0.00	0.01	0.01
High	-0.011	-0.003	-0.012	-1.78	-0.60	-2.12	-0.88	-0.20	-0.81	-2.72	-0.80	-2.58	0.03	0.00	0.03

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups. FM_VOL is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997).

Table 3
Regressions of excess stock returns on the excess market return and the mimicking returns for
liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(FM_TUR_M) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner								
	A	t(A)	L	t(L)	R ²										
Low	0.011	0.016	0.018	2.48	4.21	4.34	-0.31	0.06	-0.21	-1.34	0.33	-0.99	0.01	0.00	0.00
Medium	0.006	0.011	0.010	2.02	4.86	3.50	0.23	0.33	0.19	1.49	2.88	1.29	0.01	0.03	0.01
High	0.001	0.004	0.002	0.36	1.46	0.44	0.15	0.22	-0.28	0.80	1.61	-1.56	0.00	0.01	0.01

Panel B: Small - Medium Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner								
	A	t(A)	L	t(L)	R ²										
Low	0.016	0.018	0.015	2.44	3.21	3.03	-1.23	-0.17	-0.51	-3.67	-0.58	-2.05	0.05	0.00	0.02
Medium	0.006	0.008	0.006	1.31	2.10	1.54	-0.23	0.02	-0.30	-1.05	0.12	-1.45	0.00	0.00	0.01
High	-0.003	0.000	-0.001	-0.64	0.00	-0.14	-0.26	-0.09	-0.59	-1.09	-0.48	-2.56	0.01	0.00	0.03

Panel C: Small - High Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner								
	A	t(A)	L	t(L)	R ²										
Low	0.011	0.014	0.008	1.55	2.15	1.36	-1.31	-0.97	-1.18	-3.69	-2.85	-3.72	0.06	0.03	0.06
Medium	0.002	0.002	-0.007	0.30	0.28	-1.15	-0.97	-0.75	-1.01	-3.26	-2.69	-3.43	0.04	0.03	0.05
High	-0.009	-0.010	-0.016	-1.38	-1.67	-2.65	-1.23	-1.05	-1.17	-3.74	-3.48	-3.86	0.06	0.05	0.06

Panel D: Big - Low Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner								
	A	t(A)	L	t(L)	R ²										
Low	0.004	0.006	0.009	1.11	2.34	2.73	0.57	0.88	0.37	3.19	6.25	2.30	0.04	0.14	0.02
Medium	0.004	0.006	0.004	1.31	2.43	1.52	0.34	0.59	0.06	2.15	4.79	0.42	0.02	0.09	0.00
High	-0.003	0.001	-0.001	-0.86	0.29	-0.38	0.03	0.22	-0.11	0.19	1.38	-0.58	0.00	0.01	0.00

Panel E: Big - Medium Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner								
	A	t(A)	L	t(L)	R ²										
Low	0.007	0.008	0.009	1.79	2.62	2.43	0.33	0.52	0.12	1.62	3.50	0.62	0.01	0.05	0.00
Medium	0.004	0.003	0.006	1.00	0.84	1.74	0.44	0.01	-0.09	2.34	0.07	-0.50	0.02	0.00	0.00
High	-0.004	-0.001	-0.001	-0.98	-0.24	-0.18	-0.03	-0.03	-0.17	-0.15	-0.21	-0.92	0.00	0.00	0.00

Panel F: Big - High Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner								
	A	t(A)	L	t(L)	R ²										
Low	0.010	0.011	0.009	1.92	2.33	1.73	-0.40	-0.44	-0.58	-1.51	-1.90	-2.19	0.01	0.02	0.02
Medium	0.000	0.001	-0.006	0.02	0.19	-1.15	-0.31	-0.36	-0.64	-1.14	-1.75	-2.63	0.01	0.01	0.03
High	-0.011	-0.003	-0.012	-1.78	-0.61	-2.14	-0.72	-0.34	-1.00	-2.36	-1.49	-3.47	0.02	0.01	0.05

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups. FM_TUR is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997).

Table 4

Regressions of excess stock returns on the excess market return and the mimicking returns for liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(FM - STDVOL_M) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity

Book-to-market	Momentum												R ²								
	Loser			Neutral			Winner			Loser						Neutral			Winner		
	A			t(A)			L			t(L)											
Low	0.011	0.016	0.018	2.49	4.21	4.34	-0.37	-0.02	-0.22	-1.51	-0.11	-0.98	0.01	0.00	0.00						
Medium	0.006	0.011	0.010	2.02	4.86	3.49	0.21	0.35	0.20	1.26	2.87	1.22	0.01	0.03	0.01						
High	0.001	0.004	0.002	0.36	1.46	0.44	0.25	0.27	-0.15	1.27	1.85	-0.75	0.01	0.01	0.00						

Panel B: Small - Medium Liquidity

Book-to-market	Momentum												R ²								
	Loser			Neutral			Winner			Loser						Neutral			Winner		
	A			t(A)			L			t(L)											
Low	0.016	0.018	0.015	2.43	3.21	3.03	-1.26	-0.34	-0.53	-3.48	-1.09	-1.99	0.05	0.01	0.02						
Medium	0.006	0.008	0.006	1.32	2.10	1.54	-0.33	0.00	-0.24	-1.40	-0.01	-1.08	0.01	0.00	0.01						
High	-0.003	0.000	-0.001	-0.63	0.00	-0.14	-0.19	-0.04	-0.48	-0.76	-0.18	-1.94	0.00	0.00	0.02						

Panel C: Small - High Liquidity

Book-to-market	Momentum												R ²								
	Loser			Neutral			Winner			Loser						Neutral			Winner		
	A			t(A)			L			t(L)											
Low	0.011	0.014	0.008	1.56	2.15	1.36	-1.54	-1.09	-1.38	-4.06	-2.98	-4.06	0.07	0.04	0.07						
Medium	0.002	0.002	-0.007	0.30	0.28	-1.15	-1.14	-0.88	-1.15	-3.61	-2.97	-3.64	0.05	0.04	0.05						
High	-0.009	-0.010	-0.016	-1.38	-1.67	-2.63	-1.31	-1.04	-1.04	-3.74	-3.21	-3.20	0.06	0.04	0.04						

Panel D: Big - Low Liquidity

Book-to-market	Momentum												R ²								
	Loser			Neutral			Winner			Loser						Neutral			Winner		
	A			t(A)			L			t(L)											
Low	0.004	0.006	0.009	1.10	2.24	2.72	0.53	0.63	0.37	2.76	4.03	2.10	0.03	0.07	0.02						
Medium	0.004	0.006	0.004	1.30	2.40	1.51	0.34	0.57	0.03	2.06	4.25	0.17	0.02	0.07	0.00						
High	-0.003	0.001	-0.001	-0.86	0.29	-0.38	-0.02	0.26	-0.12	-0.11	1.57	-0.61	0.00	0.01	0.00						

Panel E: Big - Medium Liquidity

Book-to-market	Momentum												R ²								
	Loser			Neutral			Winner			Loser						Neutral			Winner		
	A			t(A)			L			t(L)											
Low	0.007	0.008	0.009	1.78	2.58	2.43	0.13	0.39	0.19	0.59	2.40	0.96	0.00	0.02	0.00						
Medium	0.004	0.003	0.006	0.99	0.84	1.74	0.38	0.01	-0.10	1.89	0.06	-0.55	0.02	0.00	0.00						
High	-0.004	-0.001	-0.001	-0.99	-0.24	-0.17	-0.09	-0.07	-0.07	-0.40	-0.38	-0.35	0.00	0.00	0.00						

Panel F: Big - High Liquidity

Book-to-market	Momentum												R ²								
	Loser			Neutral			Winner			Loser						Neutral			Winner		
	A			t(A)			L			t(L)											
Low	0.010	0.011	0.009	1.91	2.32	1.72	-0.38	-0.30	-0.35	-1.32	-1.21	-1.22	0.01	0.01	0.01						
Medium	0.000	0.001	-0.006	0.02	0.19	-1.15	-0.21	-0.38	-0.48	-0.72	-1.73	-1.85	0.00	0.01	0.01						
High	-0.011	-0.003	-0.012	-1.78	-0.60	-2.12	-0.80	-0.18	-0.83	-2.47	-0.71	-2.64	0.03	0.00	0.03						

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups. FM_STDVOL is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997).

Table 5
Regressions of excess stock returns on the excess market return and the mimicking returns for
liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(FM_STDTUR_M) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	Momentum									Loser			Neutral			Winner		
	A			t(A)			L			t(L)			R ²					
Low	0.011	0.016	0.018	2.48	4.21	4.35	-0.31	-0.06	-0.36	-1.24	-0.30	-1.57	0.01	0.00	0.01			
Medium	0.006	0.011	0.010	2.02	4.84	3.49	0.24	0.32	0.20	1.42	2.58	1.23	0.01	0.03	0.01			
High	0.001	0.004	0.002	0.36	1.46	0.44	0.17	0.24	-0.17	0.86	1.58	-0.88	0.00	0.01	0.00			

Panel B: Small - Medium Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	Momentum									Loser			Neutral			Winner		
	A			t(A)			L			t(L)			R ²					
Low	0.016	0.018	0.015	2.42	3.21	3.05	-1.20	-0.30	-0.74	-3.28	-0.94	-2.74	0.04	0.00	0.03			
Medium	0.006	0.008	0.006	1.32	2.10	1.54	-0.37	-0.06	-0.31	-1.52	-0.28	-1.37	0.01	0.00	0.01			
High	-0.003	0.000	-0.001	-0.63	0.00	-0.14	-0.25	-0.05	-0.45	-0.98	-0.24	-1.81	0.00	0.00	0.01			

Panel C: Small - High Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	Momentum									Loser			Neutral			Winner		
	A			t(A)			L			t(L)			R ²					
Low	0.011	0.014	0.008	1.56	2.15	1.35	-0.15	-1.12	-1.25	-3.95	-3.02	-3.60	0.06	0.04	0.05			
Medium	0.002	0.002	-0.007	0.29	0.28	-1.15	-1.00	-0.93	-1.10	-3.09	-3.07	-3.42	0.04	0.04	0.05			
High	-0.009	-0.010	-0.016	-1.37	-1.65	-2.62	-1.19	-0.87	-0.99	-3.34	-2.63	-2.97	0.05	0.03	0.04			

Panel D: Big - Low Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	Momentum									Loser			Neutral			Winner		
	A			t(A)			L			t(L)			R ²					
Low	0.004	0.006	0.009	1.10	2.26	2.72	0.54	0.73	0.33	2.74	4.65	1.86	0.03	0.09	0.01			
Medium	0.004	0.006	0.004	1.30	2.38	1.51	0.35	0.49	0.00	2.06	3.58	-0.01	0.02	0.05	0.00			
High	-0.003	0.001	-0.001	-0.86	0.29	-0.38	0.02	0.13	-0.24	0.08	0.79	-1.22	0.00	0.00	0.01			

Panel E: Big - Medium Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	Momentum									Loser			Neutral			Winner		
	A			t(A)			L			t(L)			R ²					
Low	0.007	0.008	0.009	1.79	2.59	2.43	0.43	0.45	0.11	1.92	2.77	0.56	0.02	0.03	0.00			
Medium	0.004	0.003	0.006	1.00	0.84	1.74	0.46	0.01	-0.06	2.24	0.04	-0.30	0.02	0.00	0.00			
High	-0.004	-0.001	-0.001	-0.98	-0.24	-0.18	0.05	-0.05	-0.16	0.23	-0.29	-0.81	0.00	0.00	0.00			

Panel F: Big - High Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	Momentum									Loser			Neutral			Winner		
	A			t(A)			L			t(L)			R ²					
Low	0.010	0.011	0.009	1.93	2.34	1.74	-0.68	-0.55	-0.70	-2.36	-2.23	-2.45	0.02	0.02	0.03			
Medium	0.000	0.001	-0.006	0.02	0.19	-1.15	-0.36	-0.39	-0.65	-1.21	-1.75	-2.47	0.01	0.01	0.03			
High	-0.011	-0.003	-0.012	-1.78	-0.60	-2.12	-0.82	-0.16	-0.92	-2.49	-0.63	-2.90	0.03	0.00	0.04			

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups. FM_STDTUR is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997).

Table 6

Regressions of excess stock returns on the excess market return and the mimicking returns for liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(FM - CVVOL_M) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner								
	A	t(A)	L	t(L)	R ²										
Low	0.011	0.016	0.018	2.48	4.21	4.34	-0.22	0.02	-0.26	-0.89	0.11	-1.15	0.00	0.00	0.01
Medium	0.006	0.011	0.010	2.02	4.79	3.48	0.19	0.15	0.02	1.14	1.17	0.09	0.01	0.01	0.00
High	0.001	0.004	0.002	0.36	1.45	0.44	0.23	0.10	-0.37	1.17	0.64	-1.90	0.01	0.00	0.02

Panel B: Small - Medium Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner								
	A	t(A)	L	t(L)	R ²										
Low	0.016	0.018	0.015	2.38	3.21	3.01	-0.55	0.08	-0.32	-1.47	0.26	-1.16	0.01	0.00	0.01
Medium	0.006	0.008	0.006	1.31	2.10	1.55	0.10	0.14	-0.39	0.40	0.68	-1.72	0.00	0.00	0.01
High	-0.003	0.000	-0.001	-0.63	0.00	-0.14	0.14	0.05	-0.43	0.56	0.23	-1.70	0.00	0.00	0.01

Panel C: Small - High Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner								
	A	t(A)	L	t(L)	R ²										
Low	0.011	0.014	0.008	1.51	2.11	1.34	-0.42	-0.28	-0.88	-1.05	-0.75	-2.50	0.00	0.00	0.03
Medium	0.002	0.002	-0.007	0.29	0.28	-1.14	-0.40	-0.24	-0.87	-1.22	-0.78	-2.68	0.01	0.00	0.03
High	-0.009	-0.010	-0.016	-1.34	-1.64	-2.63	-0.36	-0.59	-1.09	-0.99	-1.77	-3.30	0.00	0.01	0.04

Panel D: Big - Low Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner								
	A	t(A)	L	t(L)	R ²										
Low	0.004	0.006	0.009	1.10	2.21	2.70	0.53	0.51	-0.01	2.69	3.17	-0.07	0.03	0.04	0.00
Medium	0.004	0.006	0.004	1.30	2.33	1.53	0.15	0.21	-0.33	0.88	1.52	-2.10	0.00	0.01	0.02
High	-0.003	0.001	-0.001	-0.86	0.29	-0.39	-0.08	0.07	-0.80	-0.42	0.39	-4.09	0.00	0.00	0.07

Panel E: Big - Medium Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner								
	A	t(A)	L	t(L)	R ²										
Low	0.007	0.008	0.009	1.78	2.59	2.44	0.19	0.44	-0.32	0.85	2.68	-1.57	0.00	0.03	0.01
Medium	0.004	0.003	0.006	1.00	0.84	1.76	0.53	-0.20	-0.36	2.58	-1.12	-1.90	0.03	0.01	0.02
High	-0.004	-0.001	-0.001	-0.98	-0.24	-0.18	0.08	-0.01	-0.42	0.36	-0.04	-2.15	0.00	0.00	0.02

Panel F: Big - High Liquidity

Book-to-market	Momentum														
	Loser			Neutral			Winner								
	A	t(A)	L	t(L)	R ²										
Low	0.010	0.011	0.009	1.91	2.31	1.73	-0.09	0.12	-0.50	-0.31	0.47	-1.73	0.00	0.00	0.01
Medium	0.000	0.001	-0.006	0.02	0.19	-1.19	-0.10	-0.27	-1.24	-0.34	-1.20	-4.86	0.00	0.01	0.09
High	-0.011	-0.003	-0.012	-1.76	-0.60	-2.16	-0.33	-0.05	-1.26	-0.99	-0.21	-4.05	0.00	0.00	0.07

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups. FM_CVVOL is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997).

Table 7
Regressions of excess stock returns on the excess market return and the mimicking returns for
liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(FM - CVTUR_M) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	Momentum									Loser			Neutral			Winner		
	A			t(A)			L			t(L)			R ²					
Low	0.011	0.016	0.018	2.47	4.21	4.34	0.01	-0.12	-0.29	0.01	-0.32	-0.75	0.00	0.00	0.00			
Medium	0.006	0.011	0.010	2.01	4.78	3.49	0.03	-0.20	-0.30	0.10	-0.93	-1.08	0.00	0.00	0.00			
High	0.001	0.004	0.002	0.36	1.45	0.44	0.20	-0.05	-0.57	0.57	-0.18	-1.70	0.00	0.00	0.01			

Panel B: Small - Medium Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	Momentum									Loser			Neutral			Winner		
	A			t(A)			L			t(L)			R ²					
Low	0.016	0.018	0.015	2.37	3.21	3.01	0.20	0.11	-0.29	0.31	0.21	-0.61	0.00	0.00	0.00			
Medium	0.006	0.008	0.006	1.31	2.10	1.55	0.38	-0.03	-0.73	0.92	-0.09	-1.89	0.00	0.00	0.02			
High	-0.003	0.000	-0.001	-0.63	0.00	-0.14	0.24	0.08	-0.82	0.56	0.23	-1.91	0.00	0.00	0.02			

Panel C: Small - High Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	Momentum									Loser			Neutral			Winner		
	A			t(A)			L			t(L)			R ²					
Low	0.011	0.014	0.008	1.51	2.11	1.33	0.41	-0.05	-1.04	0.60	-0.08	-1.72	0.00	0.00	0.01			
Medium	0.002	0.002	-0.007	0.29	0.28	-1.13	-0.27	-0.10	-1.22	-0.47	-0.19	-2.20	0.00	0.00	0.02			
High	-0.009	-0.010	-0.016	-1.34	-1.63	-2.60	0.25	-0.64	-1.37	0.40	-1.12	-2.40	0.00	0.01	0.02			

Panel D: Big - Low Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	Momentum									Loser			Neutral			Winner		
	A			t(A)			L			t(L)			R ²					
Low	0.004	0.006	0.009	1.09	2.16	2.71	0.20	-0.08	-0.43	0.60	-0.28	-1.43	0.00	0.00	0.01			
Medium	0.004	0.006	0.004	1.29	2.33	1.54	-0.08	-0.38	-0.77	-0.27	-1.57	-2.86	0.00	0.01	0.03			
High	-0.003	0.001	-0.001	-0.86	0.29	-0.39	-0.02	0.02	-1.22	-0.07	0.07	-3.62	0.00	0.00	0.05			

Panel E: Big - Medium Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	Momentum									Loser			Neutral			Winner		
	A			t(A)			L			t(L)			R ²					
Low	0.007	0.008	0.009	1.78	2.55	2.45	-0.35	0.00	-0.78	-0.91	0.01	-2.28	0.00	0.00	0.02			
Medium	0.004	0.003	0.006	0.99	0.85	1.77	0.24	-0.68	-0.91	0.67	-2.24	-2.81	0.00	0.02	0.03			
High	-0.004	-0.001	-0.001	-0.98	-0.24	-0.18	-0.08	-0.22	-0.58	-0.19	-0.71	-1.72	0.00	0.00	0.01			

Panel F: Big - High Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	Momentum									Loser			Neutral			Winner		
	A			t(A)			L			t(L)			R ²					
Low	0.010	0.011	0.009	1.91	2.32	1.72	0.18	0.46	-0.44	0.36	1.08	-0.89	0.00	0.00	0.00			
Medium	0.000	0.001	-0.006	0.02	0.19	-1.18	-0.24	-0.72	-1.77	-0.47	-1.89	-4.00	0.00	0.02	0.06			
High	-0.011	-0.003	-0.012	-1.75	-0.60	-2.13	0.01	-0.17	-1.66	0.02	-0.41	-3.08	0.00	0.00	0.04			

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups. FM_CVTUR is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997).

examining the regressions of the various liquidity measures it is apparent that there is no clear winner among the variables, but there are two clear losers. The coefficient of variation measures seem to be unable to adequately capture a consistent relationship between liquidity and return. The other four measures of dollar volume, share turnover, the standard deviation of dollar volume, and the standard deviation of share turnover all capture the same results for the patterns of the liquidity-return relationship.

4C. Multivariate Regressions

4C1. The Effect of Liquidity on the Full Model

When liquidity is regressed with other asset-pricing variables there are various questions that can be asked. Two such questions are: ‘Is there an effect on the significance of liquidity?’ and ‘What is the significance of the other variables?’

4C1.1 The Effect on the Significance of Liquidity

In order to capture the relationship between returns and liquidity, free of any influence from other asset pricing variables, I compute a residual liquidity variable. I form this variable by first finding a return difference portfolio, the difference between the returns on illiquid stocks and liquid stocks, using size and liquidity sorts. The liquidity difference portfolio is then regressed on four popular asset-pricing variables: the market factor, size, book-to-market equity, and momentum. The residuals from this regression are used as my liquidity factor, free (purged) of any influence from the four asset pricing measures. The question can still be asked of whether this liquidity measure is affected by any of the other measures. Since the liquidity measure is a residual from the other measures it is uncorrelated and orthogonal¹⁸ to the four asset pricing variables. Given this lack of correlation the coefficients on the liquidity variable should not change from the univariate regressions to the multivariate regressions. Subsequently any mitigating factors will be evident in the significance of the variables (t-statistics).

I compare the results from the univariate regressions (Tables 2-7) to the results from the multivariate regressions (Tables 8-13) to account for any mitigating effects on liquidity. The

¹⁸ A correlation matrix (unreported) confirms the zero correlation between the residuals and the four asset pricing variables.

format of Tables 8-13 is similar to that for Tables 2-7, with the additional coefficients now included in the panels. I compare the coefficients on liquidity across those tables holding the measure of liquidity constant, Table 2 versus Table 8, Table 3 versus Table 9, Table 4 versus Table 10, Table 5 versus Table 11, Table 6 versus Table 12, and Table 7 versus Table 13. In all cases the liquidity variables are unchanged from the univariate to multivariate regressions, as expected, and there are no statistically reducing effects on liquidity. The properties of the liquidity-return relationship shown in the univariate regressions are also present in these multivariate regressions. There still exists a monotonic decrease in the liquidity coefficients moving from low liquidity to high liquidity. There is a noteworthy increase in the significance of liquidity in all panels. In the midst of this noteworthy increase, Panel C, small firms with high liquidity, and Panel D, big firms with low liquidity, still show dominance over the other panels, with the exception of Panel F, big firms with high liquidity. Where Panel F in the univariate regressions yielded on average two to four significant portfolios, in the full multivariate model Panel F has on average six to seven significant portfolios, with as many as nine of nine being significant.

The full model, through the increased significance of Panel F, big firms with high liquidity, shows the importance of liquidity. Intuitively, investors expect a guaranteed level of liquidity from big stocks. This expectation is portrayed by the significance on the liquidity-return relationship of these stocks.

4C1.2 The Effect of Liquidity on the Significance of the Other Variables

Since each of the liquidity variables used is a residual obtained from the four other asset-pricing variables (market factor, size, book-to-market, and momentum), the coefficients for these variables are entirely unaffected by the presence of the residual liquidity factor. The residual liquidity factor is ideal for assessing the pricing behavior of liquidity outside of the market, size, book-to-market, and momentum factors. However, when used to account for any effect liquidity has on returns subsumed by the other four factors the residual factor is not appropriate because of

Table 8

Regressions of excess stock returns on the excess market return and the mimicking returns for
liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(FM - VOL_m) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity

Book-to-market	Momentum																	
	Loser			Neutral			Winner			Loser			Neutral			Winner		
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.011	0.012	2.56	4.36	4.46	-0.21	-0.01	-0.14	-1.35	-0.10	-0.96	0.84	0.70	0.71	10.94	11.51	10.42
Medium	0.001	0.007	0.004	0.51	4.40	2.53	0.26	0.36	0.23	2.44	4.70	2.55	0.77	0.57	0.79	14.91	15.57	17.88
High	-0.002	-0.001	-0.002	-1.00	-0.55	-0.94	0.32	0.30	-0.10	2.83	3.72	-0.82	0.84	0.73	0.77	15.34	18.85	12.74
	S			t(S)			H			t(H)			M			t(M)		
Low	0.96	1.06	1.04	10.26	14.15	12.49	0.09	0.33	0.21	0.81	3.64	2.14	-0.05	0.17	0.24	-0.70	3.25	4.17
Medium	0.68	0.53	0.64	10.72	11.62	11.80	0.63	0.44	0.46	8.30	8.20	7.16	-0.09	0.01	0.05	-2.13	0.36	1.20
High	0.89	0.69	0.89	13.18	14.37	11.96	0.72	0.66	0.55	8.89	11.56	6.20	-0.33	-0.12	-0.18	-7.08	-3.58	-3.38
	R ²																	
Low	0.59	0.64	0.62															
Medium	0.60	0.64	0.68															
High	0.67	0.72	0.59															

Panel B: Small - Medium Liquidity

Book-to-market	Momentum																	
	Loser			Neutral			Winner			Loser			Neutral			Winner		
	A			t(A)			L			t(L)			B			t(B)		
Low	0.015	0.014	0.010	4.07	3.86	4.08	-1.11	-0.10	-0.44	-5.74	-0.52	-3.34	0.89	1.02	0.94	9.58	11.06	14.78
Medium	0.003	0.003	0.003	1.30	1.35	1.27	-0.28	0.01	-0.17	-2.44	0.15	-1.55	1.04	0.99	0.94	19.12	20.93	17.31
High	-0.005	-0.004	-0.003	-1.96	-1.73	-0.93	-0.14	-0.01	-0.39	-1.00	-0.12	-2.43	1.02	0.90	0.91	15.09	17.45	11.80
	S			t(S)			H			t(H)			M			t(M)		
Low	1.70	1.37	1.12	14.83	12.08	14.25	-0.43	0.11	-0.14	-3.13	0.80	-1.45	0.00	-0.03	0.16	-0.06	-0.35	2.85
Medium	1.03	0.89	1.00	15.45	15.30	14.99	0.33	0.41	0.28	4.06	5.83	3.49	-0.31	-0.06	-0.16	-6.51	-1.43	-3.43
High	1.14	0.92	1.02	13.60	14.39	10.68	0.68	0.56	0.43	6.83	7.38	3.77	-0.51	-0.28	-0.36	-8.79	-6.26	-5.36
	R ²																	
Low	0.73	0.63	0.77															
Medium	0.78	0.78	0.75															
High	0.70	0.72	0.59															

Panel C: Small - High Liquidity

Book-to-market	Momentum																	
	Loser			Neutral			Winner			Loser			Neutral			Winner		
	A			t(A)			L			t(L)			B			t(B)		
Low	0.013	0.012	0.008	3.89	3.21	2.94	-1.50	-1.02	-1.20	-8.75	-5.48	-8.54	1.06	1.19	1.10	12.73	13.22	16.30
Medium	0.004	0.000	-0.007	1.63	0.16	-2.61	-1.12	-0.97	-1.07	-8.77	-6.34	-7.77	1.09	1.11	1.09	17.56	15.00	16.47
High	-0.004	-0.006	-0.014	-1.23	-1.98	-3.78	-1.31	-1.02	-0.96	-7.78	-6.08	-5.15	1.09	1.12	1.10	13.42	13.87	12.12
	S			t(S)			H			t(H)			M			t(M)		
Low	1.61	1.52	1.31	15.72	13.64	15.72	-0.65	-0.29	-0.59	-5.29	-2.20	-5.94	-0.34	-0.06	-0.14	-4.70	-0.76	-2.32
Medium	1.26	1.17	1.33	16.48	12.85	16.31	-0.27	0.05	-0.26	-2.92	0.45	-2.62	-0.60	-0.40	-0.31	-11.27	-6.32	-5.35
High	1.44	1.02	1.17	14.38	10.23	10.50	0.08	0.07	0.04	0.70	0.57	0.32	-1.04	-0.93	-0.73	-14.82	-13.39	-9.31
	R ²																	
Low	0.81	0.75	0.84															
Medium	0.85	0.75	0.82															
High	0.79	0.75	0.69															

Table 8 Continued

Panel D: Big - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	-0.001	0.002	0.002	-0.29	0.94	1.14	0.57	0.59	0.39	3.89	5.92	4.01	0.83	0.79	0.94	11.70	16.52	19.97
Medium	0.001	-0.001	-0.001	0.67	-0.42	-0.55	0.38	0.56	0.05	3.94	7.58	0.48	0.83	0.81	0.85	18.00	22.64	18.16
High	-0.006	-0.005	-0.005	-2.92	-2.55	-1.62	0.04	0.24	-0.06	0.34	2.62	-0.40	0.93	0.94	0.82	17.19	21.38	10.95
	S			t(S)			H			t(H)			M			t(M)		
Low	0.20	-0.29	-0.21	2.24	-4.86	-3.58	0.33	0.08	0.12	3.12	1.09	1.75	-0.08	0.00	0.11	-1.34	0.01	2.66
Medium	0.27	0.00	0.02	4.81	0.05	0.29	0.38	0.46	0.26	5.60	8.82	3.80	-0.32	0.04	-0.01	-8.04	1.19	-0.14
High	0.46	0.14	0.06	6.94	2.62	0.65	0.63	0.74	0.36	7.92	11.42	3.26	-0.41	-0.27	-0.24	-8.83	-7.26	-3.77
	R ²																	
Low	0.44	0.64	0.70															
Medium	0.68	0.72	0.63															
High	0.67	0.71	0.41															

Panel E: Big - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.007	0.003	0.004	3.00	1.85	2.17	0.15	0.38	0.23	1.21	5.27	2.76	0.93	0.92	1.03	15.07	26.04	25.59
Medium	-0.001	-0.001	-0.001	-0.33	-0.70	-0.52	0.39	0.06	-0.04	3.73	0.78	-0.46	1.10	0.97	1.10	21.77	24.67	24.43
High	-0.007	-0.006	-0.006	-2.77	-3.51	-2.27	-0.10	-0.08	-0.08	-0.82	-0.90	-0.66	1.13	1.02	0.97	18.75	23.91	15.59
	S			t(S)			H			t(H)			M			t(M)		
Low	-0.08	-0.32	-0.28	-1.11	-7.35	-5.70	-0.11	0.09	-0.25	-1.22	1.77	-4.15	-0.50	-0.04	0.10	-9.48	-1.36	2.80
Medium	0.06	-0.22	-0.03	0.93	-4.57	-0.61	0.60	0.25	0.26	8.07	4.26	3.92	-0.42	-0.27	0.02	-9.70	-7.98	0.50
High	0.26	0.01	0.19	3.53	0.17	2.50	0.54	0.55	0.56	6.02	8.82	6.06	-0.59	-0.26	-0.24	-11.38	-7.16	-4.42
	R ²																	
Low	0.67	0.81	0.83															
Medium	0.74	0.79	0.76															
High	0.72	0.75	0.57															

Panel F: Big - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.010	0.007	4.40	4.61	3.23	-0.37	-0.35	-0.35	-2.87	-3.22	-3.19	1.13	1.07	1.16	18.15	20.39	21.99
Medium	0.002	-0.001	-0.008	0.98	-0.50	-3.02	-0.25	-0.37	-0.41	-2.17	-3.73	-2.94	1.26	1.09	1.21	23.03	22.37	18.02
High	-0.008	-0.007	-0.013	-2.51	-3.09	-3.44	-0.88	-0.20	-0.81	-5.13	-1.61	-4.22	1.30	1.32	1.25	15.64	22.23	13.50
	S			t(S)			H			t(H)			M			t(M)		
Low	0.29	0.04	0.06	3.84	0.56	0.98	-0.61	-0.54	-0.88	-6.69	-7.05	-11.39	-0.42	-0.25	0.02	-7.83	-5.47	0.50
Medium	0.40	0.19	0.22	5.95	3.14	2.71	-0.26	0.05	-0.19	-3.27	0.71	-1.97	-0.77	-0.42	-0.27	-16.30	-10.08	-4.66
High	0.37	0.34	0.48	3.61	4.70	4.20	0.05	0.60	-0.15	0.37	6.85	-1.09	-0.96	-0.48	-0.51	-13.42	-9.42	-6.34
	R ²																	
Low	0.80	0.81	0.86															
Medium	0.86	0.80	0.73															
High	0.73	0.76	0.64															

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

FM_VOL is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997). RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for size.

BM is the return on the zero investment, factor mimicking portfolio for book-to-market. RPM-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and RPM-1 are all obtained from Kenneth French's website.

Table 9

Regressions of excess stock returns on the excess market return and the mimicking returns for
liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(FM - TUR_m) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.011	0.012	2.58	4.37	4.48	-0.31	0.06	-0.21	-2.08	0.54	-1.58	0.84	0.70	0.71	11.00	11.52	10.45
Medium	0.001	0.007	0.004	0.51	4.39	2.52	0.23	0.33	0.19	2.32	4.63	2.26	0.77	0.57	0.79	14.89	15.55	17.82
High	-0.002	-0.001	-0.002	-0.99	-0.55	-0.95	0.15	0.22	-0.28	1.37	2.94	-2.44	0.84	0.73	0.77	15.14	18.65	12.89
	S			t(S)			H			t(H)			M			t(M)		
Low	0.96	1.06	1.04	10.31	14.16	12.53	0.09	0.33	0.21	0.82	3.64	2.15	-0.05	0.17	0.24	-0.71	3.25	4.18
Medium	0.68	0.53	0.64	10.71	11.61	11.76	0.63	0.44	0.46	8.29	8.19	7.13	-0.09	0.01	0.05	-2.13	0.36	1.20
High	0.89	0.69	0.89	13.00	14.21	12.10	0.72	0.66	0.55	8.77	11.43	6.27	-0.33	-0.12	-0.18	-6.98	-3.54	-3.42
	R ²																	
Low	0.60	0.64	0.62															
Medium	0.60	0.63	0.68															
High	0.67	0.71	0.60															

Panel B: Small - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.015	0.014	0.010	4.20	3.86	4.14	-1.23	-0.17	-0.51	-7.07	-0.95	-4.22	0.89	1.02	0.94	9.89	11.08	14.99
Medium	0.003	0.003	0.003	1.30	1.35	1.29	-0.23	0.02	-0.30	-2.22	0.26	-2.91	1.04	0.99	0.94	19.08	20.93	17.54
High	-0.005	-0.004	-0.003	-1.98	-1.73	-0.95	-0.26	-0.09	-0.59	-1.98	-0.91	-4.02	1.02	0.90	0.91	15.18	17.48	12.06
	S			t(S)			H			t(H)			M			t(M)		
Low	1.70	1.37	1.12	15.30	12.10	14.45	-0.43	0.11	-0.14	-3.24	0.80	-1.47	0.00	-0.03	0.16	-0.06	-0.35	2.89
Medium	1.03	0.89	1.00	15.42	15.30	15.18	0.33	0.41	0.28	4.05	5.83	3.53	-0.31	-0.06	-0.16	-6.50	-1.43	-3.47
High	1.14	0.92	1.02	13.69	14.41	10.91	0.68	0.56	0.43	6.87	7.39	3.85	-0.51	-0.28	-0.36	-8.84	-6.27	-5.48
	R ²																	
Low	0.75	0.63	0.77															
Medium	0.78	0.78	0.76															
High	0.70	0.72	0.61															

Panel C: Small - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.013	0.012	0.008	3.82	3.22	3.00	-1.31	-0.97	-1.18	-8.03	-5.58	-9.20	1.06	1.19	1.10	12.48	13.24	16.61
Medium	0.004	0.000	-0.007	1.59	0.16	-2.63	-0.97	-0.75	-1.01	-7.91	-5.08	-7.93	1.09	1.11	1.09	17.14	14.59	16.54
High	-0.004	-0.006	-0.014	-1.23	-2.01	-3.94	-1.23	-1.05	-1.17	-7.85	-6.81	-6.94	1.09	1.12	1.10	13.44	14.12	12.62
	S			t(S)			H			t(H)			M			t(M)		
Low	1.61	1.52	1.31	15.40	13.67	16.02	-0.65	-0.29	-0.59	-5.18	-2.20	-6.05	-0.34	-0.06	-0.14	-4.61	-0.76	-2.37
Medium	1.26	1.17	1.33	16.09	12.50	16.38	-0.27	0.05	-0.26	-2.85	0.44	-2.63	-0.60	-0.40	-0.31	-11.00	-6.15	-5.38
High	1.44	1.02	1.17	14.41	10.41	10.94	0.08	0.07	0.04	0.70	0.58	0.33	-1.04	-0.93	-0.73	-14.85	-13.62	-9.70
	R ²																	
Low	0.80	0.75	0.85															
Medium	0.84	0.73	0.82															
High	0.79	0.76	0.71															

Table 9 Continued

Panel D: Big - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	-0.001	0.002	0.002	-0.29	1.08	1.14	0.57	0.88	0.37	4.16	10.94	4.10	0.83	0.79	0.94	11.75	18.99	20.00
Medium	0.001	-0.001	-0.001	0.67	-0.43	-0.55	0.34	0.59	0.06	3.74	8.88	0.68	0.83	0.81	0.85	17.95	23.47	18.17
High	-0.006	-0.005	-0.005	-2.92	-2.55	-1.62	0.03	0.22	-0.11	0.32	2.56	-0.75	0.93	0.94	0.82	17.19	21.36	10.96
	S			t(S)			H			t(H)			M			t(M)		
Low	0.20	-0.29	-0.21	2.25	-5.58	-3.58	0.33	0.08	0.12	3.14	1.25	1.76	-0.08	0.00	0.11	-1.35	0.02	2.66
Medium	0.27	0.00	0.02	4.80	0.05	0.29	0.38	0.46	0.26	5.59	9.14	3.80	-0.32	0.04	-0.01	-8.01	1.23	-0.14
High	0.46	0.14	0.06	6.94	2.62	0.65	0.63	0.74	0.36	7.92	11.41	3.26	-0.41	-0.27	-0.24	-8.83	-7.25	-3.78
	R ²																	
Low	0.45	0.73	0.70															
Medium	0.68	0.74	0.63															
High	0.67	0.71	0.41															

Panel E: Big - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.007	0.003	0.004	3.04	1.99	2.15	0.33	0.52	0.12	2.85	8.23	1.46	0.93	0.92	1.03	15.29	28.00	25.29
Medium	-0.001	-0.001	-0.001	-0.34	-0.70	-0.52	0.44	0.01	-0.09	4.60	0.15	-1.00	1.10	0.97	1.10	22.09	24.64	24.47
High	-0.007	-0.006	-0.006	-2.76	-3.50	-2.27	-0.03	-0.03	-0.17	-0.29	-0.41	-1.39	1.13	1.02	0.97	18.73	23.88	15.65
	S			t(S)			H			t(H)			M			t(M)		
Low	-0.08	-0.32	-0.28	-1.13	-7.91	-5.63	-0.11	0.09	-0.25	-1.23	1.90	-4.10	-0.50	-0.04	0.10	-9.62	-1.46	2.76
Medium	0.06	-0.22	-0.03	0.95	-4.57	-0.61	0.60	0.25	0.26	8.19	4.26	3.93	-0.42	-0.27	0.02	-9.84	-7.97	0.50
High	0.26	0.01	0.19	3.52	0.17	2.51	0.54	0.55	0.56	6.01	8.80	6.08	-0.59	-0.26	-0.24	-11.37	-7.15	-4.44
	R ²																	
Low	0.68	0.83	0.82															
Medium	0.75	0.79	0.76															
High	0.72	0.75	0.57															

Panel F: Big - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.010	0.007	4.43	4.70	3.40	-0.40	-0.44	-0.58	-3.35	-4.40	-5.99	1.13	1.07	1.16	18.27	20.77	23.15
Medium	0.002	-0.001	-0.008	0.99	-0.51	-3.13	-0.31	-0.36	-0.64	-2.99	-3.82	-5.11	1.26	1.09	1.21	23.24	22.40	18.67
High	-0.008	-0.007	-0.013	-2.48	-3.14	-3.55	-0.72	-0.34	-1.00	-4.40	-3.02	-5.79	1.30	1.32	1.25	15.43	22.54	13.93
	S			t(S)			H			t(H)			M			t(M)		
Low	0.29	0.04	0.06	3.87	0.57	1.04	-0.61	-0.54	-0.88	-6.73	-7.18	-11.99	-0.42	-0.25	0.02	-7.88	-5.58	0.53
Medium	0.40	0.19	0.22	6.00	3.15	2.81	-0.26	0.05	-0.19	-3.30	0.71	-2.04	-0.77	-0.42	-0.27	-16.44	-10.09	-4.83
High	0.37	0.34	0.48	3.56	4.77	4.33	0.05	0.60	-0.15	0.37	6.95	-1.13	-0.96	-0.48	-0.51	-13.24	-9.55	-6.54
	R ²																	
Low	0.80	0.82	0.87															
Medium	0.86	0.80	0.75															
High	0.72	0.76	0.66															

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

FM_TUR is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997). RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for size.

BM is the return on the zero investment, factor mimicking portfolio for book-to-market. RPM-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and RPM-1 are all obtained from Kenneth French's website.

Table 10

Regressions of excess stock returns on the excess market return and the mimicking returns for liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(FM - STDVOL_m) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.011	0.012	2.58	4.37	4.48	-0.37	-0.02	-0.22	-2.36	-0.18	-1.58	0.84	0.70	0.71	11.03	11.51	10.45
Medium	0.001	0.007	0.004	0.51	4.39	2.52	0.21	0.35	0.20	1.96	4.62	2.14	0.77	0.57	0.79	14.84	15.55	17.80
High	-0.002	-0.001	-0.002	-0.99	-0.55	-0.94	0.25	0.27	-0.15	2.19	3.39	-1.16	0.84	0.73	0.77	15.24	18.76	12.75
	S			t(S)			H			t(H)			M			t(M)		
Low	0.96	1.06	1.04	10.34	14.15	12.53	0.09	0.33	0.21	0.82	3.64	2.15	-0.05	0.17	0.24	-0.71	3.25	4.18
Medium	0.68	0.53	0.64	10.68	11.61	11.75	0.63	0.44	0.46	8.27	8.19	7.13	-0.09	0.01	0.05	-2.12	0.36	1.20
High	0.89	0.69	0.89	13.09	14.30	11.98	0.72	0.66	0.55	8.83	11.50	6.21	-0.33	-0.12	-0.18	-7.03	-3.56	-3.38
	R ²																	
Low	0.60	0.64	0.62															
Medium	0.60	0.63	0.68															
High	0.67	0.71	0.59															
Panel B: Small - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.015	0.014	0.013	4.15	3.88	4.13	-1.26	-0.34	-0.53	-6.65	-1.79	-4.09	0.89	1.02	1.06	9.79	11.13	14.95
Medium	0.003	0.003	0.003	1.31	1.35	1.28	-0.33	0.00	-0.24	-2.99	-0.03	-2.16	1.04	0.99	0.94	19.24	20.93	17.40
High	-0.005	-0.004	-0.003	-1.97	-1.73	-0.94	-0.19	-0.04	-0.48	-1.37	-0.35	-3.02	1.02	0.90	0.91	15.11	17.45	11.88
	S			t(S)			H			t(H)			M			t(M)		
Low	1.70	1.37	1.61	15.14	12.16	14.42	-0.43	0.11	-0.65	-3.20	0.80	-1.47	0.00	-0.03	-0.34	-0.06	-0.35	2.88
Medium	1.03	0.89	1.00	15.55	15.30	15.06	0.33	0.41	0.28	4.09	5.83	3.50	-0.31	-0.06	-0.16	-6.55	-1.43	-3.44
High	1.14	0.92	1.02	13.63	14.39	10.75	0.68	0.56	0.43	6.84	7.38	3.80	-0.51	-0.28	-0.36	-8.80	-6.26	-5.40
	R ²																	
Low	0.75	0.64	0.77															
Medium	0.79	0.78	0.75															
High	0.70	0.72	0.60															
Panel C: Small - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.013	0.012	0.008	3.93	3.24	3.10	-1.54	-1.09	-1.38	-9.04	-5.86	-10.35	1.06	1.19	1.10	12.84	13.33	17.19
Medium	0.004	0.000	-0.007	1.64	0.16	-2.67	-1.14	-0.88	-1.15	-8.97	-5.67	-8.52	1.09	1.11	1.09	17.67	14.77	16.81
High	-0.004	-0.006	-0.014	-1.23	-1.99	-3.82	-1.31	-1.04	-1.04	-7.84	-6.22	-5.63	1.09	1.12	1.10	13.44	13.92	12.24
	S			t(S)			H			t(H)			M			t(M)		
Low	1.61	1.52	1.31	15.85	13.75	16.59	-0.65	-0.29	-0.59	-5.33	-2.22	-6.26	-0.34	-0.06	-0.14	-4.74	-0.76	-2.45
Medium	1.26	1.17	1.33	16.58	12.65	16.65	-0.27	0.05	-0.26	-2.94	0.45	-2.67	-0.60	-0.40	-0.31	-11.33	-6.23	-5.47
High	1.44	1.02	1.17	14.41	10.27	10.61	0.08	0.07	0.04	0.70	0.57	0.32	-1.04	-0.93	-0.73	-14.85	-13.43	-9.40
	R ²																	
Low	0.82	0.76	0.86															
Medium	0.85	0.74	0.83															
High	0.79	0.75	0.70															

Table 10 Continued

Panel D: Big - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	-0.001	0.002	0.002	-0.29	0.95	1.13	0.53	0.63	0.37	3.59	6.49	3.72	0.83	0.79	0.94	11.64	16.74	19.88
Medium	0.001	-0.001	-0.001	0.67	-0.42	-0.55	0.34	0.57	0.03	3.58	7.70	0.27	0.83	0.81	0.85	17.90	22.71	18.16
High	-0.006	-0.005	-0.005	-2.92	-2.56	-1.62	-0.02	0.26	-0.12	-0.19	2.91	-0.78	0.93	0.94	0.82	17.19	21.45	10.96
	S			t(S)			H			t(H)			M			t(M)		
Low	0.20	-0.29	-0.21	2.23	-4.92	-3.56	0.33	0.08	0.12	3.11	1.10	1.75	-0.08	0.00	0.11	-1.33	0.01	2.65
Medium	0.27	0.00	0.02	4.79	0.05	0.29	0.38	0.46	0.26	5.57	8.85	3.80	-0.32	0.04	-0.01	-7.99	1.19	-0.14
High	0.46	0.14	0.06	6.94	2.63	0.65	0.63	0.74	0.36	7.92	11.46	3.26	-0.41	-0.27	-0.24	-8.83	-7.28	-3.78
	R ²																	
Low	0.44	0.65	0.69															
Medium	0.68	0.72	0.63															
High	0.67	0.72	0.41															

Panel E: Big - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.007	0.003	0.004	2.99	1.85	2.16	0.13	0.39	0.19	1.03	5.33	2.27	0.93	0.92	1.03	15.06	26.07	25.45
Medium	-0.001	-0.001	-0.001	-0.33	-0.70	-0.52	0.38	0.01	-0.10	3.67	0.13	-1.12	1.10	0.97	1.10	21.75	24.64	24.49
High	-0.007	-0.006	-0.006	-2.76	-3.51	-2.26	-0.09	-0.07	-0.07	-0.74	-0.76	-0.53	1.13	1.02	0.97	18.74	23.90	15.59
	S			t(S)			H			t(H)			M			t(M)		
Low	-0.08	-0.32	-0.28	-1.11	-7.36	-5.67	-0.11	0.09	-0.25	-1.22	1.77	-4.13	-0.50	-0.04	0.10	-9.47	-1.36	2.78
Medium	0.06	-0.22	-0.03	0.93	-4.57	-0.61	0.60	0.25	0.26	8.06	4.26	3.93	-0.42	-0.27	0.02	-9.69	-7.97	0.50
High	0.26	0.01	0.19	3.53	0.17	2.50	0.54	0.55	0.56	6.02	8.81	6.06	-0.59	-0.26	-0.24	-11.38	-7.15	-4.42
	R ²																	
Low	0.67	0.81	0.83															
Medium	0.74	0.79	0.76															
High	0.72	0.75	0.56															

Panel F: Big - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.010	0.007	4.40	4.59	3.23	-0.38	-0.30	-0.35	-2.92	-2.75	-3.20	1.13	1.07	1.16	18.16	20.27	22.00
Medium	0.002	-0.001	-0.008	0.98	-0.50	-3.05	-0.21	-0.38	-0.48	-1.88	-3.77	-3.52	1.26	1.09	1.21	22.97	22.38	18.16
High	-0.008	-0.007	-0.013	-2.48	-3.09	-3.44	-0.80	-0.18	-0.83	-4.62	-1.42	-4.31	1.30	1.32	1.25	15.49	22.20	13.53
	S			t(S)			H			t(H)			M			t(M)		
Low	0.29	0.04	0.06	3.84	0.56	0.98	-0.61	-0.54	-0.88	-6.69	-7.01	-11.39	-0.42	-0.25	0.02	-7.83	-5.44	0.50
Medium	0.40	0.19	0.22	5.94	3.15	2.73	-0.26	0.05	-0.19	-3.26	0.71	-1.98	-0.77	-0.42	-0.27	-16.25	-10.09	-4.70
High	0.37	0.34	0.48	3.57	4.70	4.21	0.05	0.60	-0.15	0.37	6.85	-1.09	-0.96	-0.48	-0.51	-13.29	-9.41	-6.35
	R ²																	
Low	0.80	0.81	0.86															
Medium	0.85	0.80	0.73															
High	0.73	0.75	0.64															

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

FM_STDVOL is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997). RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for size.

BM is the return on the zero investment, factor mimicking portfolio for book-to-market. RPM-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and RPM-1 are all obtained from Kenneth French's website.

Table 11

Regressions of excess stock returns on the excess market return and the mimicking returns for liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(FM - STDTUR_m) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity																		
Book-to-market	Loser			Neutral			Winner			Momentum								
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner						
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.011	0.012	2.57	4.37	4.51	-0.31	-0.06	-0.36	-1.93	-0.50	-2.53	0.84	0.70	0.71	10.99	11.52	10.54
Medium	0.001	0.007	0.004	0.51	4.35	2.52	0.24	0.32	0.20	2.22	4.13	2.16	0.77	0.57	0.79	14.87	15.41	17.81
High	-0.002	-0.001	-0.002	-0.99	-0.55	-0.94	0.17	0.24	-0.17	1.48	2.89	-1.36	0.84	0.73	0.77	15.15	18.63	12.77
	S			t(S)			H			t(H)			M			t(M)		
Low	0.96	1.06	1.04	10.30	14.16	12.64	0.09	0.33	0.21	0.82	3.64	2.16	-0.05	0.17	0.24	-0.71	3.25	4.21
Medium	0.68	0.53	0.64	10.70	11.51	11.75	0.63	0.44	0.46	8.29	8.12	7.13	-0.09	0.01	0.05	-2.13	0.36	1.20
High	0.89	0.69	0.89	13.01	14.20	11.99	0.72	0.66	0.55	8.78	11.42	6.21	-0.33	-0.12	-0.18	-6.99	-3.54	-3.39
	R ²																	
Low	0.59	0.64	0.62															
Medium	0.60	0.63	0.68															
High	0.67	0.71	0.60															

Panel B: Small - Medium Liquidity																		
Book-to-market	Loser			Neutral			Winner			Momentum								
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner						
	A			t(A)			L			t(L)			B			t(B)		
Low	0.015	0.014	0.010	4.11	3.88	4.27	-1.20	-0.30	-0.74	-6.23	-1.53	-5.79	0.89	1.02	0.94	9.69	11.11	15.46
Medium	0.003	0.003	0.003	1.31	1.35	1.28	-0.37	-0.06	-0.31	-3.25	-0.59	-2.75	1.04	0.99	0.94	19.31	20.94	17.51
High	-0.005	-0.004	-0.003	-1.97	-1.73	-0.93	-0.25	-0.05	-0.45	-1.78	-0.46	-2.80	1.02	0.90	0.91	15.16	17.46	11.85
	S			t(S)			H			t(H)			M			t(M)		
Low	1.70	1.37	1.12	14.99	12.13	14.90	-0.43	0.11	-0.14	-3.17	0.80	-1.52	0.00	-0.03	0.16	-0.06	-0.35	2.98
Medium	1.03	0.89	1.00	15.60	15.31	15.15	0.33	0.41	0.28	4.10	5.83	3.53	-0.31	-0.06	-0.16	-6.58	-1.43	-3.46
High	1.14	0.92	1.02	13.67	14.39	10.73	0.68	0.56	0.43	6.86	7.38	3.79	-0.51	-0.28	-0.36	-8.83	-6.26	-5.39
	R ²																	
Low	0.74	0.63	0.79															
Medium	0.79	0.78	0.76															
High	0.70	0.72	0.60															

Panel C: Small - High Liquidity																		
Book-to-market	Loser			Neutral			Winner			Momentum								
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner						
	A			t(A)			L			t(L)			B			t(B)		
Low	0.013	0.012	0.008	3.89	3.24	2.97	-0.15	-1.12	-1.25	-8.74	-5.96	-8.84	1.06	1.19	1.10	12.73	13.36	16.43
Medium	0.004	0.000	-0.007	1.57	0.16	-2.62	-1.00	-0.93	-1.10	-7.41	-5.89	-7.91	1.09	1.11	1.09	16.92	14.84	16.53
High	-0.004	-0.006	-0.014	-1.20	-1.93	-3.79	-1.19	-0.87	-0.99	-6.86	-4.99	-5.20	1.09	1.12	1.10	13.10	13.55	12.13
	S			t(S)			H			t(H)			M			t(M)		
Low	1.61	1.52	1.31	15.71	13.78	15.86	-0.65	-0.29	-0.59	-5.29	-2.22	-5.99	-0.34	-0.06	-0.14	-4.70	-0.76	-2.34
Medium	1.26	1.17	1.33	15.88	12.71	16.37	-0.27	0.05	-0.26	-2.81	0.45	-2.63	-0.60	-0.40	-0.31	-10.85	-6.25	-5.37
High	1.44	1.02	1.17	14.04	10.00	10.51	0.08	0.07	0.04	0.68	0.56	0.32	-1.04	-0.93	-0.73	-14.47	-13.08	-9.32
	R ²																	
Low	0.81	0.76	0.85															
Medium	0.84	0.74	0.82															
High	0.78	0.74	0.69															

Table 11 Continued

Panel D: Big - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	-0.001	0.002	0.002	-0.29	0.98	1.13	0.54	0.73	0.33	3.57	7.64	3.28	0.83	0.79	0.94	11.64	17.24	19.75
Medium	0.001	-0.001	-0.001	0.67	-0.40	-0.55	0.35	0.49	0.00	3.58	6.33	-0.02	0.83	0.81	0.85	17.90	21.94	18.15
High	-0.006	-0.005	-0.005	-2.92	-2.53	-1.63	0.02	0.13	-0.24	0.14	1.44	-1.57	0.93	0.94	0.82	17.19	21.16	11.00
	S			t(S)			H			t(H)			M			t(M)		
Low	0.20	-0.29	-0.21	2.23	-5.07	-3.54	0.33	0.08	0.12	3.11	1.14	1.73	-0.08	0.00	0.11	-1.33	0.02	2.63
Medium	0.27	0.00	0.02	4.79	0.05	0.29	0.38	0.46	0.26	5.57	8.55	3.80	-0.32	0.04	-0.01	-7.99	1.15	-0.14
High	0.46	0.14	0.06	6.94	2.59	0.66	0.63	0.74	0.36	7.92	11.31	3.28	-0.41	-0.27	-0.24	-8.83	-7.18	-3.79
	R ²																	
Low	0.44	0.67	0.69															
Medium	0.68	0.70	0.63															
High	0.67	0.71	0.41															

Panel E: Big - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.007	0.003	0.004	3.06	1.89	2.15	0.43	0.45	0.11	3.38	6.24	1.32	0.93	0.92	1.03	15.39	26.60	25.27
Medium	-0.001	-0.001	-0.001	-0.34	-0.70	-0.52	0.46	0.01	-0.06	4.40	0.08	-0.61	1.10	0.97	1.10	22.01	24.64	24.44
High	-0.007	-0.006	-0.006	-2.76	-3.51	-2.27	0.05	-0.05	-0.16	0.43	-0.57	-1.21	1.13	1.02	0.97	18.73	23.88	15.63
	S			t(S)			H			t(H)			M			t(M)		
Low	-0.08	-0.32	-0.28	-1.14	-7.51	-5.63	-0.11	0.09	-0.25	-1.24	1.81	-4.10	-0.50	-0.04	0.10	-9.69	-1.39	2.76
Medium	0.06	-0.22	-0.03	0.94	-4.57	-0.61	0.60	0.25	0.26	8.16	4.26	3.93	-0.42	-0.27	0.02	-9.81	-7.97	0.50
High	0.26	0.01	0.19	3.52	0.17	2.51	0.54	0.55	0.56	6.01	8.81	6.08	-0.59	-0.26	-0.24	-11.37	-7.15	-4.43
	R ²																	
Low	0.69	0.81	0.82															
Medium	0.75	0.79	0.76															
High	0.72	0.75	0.57															

Panel F: Big - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.010	0.007	4.59	4.77	3.47	-0.68	-0.55	-0.70	-5.41	-5.22	-6.80	1.13	1.07	1.16	18.94	21.10	23.60
Medium	0.002	-0.001	-0.008	1.00	-0.50	-3.11	-0.36	-0.39	-0.65	-3.19	-3.81	-4.78	1.26	1.09	1.21	23.30	22.40	18.56
High	-0.008	-0.007	-0.013	-2.49	-3.09	-3.47	-0.82	-0.16	-0.92	-4.67	-1.26	-4.77	1.30	1.32	1.25	15.50	22.18	13.64
	S			t(S)			H			t(H)			M			t(M)		
Low	0.29	0.04	0.06	4.01	0.58	1.06	-0.61	-0.54	-0.88	-6.98	-7.29	-12.22	-0.42	-0.25	0.02	-8.17	-5.66	0.54
Medium	0.40	0.19	0.22	6.02	3.15	2.79	-0.26	0.05	-0.19	-3.31	0.71	-2.02	-0.77	-0.42	-0.27	-16.49	-10.09	-4.80
High	0.37	0.34	0.48	3.57	4.69	4.24	0.05	0.60	-0.15	0.37	6.84	-1.10	-0.96	-0.48	-0.51	-13.30	-9.40	-6.41
	R ²																	
Low	0.82	0.82	0.88															
Medium	0.86	0.80	0.74															
High	0.73	0.75	0.65															

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

FM_STDTUR is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997). RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for size.

BM is the return on the zero investment, factor mimicking portfolio for book-to-market. RPM-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and RPM-1 are all obtained from Kenneth French's website.

Table 12

Regressions of excess stock returns on the excess market return and the mimicking returns for
liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(FM - CVVOL_m) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity
Momentum

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.011	0.012	2.56	4.37	4.49	-0.22	0.02	-0.26	-1.38	0.19	-1.84	0.84	0.70	0.71	10.94	11.51	10.47
Medium	0.001	0.007	0.004	0.51	4.23	2.49	0.19	0.15	0.02	1.78	1.84	0.16	0.77	0.57	0.79	14.82	14.98	17.63
High	-0.002	-0.001	-0.002	-0.99	-0.54	-0.95	0.23	0.10	-0.37	2.02	1.16	-2.98	0.84	0.73	0.77	15.22	18.36	12.97
S			t(S)			H			t(H)			M			t(M)			
Low	0.96	1.06	1.04	10.26	14.15	12.56	0.09	0.33	0.21	0.81	3.64	2.15	-0.05	0.17	0.24	-0.70	3.25	4.19
Medium	0.68	0.53	0.64	10.66	11.18	11.63	0.63	0.44	0.46	8.26	7.89	7.06	-0.09	0.01	0.05	-2.12	0.35	1.19
High	0.89	0.69	0.89	13.07	13.99	12.17	0.72	0.66	0.55	8.81	11.25	6.31	-0.33	-0.12	-0.18	-7.02	-3.48	-3.44
R ²																		
Low	0.59	0.64	0.62															
Medium	0.60	0.61	0.68															
High	0.67	0.70	0.61															

Panel B: Small - Medium Liquidity
Momentum

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	A			t(A)			L			t(L)			B			t(B)		
Low	0.015	0.014	0.013	3.86	3.86	4.03	-0.55	0.08	-0.32	-2.67	0.42	-2.35	0.89	1.02	1.06	9.09	11.06	14.61
Medium	0.003	0.003	0.003	1.29	1.36	1.30	0.10	0.14	-0.39	0.85	1.44	-3.48	1.04	0.99	0.94	18.91	21.02	17.68
High	-0.005	-0.004	-0.003	-1.96	-1.73	-0.93	0.14	0.05	-0.43	1.00	0.44	-2.63	1.02	0.90	0.91	15.09	17.46	11.83
S			t(S)			H			t(H)			M			t(M)			
Low	1.70	1.37	1.61	14.07	12.08	14.08	-0.43	0.11	-0.65	-2.98	0.80	-1.43	0.00	-0.03	-0.34	-0.06	-0.35	2.81
Medium	1.03	0.89	1.00	15.27	15.37	15.30	0.33	0.41	0.28	4.02	5.86	3.56	-0.31	-0.06	-0.16	-6.44	-1.44	-3.50
High	1.14	0.92	1.02	13.61	14.39	10.70	0.68	0.56	0.43	6.83	7.38	3.78	-0.51	-0.28	-0.36	-8.79	-6.26	-5.38
R ²																		
Low	0.70	0.63	0.76															
Medium	0.78	0.78	0.76															
High	0.70	0.72	0.60															

Panel C: Small - High Liquidity
Momentum

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	A			t(A)			L			t(L)			B			t(B)		
Low	0.013	0.012	0.008	3.40	3.03	2.74	-0.42	-0.28	-0.88	-2.10	-1.40	-5.74	1.06	1.19	1.10	11.12	12.48	15.18
Medium	0.004	0.000	-0.007	1.43	0.15	-2.50	-0.40	-0.24	-0.87	-2.71	-1.42	-5.94	1.09	1.11	1.09	15.43	13.89	15.73
High	-0.004	-0.006	-0.014	-1.10	-1.88	-3.84	-0.36	-0.59	-1.09	-1.91	-3.29	-5.82	1.09	1.12	1.10	12.02	13.17	12.29
S			t(S)			H			t(H)			M			t(M)			
Low	1.61	1.52	1.31	13.73	12.88	14.64	-0.65	-0.29	-0.59	-4.62	-2.08	-5.53	-0.34	-0.06	-0.14	-4.11	-0.71	-2.16
Medium	1.26	1.17	1.33	14.48	11.90	15.58	-0.27	0.05	-0.26	-2.57	0.42	-2.50	-0.60	-0.40	-0.31	-9.90	-5.85	-5.12
High	1.44	1.02	1.17	12.89	9.72	10.65	0.08	0.07	0.04	0.63	0.54	0.33	-1.04	-0.93	-0.73	-13.28	-12.71	-9.44
R ²																		
Low	0.75	0.72	0.82															
Medium	0.80	0.71	0.81															
High	0.74	0.72	0.70															

Table 12 Continued

Panel D: Big - Low Liquidity

Book-to-market	Loser			Neutral			Winner			Momentum								
	A			t(A)			L			t(L)			B			t(B)		
	Loser	Neutral	Winner	Loser	Neutral	Winner	L	Neutral	Winner	t(L)	t(L)	t(L)	B	B	B	t(B)	t(B)	t(B)
Low	-0.001	0.002	0.002	-0.29	0.92	1.10	0.53	0.51	-0.01	3.49	5.01	-0.12	0.83	0.79	0.94	11.63	16.20	19.30
Medium	0.001	-0.001	-0.001	0.65	-0.38	-0.57	0.15	0.21	-0.33	1.51	2.56	-3.46	0.83	0.81	0.85	17.51	20.52	18.62
High	-0.006	-0.005	-0.005	-2.92	-2.52	-1.72	-0.08	0.07	-0.80	-0.73	0.71	-5.40	0.93	0.94	0.82	17.20	21.09	11.62
	S			t(S)			H			t(H)			M			t(M)		
Low	0.20	-0.29	-0.21	2.23	-4.76	-3.46	0.33	0.08	0.12	3.10	1.07	1.69	-0.08	0.00	0.11	-1.33	0.01	2.57
Medium	0.27	0.00	0.02	4.68	0.04	0.30	0.38	0.46	0.26	5.45	7.99	3.90	-0.32	0.04	-0.01	-7.81	1.08	-0.14
High	0.46	0.14	0.06	6.95	2.59	0.69	0.63	0.74	0.36	7.93	11.27	3.46	-0.41	-0.27	-0.24	-8.84	-7.16	-4.01
	R ²																	
Low	0.44	0.62	0.67															
Medium	0.67	0.66	0.65															
High	0.67	0.71	0.47															

Panel E: Big - Medium Liquidity

Book-to-market	Loser			Neutral			Winner			Momentum								
	A			t(A)			L			t(L)			B			t(B)		
	Loser	Neutral	Winner	Loser	Neutral	Winner	L	Neutral	Winner	t(L)	t(L)	t(L)	B	B	B	t(B)	t(B)	t(B)
Low	0.007	0.003	0.004	3.00	1.88	2.20	0.19	0.44	-0.32	1.48	6.04	-3.79	0.93	0.92	1.03	15.09	26.47	25.95
Medium	-0.001	-0.001	-0.001	-0.34	-0.71	-0.54	0.53	-0.20	-0.36	5.10	-2.44	-3.94	1.10	0.97	1.10	22.31	24.96	25.24
High	-0.007	-0.006	-0.006	-2.76	-3.50	-2.32	0.08	-0.01	-0.42	0.66	-0.09	-3.27	1.13	1.02	0.97	18.74	23.87	15.94
	S			t(S)			H			t(H)			M			t(M)		
Low	-0.08	-0.32	-0.28	-1.11	-7.48	-5.78	-0.11	0.09	-0.25	-1.22	1.80	-4.21	-0.50	-0.04	0.10	-9.50	-1.38	2.84
Medium	0.06	-0.22	-0.03	0.96	-4.63	-0.63	0.60	0.25	0.26	8.27	4.31	4.05	-0.42	-0.27	0.02	-9.94	-8.08	0.51
High	0.26	0.01	0.19	3.53	0.17	2.56	0.54	0.55	0.56	6.02	8.80	6.20	-0.59	-0.26	-0.24	-11.38	-7.14	-4.52
	R ²																	
Low	0.68	0.81	0.83															
Medium	0.76	0.79	0.77															
High	0.72	0.75	0.58															

Panel F: Big - High Liquidity

Book-to-market	Loser			Neutral			Winner			Momentum								
	A			t(A)			L			t(L)			B			t(B)		
	Loser	Neutral	Winner	Loser	Neutral	Winner	L	Neutral	Winner	t(L)	t(L)	t(L)	B	B	B	t(B)	t(B)	t(B)
Low	0.011	0.010	0.007	4.33	4.52	3.31	-0.09	0.12	-0.50	-0.68	1.05	-4.61	1.13	1.07	1.16	17.85	19.99	22.50
Medium	0.002	-0.001	-0.008	0.98	-0.50	-3.62	-0.10	-0.27	-1.24	-0.87	-2.58	-10.53	1.26	1.09	1.21	22.83	22.03	21.57
High	-0.008	-0.007	-0.013	-2.39	-3.08	-3.64	-0.33	-0.05	-1.26	-1.80	-0.43	-6.86	1.30	1.32	1.25	14.92	22.11	14.29
	S			t(S)			H			t(H)			M			t(M)		
Low	0.29	0.04	0.06	3.78	0.55	1.01	-0.61	-0.54	-0.88	-6.58	-6.91	-11.65	-0.42	-0.25	0.02	-7.70	-5.37	0.51
Medium	0.40	0.19	0.22	5.90	3.10	3.25	-0.26	0.05	-0.19	-3.24	0.70	-2.35	-0.77	-0.42	-0.27	-16.16	-9.93	-5.58
High	0.37	0.34	0.48	3.44	4.68	4.45	0.05	0.60	-0.15	0.36	6.82	-1.16	-0.96	-0.48	-0.51	-12.80	-9.37	-6.71
	R ²																	
Low	0.79	0.80	0.86															
Medium	0.85	0.79	0.81															
High	0.71	0.75	0.68															

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

FM_CVVOL is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997). RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for size.

BM is the return on the zero investment, factor mimicking portfolio for book-to-market. Rpm-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and Rpm-1 are all obtained from Kenneth French's website.

Table 13

Regressions of excess stock returns on the excess market return and the mimicking returns for liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(FM - CVTUR_m) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity
Momentum

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner			Loser			Neutral			Winner											
	A			t(A)			L			t(L)			B			t(B)			S			t(S)			H			t(H)			M			t(M)		
Low	0.008	0.011	0.012	2.55	4.37	4.47	0.01	-0.12	-0.29	0.02	-0.53	-1.20	0.84	0.70	0.71	10.90	11.52	10.43	0.96	1.06	1.04	10.21	14.16	12.50	0.09	0.33	0.21	0.81	3.64	2.14	-0.05	0.17	0.24	-0.70	3.25	4.17
Medium	0.001	0.007	0.004	0.51	4.22	2.51	0.03	-0.20	-0.30	0.16	-1.46	-1.89	0.77	0.57	0.79	14.72	14.94	17.77	0.68	0.53	0.64	10.59	11.15	11.72	0.63	0.44	0.46	8.20	7.87	7.11	-0.09	0.01	0.05	-2.10	0.35	1.19
High	-0.002	-0.001	-0.002	-0.99	-0.54	-0.95	0.20	-0.05	-0.57	0.98	-0.32	-2.66	0.84	0.73	0.77	15.11	18.31	12.92	0.89	0.69	0.89	12.98	13.95	12.13	0.72	0.66	0.55	8.75	11.22	6.28	-0.33	-0.12	-0.18	-6.97	-3.47	-3.43
Low	0.59	0.64	0.62																																	
Medium	0.59	0.60	0.68																																	
High	0.66	0.70	0.60																																	

Panel B: Small - Medium Liquidity
Momentum

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner			Loser			Neutral			Winner											
	A			t(A)			L			t(L)			B			t(B)			S			t(S)			H			t(H)			M			t(M)		
Low	0.015	0.014	0.013	3.80	3.86	4.00	0.20	0.11	-0.29	0.56	0.34	-1.23	0.89	1.02	1.06	8.96	11.06	14.48	1.70	1.37	1.61	13.87	12.08	13.96	-0.43	0.11	-0.65	-2.93	0.80	-1.42	0.00	-0.03	-0.34	-0.06	-0.35	2.79
Medium	0.003	0.003	0.003	1.30	1.35	1.30	0.38	-0.03	-0.73	1.94	-0.20	-3.84	1.04	0.99	0.94	19.03	20.93	17.77	1.03	0.89	1.00	15.38	15.30	15.38	0.33	0.41	0.28	4.04	5.83	3.58	-0.31	-0.06	-0.16	-6.48	-1.43	-3.52
High	-0.005	-0.004	-0.003	-1.96	-1.73	-0.94	0.24	0.08	-0.82	1.00	0.43	-2.97	1.02	0.90	0.91	15.09	17.46	11.87	1.14	0.92	1.02	13.60	14.39	10.75	0.68	0.56	0.43	6.83	7.38	3.80	-0.51	-0.28	-0.36	-8.79	-6.26	-5.40
Low	0.70	0.63	0.76																																	
Medium	0.78	0.78	0.77																																	
High	0.70	0.72	0.60																																	

Panel C: Small - High Liquidity
Momentum

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner			Loser			Neutral			Winner											
	A			t(A)			L			t(L)			B			t(B)			S			t(S)			H			t(H)			M			t(M)		
Low	0.013	0.012	0.008	3.38	3.02	2.64	0.41	-0.05	-1.04	1.19	-0.14	-3.84	1.06	1.19	1.10	11.05	12.42	14.64	1.61	1.52	1.31	13.64	12.82	14.12	-0.65	-0.29	-0.59	-4.59	-2.07	-5.33	-0.34	-0.06	-0.14	-4.08	-0.71	-2.09
Medium	0.004	0.000	-0.007	1.41	0.15	-2.44	-0.27	-0.10	-1.22	-1.04	-0.35	-4.78	1.09	1.11	1.09	15.22	13.83	15.36	1.26	1.17	1.33	14.28	11.85	15.21	-0.27	0.05	-0.26	-2.53	0.42	-2.44	-0.60	-0.40	-0.31	-9.77	-5.83	-4.99
High	-0.004	-0.006	-0.014	-1.09	-1.85	-3.71	0.25	-0.64	-1.37	0.77	-2.06	-4.14	1.09	1.12	1.10	11.94	12.99	11.89	1.44	1.02	1.17	12.80	9.58	10.30	0.08	0.07	0.04	0.62	0.53	0.31	-1.04	-0.93	-0.73	-13.19	-12.53	-9.14
Low	0.75	0.72	0.80																																	
Medium	0.80	0.70	0.80																																	
High	0.73	0.71	0.68																																	

Table 13 Continued

Panel D: Big - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	-0.001	0.002	0.002	-0.28	0.87	1.12	0.20	-0.08	-0.43	0.77	-0.43	-2.50	0.83	0.79	0.94	11.34	15.39	19.56
Medium	0.001	-0.001	-0.001	0.65	-0.38	-0.58	-0.08	-0.38	-0.77	-0.47	-2.66	-4.79	0.83	0.81	0.85	17.43	20.54	19.05
High	-0.006	-0.005	-0.005	-2.92	-2.52	-1.70	-0.02	0.02	-1.22	-0.12	0.13	-4.75	0.93	0.94	0.82	17.19	21.06	11.47
	S			t(S)			H			t(H)			M			t(M)		
Low	0.20	-0.29	-0.21	2.17	-4.52	-3.50	0.33	0.08	0.12	3.03	1.02	1.72	-0.08	0.00	0.11	-1.30	0.01	2.61
Medium	0.27	0.00	0.02	4.66	0.04	0.30	0.38	0.46	0.26	5.43	8.00	3.99	-0.32	0.04	-0.01	-7.78	1.08	-0.14
High	0.46	0.14	0.06	6.94	2.58	0.68	0.63	0.74	0.36	7.92	11.25	3.42	-0.41	-0.27	-0.24	-8.83	-7.15	-3.95
	R ²																	
Low	0.41	0.58	0.68															
Medium	0.66	0.66	0.66															
High	0.67	0.71	0.46															

Panel E: Big - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.007	0.003	0.004	3.00	1.75	2.28	-0.35	0.00	-0.78	-1.58	0.01	-5.66	0.93	0.92	1.03	15.10	24.58	26.88
Medium	-0.001	-0.001	-0.001	-0.32	-0.74	-0.56	0.24	-0.68	-0.91	1.29	-5.03	-6.01	1.10	0.97	1.10	21.21	25.97	26.28
High	-0.007	-0.006	-0.006	-2.76	-3.52	-2.30	-0.08	-0.22	-0.58	-0.35	-1.42	-2.61	1.13	1.02	0.97	18.73	23.97	15.81
	S			t(S)			H			t(H)			M			t(M)		
Low	-0.08	-0.32	-0.28	-1.12	-6.94	-5.99	-0.11	0.09	-0.25	-1.22	1.67	-4.36	-0.50	-0.04	0.10	-9.50	-1.28	2.94
Medium	0.06	-0.22	-0.03	0.91	-4.82	-0.65	0.60	0.25	0.26	7.86	4.48	4.22	-0.42	-0.27	0.02	-9.45	-8.40	0.54
High	0.26	0.01	0.19	3.52	0.17	2.54	0.54	0.55	0.56	6.01	8.84	6.15	-0.59	-0.26	-0.24	-11.37	-7.18	-4.48
	R ²																	
Low	0.68	0.78	0.84															
Medium	0.73	0.81	0.79															
High	0.72	0.76	0.58															

Panel F: Big - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.010	0.007	4.33	4.57	3.20	0.18	0.46	-0.44	0.77	2.43	-2.30	1.13	1.07	1.16	17.86	20.20	21.77
Medium	0.002	-0.001	-0.008	0.98	-0.51	-3.38	-0.24	-0.72	-1.77	-1.21	-4.14	-8.22	1.26	1.09	1.21	22.87	22.52	20.14
High	-0.008	-0.007	-0.013	-2.38	-3.08	-3.49	0.01	-0.17	-1.66	0.04	-0.81	-5.08	1.30	1.32	1.25	14.81	22.14	13.72
	S			t(S)			H			t(H)			M			t(M)		
Low	0.29	0.04	0.06	3.78	0.55	0.97	-0.61	-0.54	-0.88	-6.58	-6.98	-11.27	-0.42	-0.25	0.02	-7.70	-5.42	0.50
Medium	0.40	0.19	0.22	5.91	3.17	3.03	-0.26	0.05	-0.19	-3.25	0.71	-2.20	-0.77	-0.42	-0.27	-16.18	-10.15	-5.21
High	0.37	0.34	0.48	3.41	4.69	4.27	0.05	0.60	-0.15	0.35	6.83	-1.11	-0.96	-0.48	-0.51	-12.71	-9.38	-6.45
	R ²																	
Low	0.79	0.81	0.85															
Medium	0.85	0.80	0.78															
High	0.70	0.75	0.65															

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

FM_CVTUR is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997). RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for size.

BM is the return on the zero investment, factor mimicking portfolio for book-to-market. RPM-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and RPM-1 are all obtained from Kenneth French's website.

the manufactured uncorrelated relationship. Instead, any mitigating effects should be revealed in regressions using the return difference of the illiquid and liquid portfolios.

Results with this liquidity measure are reported in Tables 15 through 20. The return difference portfolios are the same as those used to compute the residual liquidity factor. These portfolios represent a zero investment, factor-mimicking portfolio for liquidity, similar to the factors used in Fama and French (1993) for size and book-to-market equity. Since the return difference portfolios are not completely uncorrelated with the other variables it should serve as a better measure to assess the mitigating effects liquidity may have on the other variables. Since liquidity and size have the more intuitive relationship to each other than any of the other variables employed, I use sorts on both liquidity and size to calculate the liquidity difference portfolio.

The residual liquidity regression results are reported in Tables 8 through 13. Since the residual liquidity factor is orthogonal to the other four factors, the coefficients on the liquidity factor and the other coefficients do not change when the factors are regressed together. Consequently, the coefficients on the non-liquidity factors are the same as if the liquidity residual factor were not in the regression. However, while the coefficients don't change, the t-statistics do change. Therefore, in order to compare the effects of the residual liquidity factor on the other four asset-pricing variables, I regress the returns versus the non-liquidity variables to form a benchmark for my comparison, and these results are reported in Table 14.

When comparing the results from the various multivariate residual liquidity regressions to the non-liquidity regression, the coefficients on the non-liquidity variables are unchanged, as expected, and the significance, while stronger in the full model (with liquidity), is still inconsequential.

Even though a direct comparison is not possible because of the added variables and different time periods, the properties of the non-liquidity factors used are consistent with prior research. For example, the market, size, and book-to-market factors taken from Fama and French (1993) exhibit similar characteristics. The coefficient on the market factor, as is the case in Fama and French (1993), averages approximately 1.0. The size factor, SMB, displays the same monotonically decreasing property. Similarly, the book-to-market factor displays the consistent monotonically increasing pattern from Fama and French (1993).

Table 14
Regressions of excess stock returns on the excess market return and the mimicking returns for
size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	<u>A</u>			<u>t(A)</u>			<u>B</u>			<u>t(B)</u>			<u>S</u>			<u>t(S)</u>		
Low	0.008	0.011	0.012	2.56	4.37	4.46	0.84	0.70	0.71	10.92	11.54	10.42	0.96	1.06	1.04	10.24	14.18	12.49
Medium	0.001	0.007	0.004	0.51	4.21	2.50	0.77	0.57	0.79	14.75	14.90	17.67	0.68	0.53	0.64	10.61	11.12	11.66
High	-0.002	-0.001	-0.002	-0.99	-0.54	-0.94	0.84	0.73	0.77	15.11	18.34	12.75	0.89	0.69	0.89	12.98	13.98	11.97
	<u>H</u>			<u>t(H)</u>			<u>M</u>			<u>t(M)</u>			<u>R²</u>					
Low	0.09	0.33	0.21	0.81	3.65	2.14	-0.05	0.17	0.24	-0.70	3.26	4.17	0.59	0.64	0.61			
Medium	0.63	0.44	0.46	8.22	7.85	7.07	-0.09	0.01	0.05	-2.11	0.35	1.19	0.59	0.60	0.68			
High	0.72	0.66	0.55	8.75	11.25	6.20	-0.33	-0.12	-0.18	-6.97	-3.48	-3.38	0.66	0.70	0.59			

Panel B: Small - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	<u>A</u>			<u>t(A)</u>			<u>B</u>			<u>t(B)</u>			<u>S</u>			<u>t(S)</u>		
Low	0.015	0.014	0.010	3.81	3.87	3.99	0.89	1.02	0.94	8.98	11.08	14.47	1.70	1.37	1.12	13.89	12.10	13.95
Medium	0.003	0.003	0.003	1.29	1.36	1.27	1.04	0.99	0.94	18.92	20.97	17.26	1.03	0.89	1.00	15.28	15.34	14.94
High	-0.005	-0.004	-0.003	-1.96	-1.73	-0.92	1.02	0.90	0.91	15.09	17.49	11.68	1.14	0.92	1.02	13.60	14.42	10.57
	<u>H</u>			<u>t(H)</u>			<u>M</u>			<u>t(M)</u>			<u>R²</u>					
Low	-0.43	0.11	-0.14	-2.94	0.80	-1.42	0.00	-0.03	0.16	-0.06	-0.35	2.79	0.70	0.63	0.76			
Medium	0.33	0.41	0.28	4.02	5.84	3.48	-0.31	-0.06	-0.16	-6.44	-1.44	-3.42	0.78	0.78	0.75			
High	0.68	0.56	0.43	6.83	7.39	3.73	-0.51	-0.28	-0.36	-8.79	-6.27	-5.31	0.70	0.72	0.58			

Panel C: Small - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	<u>A</u>			<u>t(A)</u>			<u>B</u>			<u>t(B)</u>			<u>S</u>			<u>t(S)</u>		
Low	0.013	0.012	0.008	3.38	3.02	2.57	1.06	1.19	1.10	11.04	12.45	14.22	1.61	1.52	1.31	13.63	12.85	13.71
Medium	0.004	0.000	-0.007	1.41	0.15	-2.33	1.09	1.11	1.09	15.22	13.86	14.67	1.26	1.17	1.33	14.28	11.87	14.53
High	-0.004	-0.006	-0.014	-1.09	-1.84	-3.59	1.09	1.12	1.10	11.95	12.90	11.50	1.44	1.02	1.17	12.81	9.51	9.96
	<u>H</u>			<u>t(H)</u>			<u>M</u>			<u>t(M)</u>			<u>R²</u>					
Low	-0.65	-0.29	-0.59	-4.58	-2.07	-5.18	-0.34	-0.06	-0.14	-4.08	-0.71	-2.03	0.75	0.72	0.79			
Medium	-0.27	0.05	-0.26	-2.53	0.42	-2.33	-0.60	-0.40	-0.31	-9.77	-5.84	-4.77	0.80	0.70	0.78			
High	0.08	0.07	0.04	0.62	0.53	0.30	-1.04	-0.93	-0.73	-13.20	-12.44	-8.83	0.73	0.71	0.65			

Table 14 Continued

Panel D: Big - Low Liquidity																		
Book-to-market	Momentum																	
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	<u>A</u>			<u>t(A)</u>			<u>B</u>			<u>t(B)</u>			<u>S</u>			<u>t(S)</u>		
Low	-0.001	0.002	0.002	-0.29	0.87	1.10	0.83	0.79	0.94	11.35	15.41	19.34	0.20	-0.29	-0.21	2.17	-4.53	-3.46
Medium	0.001	-0.001	-0.001	0.65	-0.37	-0.55	0.83	0.81	0.85	17.46	20.28	18.19	0.27	0.00	0.02	4.67	0.04	0.29
High	-0.006	-0.005	-0.005	-2.92	-2.52	-1.62	0.93	0.94	0.82	17.22	21.11	10.97	0.46	0.14	0.06	6.96	2.59	0.65
	<u>H</u>			<u>t(H)</u>			<u>M</u>			<u>t(M)</u>			<u>R²</u>					
Low	0.33	0.08	0.12	3.03	1.02	1.70	-0.08	0.00	0.11	-1.30	0.01	2.58	0.41	0.58	0.67			
Medium	0.38	0.46	0.26	5.43	7.90	3.81	-0.32	0.04	-0.01	-7.79	1.07	-0.14	0.66	0.65	0.63			
High	0.63	0.74	0.36	7.94	11.28	3.26	-0.41	-0.28	-0.24	-8.85	-7.16	-3.78	0.67	0.71	0.41			

Panel E: Big - Medium Liquidity																		
Book-to-market	Momentum																	
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	<u>A</u>			<u>t(A)</u>			<u>B</u>			<u>t(B)</u>			<u>S</u>			<u>t(S)</u>		
Low	0.007	0.003	0.004	2.99	1.75	2.14	0.93	0.92	1.03	15.06	24.64	25.23	-0.08	-0.32	-0.28	-1.11	-6.96	-5.62
Medium	-0.001	-0.001	-0.001	-0.32	-0.71	-0.52	1.10	0.97	1.10	21.18	24.69	24.47	0.06	-0.22	-0.03	0.91	-4.58	-0.61
High	-0.007	-0.006	-0.006	-2.77	-3.51	-2.27	1.13	1.02	0.97	18.76	23.92	15.61	0.26	0.01	0.19	3.53	0.17	2.50
	<u>H</u>			<u>t(H)</u>			<u>M</u>			<u>t(M)</u>			<u>R²</u>					
Low	-0.11	0.09	-0.25	-1.22	1.67	-4.09	-0.50	-0.04	0.10	-9.47	-1.28	2.76	0.67	0.78	0.82			
Medium	0.60	0.25	0.26	7.85	4.26	3.93	-0.42	-0.27	0.02	-9.44	-7.99	0.50	0.73	0.79	0.76			
High	0.54	0.56	0.56	6.03	8.82	6.07	-0.59	-0.26	-0.24	-11.39	-7.16	-4.43	0.72	0.75	0.56			

Panel F: Big - High Liquidity																		
Book-to-market	Momentum																	
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	<u>A</u>			<u>t(A)</u>			<u>B</u>			<u>t(B)</u>			<u>S</u>			<u>t(S)</u>		
Low	0.011	0.010	0.007	4.33	4.52	3.17	1.13	1.07	1.16	17.87	19.98	21.57	0.29	0.04	0.06	3.78	0.55	0.96
Medium	0.002	-0.001	-0.008	0.98	-0.49	-2.97	1.26	1.09	1.21	22.84	21.76	17.73	0.40	0.19	0.22	5.90	3.06	2.67
High	-0.008	-0.007	-0.013	-2.38	-3.08	-3.32	1.30	1.32	1.25	14.84	22.15	13.03	0.37	0.34	0.48	3.42	4.69	4.06
	<u>H</u>			<u>t(H)</u>			<u>M</u>			<u>t(M)</u>			<u>R²</u>					
Low	-0.61	-0.54	-0.88	-6.58	-6.91	-11.17	-0.42	-0.25	0.02	-7.71	-5.36	0.49	0.79	0.80	0.85			
Medium	-0.26	0.05	-0.19	-3.24	0.69	-1.93	-0.77	-0.42	-0.27	-16.17	-9.81	-4.58	0.85	0.78	0.72			
High	0.05	0.60	-0.15	0.36	6.83	-1.05	-0.96	-0.48	-0.51	-12.74	-9.39	-6.12	0.70	0.75	0.61			

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups. RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for size. BM is the return on the zero investment, factor mimicking portfolio for book-to-market. R_{Pm-1} is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and R_{Pm-1} are all obtained from Kenneth French's website.

It is also noteworthy to discuss the difference between the R^2 from Fama and French (1993) and those found in the full multivariate liquidity regressions. Using a three-factor model Fama and French consistently finds R^2 upward of 95-97%. In comparison, I find R^2 of up to 85-87%. The difference in the R^2 level is directly attributable to the higher level of sort on the dependent returns used in my study. Fama and French sort the dependent returns by two variables (size and book-to-market) to produce 25 portfolios, while I sort my dependent returns by four variables (liquidity, size, book-to-market, and momentum) to produce 54 portfolios. The effect of this higher level of sorting is a reduction in the number of stocks in each portfolio and, subsequently, a higher amount of noise in the regression and a reduction in the R^2 . Despite this reduction it is impressive to still have results in R^2 upward of 85%.

Tables 15 through 20 report the results from the regressions using the return difference liquidity measures. Using these regressions I can adequately account for any mitigating effects that liquidity may have on the various non-liquidity measures. In order to compare the effects of the liquidity on the other four asset-pricing variables I use the regression of the returns versus the non-liquidity variables as a benchmark for my comparison, as reported in Table 14.

In comparing the five-factor regressions, using the return difference portfolios, to the non-liquidity regression, using only the market, size, book-to-market, and momentum factors, I find consistent results across the various liquidity proxies for the effect liquidity has on the other variables.

The market factor is the most affected variable with a consistent reduction in the majority of the coefficients on the market factor, as well as the t-statistics, for the various portfolios. The exceptions to this reduction seem to be concentrated in the low liquidity portfolios. This observation can only be explained by the correlation between liquidity and the market factor, or lack thereof between the market factor and stocks with infrequent trading.

The size factor has a very interesting reaction to the presence of liquidity. The majority of the coefficients and t-statistics on the size factor increase with the addition of the liquidity variable. The increases in the size coefficients are in similar portfolios as the decreases in the market factor, where the exceptions are concentrated in the low liquidity portfolios. In this case it is interesting to note that since the return difference portfolios were formed using sorts on size as well as liquidity, the correlation between the return difference portfolio and the size factor is relatively low, as shown in Table 1C. Therefore the increase in the significance of size is due in

part to the increased ability to capture shared variation in returns when size and liquidity are regressed together. Also, as noted from Table 1B, there is an apparent reversal in the size effect. The reversal may imply that liquidity and size are not closely related. This idea is bolstered by the patterns, or lack there of, between liquidity and size reported in Table 1A. The findings of Table 1A show that size is directly related to liquidity for small firms but not for big firms. Therefore, it is implied that the intuitive liquidity-size relationship only exists with small firms.

The book-to-market and momentum factors both have inconsistent changes in their coefficients and t-statistics. There is no clear pattern to the changes in either measure. In fact, there is often a change in sign on the coefficients of the two measures.

Overall, there are clear patterns of change for the market and size factors and inconsistent patterns of change for the book-to-market and momentum factors.

4C2. The Effect of Liquidity on the Significance of the Intercepts

As is the case for the factors, a comparison of the intercepts can be made using the non-liquidity regression versus the full multivariate liquidity regressions, using the return differences. The effect of liquidity on the intercepts is important to assess because it allows an analysis of whether liquidity accounts for any or all of the shared variation missed by the four other asset-pricing variables, given that significant intercepts indicate that something is still missing from the regression. A comparison of the intercepts from the non-liquidity regression to the intercepts from any of the multivariate liquidity regression yields noticeable changes in the coefficients and t-statistics. However, the significant intercepts in some of the regressions in the full model imply that while it is clear that liquidity picks up shared variation in returns missed by the other asset-pricing variables, there is still something not captured by any of the five factors in the full model.

Changes in the intercepts from the non-liquidity regression to the full model are clearly present where liquidity has its strongest impact, in portfolios that are comprised of small stocks with high liquidity, big stocks with low liquidity, and big stocks with high liquidity. In the portfolios with high liquidity the change is a reduction in the intercept coefficients, while in the low liquidity portfolios the change is an increase in the intercepts. All the other portfolios have no clear change in the intercept coefficients.

In the full model, there are clear patterns to the presence of non-zero intercepts. Overall, more than half of the intercepts are non-zero, with thirty of the fifty-four portfolios (fifty-six percent) having non-zero intercepts.

In all of the regressions reported on the liquidity return difference (Tables 15-20) the evidence is identical. I decompose the thirty non-zero intercepts into sections based on the four characteristic and find that the only clear pattern that exists is for the book-to-market characteristic. In the liquidity portfolios I do not find an overwhelming pattern, with seven non-zero intercepts for low liquidity, ten for medium liquidity, and thirteen for high liquidity. Further, there is no clear sign relationship. In the momentum portfolio, again, the pattern is not overwhelming with nine non-zero intercepts for the losers, ten for neutrals, and eleven for winners, with no clear sign relationship. In the size categories there is a perfect split with fifteen non-zero intercept portfolios for both small and big stocks. There are some tendencies in the sign relationship of small stocks with eleven of the fifteen non-zero portfolios having positive signs. For big stocks nine of the fifteen have negative coefficients. There is an unmistakable pattern of non-zero intercepts in the book-to-market portfolios. Of the thirty non-zero intercepts, fifteen are in the low book-to-market category, four in the medium book-to-market category, and eleven in the high book-to-market category. Moreover, in the low book-to-market category, all of the fifteen non-zero intercepts are positive, while in the high book-to-market category all of the eleven non-zero intercepts are negative.

Specifically the book-to-market pattern for low book-to-market firms is overwhelming, with fifteen of the possible eighteen low book-to-market portfolios being positive and significant. The only exception is in the portfolios of big firms with low liquidity. This suggests that low book-to-market firms have positive returns after accounting for the five explanatory variables.

The pattern for high book-to-market firms is weaker, but still overwhelming, with eleven of the possible eighteen high book-to-market portfolios being negative and significant. There is an obvious pattern for high book-to-market firms in the portfolios of big stocks, with eight of the nine intercepts being negative and significant. This suggests that high book-to-market firms have negative returns after accounting for the five explanatory variables. Overall, it seems that low book-to-market firms outperform high book-to-market firms.

Table 15

Regressions of excess stock returns on the excess market return and the mimicking returns for liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(VOLDIFF_m) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity Momentum																		
Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.011	0.012	2.47	4.35	4.39	-0.21	-0.01	-0.14	-1.35	-0.10	-0.96	0.78	0.70	0.67	9.01	10.11	8.73
Medium	0.001	0.007	0.005	0.66	4.68	2.68	0.26	0.36	0.23	2.44	4.70	2.55	0.84	0.67	0.85	14.29	15.95	16.97
High	-0.002	-0.001	-0.002	-0.82	-0.32	-0.99	0.32	0.30	-0.10	2.83	3.72	-0.82	0.92	0.81	0.74	14.86	18.38	10.85
	S			t(S)			H			t(H)			M			t(M)		
Low	0.98	1.06	1.05	10.34	14.04	12.51	0.24	0.34	0.31	1.52	2.69	2.21	0.02	0.17	0.28	0.21	2.70	3.95
Medium	0.66	0.50	0.62	10.31	10.91	11.36	0.45	0.20	0.30	4.28	2.63	3.38	-0.17	-0.09	-0.02	-3.15	-2.43	-0.50
High	0.86	0.66	0.90	12.69	13.76	11.96	0.50	0.45	0.62	4.43	5.73	5.03	-0.43	-0.21	-0.15	-7.40	-5.07	-2.28
	R ²																	
Low	0.59	0.64	0.62															
Medium	0.60	0.64	0.68															
High	0.67	0.72	0.59															

Panel B: Small - Medium Liquidity Momentum																		
Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	A			t(A)			L			t(L)			B			t(B)		
Low	0.014	0.014	0.010	3.70	3.82	3.87	-1.11	-0.10	-0.44	-5.74	-0.52	-3.34	0.61	1.00	0.83	5.74	9.51	11.46
Medium	0.003	0.003	0.003	1.15	1.36	1.17	-0.28	0.01	-0.17	-2.44	0.15	-1.55	0.97	1.00	0.89	15.71	18.52	14.54
High	-0.006	-0.004	-0.003	-2.02	-1.73	-1.08	-0.14	-0.01	-0.39	-1.00	-0.12	-2.43	0.99	0.90	0.81	12.83	15.33	9.26
	S			t(S)			H			t(H)			M			t(M)		
Low	1.79	1.38	1.15	15.45	12.04	14.57	0.33	0.18	0.17	1.73	0.94	1.28	0.32	0.00	0.29	3.28	0.02	4.26
Medium	1.06	0.89	1.01	15.64	15.15	15.06	0.51	0.40	0.40	4.62	4.09	3.59	-0.22	-0.06	-0.11	-3.89	-1.25	-1.89
High	1.15	0.92	1.05	13.62	14.28	10.91	0.78	0.57	0.70	5.61	5.39	4.40	-0.47	-0.28	-0.24	-6.58	-5.03	-2.96
	R ²																	
Low	0.73	0.63	0.77															
Medium	0.78	0.78	0.75															
High	0.70	0.72	0.59															

Panel C: Small - High Liquidity Momentum																		
Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.010	0.007	3.35	2.87	2.41	-1.50	-1.02	-1.20	-8.75	-5.48	-8.54	0.67	0.93	0.80	7.10	9.07	10.34
Medium	0.003	-0.001	-0.008	1.08	-0.23	-3.09	-1.12	-0.97	-1.07	-8.77	-6.34	-7.77	0.80	0.86	0.82	11.35	10.23	10.86
High	-0.006	-0.008	-0.015	-1.70	-2.35	-4.09	-1.31	-1.02	-0.96	-7.78	-6.08	-5.15	0.75	0.86	0.85	8.16	9.36	8.26
	S			t(S)			H			t(H)			M			t(M)		
Low	1.72	1.60	1.41	16.73	14.24	16.70	0.39	0.41	0.23	2.27	2.22	1.66	0.11	0.24	0.22	1.24	2.56	3.06
Medium	1.34	1.25	1.42	17.49	13.57	17.18	0.51	0.72	0.48	3.99	4.73	3.51	-0.27	-0.12	0.01	-4.09	-1.47	0.14
High	1.54	1.10	1.25	15.28	10.94	11.08	0.98	0.77	0.71	5.90	4.64	3.81	-0.65	-0.63	-0.44	-7.56	-7.38	-4.60
	R ²																	
Low	0.81	0.75	0.84															
Medium	0.85	0.75	0.82															
High	0.79	0.75	0.69															

Table 15 Continued

Panel D: Big - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.000	0.003	0.003	-0.05	1.30	1.39	0.57	0.59	0.39	3.89	5.92	4.01	0.98	0.94	1.04	12.15	17.36	19.50
Medium	0.002	0.000	-0.001	0.91	0.05	-0.52	0.38	0.56	0.05	3.94	7.58	0.48	0.93	0.95	0.86	17.73	23.53	16.24
High	-0.006	-0.004	-0.005	-2.89	-2.39	-1.64	0.04	0.24	-0.06	0.34	2.62	-0.40	0.94	1.00	0.80	15.32	20.09	9.46
	S			t(S)			H			t(H)			M			t(M)		
Low	0.15	-0.33	-0.24	1.71	-5.59	-4.07	-0.07	-0.33	-0.15	-0.45	-3.33	-1.53	-0.25	-0.17	-0.01	-3.35	-3.42	-0.16
Medium	0.24	-0.04	0.01	4.26	-0.94	0.22	0.12	0.08	0.23	1.29	1.08	2.40	-0.43	-0.13	-0.02	-8.83	-3.43	-0.39
High	0.46	0.12	0.07	6.84	2.25	0.70	0.61	0.58	0.40	5.47	6.40	2.62	-0.43	-0.35	-0.23	-7.39	-7.43	-2.84
	R²																	
Low	0.44	0.64	0.70															
Medium	0.68	0.72	0.63															
High	0.67	0.71	0.41															

Panel E: Big - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.003	0.004	3.07	2.17	2.34	0.15	0.38	0.23	1.21	5.27	2.76	0.97	1.02	1.09	13.86	25.45	23.86
Medium	0.000	-0.001	-0.001	-0.10	-0.66	-0.55	0.39	0.06	-0.04	3.73	0.78	-0.46	1.20	0.99	1.09	20.96	22.12	21.33
High	-0.007	-0.006	-0.006	-2.81	-3.56	-2.30	-0.10	-0.08	-0.08	-0.82	-0.90	-0.66	1.11	1.00	0.95	16.15	20.66	13.44
	S			t(S)			H			t(H)			M			t(M)		
Low	-0.10	-0.35	-0.30	-1.26	-7.98	-6.01	-0.22	-0.17	-0.41	-1.72	-2.39	-4.90	-0.55	-0.16	0.03	-8.43	-4.16	0.68
Medium	0.03	-0.23	-0.03	0.44	-4.64	-0.54	0.33	0.20	0.29	3.21	2.52	3.14	-0.54	-0.29	0.03	-10.07	-6.96	0.67
High	0.27	0.02	0.20	3.60	0.29	2.57	0.61	0.61	0.62	4.90	6.97	4.82	-0.56	-0.24	-0.21	-8.80	-5.31	-3.22
	R²																	
Low	0.67	0.81	0.83															
Medium	0.74	0.79	0.76															
High	0.72	0.75	0.57															

Panel F: Big - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.009	0.006	4.21	4.41	3.03	-0.37	-0.35	-0.35	-2.87	-3.22	-3.19	1.04	0.98	1.07	14.65	16.46	17.89
Medium	0.002	-0.001	-0.009	0.85	-0.73	-3.20	-0.25	-0.37	-0.41	-2.17	-3.73	-2.94	1.20	0.99	1.10	19.28	17.97	14.51
High	-0.009	-0.008	-0.014	-2.82	-3.19	-3.69	-0.88	-0.20	-0.81	-5.13	-1.61	-4.22	1.07	1.27	1.04	11.37	18.84	9.92
	S			t(S)			H			t(H)			M			t(M)		
Low	0.32	0.06	0.09	4.18	0.98	1.39	-0.36	-0.30	-0.64	-2.82	-2.83	-5.98	-0.31	-0.14	0.13	-4.72	-2.59	2.26
Medium	0.42	0.22	0.26	6.18	3.61	3.07	-0.09	0.31	0.09	-0.85	3.10	0.62	-0.70	-0.31	-0.15	-12.02	-6.05	-2.09
High	0.44	0.36	0.54	4.25	4.87	4.72	0.65	0.74	0.41	3.83	6.05	2.14	-0.70	-0.42	-0.27	-7.96	-6.74	-2.72
	R²																	
Low	0.80	0.81	0.86															
Medium	0.86	0.80	0.73															
High	0.73	0.76	0.64															

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups. VOLDIFF is the difference in the averages of the illiquid and liquid portfolios. RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for si IFF. BM is the return on the zero investment, factor mimicking portfolio for book-to-market. Rpm-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and Rpm-1 are all obtained from Kenneth French's website.

Table 16

Regressions of excess stock returns on the excess market return and the mimicking returns for liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(TURDIFF) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.011	0.012	2.45	4.39	4.37	-0.31	0.06	-0.21	-2.08	0.54	-1.58	0.76	0.72	0.66	9.12	10.69	8.83
Medium	0.001	0.007	0.005	0.65	4.67	2.66	0.23	0.33	0.19	2.32	4.63	2.26	0.83	0.65	0.83	14.49	16.06	17.13
High	-0.002	-0.001	-0.003	-0.90	-0.37	-1.09	0.15	0.22	-0.28	1.37	2.94	-2.44	0.88	0.78	0.70	14.32	18.17	10.68
	S			t(S)			H			t(H)			M			t(M)		
Low	0.84	1.09	0.96	7.66	12.31	9.81	0.29	0.29	0.35	1.97	2.41	2.66	0.03	0.15	0.30	0.41	2.56	4.41
Medium	0.77	0.66	0.71	10.32	12.30	11.18	0.48	0.23	0.34	4.78	3.20	3.94	-0.15	-0.07	0.00	-3.00	-1.98	-0.08
High	0.95	0.77	0.78	11.76	13.62	8.98	0.62	0.51	0.74	5.76	6.76	6.35	-0.37	-0.18	-0.10	-6.74	-4.53	-1.76
	R ²																	
Low	0.60	0.64	0.62															
Medium	0.60	0.63	0.68															
High	0.67	0.71	0.60															

Panel B: Small - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.014	0.014	0.010	3.76	3.80	3.87	-1.23	-0.17	-0.51	-7.07	-0.95	-4.22	0.60	0.98	0.82	6.02	9.66	11.84
Medium	0.003	0.003	0.002	1.16	1.37	1.11	-0.23	0.02	-0.30	-2.22	0.26	-2.91	0.98	1.00	0.87	16.39	19.12	14.71
High	-0.006	-0.004	-0.004	-2.09	-1.78	-1.19	-0.26	-0.09	-0.59	-1.98	-0.91	-4.02	0.96	0.88	0.77	12.96	15.49	9.26
	S			t(S)			H			t(H)			M			t(M)		
Low	1.21	1.31	0.91	9.26	9.77	10.04	0.38	0.22	0.20	2.15	1.23	1.64	0.31	0.02	0.29	3.45	0.17	4.60
Medium	0.94	0.90	0.88	11.92	13.13	11.36	0.48	0.39	0.48	4.52	4.25	4.58	-0.25	-0.06	-0.08	-4.54	-1.37	-1.57
High	1.03	0.88	0.78	10.58	11.76	7.14	0.85	0.62	0.81	6.50	6.20	5.54	-0.45	-0.26	-0.21	-6.70	-4.99	-2.77
	R ²																	
Low	0.75	0.63	0.77															
Medium	0.78	0.78	0.76															
High	0.70	0.72	0.61															

Panel C: Small - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.010	0.007	3.32	2.87	2.43	-1.31	-0.97	-1.18	-8.03	-5.58	-9.20	0.74	0.96	0.82	7.96	9.69	11.23
Medium	0.003	0.000	-0.008	1.11	-0.15	-3.10	-0.97	-0.75	-1.01	-7.91	-5.08	-7.93	0.86	0.93	0.85	12.25	11.12	11.69
High	-0.006	-0.008	-0.015	-1.70	-2.42	-4.35	-1.23	-1.05	-1.17	-7.85	-6.81	-6.94	0.80	0.87	0.82	8.92	9.97	8.56
	S			t(S)			H			t(H)			M			t(M)		
Low	1.09	1.13	0.84	8.84	8.66	8.75	0.21	0.34	0.18	1.30	1.96	1.40	0.00	0.19	0.17	-0.02	2.11	2.50
Medium	0.87	0.88	0.93	9.48	7.93	9.72	0.37	0.54	0.41	2.99	3.64	3.17	-0.36	-0.21	-0.05	-5.64	-2.82	-0.74
High	0.95	0.60	0.71	8.09	5.25	5.62	0.89	0.75	0.81	5.65	4.87	4.77	-0.72	-0.67	-0.43	-9.01	-8.46	-4.98
	R ²																	
Low	0.80	0.75	0.85															
Medium	0.84	0.73	0.82															
High	0.79	0.76	0.71															

Table 16 Continued

Panel D: Big - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.000	0.003	0.003	-0.04	1.74	1.39	0.57	0.88	0.37	4.16	10.94	4.10	0.97	1.00	1.03	12.41	21.83	19.87
Medium	0.002	0.000	-0.001	0.89	0.11	-0.51	0.34	0.59	0.06	3.74	8.88	0.68	0.91	0.95	0.87	17.86	25.03	16.79
High	-0.006	-0.004	-0.005	-2.89	-2.39	-1.66	0.03	0.22	-0.11	0.32	2.56	-0.75	0.94	0.99	0.79	15.74	20.47	9.63
	S			t(S)			H			t(H)			M			t(M)		
Low	0.42	0.06	-0.06	4.11	1.04	-0.88	-0.05	-0.50	-0.12	-0.33	-6.18	-1.34	-0.23	-0.22	0.01	-3.23	-5.41	0.28
Medium	0.41	0.24	0.04	6.05	4.73	0.61	0.16	0.08	0.22	1.80	1.15	2.44	-0.41	-0.11	-0.02	-8.81	-3.33	-0.46
High	0.48	0.23	0.02	6.07	3.57	0.16	0.61	0.60	0.43	5.80	7.00	2.97	-0.42	-0.33	-0.22	-7.83	-7.56	-2.91
	R ²																	
Low	0.45	0.73	0.70															
Medium	0.68	0.74	0.63															
High	0.67	0.71	0.41															

Panel E: Big - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.003	0.004	3.21	2.48	2.23	0.33	0.52	0.12	2.85	8.23	1.46	1.01	1.04	1.06	15.07	28.87	23.57
Medium	0.000	-0.001	-0.001	-0.06	-0.69	-0.58	0.44	0.01	-0.09	4.60	0.15	-1.00	1.21	0.98	1.08	21.99	22.43	21.80
High	-0.007	-0.006	-0.006	-2.77	-3.52	-2.35	-0.03	-0.03	-0.17	-0.29	-0.41	-1.39	1.13	1.01	0.93	16.88	21.51	13.62
	S			t(S)			H			t(H)			M			t(M)		
Low	0.05	-0.11	-0.24	0.54	-2.37	-4.01	-0.33	-0.25	-0.32	-2.79	-3.92	-4.06	-0.59	-0.17	0.07	-9.76	-5.35	1.68
Medium	0.23	-0.22	-0.07	3.23	-3.80	-1.05	0.31	0.24	0.32	3.22	3.13	3.64	-0.54	-0.27	0.04	-10.83	-7.00	0.93
High	0.25	0.00	0.13	2.84	-0.07	1.40	0.56	0.58	0.67	4.75	6.95	5.52	-0.58	-0.26	-0.20	-9.73	-6.00	-3.16
	R ²																	
Low	0.68	0.83	0.82															
Medium	0.75	0.79	0.76															
High	0.72	0.75	0.57															

Panel F: Big - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.009	0.006	4.21	4.42	3.03	-0.40	-0.44	-0.58	-3.35	-4.40	-5.99	1.04	0.96	1.02	15.18	17.01	18.51
Medium	0.002	-0.001	-0.009	0.81	-0.74	-3.44	-0.31	-0.36	-0.64	-2.99	-3.82	-5.11	1.19	1.00	1.05	19.85	18.74	14.82
High	-0.009	-0.008	-0.014	-2.74	-3.32	-3.89	-0.72	-0.34	-1.00	-4.40	-3.02	-5.79	1.13	1.24	1.01	12.16	19.20	10.22
	S			t(S)			H			t(H)			M			t(M)		
Low	0.14	-0.14	-0.17	1.51	-1.84	-2.28	-0.35	-0.26	-0.50	-2.92	-2.58	-5.19	-0.32	-0.14	0.17	-5.18	-2.66	3.43
Medium	0.28	0.05	-0.03	3.52	0.65	-0.31	-0.06	0.28	0.22	-0.55	3.03	1.78	-0.69	-0.33	-0.11	-12.80	-6.87	-1.66
High	0.09	0.21	0.08	0.70	2.46	0.62	0.52	0.82	0.51	3.15	7.24	2.92	-0.78	-0.40	-0.25	-9.32	-6.80	-2.81
	R ²																	
Low	0.80	0.82	0.87															
Medium	0.86	0.80	0.75															
High	0.72	0.76	0.66															

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

TURDIFF is the difference in the averages of the illiquid and liquid portfolios. RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for si IFF

BM is the return on the zero investment, factor mimicking portfolio for book-to-market. Rpm-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and Rpm-1 are all obtained from Kenneth French's website.

Table 17

Regressions of excess stock returns on the excess market return and the mimicking returns for liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(STDVOLDIFF) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.007	0.011	0.012	2.39	4.34	4.34	-0.37	-0.02	-0.22	-2.36	-0.18	-1.58	0.75	0.70	0.65	8.82	10.22	8.65
Medium	0.001	0.007	0.005	0.66	4.74	2.68	0.21	0.35	0.20	1.96	4.62	2.14	0.82	0.66	0.83	14.15	15.97	16.88
High	-0.002	0.000	-0.003	-0.82	-0.28	-1.03	0.25	0.27	-0.15	2.19	3.39	-1.16	0.90	0.80	0.74	14.61	18.30	10.90
	S			t(S)			H			t(H)			M			t(M)		
Low	1.00	1.06	1.06	10.58	14.00	12.62	0.36	0.34	0.37	2.25	2.69	2.63	0.06	0.18	0.30	0.70	2.81	4.36
Medium	0.66	0.49	0.62	10.23	10.72	11.26	0.48	0.19	0.32	4.43	2.49	3.50	-0.15	-0.09	-0.01	-2.85	-2.24	-0.18
High	0.86	0.66	0.90	12.57	13.57	12.01	0.54	0.46	0.66	4.66	5.69	5.20	-0.40	-0.19	-0.14	-7.07	-4.84	-2.19
	R ²																	
Low	0.60	0.64	0.62															
Medium	0.60	0.63	0.68															
High	0.67	0.71	0.59															

Panel B: Small - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.013	0.014	0.010	3.61	3.73	3.79	-1.26	-0.34	-0.53	-6.65	-1.79	-4.09	0.59	0.94	0.81	5.79	9.16	11.56
Medium	0.002	0.003	0.002	1.07	1.35	1.10	-0.33	0.00	-0.24	-2.99	-0.03	-2.16	0.96	0.99	0.88	15.88	18.71	14.60
High	-0.006	-0.004	-0.004	-2.07	-1.75	-1.17	-0.19	-0.04	-0.48	-1.37	-0.35	-3.02	0.98	0.89	0.80	12.91	15.46	9.29
	S			t(S)			H			t(H)			M			t(M)		
Low	1.82	1.41	1.17	16.01	12.29	14.89	0.47	0.35	0.25	2.47	1.84	1.87	0.34	0.07	0.30	3.61	0.69	4.65
Medium	1.07	0.89	1.02	15.82	15.11	15.21	0.56	0.41	0.45	5.00	4.12	4.00	-0.21	-0.06	-0.09	-3.83	-1.18	-1.69
High	1.15	0.92	1.06	13.67	14.26	11.10	0.82	0.59	0.77	5.79	5.44	4.81	-0.46	-0.27	-0.23	-6.60	-5.03	-2.85
	R ²																	
Low	0.75	0.64	0.77															
Medium	0.79	0.78	0.75															
High	0.70	0.72	0.60															

Panel C: Small - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.010	0.006	3.20	2.76	2.27	-1.54	-1.09	-1.38	-9.04	-5.86	-10.35	0.69	0.93	0.77	7.45	9.31	10.76
Medium	0.002	-0.001	-0.009	0.92	-0.29	-3.34	-1.14	-0.88	-1.15	-8.97	-5.67	-8.52	0.81	0.90	0.82	11.80	10.68	11.24
High	-0.006	-0.008	-0.015	-1.85	-2.47	-4.26	-1.31	-1.04	-1.04	-7.84	-6.22	-5.63	0.77	0.87	0.85	8.52	9.68	8.44
	S			t(S)			H			t(H)			M			t(M)		
Low	1.75	1.62	1.44	17.09	14.51	18.03	0.46	0.49	0.39	2.66	2.60	2.93	0.09	0.24	0.24	1.01	2.59	3.65
Medium	1.37	1.26	1.44	17.80	13.40	17.80	0.55	0.68	0.57	4.30	4.34	4.17	-0.29	-0.16	0.01	-4.53	-2.08	0.12
High	1.56	1.12	1.27	15.47	11.13	11.37	1.03	0.81	0.79	6.06	4.82	4.23	-0.68	-0.65	-0.44	-8.08	-7.79	-4.75
	R ²																	
Low	0.82	0.76	0.86															
Medium	0.85	0.74	0.83															
High	0.79	0.75	0.70															

Table 17 Continued

Panel D: Big - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.000	0.003	0.003	-0.01	1.46	1.43	0.53	0.63	0.37	3.59	6.49	3.72	0.96	0.94	1.03	12.02	17.88	19.45
Medium	0.002	0.000	-0.001	0.95	0.20	-0.53	0.34	0.57	0.03	3.58	7.70	0.27	0.92	0.94	0.86	17.61	23.76	16.37
High	-0.006	-0.004	-0.005	-2.92	-2.32	-1.68	-0.02	0.26	-0.12	-0.19	2.91	-0.78	0.93	1.00	0.79	15.29	20.49	9.45
	S			t(S)			H			t(H)			M			t(M)		
Low	0.15	-0.35	-0.24	1.63	-5.89	-4.11	-0.05	-0.38	-0.14	-0.36	-3.83	-1.41	-0.23	-0.17	0.01	-3.09	-3.56	0.16
Medium	0.24	-0.05	0.01	4.16	-1.18	0.24	0.13	0.06	0.24	1.39	0.76	2.48	-0.42	-0.12	-0.01	-8.64	-3.24	-0.26
High	0.47	0.12	0.07	6.89	2.13	0.77	0.65	0.55	0.45	5.72	6.00	2.85	-0.41	-0.35	-0.21	-7.27	-7.68	-2.72
	R ²																	
Low	0.44	0.65	0.69															
Medium	0.68	0.72	0.63															
High	0.67	0.72	0.41															

Panel E: Big - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.003	0.004	3.07	2.27	2.34	0.13	0.39	0.19	1.03	5.33	2.27	0.96	1.01	1.08	13.93	25.71	23.79
Medium	0.000	-0.001	-0.001	-0.04	-0.69	-0.61	0.38	0.01	-0.10	3.67	0.13	-1.12	1.19	0.98	1.08	21.10	22.10	21.41
High	-0.007	-0.006	-0.006	-2.81	-3.56	-2.30	-0.09	-0.07	-0.07	-0.74	-0.76	-0.53	1.11	1.01	0.96	16.44	21.04	13.71
	S			t(S)			H			t(H)			M			t(M)		
Low	-0.10	-0.36	-0.30	-1.26	-8.12	-5.96	-0.20	-0.19	-0.38	-1.59	-2.54	-4.52	-0.54	-0.15	0.05	-8.48	-4.07	1.07
Medium	0.02	-0.22	-0.02	0.34	-4.53	-0.42	0.33	0.24	0.34	3.07	2.91	3.57	-0.53	-0.27	0.05	-10.11	-6.73	1.03
High	0.27	0.02	0.20	3.60	0.29	2.55	0.60	0.60	0.61	4.77	6.75	4.64	-0.57	-0.25	-0.22	-9.09	-5.55	-3.40
	R ²																	
Low	0.67	0.81	0.83															
Medium	0.74	0.79	0.76															
High	0.72	0.75	0.56															

Panel F: Big - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.010	0.009	0.006	4.16	4.35	2.97	-0.38	-0.30	-0.35	-2.92	-2.75	-3.20	1.04	0.99	1.07	14.95	16.91	18.25
Medium	0.002	-0.002	-0.009	0.83	-0.80	-3.32	-0.21	-0.38	-0.48	-1.88	-3.77	-3.52	1.21	0.99	1.09	19.71	18.34	14.68
High	-0.010	-0.008	-0.014	-2.84	-3.19	-3.78	-0.80	-0.18	-0.83	-4.62	-1.42	-4.31	1.11	1.28	1.05	11.80	19.23	10.18
	S			t(S)			H			t(H)			M			t(M)		
Low	0.33	0.06	0.10	4.26	0.99	1.48	-0.34	-0.33	-0.63	-2.64	-2.98	-5.75	-0.32	-0.16	0.12	-4.94	-3.03	2.18
Medium	0.42	0.22	0.27	6.16	3.71	3.26	-0.11	0.32	0.15	-0.96	3.17	1.10	-0.71	-0.32	-0.14	-12.54	-6.35	-1.98
High	0.45	0.36	0.56	4.26	4.87	4.84	0.62	0.73	0.44	3.54	5.83	2.29	-0.74	-0.43	-0.28	-8.56	-7.07	-2.93
	R ²																	
Low	0.80	0.81	0.86															
Medium	0.85	0.80	0.73															
High	0.73	0.75	0.64															

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

STDVOLDIFF is the difference in the averages of the illiquid and liquid portfolios. RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for size.

BM is the return on the zero investment, factor mimicking portfolio for book-to-market. RPM-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and RPM-1 are all obtained from Kenneth French's website.

Table 18

Regressions of excess stock returns on the excess market return and the mimicking returns for liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(STDTURDIFF) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity																		
Momentum																		
Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	A			t(A)			L			t(L)			B			t(B)		
Low	0.007	0.011	0.012	2.42	4.32	4.31	-0.31	-0.06	-0.36	-1.93	-0.50	-2.53	0.76	0.69	0.62	8.98	10.09	8.31
Medium	0.001	0.007	0.005	0.68	4.65	2.68	0.24	0.32	0.20	2.22	4.13	2.16	0.83	0.65	0.83	14.30	15.64	16.90
High	-0.002	-0.001	-0.003	-0.87	-0.33	-1.04	0.17	0.24	-0.17	1.48	2.89	-1.36	0.88	0.79	0.73	14.23	17.97	10.83
S																		
Low	0.83	1.03	0.89	7.19	11.15	8.72	0.27	0.36	0.42	1.85	3.14	3.27	0.02	0.18	0.32	0.26	3.12	4.91
Medium	0.79	0.66	0.72	9.96	11.73	10.77	0.49	0.26	0.35	5.04	3.70	4.18	-0.15	-0.06	0.00	-2.91	-1.58	0.07
High	0.96	0.79	0.82	11.39	13.18	8.89	0.62	0.52	0.65	5.89	7.06	5.69	-0.37	-0.17	-0.14	-6.89	-4.47	-2.38
R ²																		
Low	0.59	0.64	0.62															
Medium	0.60	0.63	0.68															
High	0.67	0.71	0.60															
Panel B: Small - Medium Liquidity																		
Momentum																		
Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	A			t(A)			L			t(L)			B			t(B)		
Low	0.014	0.014	0.009	3.63	3.75	3.81	-1.20	-0.30	-0.74	-6.23	-1.53	-5.79	0.61	0.95	0.77	5.90	9.26	11.26
Medium	0.002	0.003	0.002	1.06	1.31	1.07	-0.37	-0.06	-0.31	-3.25	-0.59	-2.75	0.95	0.98	0.87	15.84	18.49	14.45
High	-0.006	-0.004	-0.004	-2.10	-1.76	-1.14	-0.25	-0.05	-0.45	-1.78	-0.46	-2.80	0.96	0.89	0.81	12.78	15.42	9.36
S																		
Low	1.19	1.25	0.80	8.45	8.90	8.64	0.25	0.28	0.28	1.46	1.59	2.47	0.25	0.04	0.31	2.81	0.39	5.31
Medium	0.88	0.87	0.87	10.69	12.03	10.63	0.53	0.44	0.45	5.23	4.91	4.47	-0.23	-0.05	-0.09	-4.34	-1.00	-1.81
High	1.03	0.90	0.82	10.00	11.36	7.02	0.83	0.59	0.69	6.45	6.02	4.71	-0.46	-0.27	-0.26	-7.02	-5.34	-3.49
R ²																		
Low	0.74	0.63	0.79															
Medium	0.79	0.78	0.76															
High	0.70	0.72	0.60															
Panel C: Small - High Liquidity																		
Momentum																		
Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner		
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.010	0.006	3.22	2.78	2.29	-1.52	-1.12	-1.25	-8.74	-5.96	-8.84	0.70	0.93	0.81	7.50	9.30	10.77
Medium	0.003	-0.001	-0.009	1.00	-0.29	-3.22	-1.00	-0.93	-1.10	-7.41	-5.89	-7.91	0.85	0.89	0.83	11.84	10.66	11.27
High	-0.006	-0.008	-0.015	-1.72	-2.31	-4.17	-1.19	-0.87	-0.99	-6.86	-4.99	-5.20	0.80	0.92	0.86	8.67	9.91	8.54
S																		
Low	0.96	1.04	0.78	7.55	7.63	7.61	0.22	0.34	0.12	1.40	2.02	0.91	-0.01	0.18	0.13	-0.15	2.06	1.99
Medium	0.83	0.78	0.86	8.46	6.81	8.57	0.30	0.58	0.37	2.48	4.06	2.94	-0.39	-0.21	-0.07	-6.22	-2.84	-1.13
High	0.92	0.65	0.75	7.31	5.14	5.43	0.76	0.56	0.60	4.85	3.58	3.52	-0.78	-0.75	-0.52	-9.69	-9.31	-5.88
R ²																		
Low	0.81	0.76	0.85															
Medium	0.84	0.74	0.82															
High	0.78	0.74	0.69															

Table 18 Continued

Panel D: Big - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.000	0.003	0.003	-0.02	1.56	1.37	0.54	0.73	0.33	3.57	7.64	3.28	0.96	0.96	1.02	12.01	18.84	19.14
Medium	0.002	0.000	-0.001	0.94	0.08	-0.55	0.35	0.49	0.00	3.58	6.33	-0.02	0.92	0.92	0.85	17.62	22.46	16.24
High	-0.006	-0.004	-0.005	-2.90	-2.41	-1.74	0.02	0.13	-0.24	0.14	1.44	-1.57	0.94	0.97	0.76	15.45	19.58	9.15
	S			t(S)			H			t(H)			M			t(M)		
Low	0.43	0.03	-0.07	3.90	0.41	-0.92	0.02	-0.34	-0.07	0.17	-3.93	-0.72	-0.20	-0.16	0.04	-2.83	-3.50	0.82
Medium	0.42	0.21	0.02	5.98	3.77	0.22	0.18	0.18	0.26	2.07	2.65	2.97	-0.40	-0.07	-0.01	-8.74	-1.89	-0.11
High	0.47	0.20	-0.04	5.69	2.95	-0.39	0.62	0.66	0.50	6.07	7.88	3.53	-0.42	-0.30	-0.19	-7.90	-7.04	-2.65
	R ²																	
Low	0.44	0.67	0.69															
Medium	0.68	0.70	0.63															
High	0.67	0.71	0.41															

Panel E: Big - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.003	0.004	3.31	2.36	2.24	0.43	0.45	0.11	3.38	6.24	1.32	1.03	1.03	1.06	15.29	26.59	23.21
Medium	0.000	-0.001	-0.001	0.00	-0.70	-0.56	0.46	0.01	-0.06	4.40	0.08	-0.61	1.21	0.98	1.09	21.67	22.09	21.61
High	-0.007	-0.006	-0.006	-2.72	-3.54	-2.36	0.05	-0.05	-0.16	0.43	-0.57	-1.21	1.15	1.01	0.94	16.96	21.13	13.45
	S			t(S)			H			t(H)			M			t(M)		
Low	0.10	-0.13	-0.23	1.07	-2.40	-3.77	-0.35	-0.17	-0.31	-3.09	-2.53	-4.02	-0.59	-0.14	0.07	-10.15	-4.10	1.84
Medium	0.26	-0.22	-0.06	3.35	-3.64	-0.85	0.34	0.24	0.29	3.57	3.26	3.43	-0.52	-0.27	0.03	-10.73	-7.12	0.72
High	0.29	-0.01	0.12	3.10	-0.20	1.31	0.50	0.58	0.65	4.40	7.20	5.49	-0.60	-0.25	-0.20	-10.29	-6.09	-3.38
	R ²																	
Low	0.69	0.81	0.82															
Medium	0.75	0.79	0.76															
High	0.72	0.75	0.57															

Panel F: Big - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.010	0.009	0.006	4.17	4.36	2.94	-0.68	-0.55	-0.70	-5.41	-5.22	-6.80	0.97	0.94	0.99	14.55	16.56	18.10
Medium	0.002	-0.002	-0.009	0.75	-0.79	-3.47	-0.36	-0.39	-0.65	-3.19	-3.81	-4.78	1.18	0.99	1.05	19.43	18.35	14.48
High	-0.010	-0.008	-0.014	-2.83	-3.17	-3.82	-0.82	-0.16	-0.92	-4.67	-1.26	-4.77	1.11	1.29	1.03	11.80	19.30	10.08
	S			t(S)			H			t(H)			M			t(M)		
Low	0.00	-0.20	-0.24	0.05	-2.60	-3.15	-0.23	-0.23	-0.48	-2.02	-2.38	-5.21	-0.28	-0.13	0.17	-4.76	-2.63	3.61
Medium	0.25	0.02	-0.06	2.99	0.30	-0.56	-0.06	0.27	0.18	-0.56	2.95	1.44	-0.69	-0.34	-0.13	-13.17	-7.21	-2.06
High	0.02	0.28	0.09	0.14	3.05	0.62	0.51	0.69	0.37	3.23	6.11	2.14	-0.79	-0.45	-0.31	-9.66	-7.76	-3.49
	R ²																	
Low	0.82	0.82	0.88															
Medium	0.86	0.80	0.74															
High	0.73	0.75	0.65															

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

STDTURDIFF is the difference in the averages of the illiquid and liquid portfolios. RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for IFF is

BM is the return on the zero investment, factor mimicking portfolio for book-to-market. RPM-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and RPM-1 are all obtained from Kenneth French's website.

Table 19

Regressions of excess stock returns on the excess market return and the mimicking returns for liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(CVVOLDIFF) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.011	0.012	2.59	4.36	4.52	-0.22	0.02	-0.26	-1.38	0.19	-1.84	0.82	0.70	0.69	10.71	11.46	10.18
Medium	0.001	0.006	0.004	0.47	4.19	2.49	0.19	0.15	0.02	1.78	1.84	0.16	0.78	0.58	0.79	14.92	15.09	17.52
High	-0.002	-0.001	-0.002	-1.04	-0.56	-0.89	0.23	0.10	-0.37	2.02	1.16	-2.98	0.85	0.74	0.75	15.35	18.37	12.52
	S			t(S)			H			t(H)			M			t(M)		
Low	0.91	1.07	0.98	8.87	13.07	10.80	0.16	0.32	0.29	1.28	3.29	2.69	-0.03	0.17	0.27	-0.39	3.13	4.49
Medium	0.73	0.56	0.64	10.49	10.99	10.74	0.58	0.40	0.46	6.94	6.58	6.45	-0.11	0.00	0.04	-2.46	-0.06	1.12
High	0.95	0.71	0.80	12.80	13.30	9.99	0.65	0.63	0.66	7.36	9.95	6.97	-0.36	-0.13	-0.14	-7.29	-3.65	-2.70
	R ²																	
Low	0.59	0.64	0.62															
Medium	0.60	0.61	0.68															
High	0.67	0.70	0.61															

Panel B: Small - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.016	0.014	0.011	3.92	3.85	4.08	-0.55	0.08	-0.32	-2.67	0.42	-2.35	0.86	1.03	0.92	8.72	11.03	14.23
Medium	0.003	0.003	0.003	1.27	1.33	1.37	0.10	0.14	-0.39	0.85	1.44	-3.48	1.05	1.00	0.92	18.88	21.05	17.14
High	-0.005	-0.004	-0.003	-1.98	-1.74	-0.87	0.14	0.05	-0.43	1.00	0.44	-2.63	1.03	0.91	0.89	15.10	17.39	11.43
	S			t(S)			H			t(H)			M			t(M)		
Low	1.56	1.39	1.04	11.86	11.25	12.00	-0.27	0.08	-0.04	-1.72	0.58	-0.42	0.05	-0.04	0.19	0.53	-0.43	3.26
Medium	1.06	0.93	0.90	14.36	14.68	12.67	0.30	0.37	0.39	3.38	4.85	4.63	-0.31	-0.07	-0.12	-6.47	-1.72	-2.65
High	1.17	0.93	0.91	12.89	13.39	8.79	0.64	0.55	0.55	5.92	6.64	4.50	-0.53	-0.28	-0.32	-8.79	-6.20	-4.67
	R ²																	
Low	0.70	0.63	0.76															
Medium	0.78	0.78	0.76															
High	0.70	0.72	0.60															

Panel C: Small - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.013	0.012	0.008	3.45	3.06	2.86	-0.42	-0.28	-0.88	-2.10	-1.40	-5.74	1.03	1.18	1.06	10.80	12.23	14.39
Medium	0.004	0.001	-0.007	1.49	0.18	-2.37	-0.40	-0.24	-0.87	-2.71	-1.42	-5.94	1.07	1.10	1.04	15.00	13.62	14.92
High	-0.004	-0.006	-0.013	-1.06	-1.81	-3.71	-0.36	-0.59	-1.09	-1.91	-3.29	-5.82	1.07	1.09	1.04	11.71	12.69	11.52
	S			t(S)			H			t(H)			M			t(M)		
Low	1.50	1.44	1.09	11.77	11.27	11.17	-0.52	-0.21	-0.34	-3.46	-1.38	-2.90	-0.30	-0.03	-0.06	-3.55	-0.39	-0.86
Medium	1.16	1.11	1.11	12.22	10.36	11.95	-0.15	0.12	0.00	-1.33	0.93	-0.03	-0.57	-0.38	-0.23	-9.07	-5.40	-3.69
High	1.34	0.87	0.89	11.07	7.62	7.47	0.19	0.24	0.36	1.31	1.77	2.54	-1.00	-0.88	-0.63	-12.54	-11.68	-7.94
	R ²																	
Low	0.75	0.72	0.82															
Medium	0.80	0.71	0.81															
High	0.74	0.72	0.70															

Table 19 Continued

Panel D: Big - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	-0.001	0.002	0.002	-0.37	0.81	1.10	0.53	0.51	-0.01	3.49	5.01	-0.12	0.86	0.82	0.94	11.96	16.68	19.15
Medium	0.001	-0.001	-0.001	0.62	-0.43	-0.49	0.15	0.21	-0.33	1.51	2.56	-3.46	0.84	0.82	0.83	17.56	20.68	18.09
High	-0.006	-0.005	-0.005	-2.90	-2.53	-1.60	-0.08	0.07	-0.80	-0.73	0.71	-5.40	0.93	0.94	0.77	17.00	21.02	10.90
	S			t(S)			H			t(H)			M			t(M)		
Low	0.33	-0.16	-0.21	3.43	-2.39	-3.22	0.17	-0.07	0.13	1.53	-0.94	1.61	-0.13	-0.05	0.11	-2.06	-1.08	2.53
Medium	0.31	0.06	-0.07	4.89	1.06	-1.10	0.34	0.40	0.36	4.45	6.40	4.93	-0.33	0.02	0.03	-7.95	0.49	0.62
High	0.44	0.16	-0.14	6.09	2.66	-1.50	0.66	0.72	0.59	7.60	10.13	5.27	-0.41	-0.28	-0.17	-8.47	-7.14	-2.73
	R²																	
Low	0.44	0.62	0.67															
Medium	0.67	0.66	0.65															
High	0.67	0.71	0.47															

Panel E: Big - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.007	0.002	0.004	2.97	1.75	2.29	0.19	0.44	-0.32	1.48	6.04	-3.79	0.94	0.94	1.02	15.16	27.00	25.32
Medium	-0.001	-0.001	-0.001	-0.45	-0.66	-0.45	0.53	-0.20	-0.36	5.10	-2.44	-3.94	1.13	0.96	1.08	22.76	24.49	24.60
High	-0.007	-0.006	-0.006	-2.78	-3.50	-2.24	0.08	-0.01	-0.42	0.66	-0.09	-3.27	1.14	1.02	0.95	18.69	23.69	15.44
	S			t(S)			H			t(H)			M			t(M)		
Low	-0.04	-0.21	-0.36	-0.44	-4.47	-6.81	-0.17	-0.04	-0.15	-1.69	-0.66	-2.43	-0.52	-0.08	0.13	-9.59	-2.67	3.60
Medium	0.19	-0.27	-0.13	2.90	-5.22	-2.14	0.45	0.31	0.37	5.67	4.92	5.26	-0.47	-0.25	0.05	-10.81	-7.35	1.36
High	0.28	0.01	0.09	3.50	0.12	1.05	0.51	0.56	0.68	5.30	8.16	6.98	-0.60	-0.26	-0.20	-11.25	-6.95	-3.70
	R²																	
Low	0.68	0.81	0.83															
Medium	0.76	0.79	0.77															
High	0.72	0.75	0.58															

Panel F: Big - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.010	0.007	4.34	4.50	3.41	-0.09	0.12	-0.50	-0.68	1.05	-4.61	1.13	1.07	1.13	17.65	19.97	21.80
Medium	0.002	-0.001	-0.008	1.00	-0.44	-3.39	-0.10	-0.27	-1.24	-0.87	-2.58	-10.53	1.26	1.07	1.14	22.57	21.57	20.18
High	-0.008	-0.007	-0.012	-2.35	-3.07	-3.49	-0.33	-0.05	-1.26	-1.80	-0.43	-6.86	1.28	1.32	1.18	14.60	21.91	13.38
	S			t(S)			H			t(H)			M			t(M)		
Low	0.27	0.07	-0.06	3.20	0.92	-0.90	-0.59	-0.58	-0.74	-5.81	-6.78	-8.98	-0.41	-0.26	0.07	-7.36	-5.47	1.51
Medium	0.38	0.12	-0.09	5.07	1.82	-1.19	-0.23	0.13	0.17	-2.66	1.63	1.87	-0.76	-0.40	-0.16	-15.58	-9.12	-3.14
High	0.29	0.33	0.16	2.45	4.13	1.36	0.14	0.62	0.22	1.02	6.46	1.57	-0.93	-0.48	-0.39	-12.10	-9.05	-5.05
	R²																	
Low	0.79	0.80	0.86															
Medium	0.85	0.79	0.81															
High	0.71	0.75	0.68															

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

CVVOLDIFF is the difference in the averages of the illiquid and liquid portfolios. RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for IFF is

BM is the return on the zero investment, factor mimicking portfolio for book-to-market. RPM-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and RPM-1 are all obtained from Kenneth French's website.

Table 20

Regressions of excess stock returns on the excess market return and the mimicking returns for
liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - Rf_m = A + L(CVTURDIFF) + B(RM_m) + S(SIZE_m) + H(BM_m) + M(RP_{m-1}) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.011	0.013	2.52	4.40	4.60	0.01	-0.12	-0.29	0.02	-0.53	-1.20	0.84	0.70	0.71	10.89	11.53	10.46
Medium	0.001	0.007	0.005	0.48	4.39	2.77	0.03	-0.20	-0.30	0.16	-1.46	-1.89	0.77	0.57	0.79	14.70	14.97	17.81
High	-0.003	-0.001	-0.001	-1.12	-0.48	-0.53	0.20	-0.05	-0.57	0.98	-0.32	-2.66	0.84	0.73	0.78	15.08	18.31	12.99
	S			t(S)			H			t(H)			M			t(M)		
Low	0.97	1.04	0.99	9.07	12.32	10.54	0.09	0.32	0.20	0.81	3.59	2.04	-0.05	0.17	0.24	-0.70	3.21	4.07
Medium	0.69	0.49	0.58	9.47	9.22	9.53	0.63	0.44	0.45	8.19	7.73	6.94	-0.09	0.01	0.04	-2.09	0.24	1.05
High	0.92	0.68	0.79	11.96	12.23	9.53	0.72	0.66	0.53	8.80	11.16	6.06	-0.33	-0.12	-0.19	-6.88	-3.49	-3.62
	R ²																	
Low	0.59	0.64	0.62															
Medium	0.59	0.60	0.68															
High	0.66	0.70	0.60															

Panel B: Small - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.015	0.014	0.011	3.67	3.76	4.14	0.20	0.11	-0.29	0.56	0.34	-1.23	0.89	1.02	0.94	8.94	11.04	14.51
Medium	0.002	0.003	0.004	0.98	1.37	1.88	0.38	-0.03	-0.73	1.94	-0.20	-3.84	1.04	0.99	0.95	18.97	20.93	17.88
High	-0.006	-0.004	-0.001	-2.09	-1.77	-0.47	0.24	0.08	-0.82	1.00	0.43	-2.97	1.02	0.90	0.92	15.05	17.44	11.95
	S			t(S)			H			t(H)			M			t(M)		
Low	1.74	1.39	1.07	12.56	10.87	11.82	-0.42	0.11	-0.15	-2.88	0.82	-1.51	0.00	-0.03	0.15	-0.01	-0.32	2.69
Medium	1.10	0.89	0.87	14.54	13.49	11.87	0.34	0.41	0.25	4.18	5.80	3.27	-0.30	-0.06	-0.17	-6.32	-1.44	-3.79
High	1.18	0.93	0.87	12.53	12.97	8.17	0.69	0.56	0.40	6.89	7.39	3.55	-0.51	-0.28	-0.37	-8.69	-6.21	-5.60
	R ²																	
Low	0.70	0.63	0.76															
Medium	0.78	0.78	0.77															
High	0.70	0.72	0.60															

Panel C: Small - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A			t(A)			L			t(L)			B			t(B)		
Low	0.012	0.012	0.010	3.16	3.00	3.20	0.41	-0.05	-1.04	1.19	-0.14	-3.84	1.05	1.19	1.11	11.01	12.42	14.74
Medium	0.005	0.001	-0.005	1.55	0.20	-1.68	-0.27	-0.10	-1.22	-1.04	-0.35	-4.78	1.09	1.11	1.10	15.24	13.83	15.49
High	-0.004	-0.005	-0.011	-1.20	-1.52	-3.03	0.25	-0.64	-1.37	0.77	-2.06	-4.14	1.09	1.13	1.11	11.92	13.04	12.01
	S			t(S)			H			t(H)			M			t(M)		
Low	1.68	1.51	1.13	12.65	11.31	10.76	-0.63	-0.29	-0.63	-4.48	-2.07	-5.62	-0.33	-0.06	-0.15	-3.98	-0.72	-2.37
Medium	1.21	1.16	1.11	12.20	10.35	11.29	-0.28	0.05	-0.30	-2.60	0.39	-2.81	-0.61	-0.41	-0.33	-9.82	-5.84	-5.34
High	1.48	0.91	0.93	11.71	7.55	7.23	0.09	0.05	0.00	0.68	0.37	-0.01	-1.03	-0.95	-0.75	-13.10	-12.65	-9.42
	R ²																	
Low	0.75	0.72	0.80															
Medium	0.80	0.70	0.80															
High	0.73	0.71	0.68															

Table 20 Continued

Panel D: Big - Low Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	-0.001	0.002	0.003	-0.40	0.93	1.49	0.20	-0.08	-0.43	0.77	-0.43	-2.50	0.83	0.79	0.95	11.32	15.39	19.62
Medium	0.001	0.000	0.000	0.71	0.03	0.16	-0.08	-0.38	-0.77	-0.47	-2.66	-4.79	0.83	0.81	0.86	17.43	20.61	19.18
High	-0.006	-0.005	-0.003	-2.86	-2.51	-0.95	-0.02	0.02	-1.22	-0.12	0.13	-4.75	0.93	0.94	0.83	17.18	21.05	11.60
	S			t(S)			H			t(H)			M			t(M)		
Low	0.23	-0.30	-0.29	2.28	-4.21	-4.26	0.33	0.07	0.11	3.08	0.98	1.52	-0.08	0.00	0.10	-1.24	-0.02	2.41
Medium	0.26	-0.06	-0.12	3.92	-1.19	-1.94	0.38	0.45	0.24	5.37	7.77	3.60	-0.32	0.03	-0.02	-7.79	0.88	-0.50
High	0.46	0.15	-0.16	6.10	2.35	-1.58	0.63	0.74	0.32	7.89	11.23	3.03	-0.41	-0.27	-0.27	-8.81	-7.12	-4.30
	R²																	
Low	0.41	0.58	0.68															
Medium	0.66	0.66	0.66															
High	0.67	0.71	0.46															

Panel E: Big - Medium Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.008	0.003	0.005	3.21	1.72	3.12	-0.35	0.00	-0.78	-1.58	0.01	-5.66	0.93	0.92	1.04	15.14	24.57	27.03
Medium	-0.001	0.000	0.001	-0.52	0.04	0.37	0.24	-0.68	-0.91	1.29	-5.03	-6.01	1.10	0.98	1.11	21.17	26.10	26.44
High	-0.007	-0.006	-0.005	-2.68	-3.26	-1.87	-0.08	-0.22	-0.58	-0.35	-1.42	-2.61	1.13	1.02	0.98	18.73	24.00	15.88
	S			t(S)			H			t(H)			M			t(M)		
Low	-0.15	-0.32	-0.42	-1.72	-6.16	-7.92	-0.12	0.09	-0.27	-1.34	1.67	-4.79	-0.51	-0.04	0.08	-9.59	-1.28	2.51
Medium	0.10	-0.34	-0.20	1.40	-6.59	-3.35	0.61	0.23	0.23	7.94	4.07	3.74	-0.42	-0.28	0.00	-9.33	-8.76	0.09
High	0.25	-0.03	0.09	2.96	-0.50	1.05	0.53	0.55	0.54	5.97	8.70	5.92	-0.59	-0.27	-0.25	-11.37	-7.26	-4.67
	R²																	
Low	0.68	0.78	0.84															
Medium	0.73	0.81	0.79															
High	0.72	0.76	0.58															

Panel F: Big - High Liquidity																		
Momentum																		
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A			t(A)			L			t(L)			B			t(B)		
Low	0.011	0.009	0.008	4.16	4.14	3.51	0.18	0.46	-0.44	0.77	2.43	-2.30	1.13	1.06	1.16	17.83	20.12	21.82
Medium	0.003	0.000	-0.005	1.15	0.13	-2.08	-0.24	-0.72	-1.77	-1.21	-4.14	-8.22	1.27	1.09	1.22	22.89	22.63	20.37
High	-0.008	-0.007	-0.010	-2.35	-2.92	-2.68	0.01	-0.17	-1.66	0.04	-0.81	-5.08	1.30	1.32	1.27	14.80	22.15	13.86
	S			t(S)			H			t(H)			M			t(M)		
Low	0.33	0.12	-0.01	3.71	1.61	-0.20	-0.61	-0.53	-0.90	-6.50	-6.77	-11.42	-0.42	-0.24	0.01	-7.62	-5.22	0.32
Medium	0.36	0.06	-0.09	4.68	0.90	-1.10	-0.27	0.03	-0.25	-3.33	0.38	-2.84	-0.78	-0.43	-0.30	-16.23	-10.43	-5.81
High	0.37	0.31	0.18	3.05	3.78	1.45	0.05	0.59	-0.20	0.36	6.74	-1.51	-0.96	-0.49	-0.54	-12.67	-9.41	-6.81
	R²																	
Low	0.79	0.81	0.85															
Medium	0.85	0.80	0.78															
High	0.70	0.75	0.65															

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

CVTURDIFF is the difference in the averages of the illiquid and liquid portfolios. RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for IFF is

BM is the return on the zero investment, factor mimicking portfolio for book-to-market. Rpm-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and Rpm-1 are all obtained from Kenneth French's website.

Although a direct comparison is not possible, these findings seem to be contradictory to the findings of Fama and French (1993). They report results that imply the tendency for non-zero intercepts to exist only in portfolios that are comprised of the smallest stocks with the lowest book-to-market ratios, and for the biggest stocks with the lowest book-to-market ratios. For example, in the small-low book-to-market portfolio they find a negative and significant intercept coefficient. Whereas, my findings indicate that small firms and low book-to-market firms tend to have positive and significant intercept coefficients.

4D. Bull and Bear Decomposition

4D1. Bull and Bear Summary Statistics

Prior to my discussion of the results of the regressions for the bull and bear decompositions, I examine the summary statistics of the explanatory returns for bull and bear months. The bull market results are reported in Table 21A and the bear market results are reported in Table 21B. The summary statistics reported are similar to the summary statistics of the full.

In the tables there are expected patterns to the returns for the bull and bear months. The market factor and the size factor both have higher values in bull months than in bear months. In the book-to-market and liquidity factors the bear month values are higher than the bull month values, with the bull month average being negative, indicating a reversal of each construct in bull months. For the book-to-market factor, high minus low book-to-market firms, the negative bull month average shows that in bull months firms with a low book-to-market ratio, typically referred to as glamour stocks, do better than high book-to-market firms. The average liquidity factor indicates that liquid firms do better than illiquid firms in bull months, and vice versa in bear months, as shown by the negative value in bull months and the positive value in bear months. For the momentum factor, winners minus losers, both the bull and bear month values are positive. However, the value for bull months is lower than that for bear months. This illustrates the fact that all stocks do well in bull months. In bull months, the “loser” stocks do well enough to reduce the gap between the winners and losers, as compared to bear months.

Table 21A
Summary statistics for the monthly explanatory returns (in percent) in the time-series regressions:
Bull months between July 1983 to December 2002, 117 observations. (Value-weighted)

Name	Mean	Std.	t(mean)	Min	Max
VOLDIFF	-1.79	3.38	-5.74	-22.43	10.61
TURDIFF	-1.77	4.09	-4.68	-24.32	10.19
FM_VOL	-0.02	2.05	-0.09	-10.58	4.71
FM_TUR	0.09	2.13	0.43	-10.46	6.19
RM	3.94	2.30	8.53	0.87	12.42
SIZE	0.36	3.80	1.01	-16.26	21.38
BM	-1.25	2.90	-4.66	-12.05	7.48
RP _{m-1}	0.65	5.20	1.35	-25.13	18.21

VOLDIFF and TURDIFF are the differences between illiquid stock portfolios and liquid stock portfolios using dollar volume and share turnover. FM_VOL and FM_TUR are the residuals from the regressions of the volume differences versus the three factors from Fama and French (1993) and the momentum factor from Carhart (1997). RM, SIZE, and BM are the three factors from Fama and French (1993) and RP_{m-1} is the momentum factor. All four factors were obtained from Kenneth French's website.

Table 21B
Summary statistics for the monthly explanatory returns (in percent) in the time-series regressions:
Bear months between July 1983 to December 2002, 117 observations. (Value-weighted)

Name	Mean	Std.	t(mean)	Min	Max
VOLDIFF	2.41	2.83	9.21	-1.83	14.64
TURDIFF	2.39	3.37	7.69	-4.72	15.33
FM_VOL	0.02	1.61	0.11	-4.82	4.61
FM_TUR	-0.09	1.80	-0.51	-4.30	4.54
RM	-2.92	3.58	-8.81	-23.09	1.06
SIZE	-0.56	3.05	-2.00	-8.31	8.49
BM	2.13	2.99	7.71	-3.52	13.67
RP _{m-1}	1.15	3.65	3.41	-9.18	12.66

VOLDIFF and TURDIFF are the differences between illiquid stock portfolios and liquid stock portfolios using dollar volume and share turnover. FM_VOL and FM_TUR are the residuals from the regressions of the volume differences versus the three factors from Fama and French (1993) and the momentum factor from Carhart (1997). RM, SIZE, and BM are the three factors from Fama and French (1993) and RP_{m-1} is the momentum factor. All four factors were obtained from Kenneth French's website.

4D2. Bull and Bear Month Regressions

In this section I discuss the results from the decomposition of the sample into bull and bear months and state the outcome of the differences in the relationships between returns and the various asset-pricing variables across these market conditions. Tables 22 through 25¹⁹ report the results from the regressions that include an indicator variable for the market condition. The benefit of using a dummy variable to account for the difference is that there is a clear test of significance for a difference between the conditions. The interaction terms in the regression pick up these differences and show their significance. Overall there seems to be no distinct pattern of a difference between bull and bear months, as evidenced by the lack of significance on the interaction terms in the regression equations.

¹⁹ The bull-bear regressions for the variability in liquidity measures are not reported.

Table 22

Regressions of excess stock returns on the excess market return and the mimicking returns for liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - RF_m = A + A1(D) + L(FM_VOL_m) + L1(FM_VOL_m * D) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity

Book-to-market	Momentum																										
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)			R ²		
Low	0.029	0.021	0.024	4.69	3.96	4.20	-0.036	-0.009	-0.013	-4.07	-1.24	-1.53	-0.30	-0.66	-0.56	-0.83	-2.12	-1.66	0.10	1.14	0.73	0.20	2.75	1.63	0.07	0.04	0.02
Medium	0.009	0.010	0.006	2.01	2.99	1.43	-0.005	0.003	0.009	-0.78	0.65	1.53	0.03	0.23	0.01	0.12	1.26	0.05	0.41	0.23	0.41	1.20	0.92	1.26	0.02	0.04	0.03
High	-0.003	-0.001	-0.007	-0.58	-0.14	-1.45	0.009	0.009	0.018	1.22	1.75	2.57	0.02	-0.05	-0.57	0.08	-0.25	-1.98	0.54	0.65	0.86	1.38	2.19	2.24	0.03	0.05	0.05

Panel B: Small - Medium Liquidity

Book-to-market	Momentum																										
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)			R ²		
Low	0.029	0.024	0.016	3.14	2.96	2.28	-0.025	-0.009	-0.001	-1.92	-0.83	-0.15	-1.97	-1.14	-0.96	-3.65	-2.46	-2.38	1.51	1.85	0.93	2.08	2.98	1.72	0.07	0.04	0.02
Medium	0.005	0.004	0.000	0.81	0.67	0.06	0.002	0.009	0.012	0.21	1.22	1.53	-0.65	-0.37	-0.60	-1.81	-1.19	-1.80	0.68	0.70	0.78	1.40	1.69	1.75	0.01	0.02	0.03
High	-0.008	-0.007	-0.011	-1.26	-1.28	-1.74	0.011	0.014	0.021	1.20	1.88	2.36	-0.57	-0.48	-0.67	-1.51	-1.59	-1.80	0.79	0.86	0.53	1.56	2.13	1.08	0.02	0.03	0.04

Panel C: Small - High Liquidity

Book-to-market	Momentum																										
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)			R ²		
Low	0.021	0.020	0.009	2.08	2.13	1.05	-0.019	-0.011	-0.001	-1.34	-0.80	-0.07	-2.11	-1.77	-1.80	-3.69	-3.23	-3.49	1.05	1.32	1.07	1.37	1.80	1.55	0.08	0.05	0.06
Medium	-0.002	-0.004	-0.017	-0.19	-0.49	-2.13	0.007	0.011	0.022	0.59	1.06	1.89	-1.43	-1.75	-1.41	-2.99	-3.96	-2.97	0.56	1.41	0.65	0.88	2.38	1.02	0.06	0.07	0.07
High	-0.017	-0.022	-0.032	-1.84	-2.67	-3.77	0.016	0.025	0.032	1.25	2.12	2.68	-1.61	-1.13	-0.86	-3.05	-2.33	-1.75	0.58	0.24	-0.14	0.81	0.36	-0.21	0.07	0.06	0.07

Panel D: Big - Low Liquidity

Book-to-market	Momentum																										
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)			R ²		
Low	0.001	-0.003	-0.005	0.11	-0.84	-1.20	0.007	0.020	0.028	1.04	3.49	4.57	0.06	0.46	0.23	0.20	1.97	0.91	0.94	0.26	0.34	2.44	0.82	1.00	0.07	0.11	0.11
Medium	-0.004	-0.003	-0.008	-0.83	-0.75	-2.10	0.015	0.017	0.025	2.49	3.53	4.56	0.41	0.55	-0.03	1.63	2.79	-0.12	-0.03	0.05	0.17	-0.09	0.17	0.57	0.05	0.12	0.08
High	-0.012	-0.013	-0.017	-2.40	-3.16	-3.33	0.018	0.028	0.031	2.51	4.78	4.36	0.14	0.20	-0.29	0.48	0.82	-1.02	-0.15	0.11	0.46	-0.40	0.35	1.20	0.03	0.10	0.08

Panel E: Big - Medium Liquidity

Book-to-market	Momentum																										
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)			R ²		
Low	-0.008	-0.004	-0.008	-1.46	-0.98	-1.54	0.030	0.023	0.033	3.87	4.06	4.73	0.40	0.35	0.18	1.22	1.47	0.61	-0.38	0.10	0.15	-0.89	0.32	0.39	0.07	0.09	0.09
Medium	-0.010	-0.016	-0.012	-1.98	-3.76	-2.52	0.028	0.037	0.036	3.82	6.18	5.44	0.42	0.31	-0.18	1.41	1.26	-0.66	-0.01	-0.38	0.30	-0.03	-1.16	0.83	0.07	0.15	0.12
High	-0.021	-0.016	-0.018	-3.66	-3.74	-3.84	0.034	0.031	0.036	4.12	5.01	5.28	0.21	0.12	-0.28	0.62	0.46	-1.00	-0.51	-0.30	0.40	-1.12	-0.89	1.08	0.07	0.10	0.11

Panel F: Big - High Liquidity

Book-to-market	Momentum																										
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)			R ²		
Low	-0.002	-0.007	-0.011	-0.21	-1.16	-1.46	0.023	0.035	0.039	2.21	4.03	3.87	-0.24	-0.36	-0.59	-0.57	-1.01	-1.41	-0.19	0.08	0.50	-0.33	0.17	0.89	0.03	0.07	0.07
Medium	-0.020	-0.018	-0.033	-2.68	-3.35	-5.14	0.040	0.038	0.054	3.79	4.91	6.04	0.09	-0.12	-0.34	0.21	-0.40	-0.91	-0.54	-0.39	-0.04	-0.93	-0.92	-0.08	0.06	0.11	0.15
High	-0.037	-0.027	-0.053	-4.54	-4.49	-7.35	0.052	0.049	0.082	4.52	5.71	8.04	-0.46	-0.16	-1.03	-0.98	-0.46	-2.45	-0.67	0.01	0.52	-1.07	0.02	0.93	0.11	0.13	0.24

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups. FM VOL is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997). D is an indicator variable that equal 1 for a bear market and 0 for bull markets.

Table 23

Regressions of excess stock returns on the excess market return and the mimicking returns for liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - RF_m = A + A1(D) + L(FM_TUR_m) + L1(FM_TUR_m * D) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity

Book-to-market	Momentum																										
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)			R ²		
Low	0.029	0.021	0.025	4.75	3.94	4.28	-0.036	-0.009	-0.013	-4.14	-1.21	-1.57	-0.45	-0.41	-0.65	-1.39	-1.45	-2.12	0.18	0.86	0.79	0.39	2.21	1.88	0.08	0.03	0.03
Medium	0.009	0.009	0.006	1.97	2.94	1.42	-0.005	0.003	0.009	-0.74	0.72	1.55	0.13	0.25	0.03	0.54	1.49	0.13	0.19	0.15	0.33	0.59	0.66	1.10	0.01	0.04	0.02
High	-0.003	-0.001	-0.007	-0.57	-0.15	-1.37	0.009	0.010	0.018	1.21	1.77	2.50	0.02	0.00	-0.64	0.09	0.01	-2.46	0.25	0.44	0.72	0.68	1.58	2.02	0.01	0.03	0.05

Panel B: Small - Medium Liquidity

Book-to-market	Momentum																										
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)			R ²		
Low	0.031	0.024	0.016	3.31	3.04	2.36	-0.027	-0.010	-0.002	-2.07	-0.86	-0.21	-2.15	-1.15	-0.97	-4.40	-2.72	-2.65	1.62	1.79	0.85	2.44	3.11	1.70	0.09	0.04	0.03
Medium	0.005	0.004	0.001	0.84	0.67	0.13	0.006	0.011	0.012	0.19	1.22	1.47	-0.53	-0.20	-0.67	-1.59	-0.72	-2.19	0.55	0.45	0.71	1.22	1.16	1.72	0.01	0.01	0.03
High	-0.008	-0.006	-0.011	-1.23	-1.24	-1.67	0.011	0.014	0.020	1.16	1.85	2.28	-0.46	-0.38	-0.80	-1.33	-1.38	-2.39	0.41	0.58	0.45	0.86	1.53	0.99	0.01	0.03	0.05

Panel C: Small - High Liquidity

Book-to-market	Momentum																										
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)			R ²		
Low	0.021	0.021	0.010	2.14	2.21	1.15	-0.020	-0.012	-0.002	-1.42	-0.88	-0.18	-1.74	-1.64	-1.72	-3.32	-3.27	-3.67	0.74	1.20	0.99	1.03	1.76	1.55	0.07	0.05	0.07
Medium	-0.001	-0.003	-0.017	-0.12	-0.44	-2.05	0.006	0.011	0.021	0.52	1.00	1.80	-1.24	-1.27	-1.30	-2.83	-3.10	-3.00	0.52	1.00	0.59	0.87	1.79	0.99	0.05	0.05	0.07
High	-0.016	-0.022	-0.031	-1.78	-2.61	-3.73	0.015	0.024	0.031	1.16	2.03	2.59	-1.33	-1.11	-1.08	-2.74	-2.52	-2.44	0.22	0.19	-0.08	0.34	0.32	-0.13	0.06	0.07	0.09

Panel D: Big - Low Liquidity

Book-to-market	Momentum																										
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)			R ²		
Low	0.000	-0.004	-0.005	0.08	-1.06	-1.25	0.008	0.021	0.028	1.13	3.93	4.64	0.16	0.83	0.33	0.61	4.10	1.46	0.78	0.15	0.15	2.20	0.56	0.48	0.07	0.20	0.11
Medium	-0.004	-0.003	-0.008	-0.91	-0.91	-2.14	0.015	0.018	0.026	2.55	3.73	4.59	0.53	0.73	0.12	2.31	4.14	0.57	-0.31	-0.22	-0.03	-1.01	-0.90	-0.12	0.05	0.14	0.08
High	-0.012	-0.014	-0.017	-2.40	-3.24	-3.31	0.018	0.029	0.031	2.52	4.84	4.34	0.11	0.41	-0.23	0.40	1.83	-0.85	-0.09	-0.27	0.30	-0.24	-0.90	0.83	0.03	0.10	0.08

Panel E: Big - Medium Liquidity

Book-to-market	Momentum																										
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)			R ²		
Low	-0.009	-0.005	-0.008	-1.54	-1.13	-1.53	0.031	0.024	0.033	3.97	4.27	4.73	0.57	0.66	0.04	1.95	3.11	0.15	-0.36	-0.19	0.23	-0.89	-0.67	0.65	0.08	0.12	0.09
Medium	-0.011	-0.016	-0.012	-2.10	-3.82	-2.51	0.028	0.037	0.036	3.93	6.20	5.42	0.69	0.36	-0.12	2.54	1.60	-0.48	-0.38	-0.54	0.15	-1.03	-1.78	0.45	0.09	0.15	0.11
High	-0.022	-0.017	-0.018	-3.72	-3.80	-3.81	0.034	0.031	0.035	4.14	5.03	5.24	0.38	0.26	-0.22	1.24	1.14	-0.85	-0.68	-0.47	0.19	-1.62	-1.48	0.54	0.08	0.11	0.11

Panel F: Big - High Liquidity

Book-to-market	Momentum																										
	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)			R ²		
Low	-0.001	-0.007	-0.010	-0.16	-1.10	-1.37	0.023	0.035	0.039	2.16	3.98	3.81	-0.45	-0.51	-0.94	-1.15	-1.55	-2.48	0.15	0.23	0.77	0.29	0.51	1.49	0.03	0.08	0.09
Medium	-0.020	-0.018	-0.032	-2.68	-3.34	-5.08	0.040	0.037	0.053	3.76	4.87	5.99	0.04	-0.07	-0.74	0.09	-0.26	-2.21	-0.54	-0.43	0.33	-1.01	-1.09	0.73	0.07	0.11	0.16
High	-0.037	-0.027	-0.052	-4.53	-4.49	-7.32	0.051	0.048	0.081	4.47	5.67	8.02	-0.15	-0.12	-1.31	-0.35	-0.38	-3.47	-0.91	-0.28	0.78	-1.55	-0.64	1.52	0.11	0.13	0.26

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

FM TUR is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997).

D is an indicator variable that equal 1 for a bear market and 0 for bull markets.

Table 24

Regressions of excess stock returns on the excess market return and the mimicking returns for
liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - RF_m = A + A1(D) + L(FM_VOL_m) + L1(FM_VOL_m * D) + B(RM_m) + B1(RM_m * D) + S(SIZE_m) + S1(SIZE_m * D) + H(BM_m) + H1(BM_m * D) + M(RP_{m-1}) + M1(RP_{m-1} * D) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner			Loser			Neutral			Winner			Loser			Neutral			Winner																																						
	A = Bull									t(A)									A1 = (Bear-Bull)									t(A1)									L = Bull									t(L)									L1 = (Bear-Bull)									t(L1)								
Low	0.033	0.020	0.023	9.52	5.85	5.97	-0.053	-0.020	-0.023	-10.33	-3.90	-4.17	0.21	-0.12	0.04	1.05	-0.60	0.17	-0.75	0.19	-0.34	-2.87	0.73	-1.18																																																
Medium	0.010	0.010	0.007	3.64	5.11	2.80	-0.019	-0.006	-0.007	-4.43	-2.09	-1.79	0.32	0.46	0.32	2.04	4.03	2.26	-0.12	-0.28	-0.25	-0.58	-1.83	-1.33																																																
High	0.001	0.001	-0.005	0.44	0.57	-1.34	-0.007	-0.004	0.005	-1.59	-1.27	0.96	0.25	0.16	-0.27	1.39	1.29	-1.39	0.10	0.17	0.29	0.41	1.02	1.13																																																
	B = Bull									t(B)									B1 = (Bear-Bull)									t(B1)									S = Bull									t(S)									S1 = (Bear-Bull)									t(S1)								
Low	1.16	0.76	0.77	12.73	8.50	7.83	-0.16	0.02	0.08	-1.26	0.19	0.56	0.91	1.07	1.00	9.45	11.38	9.58	-0.05	-0.14	0.05	-0.33	-0.87	0.30																																																
Medium	0.91	0.64	0.73	12.34	12.16	11.13	-0.10	-0.08	0.17	-0.96	-1.05	1.80	0.61	0.41	0.58	7.80	7.33	8.44	0.09	0.31	0.17	0.73	3.36	1.53																																																
High	0.88	0.71	0.74	10.73	12.29	8.17	0.02	0.08	0.05	0.17	0.94	0.38	0.76	0.58	0.80	8.75	9.51	8.36	0.29	0.25	0.23	2.04	2.52	1.43																																																
	H = Bull									t(H)									H1 = (Bear-Bull)									t(H1)									M = Bull									t(M)									M1 = (Bear-Bull)									t(M1)								
Low	0.24	0.32	0.19	2.18	2.95	1.53	-0.08	0.08	0.23	-0.43	0.43	1.08	0.03	0.14	0.26	0.34	1.86	3.13	-0.13	0.01	-0.04	-1.19	0.10	-0.38																																																
Medium	0.73	0.47	0.43	8.09	7.22	5.32	-0.16	-0.02	0.11	-1.05	-0.14	0.82	-0.04	0.01	0.02	-0.67	0.30	0.35	-0.10	0.04	0.06	-1.10	0.69	0.75																																																
High	0.68	0.62	0.44	6.79	8.86	3.97	0.17	0.09	0.32	0.96	0.72	1.66	-0.28	-0.12	-0.14	-4.02	-2.52	-1.79	-0.11	0.00	-0.08	-1.09	0.01	-0.78																																																
	R ²																																																																							
Low	0.75	0.67	0.65																																																																					
Medium	0.65	0.67	0.70																																																																					
High	0.69	0.73	0.61																																																																					

Panel B: Small - Medium Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner			Loser			Neutral			Winner			Loser			Neutral			Winner																																						
	A = Bull									t(A)									A1 = (Bear-Bull)									t(A1)									L = Bull									t(L)									L1 = (Bear-Bull)									t(L1)								
Low	0.033	0.026	0.019	6.76	5.26	5.23	-0.041	-0.030	-0.018	-5.56	-4.03	-3.33	-1.15	-0.47	-0.31	-4.12	-1.69	-1.54	0.17	0.76	-0.24	0.45	2.04	-0.90																																																
Medium	0.012	0.007	0.005	3.93	2.73	1.56	-0.021	-0.009	-0.004	-4.65	-2.27	-0.90	-0.30	0.03	-0.19	-1.80	0.21	-1.11	0.02	-0.09	0.02	0.08	-0.44	0.11																																																
High	-0.001	-0.002	-0.005	-0.34	-0.54	-1.19	-0.008	-0.002	0.006	-1.43	-0.42	0.85	-0.32	-0.21	-0.39	-1.46	-1.26	-1.57	0.32	0.31	-0.07	1.09	1.40	-0.20																																																
	B = Bull									t(B)									B1 = (Bear-Bull)									t(B1)									S = Bull									t(S)									S1 = (Bear-Bull)									t(S1)								
Low	1.06	1.02	1.05	8.21	7.88	11.27	0.04	0.31	-0.02	0.23	1.67	-0.18	1.65	1.23	1.02	12.03	8.97	10.41	-0.11	0.10	0.17	-0.50	0.45	1.08																																																
Medium	1.05	1.05	0.98	13.58	14.93	12.05	0.15	-0.04	-0.02	1.32	-0.38	-0.15	0.96	0.81	0.90	11.72	10.82	10.48	0.07	0.19	0.22	0.55	1.57	1.51																																																
High	1.06	0.97	0.93	10.45	12.56	8.08	0.00	-0.10	0.00	0.00	-0.95	0.01	1.06	0.79	0.79	9.87	9.65	6.52	0.09	0.28	0.60	0.53	2.06	3.02																																																
	H = Bull									t(H)									H1 = (Bear-Bull)									t(H1)									M = Bull									t(M)									M1 = (Bear-Bull)									t(M1)								
Low	-0.50	-0.09	-0.18	-3.14	-0.54	-1.60	0.46	0.72	0.30	1.68	2.61	1.50	0.10	0.14	0.22	0.92	1.25	2.77	-0.29	-0.46	-0.11	-1.86	-2.95	-1.03																																																
Medium	0.34	0.42	0.25	3.60	4.82	2.53	0.02	0.03	0.13	0.13	0.18	0.74	-0.27	-0.05	-0.10	-4.01	-0.86	-1.47	-0.11	0.00	-0.11	-1.22	0.03	-1.09																																																
High	0.73	0.58	0.35	5.90	6.09	2.52	-0.13	-0.03	0.26	-0.62	-0.18	1.08	-0.47	-0.25	-0.25	-5.40	-3.79	-2.53	-0.12	-0.05	-0.17	-0.98	-0.57	-1.23																																																
	R ²																																																																							
Low	0.78	0.69	0.78																																																																					
Medium	0.81	0.79	0.76																																																																					
High	0.71	0.73	0.61																																																																					

Panel C: Small - High Liquidity

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner			Loser			Neutral			Winner			Loser			Neutral			Winner																																						
	A = Bull									t(A)									A1 = (Bear-Bull)									t(A1)									L = Bull									t(L)									L1 = (Bear-Bull)									t(L1)								
Low	0.032	0.028	0.019	7.38	5.72	5.16	-0.043	-0.035	-0.024	-6.70	-4.75	-4.28	-1.50	-1.05	-1.17	-6.10	-3.77	-5.54	-0.01	0.04	-0.05	-0.02	0.10	-0.19																																																
Medium	0.012	0.008	-0.010	3.59	1.79	-2.64	-0.016	-0.012	0.002	-3.21	-1.88	0.35	-1.13	-1.41	-0.87	-5.90	-5.95	-4.14	-0.09	0.75	-0.32	-0.36	2.38	-1.15																																																
High	0.000	-0.004	-0.017	0.10	-0.90	-3.40	-0.009	-0.004	0.008	-1.30	-0.51	1.07	-1.49	-1.10	-0.66	-5.67	-4.18	-2.28	0.29	0.07	-0.65	0.83	0.21	-1.70																																																
	B = Bull									t(B)									B1 = (Bear-Bull)									t(B1)									S = Bull									t(S)									S1 = (Bear-Bull)									t(S1)								
Low	1.13	1.36	1.24	9.95	10.49	12.70	0.17	-0.04	-0.05	1.06	-0.23	-0.34	1.65	1.46	1.23	13.72	10.62	11.92	-0.31	0.00	0.09	-1.58	-0.02	0.53																																																
Medium	1.18	1.18	1.03	13.32	10.74	10.51	-0.02	-0.11	0.21	-0.15	-0.72	1.53	1.05	1.18	1.22	11.23	10.12	11.79	0.44	-0.14	0.30	2.85	-0.72	1.77																																																
High	1.12	1.14	1.13	9.16	9.32	8.45	0.02	-0.01	-0.03	0.14	-0.03	-0.14	1.32	0.92	0.95	10.23	7.08	6.72	0.21	0.26	0.70	0.99	1.21	3.00																																																
	H = Bull									t(H)									H1 = (Bear-Bull)									t(H1)									M = Bull									t(M)									M1 = (Bear-Bull)									t(M1)								
Low	-0.62	-0.33	-0.63	-4.46	-2.10	-5.24	0.09	0.32	0.27	0.35	1.16	1.32	-0.36	-0.06	-0.09	-3.72	-0.52	-1.05	-0.04	-0.04	-0.11	-0.28	-0.25	-0.92																																																
Medium	-0.20	0.10	-0.32	-1.87	0.73	-2.67	-0.09	-0.18	0.24	-0.50	-0.78	1.18	-0.53	-0.50	-0.14	-6.98	-5.29	-1.71	-0.12	0.12	-0.31	-1.16	0.90	-2.64																																																
High	0.08	0.03	-0.09	0.55	0.23	-0.55	0.03	0.11	0.49	0.11	0.42	1.72	-1.00	-0.94	-0.63	-9.62	-9.03	-5.53	-0.09	0.03	-0.09	-0.61	0.20	-0.54																																																
	R ²																																																																							
Low	0.85	0.78	0.86																																																																					
Medium	0.86	0.76	0.83																																																																					
High	0.79	0.75	0.71																																																																					

Table 24 Continued

Panel D: Big - Low Liquidity
Momentum

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner			Loser			Neutral			Winner		
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)					
Low	0.006	0.003	0.000	1.47	0.93	0.15	-0.015	0.001	0.004	-2.51	0.35	1.06	0.17	0.51	0.36	0.76	3.35	2.39	0.69	0.14	0.02	2.27	0.68	0.09			
Medium	0.002	-0.001	-0.003	0.94	-0.36	-1.01	-0.004	-0.002	0.007	-1.12	-0.84	1.92	0.52	0.69	0.12	3.50	6.11	0.82	-0.16	-0.23	-0.14	-0.80	-1.55	-0.73			
High	-0.006	-0.006	-0.008	-1.99	-2.48	-1.89	-0.004	0.004	0.009	-0.96	1.21	1.51	0.25	0.22	-0.35	1.46	1.53	-1.48	-0.35	0.03	0.38	-1.52	0.16	1.20			
	B = Bull			t(B)			B1 = (Bear-Bull)			t(B1)			S = Bull			t(S)			S1 = (Bear-Bull)			t(S1)					
Low	0.80	0.89	0.94	7.58	12.70	13.42	0.16	-0.21	0.00	1.08	-2.06	0.01	0.13	-0.36	-0.32	1.17	-4.83	-4.35	0.03	0.14	0.32	0.17	1.12	2.60			
Medium	0.87	0.74	1.00	12.73	14.25	14.65	0.00	0.17	-0.31	-0.02	2.26	-3.23	0.31	-0.01	-0.08	4.30	-0.22	-1.06	-0.15	0.04	0.28	-1.28	0.44	2.33			
High	0.91	0.94	0.80	11.46	14.43	7.36	0.16	-0.04	-0.02	1.43	-0.47	-0.16	0.38	0.13	-0.18	4.54	1.84	-1.58	0.19	0.07	0.67	1.38	0.64	3.49			
	H = Bull			t(H)			H1 = (Bear-Bull)			t(H1)			M = Bull			t(M)			M1 = (Bear-Bull)			t(M1)					
Low	0.27	0.21	0.05	2.09	2.48	0.59	0.15	-0.39	0.22	0.68	-2.64	1.50	-0.10	0.05	0.15	-1.09	0.83	2.58	-0.05	-0.07	-0.07	-0.42	-0.84	-0.81			
Medium	0.48	0.47	0.28	5.69	7.40	3.35	-0.22	-0.03	0.01	-1.54	-0.23	0.09	-0.23	0.09	0.03	-3.94	1.93	0.58	-0.18	-0.10	0.00	-2.26	-1.62	-0.04			
High	0.62	0.66	0.18	6.35	8.25	1.36	0.12	0.23	0.49	0.74	1.64	2.10	-0.27	-0.29	-0.24	-3.97	-5.27	-2.58	-0.28	0.05	0.02	-2.90	0.66	0.19			
	R ²																										
Low	0.47	0.66	0.71																								
Medium	0.70	0.74	0.66																								
High	0.69	0.72	0.45																								

Panel E: Big - Medium Liquidity
Momentum

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner			Loser			Neutral			Winner		
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)					
Low	0.005	0.003	0.000	1.36	1.36	0.19	0.002	-0.001	0.007	0.30	-0.23	1.94	0.27	0.40	0.33	1.40	3.59	2.56	-0.25	0.01	-0.19	-0.96	0.07	-1.10			
Medium	-0.001	-0.008	-0.005	-0.24	-3.71	-1.96	-0.001	0.012	0.010	-0.29	3.80	2.56	0.41	0.33	-0.03	2.55	2.74	-0.24	0.04	-0.37	-0.09	0.17	-2.27	-0.47			
High	-0.012	-0.011	-0.012	-3.47	-4.71	-3.29	0.006	0.007	0.014	1.16	2.10	2.62	0.27	0.21	-0.22	1.40	1.62	-1.11	-0.50	-0.40	0.20	-1.95	-2.26	0.76			
	B = Bull			t(B)			B1 = (Bear-Bull)			t(B1)			S = Bull			t(S)			S1 = (Bear-Bull)			t(S1)					
Low	0.78	0.94	1.03	8.63	17.91	17.01	0.31	-0.02	-0.02	2.41	-0.24	-0.24	-0.15	-0.30	-0.31	-1.53	-5.47	-4.81	0.19	-0.08	0.11	1.22	-0.92	1.03			
Medium	1.09	0.97	1.08	14.47	17.41	16.28	0.02	0.00	-0.01	0.16	0.00	-0.09	0.18	-0.23	-0.14	2.27	-3.93	-1.96	-0.35	0.06	0.34	-2.68	0.63	2.90			
High	1.11	1.01	0.95	12.54	16.57	10.34	0.10	0.04	-0.02	0.76	0.43	-0.17	0.34	0.05	0.05	3.66	0.71	0.49	-0.20	-0.09	0.41	-1.29	-0.86	2.57			
	H = Bull			t(H)			H1 = (Bear-Bull)			t(H1)			M = Bull			t(M)			M1 = (Bear-Bull)			t(M1)					
Low	-0.15	0.19	-0.23	-1.32	2.90	-3.14	0.08	-0.27	-0.05	0.40	-2.48	-0.37	-0.43	0.01	0.13	-5.62	0.15	2.43	-0.14	-0.10	-0.02	-1.27	-1.61	-0.33			
Medium	0.69	0.26	0.23	7.48	3.75	2.87	-0.28	0.02	0.05	-1.77	0.21	0.34	-0.43	-0.11	0.03	-6.64	-2.39	0.53	-0.02	-0.27	0.02	-0.26	-4.12	0.28			
High	0.59	0.64	0.47	5.49	8.54	4.23	-0.11	-0.21	0.20	-0.58	-1.61	1.05	-0.42	-0.11	-0.18	-5.63	-2.06	-2.36	-0.32	-0.29	-0.08	-3.06	-3.94	-0.69			
	R ²																										
Low	0.69	0.81	0.83																								
Medium	0.75	0.82	0.78																								
High	0.74	0.78	0.59																								

Panel F: Big - High Liquidity
Momentum

Book-to-market	Loser			Neutral			Winner			Loser			Neutral			Winner			Loser			Neutral			Winner		
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)					
Low	0.014	0.006	0.002	3.94	1.91	0.57	-0.009	0.008	0.009	-1.66	1.92	1.99	-0.09	-0.23	-0.31	-0.43	-1.38	-1.85	-0.48	-0.17	-0.07	-1.79	-0.78	-0.32			
Medium	-0.003	-0.007	-0.021	-0.90	-2.74	-5.73	0.006	0.012	0.025	1.37	2.90	4.63	0.16	-0.02	-0.16	0.94	-0.11	-0.77	-0.61	-0.55	-0.45	-2.63	-2.68	-1.67			
High	-0.020	-0.017	-0.039	-4.26	-5.13	-8.41	0.018	0.020	0.053	2.65	4.06	7.70	-0.48	-0.02	-0.89	-1.83	-0.13	-3.41	-0.53	-0.18	0.23	-1.53	-0.71	0.65			
	B = Bull			t(B)			B1 = (Bear-Bull)			t(B1)			S = Bull			t(S)			S1 = (Bear-Bull)			t(S1)					
Low	1.13	1.06	1.03	12.22	13.63	13.16	0.09	-0.05	0.17	0.65	-0.46	1.52	0.36	0.09	0.14	3.69	1.13	1.65	-0.17	-0.12	-0.12	-1.07	-0.86	-0.88			
Medium	1.24	1.09	1.12	15.45	15.49	11.99	0.09	-0.03	0.06	0.77	-0.33	0.48	0.47	0.21	0.13	5.52	2.87	1.30	-0.13	-0.01	0.42	-0.94	-0.07	2.55			
High	1.23	1.33	0.98	10.19	15.39	8.14	0.13	-0.13	0.15	0.74	-1.07	0.90	0.41	0.42	0.53	3.18	4.53	4.12	-0.06	-0.14	0.11	-0.26	-0.90	0.52			
	H = Bull			t(H)			H1 = (Bear-Bull)			t(H1)			M = Bull			t(M)			M1 = (Bear-Bull)			t(M1)					
Low	-0.54	-0.42	-0.90	-4.79	-4.46	-9.38	-0.15	-0.39	-0.05	-0.75	-2.34	-0.30	-0.39	-0.23	-0.02	-4.97	-3.41	-0.24	-0.05	-0.02	0.06	-0.45	-0.21	0.69			
Medium	-0.21	0.12	-0.37	-2.18	1.37	-3.25	-0.08	-0.16	0.52	-0.50	-1.05	2.64	-0.63	-0.30	-0.17	-9.16	-4.90	-2.12	-0.26	-0.20	-0.12	-2.73	-2.34	-1.09			
High	0.08	0.69	-0.40	0.56	6.52	-2.73	-0.07	-0.29	0.53	-0.26	-1.59	2.08	-0.71	-0.38	-0.47	-6.91	-5.15	-4.53	-0.46	-0.17	-0.06	-3.22	-1.59	-0.39			
	R ²																										
Low	0.81	0.82	0.86																								
Medium	0.87	0.81	0.77																								
High	0.75	0.77	0.74																								

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

FM VOL is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997).

RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for size. BM is the return on the zero investment, factor mimicking portfolio for book-to-market. Rpm-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and Rpm-1 are all obtained from Kenneth French's website. D is an indicator variable that equal 1 for a bear market and 0 for bull markets.

Table 25

Regressions of excess stock returns on the excess market return and the mimicking returns for
liquidity, size, book-to-market and momentum: July 1983 to December 2002, 234 months

$$RP_m - RF_m = A + A(D) + L(FM_TUR_m) + L(FM_TUR_m * D) + B(RM_m) + B(RM_m * D) + S(SIZE_m) + S(SIZE_m * D) + H(BM_m) + H(BM_m * D) + M(RP_{m-1}) + M(RP_{m-1} * D) + e_m$$

Dependent variable: Excess returns on 54 stock portfolios formed on liquidity, size, book-to-market, and momentum

Panel A: Small - Low Liquidity																								
Momentum																								
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner						
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)		
Low	0.034	0.020	0.023	9.72	5.73	6.06	-0.054	-0.019	-0.024	-10.47	-3.83	-4.22	-0.05	0.08	-0.12	-0.26	0.46	-0.62	-0.59	-0.02	-0.21	-2.43	-0.10	-0.79
Medium	0.010	0.010	0.007	3.60	5.04	2.79	-0.019	-0.006	-0.007	-4.44	-2.10	-1.80	0.28	0.38	0.24	1.95	3.66	1.90	-0.16	-0.23	-0.19	-0.81	-1.58	-1.06
High	0.002	0.001	-0.004	0.48	0.57	-1.21	-0.008	-0.004	0.004	-1.68	-1.34	0.84	0.13	0.11	-0.43	0.80	0.95	-2.46	-0.03	0.12	0.27	-0.16	0.79	1.14
	B = Bull			t(B)			B1 = (Bear-Bull)			t(B1)			S = Bull			t(S)			S1 = (Bear-Bull)			t(S1)		
Low	1.14	0.77	0.77	12.78	8.64	7.86	-0.17	0.02	0.07	-1.34	0.15	0.51	0.89	1.09	0.99	9.34	11.50	9.49	-0.02	-0.15	0.07	-0.12	-0.95	0.40
Medium	0.89	0.63	0.71	12.20	11.80	10.96	-0.08	-0.05	0.18	-0.76	-0.71	1.97	0.61	0.41	0.58	7.77	7.27	8.38	0.10	0.31	0.18	0.80	3.35	1.55
High	0.86	0.70	0.75	10.53	12.11	8.40	0.05	0.10	0.04	0.39	1.18	0.34	0.75	0.58	0.78	8.57	9.36	8.28	0.33	0.27	0.27	2.27	2.62	1.71
	H = Bull			t(H)			H1 = (Bear-Bull)			t(H1)			M = Bull			t(M)			M1 = (Bear-Bull)			t(M1)		
Low	0.23	0.33	0.18	2.09	3.03	1.52	-0.12	0.08	0.20	-0.64	0.43	0.96	0.01	0.16	0.25	0.09	2.07	3.02	-0.10	0.00	-0.03	-0.93	-0.03	-0.25
Medium	0.71	0.44	0.41	7.92	6.83	5.12	-0.13	0.03	0.14	-0.83	0.22	0.98	-0.05	0.01	0.01	-0.76	0.11	0.21	-0.09	0.05	0.07	-0.97	0.84	0.86
High	0.67	0.62	0.45	6.60	8.69	4.15	0.21	0.13	0.30	1.19	1.03	1.62	-0.29	-0.13	-0.15	-4.13	-2.60	-1.95	-0.08	0.01	-0.06	-0.79	0.18	-0.56
	R ²																							
Low	0.75	0.67	0.65																					
Medium	0.65	0.67	0.70																					
High	0.68	0.72	0.61																					

Panel B: Small - Medium Liquidity																								
Momentum																								
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner						
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)		
Low	0.034	0.026	0.019	7.18	5.32	5.38	-0.041	-0.030	-0.018	-5.85	-4.10	-3.41	-1.29	-0.51	-0.35	-5.28	-2.01	-1.98	0.17	0.78	-0.32	0.52	2.23	-1.32
Medium	0.012	0.007	0.005	3.92	2.67	1.71	-0.020	-0.009	-0.005	-4.62	-2.24	-1.02	-0.25	0.10	-0.34	-1.62	0.75	-2.15	-0.03	-0.23	0.03	-0.14	-1.20	0.13
High	-0.001	-0.001	-0.005	-0.30	-0.50	-1.06	-0.009	-0.002	0.005	-1.51	-0.49	0.77	-0.32	-0.22	-0.61	-1.60	-1.45	-2.79	0.05	0.15	-0.07	0.20	0.74	-0.23
	B = Bull			t(B)			B1 = (Bear-Bull)			t(B1)			S = Bull			t(S)			S1 = (Bear-Bull)			t(S1)		
Low	1.10	1.04	1.06	8.90	8.09	11.66	-0.03	0.30	-0.05	-0.19	1.65	-0.42	1.62	1.22	1.02	12.27	8.91	10.51	-0.06	0.11	0.21	-0.28	0.49	1.28
Medium	1.07	1.05	0.99	13.81	15.07	12.37	0.12	-0.04	-0.03	1.12	-0.40	-0.24	0.96	0.81	0.89	11.69	10.91	10.46	0.08	0.20	0.25	0.56	1.61	1.78
High	1.07	0.97	0.94	10.69	12.75	8.44	-0.01	-0.11	-0.02	-0.07	-0.98	-0.15	1.06	0.78	0.77	9.87	9.60	6.50	0.14	0.30	0.66	0.77	2.26	3.38
	H = Bull			t(H)			H1 = (Bear-Bull)			t(H1)			M = Bull			t(M)			M1 = (Bear-Bull)			t(M1)		
Low	-0.44	-0.06	-0.17	-2.90	-0.39	-1.50	0.31	0.72	0.23	1.17	2.64	1.17	0.10	0.14	0.22	0.94	1.27	2.82	-0.27	-0.46	-0.10	-1.82	-2.97	-0.92
Medium	0.36	0.42	0.26	3.78	4.85	2.67	-0.02	0.02	0.10	-0.13	0.15	0.60	-0.26	-0.05	-0.11	-3.94	-0.78	-1.63	-0.12	0.00	-0.08	-1.28	0.04	-0.89
High	0.75	0.59	0.37	6.09	6.24	2.73	-0.15	-0.03	0.20	-0.73	-0.20	0.84	-0.47	-0.25	-0.26	-5.43	-3.80	-2.75	-0.10	-0.04	-0.14	-0.82	-0.44	-1.02
	R ²																							
Low	0.79	0.69	0.79																					
Medium	0.81	0.79	0.76																					
High	0.71	0.73	0.63																					

Panel C: Small - High Liquidity																								
Momentum																								
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner						
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)		
Low	0.032	0.029	0.020	7.20	5.78	5.38	-0.042	-0.035	-0.024	-6.46	-4.74	-4.37	-1.04	-0.92	-1.05	-4.58	-3.62	-5.65	-0.54	-0.14	-0.27	-1.74	-0.40	-1.05
Medium	0.012	0.007	-0.010	3.58	1.65	-2.62	-0.016	-0.011	0.002	-3.07	-1.71	0.43	-0.93	-0.94	-0.74	-5.28	-4.21	-3.89	-0.24	0.31	-0.49	-1.00	1.02	-1.87
High	0.001	-0.004	-0.017	0.12	-0.80	-3.38	-0.009	-0.004	0.008	-1.25	-0.54	1.05	-1.19	-1.11	-0.90	-4.99	-4.70	-3.61	-0.16	0.00	-0.62	-0.48	0.00	-1.83
	B = Bull			t(B)			B1 = (Bear-Bull)			t(B1)			S = Bull			t(S)			S1 = (Bear-Bull)			t(S1)		
Low	1.20	1.40	1.29	10.44	10.93	13.62	0.05	-0.12	-0.14	0.32	-0.67	-1.03	1.67	1.45	1.23	13.63	10.63	12.17	-0.31	0.01	0.12	-1.51	0.06	0.74
Medium	1.23	1.24	1.06	13.75	10.98	11.03	-0.11	-0.20	0.13	-0.87	-1.23	0.97	1.05	1.19	1.22	11.07	9.90	11.86	0.44	-0.15	0.32	2.83	-0.77	1.87
High	1.18	1.18	1.15	9.78	9.92	9.06	-0.08	-0.08	-0.09	-0.47	-0.50	-0.52	1.32	0.90	0.92	10.30	7.10	6.83	0.24	0.29	0.77	1.13	1.40	3.45
	H = Bull			t(H)			H1 = (Bear-Bull)			t(H1)			M = Bull			t(M)			M1 = (Bear-Bull)			t(M1)		
Low	-0.54	-0.28	-0.57	-3.84	-1.77	-4.89	-0.14	0.17	0.10	-0.57	0.62	0.48	-0.32	-0.04	-0.07	-3.26	-0.37	-0.89	-0.07	-0.05	-0.11	-0.49	-0.31	-0.96
Medium	-0.14	0.17	-0.27	-1.32	1.26	-2.32	-0.27	-0.32	0.08	-1.42	-1.33	0.42	-0.51	-0.45	-0.13	-6.64	-4.69	-1.55	-0.14	0.08	-0.32	-1.34	0.56	-2.74
High	0.16	0.09	-0.06	1.09	0.62	-0.38	-0.17	-0.04	0.33	-0.65	-0.18	1.22	-0.97	-0.94	-0.64	-9.42	-9.20	-5.94	-0.10	0.03	-0.05	-0.72	0.23	-0.32
	R ²																							
Low	0.84	0.78	0.87																					
Medium	0.86	0.74	0.84																					
High	0.79	0.76	0.73																					

Table 25 Continued

Panel D: Big - Low Liquidity Momentum																								
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)		
Low	0.006	0.002	0.000	1.45	0.71	0.08	-0.015	0.002	0.004	-2.57	0.63	1.06	0.19	0.77	0.36	0.92	6.42	2.64	0.70	0.18	0.00	2.51	1.10	0.00
Medium	0.002	-0.001	-0.003	0.83	-0.63	-1.05	-0.004	-0.002	0.008	-1.11	-0.78	1.95	0.53	0.76	0.15	3.97	7.70	1.09	-0.31	-0.30	-0.19	-1.66	-2.20	-1.03
High	-0.006	-0.006	-0.008	-1.90	-2.58	-1.84	-0.004	0.005	0.009	-0.97	1.23	1.47	0.09	0.29	-0.37	0.55	2.22	-1.73	-0.07	-0.11	0.37	-0.30	-0.61	1.28
	B = Bull			t(B)			B1 = (Bear-Bull)			t(B1)			S = Bull			t(S)			S1 = (Bear-Bull)			t(S1)		
Low	0.79	0.88	0.93	7.63	14.38	13.35	0.20	-0.17	0.03	1.35	-1.95	0.29	0.13	-0.33	-0.32	1.20	-5.11	-4.30	0.02	0.06	0.31	0.09	0.58	2.56
Medium	0.85	0.72	0.99	12.51	14.51	14.71	0.03	0.21	-0.31	0.33	2.97	-3.21	0.32	0.00	-0.07	4.40	0.03	-1.02	-0.14	0.02	0.28	-1.21	0.25	2.33
High	0.90	0.94	0.82	11.32	14.44	7.53	0.17	-0.03	-0.04	1.49	-0.30	-0.23	0.37	0.14	-0.19	4.41	1.95	-1.63	0.18	0.07	0.68	1.32	0.64	3.55
	H = Bull			t(H)			H1 = (Bear-Bull)			t(H1)			M = Bull			t(M)			M1 = (Bear-Bull)			t(M1)		
Low	0.26	0.19	0.03	2.05	2.53	0.38	0.24	-0.30	0.28	1.10	-2.35	1.87	-0.10	0.07	0.15	-1.11	1.25	2.56	-0.06	-0.11	-0.07	-0.48	-1.57	-0.79
Medium	0.45	0.44	0.27	5.40	7.22	3.30	-0.17	0.05	0.02	-1.15	0.49	0.12	-0.23	0.09	0.03	-4.00	2.03	0.60	-0.17	-0.10	0.00	-2.12	-1.74	-0.03
High	0.60	0.65	0.20	6.21	8.18	1.50	0.13	0.26	0.47	0.78	1.88	2.05	-0.28	-0.29	-0.24	-4.17	-5.25	-2.59	-0.27	0.05	0.03	-2.85	0.67	0.20
	R ²																							
Low	0.48	0.74	0.71																					
Medium	0.70	0.76	0.66																					
High	0.69	0.73	0.45																					

Panel E: Big - Medium Liquidity Momentum																								
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)		
Low	0.004	0.002	0.001	1.24	1.11	0.33	0.002	0.000	0.006	0.44	-0.06	1.78	0.43	0.62	0.11	2.44	6.49	0.91	-0.17	-0.14	-0.01	-0.72	-1.05	-0.08
Medium	-0.001	-0.008	-0.005	-0.41	-3.70	-1.89	-0.001	0.012	0.009	-0.23	3.78	2.53	0.54	0.26	-0.10	3.73	2.35	-0.81	-0.10	-0.35	-0.06	-0.52	-2.32	-0.32
High	-0.012	-0.011	-0.011	-3.54	-4.72	-3.22	0.006	0.008	0.013	1.25	2.16	2.57	0.31	0.20	-0.29	1.81	1.69	-1.63	-0.47	-0.33	0.19	-1.99	-1.99	0.78
	B = Bull			t(B)			B1 = (Bear-Bull)			t(B1)			S = Bull			t(S)			S1 = (Bear-Bull)			t(S1)		
Low	0.77	0.92	1.01	8.72	19.21	16.60	0.32	0.01	0.00	2.51	0.13	0.01	-0.13	-0.28	-0.32	-1.39	-5.49	-4.92	0.14	-0.12	0.13	0.93	-1.39	1.18
Medium	1.08	0.96	1.08	14.63	17.23	16.44	0.05	0.01	-0.01	0.45	0.16	-0.14	0.20	-0.23	-0.14	2.50	-3.93	-2.05	-0.37	0.07	0.35	-2.85	0.72	3.01
High	1.10	1.01	0.95	12.53	16.50	10.52	0.10	0.04	-0.03	0.76	0.44	-0.23	0.35	0.05	0.04	3.73	0.74	0.41	-0.21	-0.10	0.43	-1.39	-0.94	2.71
	H = Bull			t(H)			H1 = (Bear-Bull)			t(H1)			M = Bull			t(M)			M1 = (Bear-Bull)			t(M1)		
Low	-0.16	0.17	-0.25	-1.46	2.83	-3.37	0.09	-0.22	-0.02	0.50	-2.11	-0.12	-0.43	0.02	0.11	-5.62	0.46	2.06	-0.17	-0.12	0.00	-1.56	-2.07	-0.03
Medium	0.67	0.24	0.23	7.42	3.50	2.91	-0.22	0.04	0.03	-1.41	0.32	0.25	-0.42	-0.12	0.03	-6.69	-2.55	0.45	-0.03	-0.26	0.03	-0.35	-3.94	0.38
High	0.58	0.63	0.49	5.41	8.42	4.36	-0.12	-0.21	0.19	-0.62	-1.65	0.99	-0.42	-0.11	-0.19	-5.65	-2.11	-2.43	-0.33	-0.29	-0.07	-3.14	-3.97	-0.60
	R ²																							
Low	0.70	0.84	0.83																					
Medium	0.76	0.82	0.78																					
High	0.74	0.78	0.60																					

Panel F: Big - High Liquidity Momentum																								
Book-to-market	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner	Loser	Neutral	Winner			
	A = Bull			t(A)			A1 = (Bear-Bull)			t(A1)			L = Bull			t(L)			L1 = (Bear-Bull)			t(L1)		
Low	0.014	0.006	0.003	4.08	2.12	0.92	-0.009	0.008	0.008	-1.69	1.87	1.90	-0.30	-0.41	-0.65	-1.63	-2.73	-4.44	-0.20	-0.07	0.10	-0.79	-0.36	0.49
Medium	-0.003	-0.007	-0.019	-0.88	-2.71	-5.58	0.006	0.012	0.024	1.39	2.96	4.61	0.08	-0.05	-0.62	0.52	-0.37	-3.49	-0.62	-0.50	0.00	-2.93	-2.64	-0.02
High	-0.020	-0.017	-0.038	-4.30	-5.10	-8.44	0.019	0.020	0.052	2.76	4.03	7.85	-0.21	-0.16	-1.18	-0.89	-0.93	-5.13	-0.73	-0.26	0.49	-2.22	-1.11	1.57
	B = Bull			t(B)			B1 = (Bear-Bull)			t(B1)			S = Bull			t(S)			S1 = (Bear-Bull)			t(S1)		
Low	1.13	1.07	1.03	12.31	14.09	14.05	0.06	-0.07	0.15	0.49	-0.66	1.43	0.35	0.08	0.11	3.52	0.95	1.37	-0.16	-0.09	-0.06	-1.01	-0.65	-0.49
Medium	1.23	1.09	1.12	15.62	15.62	12.41	0.08	-0.05	0.04	0.71	-0.55	0.34	0.46	0.21	0.09	5.52	2.84	0.96	-0.11	0.00	0.46	-0.79	-0.03	2.90
High	1.25	1.33	1.01	10.36	15.69	8.72	0.07	-0.14	0.10	0.39	-1.13	0.61	0.42	0.41	0.49	3.26	4.47	3.99	-0.07	-0.09	0.15	-0.33	-0.63	0.74
	H = Bull			t(H)			H1 = (Bear-Bull)			t(H1)			M = Bull			t(M)			M1 = (Bear-Bull)			t(M1)		
Low	-0.54	-0.41	-0.88	-4.80	-4.47	-9.81	-0.20	-0.44	-0.10	-1.03	-2.71	-0.65	-0.41	-0.24	-0.04	-5.19	-3.67	-0.59	-0.04	0.00	0.10	-0.36	-0.01	1.15
Medium	-0.22	0.12	-0.37	-2.31	1.38	-3.33	-0.12	-0.21	0.46	-0.71	-1.41	2.41	-0.63	-0.30	-0.20	-9.42	-4.98	-2.61	-0.24	-0.19	-0.09	-2.58	-2.31	-0.79
High	0.11	0.69	-0.36	0.74	6.64	-2.54	-0.19	-0.32	0.43	-0.73	-1.74	1.74	-0.69	-0.39	-0.48	-6.68	-5.37	-4.86	-0.49	-0.14	-0.04	-3.36	-1.35	-0.27
	R ²																							
Low	0.81	0.83	0.88																					
Medium	0.87	0.81	0.78																					
High	0.75	0.78	0.75																					

The dependent variable (RP-Rf) is the excess return on the 54 size/liquidity/book-to-market/momentum portfolios formed from the intersection of two size groups, three liquidity groups, three book-to-market groups, and three momentum groups.

FM TUR is the residual liquidity factor obtained by regressing the difference in the averages of the illiquid and liquid portfolios on the three stock factors from Fama and French (1993) and the momentum factor from Carhart (1997).

RM is the value-weighted monthly excess return on the stocks in 25 size/book-to-market portfolios. SIZE is the return on the zero investment, factor mimicking portfolio for size. BM is the return on the zero investment, factor mimicking portfolio for book-to-market. RPM-1 is the return on the zero investment, factor mimicking portfolio for momentum. RM, SIZE, BM, and RPM-1 are all obtained from Kenneth French's website. D is an indicator variable that equal 1 for a bear market and 0 for bull markets.

CHAPTER 5- CONCLUSIONS

5A. Overview

Considerable research has been done in the area of accounting for the relationship between liquidity and asset returns. The bulk of research in this area uses some form of cross-sectional methodology and finds that there is a statistically significant relationship between liquidity and returns. The recent trend in the asset pricing literature has been away from static models and toward some form of time-varying model, shown by the empirical evidence documented in Ferson and Harvey (1991) and Jagannathan and Wang (1996). Taken collectively there should be substantial effort in the research of exploring the relationship between liquidity and asset returns in a time-varying framework. However, to date there has been little to no work in this area, with the notable exception of Amihud (2002).

This dissertation looks at the role of liquidity in asset pricing using a time-series asset-pricing model. Contributions include an extensive look at the role of liquidity, including time variation in risk measures and a complete examination of the interaction between liquidity and other important asset pricing variables. This should provide a more accurate and complete model of asset pricing. I incorporate new time-varying liquidity variables into a time-series asset-pricing model and examine the specification and predictability of the model. I also examine the interaction between liquidity variables and a full range of other important asset pricing variables. I further compare and contrast the main cross-sectional liquidity variables seen in the literature in a time-varying framework.

5B. Conclusions

In this study I examine and test models of asset pricing given four main hypotheses. My four hypotheses are as follows: there exists a statistically significant time-series relationship between liquidity and asset returns, there exists some specific liquidity proxies that outperform other comparable proxies, liquidity has a mitigating effect on other variables that are commonly significant in predicting asset returns, and the effect of liquidity is stronger in bear markets than in bull markets.

5B1. The Time-Series Relationship between Liquidity and Asset Returns

In order to capture liquidity, without the effects of the other variables, I use a residual effect of liquidity. This is done by first forming a liquidity factor-mimicking portfolio using sorts on size and liquidity. The residuals from a regression of liquidity on the other four factors are used as my measure of liquidity, free of any influence from the market, size, book-to-market and momentum. Univariate time-series regressions are then estimated using the various measures of residual liquidity. There are six underlying liquidity proxies used in the calculation of the residual liquidity factors. The six measures can be classified into two main categories, liquidity levels and the variability of the levels. The liquidity levels are the dollar volume of shares traded and the share turnover values. The variability figures are the standard deviation of the dollar volume, the standard deviation of share turnover, the coefficient of variation of dollar volume, and the coefficient of variation of share turnover. The residual liquidity factors generated from these measures are then used in the univariate regressions. The time-series regressions are estimated using all of the various underlying liquidity proxies, using monthly data, over the period between July 1983 and December 2002. In total, for every regression, 54 portfolios of stocks are examined. These 54 portfolios are based on sorts on liquidity, size, book-to-market, and momentum.

The main finding in the 54 time-series regressions, using dollar volume, is that liquidity is priced and that liquidity explains a portion of the shared variation in returns. The time-series univariate regression results using share turnover show that liquidity is again priced for this proxy. The time-series univariate regression results using the standard deviation of dollar volume, as is the case for both dollar volume and share turnover, show that liquidity is also

priced when using the standard deviation of dollar volume. The same is true for the time-series univariate regression results using the standard deviation of share turnover. However, the coefficient of variation measures seems to be unable to adequately capture a consistent relationship between liquidity and returns.

5B2. The Mitigating Effect of Liquidity on Other Variables

Since the residual liquidity variable has no effect on the other variables, given its residual construction, the effect of liquidity on the other variables is not adequately explored by this residual variable. In order to address the hypothesis of whether liquidity has a mitigating effect on other variables that are commonly significant in predicting asset returns I take a step back and use the liquidity return difference portfolio instead of the residual liquidity factor. By using this return difference variable I am better able to study the nominal relationship between the various measures.

In comparing the five-factor regressions, using the return difference portfolios, to the non-liquidity regression, using only the market, size, book-to-market, and momentum factors, I find consistent results across the various liquidity proxies for the effect liquidity has on other variables.

The market factor is the most affected variable with a consistent reduction in the majority of the coefficients on the market factor, as well as the t-statistics, for the various portfolios. The exceptions to this reduction seem to be concentrated in the low liquidity portfolios.

Given the intuitive relationship between liquidity and size, the size factor has a very interesting reaction to the presence of liquidity. The majority of the coefficients and t-statistics on the size factor increase with the addition of the liquidity variable. The increase may be due to the combination of the increased ability to capture shared variation in returns when size and liquidity are regressed together and the apparent reversal of the size effect in the time period studied, implying that liquidity and size may be unrelated.

The book-to-market and momentum factors both have inconsistent changes in their coefficients and t-statistics and, therefore, no clear pattern to the changes in either measure.

As is the case for the factors, a comparison of the intercepts can be made using the non-liquidity regression versus the full multivariate liquidity regressions. Changes in the intercepts from the non-liquidity regression to the full model are clearly present in portfolios that are

comprised of small stocks with high liquidity, big stocks with low liquidity, and big stocks with high liquidity. There are also clear patterns to the presence of non-zero intercepts. Namely, there is an unmistakable pattern of non-zero intercepts in portfolios consisting of stocks with low book-to-market ratios, with the exception of big firms with low liquidity. A weaker relationship exists with stocks that have high book-to-market ratios. The significant intercepts indicate that certain categories of firms have significant positive or negative returns after accounting for the five independent variables. This may suggest that there are still remaining risk factors not included in the model.

5B3. The Effect of Liquidity in Bull and Bear Months

I next address the hypothesis of whether the effect of liquidity is stronger in bear markets than in bull markets. I decompose my sample into groups based on up and down months, as characterized by Bhardwaj and Brooks (1993). Once I have these two groups of up and down months, or bull and bear months, I re-test the dollar volume and share turnover regressions to account for differences between bull and bear months. Explicitly, I test the sensitivity of the results to the specific market condition by using an indicator variable for bear months. The benefit of using an indicator variable to account for the difference is that there is a clear test of significance for a difference between the conditions. Interaction terms in the regressions pick up these differences and show their significance.

Overall the results show no distinct pattern of a difference between bull and bear months, as evidenced by the lack of significance on the interaction terms in the regression equations. This is in contrast to Bhardwaj and Brooks (1993) who find statistically significant differences in risks and returns on size-based portfolios in bull and bear months from 1926 to 1988.

The results of the tests of asset pricing models explored in this study, given my four hypotheses, are as follows. The results indicate that liquidity is priced, yielding a statistically significant time-series relationship between liquidity and asset returns. All other liquidity proxies outperform the liquidity variables that use the coefficient of variation measure. Liquidity has adverse effects on other variables that are important to asset returns. Namely, liquidity has a reducing effect on the market factor and an amplifying effect on the size factor. There is no clear difference between the significance of liquidity in bull markets versus bear markets.

In this dissertation I examine the importance of liquidity in various environments as well as the effect of liquidity on these environments. One of the findings of this study show that there exists significant non-zero intercepts after accounting for factors relating to liquidity, the market, size, book-to-market, and momentum. As an avenue of further research this suggests that there are variables other than the five examined in this study that are important to asset returns.

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BIOGRAPHICAL SKETCH

Marvin Keene was born and raised in the Flatbush area of Brooklyn, NY. He left New York after graduating from high school and has lived in Tallahassee, FL ever since. While in Tallahassee he met and married his wife, of five years. They are the proud parents of two wonderful boys. Marvin attended Florida State University where he completed his undergraduate degree with a Bachelor's of Science in Applied Economics. He then went on to complete his Doctorate of Philosophy in the field of Finance, also at FSU. Now he will start the next chapter of his life at Coastal Carolina University in Myrtle Beach, SC.