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LIQUIDITY AND ASSET PRICING: EVIDENCE FROM A NEW FREE FLOAT ADJUSTED PRICE IMPACT RATIO

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Abstract

In this paper we empirically examine the relationship between stock liquidity and asset pricing, using a new price impact ratio adjusted for free float as our approximation of liquidity. The free float adjusted ratio is free from size bias and encapsulates the impact of trading frequency. It is more comprehensive than alternative price impact ratios because it incorporates the shares available to the public for trading. Using a data sample of all US listed companies over the time period of 1997-2017, we provide evidence that the free float adjusted price impact ratio is superior to all price impact ratios used in the previous academic literature. We also discover that our findings are robust to the financial crises between 2007-2009.

JEL Classification: G10, G12.

Keywords: Price impact ratio, Amihud illiquidity ratio, Asset pricing

1. Introduction

Liquidity defined as the ability to trade stocks quickly, anonymously and with little price impact, is one of the most fundamental components of financial research. The growing interest in liquidity and its impact on financial markets, has resulted in the establishment of several liquidity measures by academic scholars. These measures capture different dimensions of liquidity including trading quantity, cost, speed and price impact. One of the most widely used liquidity proxies is the Amihud illiquidity ratio, known in the literature as the return to volume ratio (Amihud, 2002). It reflects the change of security prices when a number of stocks are traded. The return to volume ratio (hereby RtoV ratio) is used in thousands of research manuscripts because of its straightforward computation, easy interpretation and for its accurate approximation of liquidity. Amihud (2002) treats volume as a measure of trading activity as it captures the transaction costs. When comparing several liquidity measures, Goyenko, Holden, and Trzcinka (2009) provide evidence that the Amihud illiquidity ratio is measuring price impact with a high level of accuracy. However, the return to volume ratio also comes with some limitations. First, the ratio exhibits a firm size bias as there is a very strong positive relationship between trading volume and firm's market capitalization (MV). Indeed, small capitalization stocks (usually small trading volume) are expected to have a higher RtoV ratio than big capitalization stocks with higher trading volume. As a result, it leads to an automatic conclusion that small stocks are less liquid compared to the larger transactions. Another shortcoming of the return to volume ratio is that it fails to reflect the trading frequency aspect of stock liquidity. Amihud and Mendelson (1986) show in a theoretical framework that security liquidity is related to trading frequency.

An alternative price impact ratio is proposed by Florackis, Gregoriou, and Kostakis (2011) namely, the return to turnover ratio (hereby RtoTR ratio), which is defined as the ratio of daily absolute stock return to turnover. Through replacing trading volume with the turnover ratio in the denominator of the Amihud ratio, the RtoTR ratio not only inherits the advantages of the RtoV ratio, but also overcomes its disadvantages. In particular, as the data for turnover ratio is easy to obtain the RtoTR ratio also has the advantage of simplicity and data availability. Turnover ratio is not positively correlated with market capitalization, which implies that the return to turnover ratio is free of size bias. Moreover, employing turnover in calculating liquidity measures allows the RtoTR ratio to control both the effect of trading costs and trading frequency on asset pricing. Using all listed UK companies from 1991 to 2008, Florackis, Gregoriou, and Kostakis (2011) provide evidence that the RtoTR ratio is free of size bias and that there is a combination effect of trading costs and trading frequency on asset pricing.

Nevertheless, there is an issue with both the RtoV and RtoTR ratios, which has not been mentioned in the Florackis, Gregoriou, and Kostakis (2011) study. The problem is that the number of shares outstanding used in constructing these liquidity proxies does not reflect the real number of available stocks that are available to the public for trading. Lam, Lin, and Michayluk (2011) argue that the number of available shares (public free float factor) and liquidity are correlated as the higher supply of the stock makes it easier to trade. Hence, they suggest that a liquidity measure should consider the supply ability of stocks in predicting trading costs. In our study we aim to test the efficiency of a new price impact ratio – the free float adjusted price impact ratio introduced by Karim et al. (2016). This new liquidity measure replaces the turnover ratio in the denominator component of the RtoTR ratio by adjusted turnover ratio controlling for the public free float factor. The adjusted turnover ratio increases the encapsulation power of price impact, which is defined as the ability of the ratio to approximately capture the cross-sectional variability turnover ratio of the security.

The free float adjusted price impact ratio (hereby RtoTRF ratio) not only inherits the benefits of the RtoTR ratio but it also has additional appealing features. In particular, the RtoTRF ratio incorporates the "real supply" of available shares to the public by taking into account the public free float factor. Therefore, the proposed measure is expected to be a more accurate measure of stock liquidity then the RtoV and RtoTR ratios. The RtoTRF ratio eliminates the size bias and trading frequency issues of the Amihud ratio and is based on the real supply of assets available for trading, which is not the case for the Florackis, Gregoriou, and Kostakis (2011) ratio.

Our paper provides new evidence on the impact of liquidity on asset pricing by employing price impact ratios to measure liquidity. In particular, we conduct analysis using three alternative price impact ratios as proxies for stock liquidity for comparison purposes. We implement the Amihud ratio, the return to turnover ratio by Florackis, Gregoriou, and Kostakis (2011), and the free-float adjusted price impact ratio by Karim et al. (2016). We focus on price impact ratios instead of traditional liquidity measures such as bid-ask spreads due to the following reasons. First, liquidity measures which capture the price impact dimension are better in reflecting the long-term volatility of stock. This also explains the overwhelming usage of the Amihud ratio in the previous academic literature. Second, despite measuring the transaction costs, bid-ask spreads do not capture the actual costs of a trade. Roll (1984) finds that actual transactions are executed mostly within the quoted bid-ask spreads, not exactly at the quoted prices which is assumed in the computation of bid-ask spreads. In addition, the daily bid-ask spreads may be noisy and uninformative as they are usually wider for large price stocks. The spreads may be good at reflecting the price changes around news but they do not capture the long-term financial stability of an asset. Hence, the bid-ask spread is not a good proxy for liquidity (Peterson and Fialkowski, 1994). One of the key factors in determining the accuracy of stock market efficiency tests is to use accurate measures of liquidity (Lesmond, 2005).

Amihud and Mendelson (1986) also argue that the liquidity proxies have influence on determining the stock return. Therefore, the accuracy of liquidity measures plays an important role in asset pricing tests further motivating our research study.

In order to examine the relationship between stock liquidity and expected stock returns, we use a sample of listed stocks in the three main stock exchanges of the US market including the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and NASDAQ over the time period of 1997-2017. Specifically, stocks are ranked each month on the basis of each liquidity measure and then constructed on 25 decile portfolios. For comparison purposes, we use three alternative price impact ratios as a proxy for liquidity, namely the RtoV, RtoTR, and RtoTRF ratios. We find a positive relationship between average stock return of decile portfolios and the level of RtoV ratio. Indeed, the stocks with low RtoV value (high liquidity) have lower return compared to stocks with high return to volume ratio. This evidence is consistent with previous studies such as Amihud (2002) and Nguyen et al. (2007). However, a puzzling result is that a decrease in the liquidity level leads to a decline in stock returns when using the RtoTR and RtoTRF ratios as liquidity measures. In particular, more liquid stocks (low RtoTR or RtoTRF ratios) yield higher returns than less liquid stocks. The spread between the average value-weighted returns of the top and bottom decile portfolios is 28.02% per year for portfolios sorted on the basis of RtoTRF ratio, and 20.03% per year for portfolios sorted by the RtoTR ratio. This is surprising because according to the Capital Asset Pricing Model (CAPM), higher risk is correlated with higher expected return. However, it can be explained by a trading frequency argument, liquid stocks may get traded more frequency and thus they have greater returns. This finding is consistent with the information-trading hypothesis of Wilcox (1993), which suggests that a delay in trading execution can lessen the security return of an active investor with predictive information. We also divide our sample into two sub periods to capture the influence of the global financial crises between 2007-2009 on asset pricing and liquidity.

We define the pre-financial crisis period as 1997-2007 and the post-financial crisis period as 2008-2017. Similar results are seen in both sub samples when considering portfolios sorted by the RtoTRF ratio. Our findings support the argument of Florackis, Gregoriou, and Kostakis (2011), which states that both trading costs and trading frequency are important factors in asset pricing and the former is dominated by the latter effect.

In addition, using the time-series tests we find that risk adjusted return of portfolios constructed on the basis of RtoTRF ratio is higher as compared to the returns of portfolios sorted based on RtoTR ratio. This suggests that the free float adjusted price impact ratio has superior performance than the RtoTR ratio in the US market. Following Florackis, Gregoriou, and Kostakis (2011), a price factor (PI) is added to the asset pricing models to examine whether the PI-adjusted models can explain the anomalies. There is a positive and significant correlation between PI and average portfolio return when using the RtoTR and RtoTRF ratios to assign stocks on decile portfolios. This implies that the price factor can partly explain the anomalies.

Our research contributes to the previous literature in the following ways. First, to the best of our knowledge, this is the first paper to provide empirical US evidence on the influence of liquidity on asset prices using the free float adjusted price impact ratio (Karim et al., 2016) as a liquidity proxy. We use in our opinion the best approximation of liquidity in the market microstructure literature to date for the reasons mentioned previously. This will enable us to capture the impact of liquidity on asset pricing in a more accurate manner then in previous research. Given the lack of empirical studies on liquidity and asset pricing, and the importance of the topic pre and post the 2007-2009 financial crises, we believe that our study provides an important contribution to the literature.

Second, the price impact ratio proposed by Florackis, Gregoriou, and Kostakis (2011) – the return to turnover ratio (RtoTR) has proved that it is priced in stock returns using data from the

London stock exchange over the period 1991-2008. In particular, they find that stocks with low RtoTR ratio have higher post-ranking returns compared to low RtoTR ratio stocks. In this paper, we test whether this result holds for the US equity market, which provides a robustness test for the quality of the RtoTR liquidity measure.

Moreover, we contribute to the literature in understanding the explanatory power of the most commonly used asset pricing models by academics and practitioners. We do this by conducting analysis in the context of multiple forms of asset pricing frameworks. We estimate three well-known asset pricing models including the single factor classic CAPM, three-factor model by Fama and French (1993), and the four-factor model of Carhart (1997). We are to our knowledge the first paper to augment the newly established Fama and French (2015) five factor asset pricing model with liquidity. Finally, we also provide evidence of the impact of the recent financial crisis on liquidity and stock return. We do this by analysing two subsamples including pre-financial crisis (1997 to 2007) and post-financial crisis (2008 to 2017). Our results establish that the stock illiquidity level is higher in the pre-crisis period compared to the post-crisis period, and the difference between top and bottom portfolios is statistically significant. However, the relationship between liquidity and stock return is only statistically significant for the pre crises period. The result could be attributed to the change in financial regulation in order to reduce the liquidity risk in the post-crisis period. After the global credit crunch financial crisis between 2007-2009, the Securities and Exchange Commission (SEC) released 2010 Reforms which adopted amendments to certain rules that govern money market funds in order to make assets more resilient to certain short-term market risks. The aim of the new rules is to improve the quality of portfolio securities and tighten the risk for the financial system. Following Duffie (2018), financial regulations have been set to reduce the likelihood and severity of future financial turmoil. In particular, they focus on “four core elements” including making financial institutions more resilient, ending "too-big to fail", making derivatives markets safer and transforming shadow banking.

The remainder of the study is organized as follows: Section 2 reviews the literature of liquidity and asset prices. Section 3 describes the liquidity measures used in this paper, including the RtoV, RtoTR, and RtoTRF ratios. Section 4 presents the data as well as the construction of the decile portfolios. The empirical results are reported in Section 5. Finally, Section 6 concludes the paper.

2. Literature Review

Over the last three decades, although numerous studies have been carried out to explain the role of liquidity in asset pricing, different conclusions are obtained about the liquidity's importance when different liquidity proxies are employed. On the one hand, it is argued that more liquid securities tend to be held with shorter investment horizons and they require lower expected returns. For instance, Amihud and Mendelson (1986) using the bid-ask spread, which is defined as the difference between bid and ask price as a liquidity proxy, provide evidence that there is a positive relationship between the bid-ask spread and market expected return. Focusing on US equities, Brennan, Chordia, and Subrahmanyam (1998) also provide evidence that liquidity is correlated negatively on required asset returns when employing dollar trading volume to measure liquidity. In particular, they find a statistically significant correlation between dollar volume and asset return on the NYSE and AMEX stock exchanges. Supporting evidences are seen in other studies when using samples from other stock markets such as the Australia market (Chan and Faff, 2005), emerging markets (Bekaert, Harvey, and Lundblad, 2007), and the Hong Kong market (Lam and Tam, 2011).

On the other hand, some empirical studies have shown conflicting evidence. For instance, Bekaert, Harvey, and Lundblad (2007), suggest that turnover ratio, which is considered as a proxy for liquidity as it captures the trading frequency dimension, does not significantly predict future return. Chordia, Subrahmanyam, and Anshuman (2001) also study whether expected stock return correlates to trading activity, which is another liquidity measure. They discover a strong and negative relation between stock return and the volatility of trading volume and share turnover. Furthermore, Eleswarapu and Reinganum (1993) suggest a seasonal affect because the bid-ask spread and average return is positively correlated to each other merely in January. Meanwhile, Hasbrouck (2009) proposes a new estimation of the trading effective cost from daily closing prices and find mixed evidence when examining the relationship between their trading cost and stock return. In particular, he shows that the effective cost has a positive association to stock return with the strongest relationship occurring in January.

In terms of asset pricing, in numerous models both single and multiple factors are developed to deal with asset choice under risk conditions. As a result, different asset models are used in empirical studies in order to explain the relation between liquidity and asset returns. Some widely used asset pricing models are the single factor CAPM, three-factor model of Fama and French (1993) (hereby 3FF model), and four-factor model of Carhart (1997). In CAPM, the expected return of stock is related to value of the security market. Fama and French (1993) expand the factors used to explain stock return by including size and book-to-market value to the asset pricing model. Meanwhile the four-factor model of Carhart (1997) accounts for these three factors and the momentum factor. As explanatory powers of asset pricing models are not the same and there is lack of investigation in research applications of these models, we apply four different model frameworks on our empirical data. They include the above three well-known asset pricing models and a new proposed model by Fama and French (2015) known as the five-factor model (5FF model). Besides some common risk factors such as the market, size, and value, the 5FF model captures two more patterns namely profitability and investment. Fama and French (2015) provide evidence that the five-factor model outperforms the three factor model of Fama and French (1993) in reflecting the average security return.

3. Liquidity measures

Our study mainly focuses on three alternative price impact ratios, namely the return to volume ratio by Amihud (2002), the return to turnover ratio developed by Florackis, Gregoriou, and Kostakis (2011) and the free-float adjusted price impact ratio by Karim et al. (2016).

3.1 Return to volume ratio by Amihud (2002) – RtoV ratio

The illiquidity ratio proposed by Amihud (2002) is the most commonly used price impact measure of liquidity in the finance literature. In particular, the illiquidity ratio also known as the return to volume ratio reflects the sensitivity of average absolute daily price to $1 trading volume for a stock. The average daily impact over a sample period is calculated as follows:

$$RtoV_{it} = \frac{1}{D_{it}} \sum_{d=1}^{D_{it}} \frac{|R_{idt}|}{Dvol_{idt}} \quad (1)$$

Where $RtoV_{it}$ is the return to volume ratio of stock i in the period t, D_{it} is the number of total trading days in the period t for stock i, R_{idt} is the return of stock i at day d, and $Dvol_{idt}$ is the dollar volume of stock i at day d in the period t. The stock is considered to be illiquid if the return to volume RtoV ratio is high.

In spite of the fact that the Amihud (2002) ratio is a useful and a convenient proxy for liquidity, there are still some limitations with using this ratio. First, it carries a size bias. Cochrane (2005) argues that for two stocks with the same turnover, the stock with large market capitalization is automatically less illiquid than small stocks because they have lower Amihud ratio levels. As a result, the illiquidity ratio is incomparable across stocks with different market capitalization (Florackis, Gregoriou, and Kostakis, 2011). Florackis, Gregoriou, and Kostakis (2011) also argue that it fails to reflect the trading frequency aspect of liquidity.

3.2 Return to turnover ratio by Florackis, Gregoriou, and Kostakis (2011) – RtoTR ratio

Florackis, Gregoriou, and Kostakis (2011) develop another price impact ratio to measure stock liquidity, which is known as the return to turnover ratio. It is considered as an alternative method to the widely used return to volume ratio in Amihud (2002). Using cross-sectional asset pricing test, Florackis, Gregoriou, and Kostakis (2011) argue that the Amihud ratio comes with two major shortcomings. First, it contains a size bias as this ratio does not capture the difference in market capitalization across stocks. Second, the information about trading frequency is not considered in this return to volume ratio.

Florackis, Gregoriou, and Kostakis (2011) introduce a new liquidity proxy that captures the price impact dimension, which is calculated as the absolute stock return to its turnover ratio.

$$RtoTR_{it} = \frac{1}{D_{it}}\sum_{d=1}^{D_{it}} \frac{|R_{idt}|}{TR_{idt}} \tag{2}$$

Where $RtoTR_{it}$ is the return to turnover ratio of stock i over the period of time t, TR_{itd} is the turnover ratio calculated as the ratio of share traded over share outstanding of stock i at day d, D_{it} and R_{itd} are defined as in equation (1).

Compared to the Amihud ratio, the dollar trade volume in the denominator is substituted by share turnover ratio in the RtoTR ratio. The Florackis, Gregoriou, and Kostakis (2011) return to turnover ratio is free of size bias and captures trading frequency.

3.3 Free-float Adjusted Price Impact Ratio by Karim et al. (2016) – RtoTRF ratio

Recently, a new price impact ratio which considers the percentage of shares that are traded to public investors (i.e. free float factor) is introduced by Karim et al. (2016). It is defined as below:

$$RtoTRF_{it} = \frac{1}{D_{it}}\sum_{d\,=\,1}^{D_{it}} \frac{|R_{idt}|}{TRF_{idt}} \tag{3}$$

Where $RtoTRF_{it}$ is the free float adjusted price impact ratio of stock i in period t, TRF_{itd} is the turnover ratio adjusted with public free float factor of stock i in period t, $D_{it}$and R_{itd} are defined in equation (1).

Compared to the RtoV and RtoTR ratios, the price impact ratio of Karim et al (2016) is not only free of size bias and captures the effect of trading frequency, but it also reflects the real supply of available shares available to the public for trading.

4. Data and summary statistics

4.1 Data selection

The data samples for our investigation on stock liquidity and asset pricing for the US market are obtained from the Centre for Research in Security Prices (CRSP) database and Thomson DataStream. We collect data on all public firms whose stocks are traded on three major US stock exchanges including NYSE, AMEX and NASDAQ exchanges over the 21-year period from 1997 to 2017. We consider all common stocks (CRSP share codes are 10 and 11) including both listed and de-listed assets to avoid the issue of survivorship bias.

For each stock, we collect daily data on share price, return, trading volume, and shares outstanding from the CRSP database. The free float factor (the percentage of common shares outstanding that are available for trading on the stock exchanges) and price to book ratio are obtained daily from Thomson DataStream. We then merge daily data from CRSP with data from DataStream using the CUSIP number. Given that the free float factor of public US firms is only available daily in DataStream from January 1996, our study begins in 1996. Moreover, monthly data on the risk-free rate, market return, and risk factors including size, value, momentum, profitability and investment for asset pricing models are obtained directly from the Kenneth R. French website[1].

Following Acharya and Pedersen (2005) and Pastor and Stambaugh (2003), we employ some filter criteria on our sample to remove outliers and reduce the measurement errors. In particular, we exclude stocks with daily share price below $5 and more than $1000. Moreover, a stock kept in the sample must have at least 15 daily observations in a month and its market value must be a minimum of $10 million. We also exclude stocks with a zero free float number.

4.2 Monthly data and portfolio construction

In line with prior studies on asset pricing, we use portfolios to test the correlation between expected stock returns and stock liquidity. Using portfolio levels are less affected by noise and outliers than individual stocks (Patton and Timmermann, 2007). In particular, following Nguyen et al. (2007), stocks are sorted into 25 portfolios based on the ascending order of liquidity measures (RtoV, RtoTR, and RtoTRF ratios). At the end of month t-1, stocks are classified in 25 portfolios according to their liquidity value. Stocks with lowest liquidity ratio are included in portfolio 1 (P1) and portfolio 25 (P25) contains the stocks with highest liquidity ratio. For robustness, both monthly equal weighted and value weighted portfolio returns are calculated. Portfolios are rebalanced on a monthly basis. Other monthly variables (liquidity, market value, and price to book) are calculated as the monthly average of their daily values. We also exclude months with less than 25 firms. Our final sample consists of 4051 firms, 252 months in the 21-year period from Jan 1997 to Dec 2017. It is common practice to sort stocks into 25 portfolios in financial empirical research (see among others, Acharya and Pedersen, 2005, and Bali et al., 2014).

[1] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Four models are considered for the asset pricing test in our study. The first model is the single factor classic CAPM which captures the market factor. The second model is the Fama and French three-factor model (Fama and French, 1993) which accounts for the market, size and value factors. The third model is the Carhart four-factor model (Carhart, 1997) which includes the three risk factors of the 3FF model and adds the momentum factor. The last model is the five-factor model introduced by Fama and French (2015), which consists of the 3FF model with profitability and investment as additional factors. The first three models are used widely in the asset pricing empirical studies, whereas the five factor model is still quite new and we are one of the first papers to implement this model in asset pricing.

5. Asset pricing tests

In this section, we test the risk-adjusted performance of 25 sorted portfolios constructed based on the liquidity measures using asset pricing tests.

In order to conduct a thorough comprehensive econometric analysis, we examine the portfolio abnormal performance using four asset pricing models. They are the standard original single factor CAPM, Fama and French three-factor model, Carhart four-factor model, and the Fama and French five factor model. The first model of modern asset pricing theory is the CAPM developed by Sharpe (1964) and Lintner (1965). According to the CAPM, the expected excess return of a security is a linear function of systematic or market risk.

$$R_{it} - R_{ft} = \alpha_i + \beta_{i,MKT} MKT_t + \varepsilon_{it} \tag{4}$$

Where R_{it} is the return of portfolio i in month t, R_{ft} is risk-free rate return in month t, and MKT_t is the market excess return that is obtained by subtracting the risk free rate from the market portfolio return in month t. The next model is the Fama-French three-factor model by Fama and French (1993). It captures the market, value and size factors.

$$R_{it} - R_{ft} = \alpha_i + \beta_{i,MKT} MKT_t + \beta_{i,SMB} SMB_t + \beta_{i,HML} HML_t + \varepsilon_{it} \tag{5}$$

Where SMB_t stands for the size factor, HML_t stands for the value risk factor. Other variables are defined as in equation (4). We also estimate the four-factor model by Carhart (1997) for asset pricing test with the following equation:

$$R_{it} - R_{ft} = \alpha_i + \beta_{i,MKT} MKT_t + \beta_{i,SMB} SMB_t + \beta_{i,HML} HML_t + \beta_{i,MOM} MOM_t + \varepsilon_{it} \quad (6)$$

Where MOM_t stands for the past performance factor (momentum). The last model we implement is the Fama and French five factor model – 5FF, introduced by Fama and French (2015).

$$R_{it} - R_{ft} = \alpha_i + \beta_{i,MKT} MKT_t + \beta_{i,SMB} SMB_t + \beta_{i,HML} HML_t + \beta_{i,RMW} RMW_t + \beta_{i,CMA} CMA_t + \varepsilon_{it} \quad (7)$$

Where RMW_t and CMA_t stand for profitability and investments, respectively. In order to test the null hypothesis that all 25 alphas are jointly equal to zero, we use the multivariate test of Gibbons, Ross and Shanken (1989) (GRS test). This test is widely used in the asset pricing literature, for instance it is used among others by Pastor and Stambaugh (2003), Nguyen et al. (2007), and Grauer and Janmaat (2010).

For comparison purposes, results of portfolio's alpha value are reported for all three liquidity measures formed portfolios (Table 1, 2, and 3). First, Table 1 presents the value weighted portfolio's alphas estimated under the four asset pricing models for portfolios constructed on the basis of the RtoV price impact ratio. Panel A shows the results for the whole period from 1997 to 2017, results of the two sub-periods are reported in Panel B and Panel C. It can be seen that none of the four asset pricing models can account for the liquidity premium by the return to volume ratio. All four alphas of the P1-P25 spread are negative and statistically significant. The CAPM alpha is -0.775% per month (t=-3.155) and the three factor Fama and French alpha is -0.593% per month (t=-2.679). The alpha values of the five factor Fama and French model and Carhart four factor model have similar figures. For the sub-periods, the post-financial crisis period from Jan 2008 to Dec 2017 shows a similar trend on the alpha value of the P1-P25 spread but with greater magnitude. Interestingly, as shown in Panel B, which refers to the pre- financial crisis period, the difference in alpha values of P1 and P25 for all four asset pricing models are not statistically significant.

[INSERT TABLE 1 HERE]

The corresponding alpha value of portfolios sorted on RtoTR and RtoTRF levels are presented in Table 2 and Table 3, respectively. There is similar movement of RtoTR and RtoTRF sorted portfolio alphas when moving from P1 to P25. Portfolios with smallest levels of liquidity measure (P1) yield the highest estimated alpha whereas P25 with biggest level of price impact ratio experiences the lowest alpha value. However, portfolios constructed on the free float adjusted price impact ratio display a greater alpha value, compared to the return to turnover sorted portfolios. In particular, Table 2 shows the value-weighted alpha value of portfolios formed on the RtoTR ratio. As shown in Panel A of Table 2, all four alphas of the P1-P25 spread computed with respect to different factors of asset pricing models are positive and statistically significant. CAPM adjusted premium is lowest with 1.461% per month (t=4.794), the highest premium belongs to the five factor Fama and French model (1.701% per month with t=6.066). Similar results are seen in Panel B when using the sample from 1997 to 2007 but with higher subsample alphas. For example, the five factor Fama and French alpha value of the P1-P25 spread is 2.518% per month (t=6.252). Nevertheless, in the later sub-period, the asset pricing models cannot completely account for RtoTR premium, as alpha value of the P1-P25 spread obtained from these models are positive but only significant at the 10% level, except for the 5FF alpha. For instance, CAPM alpha of P1-P25 spread is 0.739% per month (t=1.734) whereas the corresponding alpha of 3FF model is 0.681% per month(t=1.683). The 5FF premium yielded by the P1-P25 difference is positive at 0.489% per month but not statistically significant (t=1.161).

[INSERT TABLE 2 HERE]

Table 3 reports the value weighted alpha of portfolios formed on the RtoTRF ratio. It is clear that neither CAPM nor 3FF, four-factor model or 5FF can completely account for the risk adjusted performance. Indeed, Panel A shows that the liquidity premiums are positive and significant at the 1% level under four different asset pricing models. The CAPM adjusted return on the most liquid portfolio is 1.632% per month (t= 8.629) and the figure for the least liquid portfolio is -0.19% per month (t=-0.95). It leads to a high and significant liquidity premium of 1.97% per month (t=6.614). The three factor Fama and French and four factor Carhart premiums are greater than 2% per month. The five factor Fama and French model yields the highest alpha of the P1-P25 spread with 2.176% per month (t=7.852). The results are also robust across the two financial crises sub-periods. We witness that the pre crises period experiences greater alpha values compared to the post crises period.

[INSERT TABLE 3 HERE]

In term of the GRS test, the null hypothesis that the 25 estimated alphas are jointly equal to zero is rejected at the 1% significance level, over the entire sample period for four asset pricing models considered when using three liquidity measures to construct portfolios. Our findings support the argument that abnormal returns yielded from 25 decile portfolios constructed on the basis of three price impact ratios cannot be accounted completely by the asset pricing models.

Overall, the evidence has implied that the free float adjusted price impact ratio RtoTRF and the return to turnover ratio – RtoTR, are superior to the return to volume ratio – RtoV. This is because they both capture the impact of trading frequency on liquidity, and the RtoTRF ratio accounts for the real supply of available stocks to the public for trading. The premiums of the portfolio formed on the basis of the RtoTRF ratio are positive and significant using data on the US market between 1997 and 2017. This finding is robust when considering two sub-samples including pre and post financial crises periods. It suggests that stocks with higher liquidity levels offer higher expected returns. In addition, the RtoTR ratio's performance strongly supports the finding of Florackis, Gregoriou, and Kostakis (2011), that the trading cost effect is dominated by the impact of trading frequency. Equities with low transaction costs may still get the high premium if they are traded more frequency. Moreover, the finding of significant portfolios' alphas also shows that widely used asset pricing models cannot account for the entire abnormal returns yielded by liquidity measures.

For robustness, we also calculate alphas for equal-weighted portfolios constructed on the basis of the three price impact ratios. Tables 4, 5, and 6 show similar results for equal-weighted alphas of decile portfolios based on RtoV, RtoTR, and the RtoTRF price impact ratios, respectively. For example, the equal-weighted alpha of portfolios constructed on RtoTR ratios in Table 5 show a similar trend compared to value-weighted alpha (Table 2). However, the difference in alphas between P1 and P25 in the post-crisis period are stronger because they are significant at the 5% level for the first three asset pricing models, and at the 10% level for the five-factor Fama and French model. The equally-weighted alpha of portfolios formed on the RtoTRF ratio are reported in Table 6. CAPM alpha value declines significantly from 1.385% per month (t=8.368) in P1 to -0.035% per month (t=-1.706) in P25. This leads to a positive and significant P1-P25 premium at 1.716% per month (t=6.731). Lowest P1-P25 spread premium are viewed in the Fama and French five-factor model. This finding is robust across two sub financial crises periods as shown in Panel B and Panel C of Table 6.

[INSERT TABLE 4, 5, 6 HERE]

6. Conclusion

This study empirically examines the relationship between stock returns and liquidity using a new price impact ratio as our measure of liquidity. The free-float adjusted price impact ratio established by Karim et al. (2016), which is defined as the absolute daily stock return to the free-float adjusted turnover (RtoTRF ratio) is employed as an alternative to the widely used liquidity measure, the Amihud return to volume ratio (RtoV ratio). Compared to the RtoV ratio, the new liquidity measure is free of size bias. The RtoV ratio suffers from a size bias as small capitalization stocks are less liquid (high RtoV value) than stocks with greater market value. Our empirical findings support this argument, because the Spearman rank correlation between RtoV and market value is exceedingly strong (-0.947), whereas the figure of the RtoTRF ratio is -0.666.

In order to study the impact of the new liquidity measure on asset pricing, we use a data sample of all common stocks listed on three main stock exchanges of US markets from 1997 to 2017. By sorting these stocks into 25 decile portfolios based on the level of free-float price impact ratio, we find a negative correlation between RtoTRF ratio and expected stock returns. In particular, stocks with low RtoTRF (more liquid shares) have higher post ranking returns, compared to high RtoTRF stocks. This finding is robust when we use alternative asset pricing models. Furthermore, we include a price impact factor (PI) which is defined as the difference in return between portfolios with low RtoTRF and portfolios with high RtoTRF ratios, in order to explain the cross-sectional variation in post-ranking portfolio returns. We find a strong and statistically significant risk premium of PI when using four different asset pricing models including CAPM, three-factor Fama and French model (Fama and French, 1993), four-factor Carhart model (Carhart, 1997), and the five-factor Fama and French model (Fama and French, 2015).

Our research also tests the efficiency of another alternative to the Amihud ratio, the return to turnover ratio, which is constructed by Florackis, Gregoriou, and Kostakis (2011). Through substituting the denominator of the RtoV with the turnover ratio, they provide evidence that RtoTR is free of size bias when using a sample of listed stocks on the London Stock Exchange in the period from 1991 to 2008. They also suggest that the effect of trading activity dominates trading costs with respect to influencing expected stock returns. In our study we report that stocks with low RtoTR (liquid stocks) have higher post-ranking return than high RtoTR stocks, which are in agreement with the results in the UK stock market. The RtoTRF liquidity measure is superior to the RtoTR ratio because it encapsulates the number of shares that are available to the public for trading.

Overall, our findings have important implications for both academics and investors. We introduce a new price impact ratio, which is a more comprehensive alternative to the Amihud ratio as a measure of stock liquidity. As a result, the free float adjusted price impact ratio provides researchers with a more accurate approximation of stock market liquidity. This makes a strong contribution to the market microstructure and asset pricing literature. From a practical perspective, liquidity is one of the main drivers for the trading frequency of investors. Our superior liquidity measure will improve the efficiency of stock markets, give investors more confidence in investing, and improve the quality of academic research. Including our new measure of liquidity in the seven-factor asset pricing model based on prospect theory developed by Gregoriou et al (2019), would be an interesting avenue for further research.

References

Acharya, V. and Pedersen, L., 2005, Asset pricing with liquidity risk. *Journal of Financial Economics* 77, 375-410.

Amihud, Y. and Mendelson, H., 1986, Asset pricing and the bid-ask spread. *Journal of Financial Economics* 17, 223-249.

Amihud, Y., 2002, Illiquidity and Stock Returns: Cross-section and Time-series Effects. *Journal of Financial Markets* 5, 31-56.

Bali, Turan G., Lin Peng, Yannan Shen, and Yi Tang, 2014, Liquidity Shocks and Stock Market Reactions. *Review of Financial Studies* 27, 1434-1485.

Bekaert, G., Harvey, C. and Lundblad, C. 2007, Liquidity and Expected Returns: Lessons from Emerging Markets. *Review of Financial Studies* 20, 1783-1831.

Brennan, Michael J., T. Chordia, and A. Subrahmanyam, 1998, Alternative factor specifications, security characteristics, and the cross-section of expected stock returns, *Journal of Financial Economics* 49, 345-373.

Carhart, Mark M., 1997, On Persistence in Mutual Fund Performance. *The Journal of Finance* 52, 57.

Chan, Howard W., and Robert W. Faff, 2005, Asset Pricing and the Illiquidity Premium. *The Financial Review* 40, 429-458.

Chordia, Tarun, Avanidhar Subrahmanyam, and V.Ravi Anshuman, 2001, Trading activity and expected stock returns. *Journal of Financial Economics* 59, 3-32.

Cochrane, J.H., 2005, Asset Pricing Program Review: Liquidity, Trading and Asset Prices. *NBER Reporter*.

Duffie, Darrell, 2018, Financial Regulatory Reform After the Crisis: An Assessment. *Management Science* 64, 4835-4857.

Eleswarapu, V.R., Reinganum, M., 1993, The seasonal behavior of liquidity premium in asset pricing. *Journal of Financial Economics* 34, 373–386.

Fama, Eugene F., and Kenneth R. French, 1993, Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* 33, 3–56.

Fama, Eugene F., and Kenneth R. French, 2015, A five-factor asset pricing model. *Journal of Financial Economics* 116, 1-22.

Florackis, C., Gregoriou, A. and Kostakis, A., 2011, Trading frequency and asset pricing on the London Stock Exchange: Evidence from a new price impact ratio. *Journal of Banking and Finance* 35, 3335-3350.

Gibbons, Michael R., Stephen A. Ross, and Jay Shanken, 1989, A Test of the Efficiency of a Given Portfolio, *Econometrica* 57, 1121.

Goyenko, R., Holden, C. and Trzcinka, C. 2009, Do liquidity measures measure liquidity? *Journal of Financial Economics* 92, 153-181.

Grauer, Robert R., and Johannus A. Janmaat, 2010, Cross-sectional tests of the CAPM and Fama–French three-factor model. *Journal of Banking and Finance* 34, 457-470.

Gregoriou, A., Healy, J.V. and Le, H., 2019. Prospect theory and stock returns: A seven factor pricing model. *Journal of Business Research*, *101*, pp.315-322.

Karim, M., Azevedo, A., Gregoriou, A., and Rhodes, M., 2016, Bursa Malaysia Index Series Revision Effects on Market Microstructure. *PhD thesis, University of Hull*.

Lam, D. Lin, B. X., and Michayluk, D., 2011, Demand and supply and their relationship to liquidity: Evidence from the S&P 500 change to free float. *Financial Analysts Journal* 67, 55-71

Lam, K. and Tam, L., 2011, Liquidity and asset pricing: Evidence from the Hong Kong stock market. *Journal of Banking and Finance* 35, 2217-2230.

Lesmond, A., David, 2005, Liquidity of emerging markets. *Journal of Financial Economics* 77, 411-452.

Lintner, J., 1965, The valuation of risk assets on the selection of risky investments in stock portfolios and capital budgets. *Review of Economics and Statistics* 47, 13-37.

Newey, Whitney K., and Kenneth D. West, 1987, A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. *Econometrica* 55, 703.

Nguyen, D., Mishra, S., Prakash, A. and Ghosh, D., 2007, Liquidity and Asset Pricing under Three-moment CAPM Paradigm. *Journal of Financial Research* 30, 379-398.

Pástor, Ľ, and Stambaugh, R., 2003, Liquidity Risk and Expected Stock Returns. *Journal of Political Economy* 111, 642-685.

Patton, A.J and Timmermann, A., 2007, Portfolio Sorts and Tests of Cross-Sectional Patterns in Expected Returns. *Working Paper, 1-44.*

Peterson, M. and Fialkowski, D., 1994, Posted Versus Effective Spreads: Good Prices or Bad Quotes? *Journal of Financial Economics* 35, 269-292.

Roll, Richard., 1984, A Simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market. *Journal of Finance* 39, 1127-1139.

Sharpe, William F., 1964, Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *The Journal of Finance* 19, 425.

Wilcox, Jarrod W., 1993, The Effect of Transaction Costs and Delay on Performance Drag. *Financial Analysts Journal* 3, 45-54.

Table 1: Alpha value of value weighted portfolio based on RtoV ratio

a of 25 value-weighted decile portfolios constructed based on the RtoV ratio. At month t-1, all stocks are sorted and classified into 25 decile portfolios based on the RtoV price impact ratio. P25 co
t ratio are assigned on P1. The sorting procedure at each month with all eligible stocks at that time. The excess sorted portfolio returns for one post ranking months are obtained as the post ranking p
ntercepts from the regression of asset pricing model. CAPM alpha is monthly alpha estimated from CAPM, 3FF alpha is monthly alpha obtained from Fama and French three-factor model, 5FF alph
hart alpha is monthly alpha estimated from Carhart four-factor model. P25-P1 is the difference of alphas between highest and lowest liquidity ratio portfolios. GRS test is the F-value of Gibbons, Ross
alphas jointly equal zero. *, **, ***, denotes statistical significant at the 10%, 5%, and 1% level, respectively.

4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
								Panel A: Feb 1997 to Dec 2017											
[illegible]	0.798	0.734	0.813	0.870	0.935	0.964	1.133	0.944	1.000	1.068	1.159	1.282	1.273	1.463	1.384	1.549	1.504	1.728	1.645
[illegible]	*5.887****	*5.122****	*5.586****	*5.659****	*6.057****	*5.585****	*6.689****	*4.918****	*5.200****	*5.258****	*5.777****	*5.843****	*5.716****	*6.314****	*6.037****	*6.282****	*6.468****	*7.689****	*8.042****
0.613	0.687	0.627	0.688	0.732	0.810	0.803	0.986	0.780	0.821	0.879	0.984	1.068	1.060	1.252	1.162	1.308	1.290	1.544	1.480
*5.139****	*6.080****	*5.050****	*6.119****	*6.665****	*6.931****	*6.564****	*8.099****	*5.939****	*7.022****	*6.499****	*7.805****	*8.133****	*7.707****	*8.130****	*7.411****	*7.898****	*7.963****	*8.734****	*8.944****
0.665	0.746	0.669	0.730	0.764	0.857	0.854	1.040	0.819	0.888	0.922	1.054	1.160	1.136	1.381	1.283	1.403	1.416	1.652	1.525
*5.630****	*6.745****	*5.398****	*6.524****	*6.939****	*7.395****	*7.043****	*8.634****	*6.234****	*7.799****	*6.815****	*8.586****	*9.256****	*8.465****	*9.679****	*8.694****	*8.707****	*9.306****	*9.656****	*9.195****
[illegible]	0.525	0.440	0.564	0.611	0.671	0.678	0.897	0.680	0.732	0.741	0.892	0.996	0.986	1.162	1.124	1.209	1.237	1.521	1.422
[illegible]	*4.689****	*3.596****	*4.970****	*5.500****	*5.697****	*5.456****	*7.152****	*5.051****	*6.072****	*5.422****	*6.893****	*7.314****	*6.911****	*7.342****	*6.890****	*7.066****	*7.327****	*8.242****	*8.253****
								Panel B: Feb 1997 to Dec 2007											
0.906	0.972	0.921	0.965	1.191	1.130	1.126	1.383	1.102	1.261	1.269	1.345	1.381	1.532	1.454	1.548	1.601	1.536	1.619	1.531
4.286	*4.412*	*4.103*	*4.321*	*4.931*	*5.115*	*4.487*	*5.329*	*3.743*	*4.350*	*4.126*	*4.455*	*4.212*	*4.717*	*4.481*	*4.947*	*4.614*	*4.938*	*5.227*	*5.626*
0.588	0.613	0.556	0.626	0.814	0.807	0.747	1.014	0.685	0.837	0.825	0.940	0.895	1.072	0.993	1.106	1.109	1.105	1.246	1.180
[illegible]	*3.540*	*3.109*	*3.646*	*4.832*	*4.874*	*3.920*	*5.349*	*3.367*	*4.631*	*3.777*	*4.974*	*4.553*	*5.138*	*4.513*	*4.737*	*4.414*	*4.993*	*4.908*	*5.290*
0.716	0.754	0.637	0.670	0.881	0.913	0.842	1.138	0.760	0.968	0.915	1.053	1.105	1.258	1.219	1.355	1.322	1.329	1.467	1.239
[illegible]	*4.575*	*3.557*	*3.841*	*5.196*	*5.631*	*4.428*	*6.139*	*3.698*	*5.541*	*4.164*	*5.658*	*6.265*	*6.429*	*6.108*	*6.467*	*5.553*	*6.591*	*6.132*	*5.469*
0.476	0.499	0.437	0.514	0.701	0.738	0.661	0.953	0.594	0.751	0.675	0.906	0.832	1.025	0.940	1.041	1.066	1.048	1.224	1.132
2.696	*2.867*	*2.434*	*3.003*	*4.170*	*4.365*	*3.394*	*4.918*	*2.865*	*4.079*	*3.110*	*4.652*	*4.112*	*4.758*	*4.211*	*4.328*	*4.121*	*4.603*	*4.656*	*4.916*
								Panel C: Jan 2008 to Dec 2017											
0.440	0.559	0.492	0.609	0.485	0.679	0.730	0.830	0.734	0.672	0.801	0.885	1.139	0.904	1.400	1.130	1.408	1.386	1.766	1.687
3.194	*4.099*	*3.002*	*3.566*	*2.795*	*3.257*	*3.261*	*3.975*	*3.124*	*2.808*	*3.248*	*3.598*	*4.256*	*3.131*	*4.387*	*3.546*	*4.338*	*4.316*	*5.792*	*5.766*
0.423	0.553	0.469	0.614	0.497	0.669	0.745	0.854	0.743	0.687	0.826	0.891	1.180	0.951	1.435	1.193	1.479	1.429	1.813	1.736
[illegible]	*4.807*	*3.606*	*4.711*	*3.961*	*4.550*	*5.977*	*5.903*	*4.921*	*5.149*	*6.007*	*5.675*	*7.041*	*5.488*	*7.148*	*5.930*	*7.062*	*6.257*	*7.500*	*7.034*
0.426	0.557	0.473	0.621	0.500	0.672	0.748	0.856	0.747	0.692	0.829	0.899	1.183	0.952	1.443	1.199	1.482	1.438	1.818	1.740
3.347	*4.949*	*3.764*	*5.186*	*4.056*	*4.598*	*6.135*	*5.946*	*5.007*	*5.349*	*6.063*	*6.146*	*7.120*	*5.491*	*7.594*	*6.064*	*7.086*	*6.561*	*7.566*	*7.088*
0.410	0.538	0.442	0.634	0.517	0.601	0.716	0.852	0.780	0.721	0.874	0.885	1.230	0.908	1.476	1.303	1.446	1.557	1.961	1.845
3.051	*4.468*	*3.239*	*4.622*	*3.911*	*3.943*	*5.476*	*5.640*	*4.940*	*5.150*	*6.071*	*5.356*	*7.009*	*5.018*	*7.017*	*6.280*	*6.575*	*6.557*	*7.906*	*7.295*

Table 3: Alpha value of value-weighted portfolio based on RtoTRF ratio

Table 2: Alpha value of value-weighted portfolio based on RtoTR ratio

This table shows the post-ranking alpha of 25 value-weighted decile portfolios constructed based on the RtoTRF ratio. At month t-1, all stocks are sorted and classified into 25 decile portfoli [illegible] Ross and Shanken (1989) test under the null hypothesis that all 25 decile portfolios' alphas jointly equal zero. *, **, ***, denotes statistical significant at the 10%, 5%, and 1% level, respec

Decile	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Panel A: Feb 1997 to Dec 2017																			
CAPM	1.632	1.169	1.039	1.037	1.029	1.000	0.816	0.647	0.718	0.513	0.206	0.318	0.315	-0.148	0.315	0.085	0.421	0.218	0.469
	*8.629****	*7.813****	*7.558****	*7.074****	*7.731****	*6.019****	*5.792****	*4.290****	*4.310****	*3.348****	*1.134*	*1.654**	*1.605*	*-0.70*	*1.934*	*0.985*	*1.757**	*0.993*	*1.905**
3FF	1.626	1.184	1.018	1.001	1.006	0.983	0.794	0.648	0.731	0.493	0.191	0.348	0.267	-0.183	0.270	0.016	0.366	0.208	0.391
	*9.028****	*7.938****	*7.417****	*6.864****	*7.550****	*5.928****	*5.659****	*4.260****	*4.441****	*3.262****	*1.048*	*1.812**	*1.397*	*-0.89*	*1.934*	*0.074*	*1.531*	*0.949*	*1.642*
Carthart	1.627	1.165	0.994	1.000	1.030	0.995	0.771	0.598	0.792	0.485	0.186	0.347	0.308	-0.062	0.302	0.014	0.406	0.319	0.332
	*8.932****	*7.743****	*7.187****	*6.784****	*7.670****	*5.943****	*5.449****	*3.940****	*4.838****	*3.161****	*1.011*	*1.789**	*1.609*	*-0.31*	*1.480*	*0.061*	*1.706*	*1.482*	*1.466*
5FF	1.683	1.126	0.932	0.890	0.938	0.981	0.745	0.675	0.760	0.421	0.050	0.331	0.150	-0.225	0.212	-0.105	0.219	0.174	0.071
	*9.006****	*7.251****	*6.594****	*5.949****	*6.787****	*5.670****	*5.109****	*4.280****	*4.422****	*2.687****	*0.264*	*1.672**	*0.758*	*-1.040*	*1.005*	*-0.460*	*0.914*	*0.776*	*0.299*
Panel B: Feb 1997 to Dec 2007																			
CAPM	2.022	1.191	1.446	1.210	0.735	1.250	1.167	0.669	0.593	0.903	0.729	-0.019	0.992	0.539	0.863	0.787	0.091	0.687	0.404
	6.343	*3.822*	*5.079*	*3.690*	*3.220*	*5.924*	*4.668*	*2.044*	*2.247*	*3.276*	*2.628*	*-0.073*	*3.335*	*1.967*	*2.993*	*2.618*	*0.253*	*1.658*	*1.023*
3FF	2.172	1.418	1.431	1.213	0.763	1.208	1.139	0.636	0.565	0.961	0.635	-0.127	0.919	0.458	0.618	0.772	-0.106	0.546	0.127
	7.522	*4.934*	*4.989*	*3.617*	*3.284*	*5.779*	*4.423*	*2.445*	*2.076*	*3.394*	*2.311*	*-0.511*	*3.101*	*1.998*	*2.023*	*2.546*	*-0.399*	*1.375*	*0.354*
Carthart	2.147	1.437	1.399	1.365	0.691	1.141	1.281	0.652	0.731	0.767	0.780	-0.089	1.021	0.398	0.605	0.914	0.017	0.449	0.124
	7.271	*4.889*	*4.770*	*4.063*	*2.934*	*5.388*	*5.018*	*2.452*	*2.726*	*2.781*	*2.858*	*-0.330*	*3.410*	*1.964*	*1.935*	*3.016*	*0.058*	*1.112*	*0.356*
5FF	2.379	1.383	1.467	1.365	0.765	1.192	1.189	0.590	0.578	0.916	0.397	-0.183	0.875	0.311	0.349	0.667	-0.144	0.318	-0.027
	8.261	*4.661*	*5.027*	*3.985*	*3.176*	*5.519*	*4.477*	*2.233*	*2.053*	*3.156*	*1.473*	*-0.708*	*2.877*	*1.067*	*1.174*	*2.239*	*-0.474*	*0.790*	*-0.074*

Decile	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Panel A: Feb 1997 to Dec 2017																			
CAPM	1.274	1.192	1.168	1.134	1.088	0.660	0.839	0.793	0.222	0.199	0.401	0.402	0.024	-0.070	0.321	0.261	0.335	0.532	0.470
	*6.976****	*7.796****	*8.590****	*8.089****	*7.307****	*4.843****	*6.047****	*4.579****	*1.316*	*1.138*	*2.323***	*1.841**	*0.111*	*0.353*	*1.587*	*1.261*	*1.400*	*2.251***	*1.637*
3FF	1.290	1.182	1.138	1.114	1.082	0.635	0.852	0.801	0.170	0.195	0.401	0.376	-0.017	-0.029	0.254	0.239	0.289	0.500	0.373
	*7.391****	*7.717****	*8.412****	*7.015****	*7.341****	*4.655****	*6.207****	*4.631****	*1.024****	*1.144****	*2.213***	*1.833**	*-0.08*	*0.150*	*1.285*	*1.150*	*1.326*	*2.156***	*1.392*
Carhart	1.275	1.153	1.117	1.112	1.112	0.608	0.852	0.858	0.179	0.225	0.424	0.391	0.084	-0.099	0.261	0.265	0.373	0.497	0.351
	*7.232****	*7.479****	*8.185****	*7.816****	*7.500****	*4.428****	*6.137****	*4.966****	*1.068*	*1.309*	*2.317***	*1.885**	*0.405*	*0.508*	*1.309*	*1.264*	*1.584*	*2.178***	*1.298*
5FF	1.349	1.129	0.990	1.080	1.092	0.564	0.821	0.792	0.149	0.072	0.344	0.281	-0.092	-0.090	0.137	0.123	0.225	0.224	0.109
	*7.428****	*7.076****	*7.213****	*7.356****	*7.088****	*3.982****	*5.778****	*4.388****	*0.856*	*0.407*	*1.824**	*1.319*	*-0.42*	*-0.44*	*0.671*	*0.590*	*0.942*	*0.960*	*0.398*
Panel B: Feb 1997 to Dec 2007																			
CAPM	1.583	1.200	1.359	1.006	1.215	1.330	0.963	0.452	1.075	0.460	0.017	0.749	0.556	0.571	0.412	0.764	1.027	0.452	0.812
	4.649	*4.405*	*4.699*	*3.767*	*6.265*	*4.852*	*3.687*	*3.130*	*3.672*	*1.463*	*0.063*	*2.753*	*2.031*	*1.866*	*1.201*	*2.202*	*3.453*	*1.136*	*3.080*
3FF	1.802	1.272	1.457	1.038	1.202	1.237	1.035	0.401	1.154	0.508	-0.067	0.652	0.369	0.330	0.343	0.606	0.891	0.119	0.570
	5.725	*4.712*	*4.947*	*3.852*	*6.102*	*4.419*	*3.857*	*1.837*	*3.847*	*1.579*	*0.251*	*2.520*	*1.379*	*1.148*	*1.020*	*1.840*	*3.275*	*0.337*	*1.457*
Carhart	1.813	1.294	1.549	0.992	1.183	1.423	1.075	0.354	1.134	0.652	0.023	0.650	0.368	0.257	0.469	0.627	0.833	0.117	0.600
	5.626	*4.689*	*5.194*	*3.607*	*5.872*	*5.207*	*3.924*	*1.590*	*3.695*	*3.019*	*0.084*	*2.456*	*1.346*	*0.878*	*1.380*	*1.862*	*3.038*	*0.314*	*1.500*
5FF	1.997	1.220	1.561	1.058	1.225	1.337	0.975	0.324	1.049	0.452	-0.128	0.634	0.291	0.054	0.299	0.513	0.609	0.087	0.448
	6.311	*4.409*	*5.168*	*3.794*	*6.005*	*4.649*	*3.559*	*1.451*	*3.403*	*1.358*	*-0.462*	*2.366*	*1.061*	*0.194*	*0.904*	*1.518*	*1.520*	*-0.235*	*1.160*
Panel C: Jan 2008 to Dec 2017																			
CAPM	1.261	0.971	1.121	0.973	1.075	1.047	0.658	0.537	0.570	0.702	0.141	-0.121	0.089	-0.351	-0.366	-0.448	-0.216	0.283	0.068
	5.624	*5.487*	*7.344*	*7.572*	*7.895*	*6.449*	*4.487*	*3.536*	*3.359*	*4.194*	*0.729*	*-0.637*	*0.386*	*-1.470*	*-1.555*	*-1.397*	*-0.743*	*1.024*	*0.227*
3FF	1.209	0.959	1.097	0.958	1.082	1.032	0.653	0.564	0.573	0.731	0.219	-0.096	0.067	-0.313	-0.343	-0.436	-0.174	0.262	0.074
	5.716	*5.384*	*7.214*	*7.587*	*7.889*	*6.370*	*4.410*	*3.743*	*3.348*	*4.425*	*1.262*	*-0.511*	*0.292*	*-1.360*	*-1.583*	*-1.452*	*-0.639*	*1.035*	*0.254*
Carhart	1.211	0.963	1.096	0.957	1.081	1.034	0.653	0.566	0.575	0.729	0.216	-0.100	0.069	-0.304	-0.338	-0.433	-0.169	0.267	0.076
	5.730	*5.490*	*7.190*	*7.564*	*7.875*	*6.361*	*4.389*	*3.778*	*3.356*	*4.414*	*1.252*	*-0.538*	*0.297*	*-1.379*	*-1.582*	*-1.440*	*-0.624*	*1.059*	*0.257*
5FF	1.223	0.861	1.064	0.853	1.094	0.998	0.648	0.495	0.554	0.651	0.235	-0.127	-0.127	-0.346	-0.370	-0.488	-0.094	0.208	0.128
	5.489	*4.651*	*6.689*	*6.971*	*7.617*	*6.113*	*4.219*	*3.147*	*3.153*	*3.784*	*1.285*	*-0.645*	*-0.549*	*-1.431*	*-1.650*	*-1.545*	*-0.330*	*0.786*	*0.419*

CAPM	1.499	1.087	0.968	1.036	0.864	1.060	0.798	0.813	0.751	0.537	0.498	0.551	-0.085	-0.101	-0.316	-0.421	-0.698	-0.465	0.128
	6.206	*5.688*	*5.237*	*6.151*	*6.360*	*7.307*	*5.011*	*5.066*	*5.104*	*3.234*	*2.718*	*3.326*	*-0.421*	*-0.444*	*-1.452*	*-1.522*	*-2.387*	*-1.696*	*0.390*
3FF	1.466	1.050	0.948	1.023	0.844	1.050	0.785	0.806	0.780	0.554	0.516	0.587	-0.039	-0.053	-0.291	-0.407	-0.670	-0.460	0.122
	6.222	*5.728*	*5.124*	*6.113*	*6.228*	*7.191*	*4.900*	*4.969*	*5.545*	*3.345*	*2.800*	*3.655*	*-0.199*	*-0.238*	*-1.334*	*-1.580*	*-2.348*	*-1.848*	*0.400*
Carthart	1.471	1.052	0.955	1.022	0.841	1.050	0.784	0.805	0.784	0.556	0.515	0.588	-0.040	-0.045	-0.290	-0.400	-0.673	-0.458	0.130
	6.274	*5.729*	*5.378*	*6.089*	*6.259*	*7.160*	*4.879*	*4.953*	*5.729*	*3.362*	*2.785*	*3.641*	*-0.203*	*-0.208*	*-1.323*	*-1.584*	*-2.359*	*-1.836*	*0.436*
5FF	1.461	1.020	0.885	0.946	0.777	1.009	0.787	0.799	0.617	0.568	0.515	0.514	-0.078	-0.223	-0.336	-0.277	-0.695	-0.432	0.028
	5.952	*5.299*	*4.557*	*5.491*	*5.577*	*6.707*	*4.735*	*4.728*	*4.442*	*3.377*	*2.672*	*3.117*	*-0.375*	*-0.975*	*-1.510*	*-1.032*	*-2.332*	*-1.652*	*0.090*

Table 4: Alpha value of equal-weighted portfolio based on RtoV ratio

This table shows the post-ranking alpha of 25 equal-weighted decile portfolios constructed based on the RtoV ratio. At month t-1, all stocks are sorted and classified into 25 decile po
liquidity level stocks whereas stock with lowest liquidity price impact ratio are assigned on P1. The sorting procedure at each month with all eligible stocks at that time. The excess r
post ranking portfolio returns minus the monthly risk free rate. The alphas are estimated as intercepts from the regression of asset pricing model. CAPM alpha is monthly alpha estim
French three factor model, 5FF alpha is monthly alpha derived from Fama and French five factor model, and Carhart alpha is monthly alpha estimated from Carhart four factor
liquidity ratio portfolios. GRS test is the F-value of Gibbons, Ross and Shanken (1989) test under the null hypothesis that all 25 decile portfolios' alphas jointly equal zero. *,
respectively.

Decile	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	2
												Panel A: Feb 1997 to Dec 2017								
CAPM	0.113	0.243	0.316	0.270	0.305	0.256	0.266	0.464	0.411	0.415	0.562	0.398	0.521	0.444	0.616	0.653	0.750	0.940	1.001	1.
	1.592	*2.738*	*2.837*	*2.177*	*2.355*	*1.842*	*1.786*	*2.948*	*2.580*	*2.390*	*3.186*	*1.944*	*2.664*	*2.135*	*2.985*	*2.866*	*3.222*	*4.084*	*4.422*	*4.*
3FF	0.143	0.213	0.256	0.203	0.207	0.154	0.148	0.341	0.284	0.264	0.423	0.236	0.352	0.264	0.446	0.448	0.531	0.727	0.788	0.9
	2.105	*2.562*	*2.501*	*1.779*	*1.953*	*1.317*	*1.342*	*3.226*	*2.593*	*2.242*	*3.509*	*1.811*	*3.154*	*2.134*	*3.692*	*3.260*	*4.022*	*5.124*	*5.176*	*5.*
Carhart	0.138	0.203	0.283	0.247	0.263	0.189	0.186	0.387	0.347	0.334	0.496	0.304	0.424	0.337	0.537	0.575	0.646	0.864	0.921	1.0
	2.000	*2.411*	*2.763*	*2.178*	*2.537*	*1.618*	*1.690*	*3.706*	*3.259*	*2.916*	*4.254*	*2.383*	*3.951*	*2.815*	*4.703*	*4.600*	*5.320*	*6.773*	*6.570*	*7.*
5FF	0.173	0.199	0.157	0.089	0.085	-0.003	0.066	0.276	0.181	0.195	0.378	0.180	0.290	0.206	0.396	0.412	0.512	0.669	0.776	0.9
	2.456	*2.324*	*1.503*	*0.770*	*0.791*	*-0.023*	*0.579*	*2.538*	*1.615*	*1.596*	*3.020*	*1.333*	*2.510*	*1.608*	*3.159*	*2.882*	*3.716*	*4.559*	*4.884*	*5.*
												Panel B: Feb 1997 to Dec 2007								
CAPM	0.127	0.334	0.493	0.391	0.442	0.378	0.372	0.756	0.558	0.511	0.785	0.616	0.821	0.634	0.854	0.708	1.030	1.066	1.301	1.2
	1.155	*2.257*	*2.627*	*1.958*	*2.140*	*1.718*	*1.579*	*2.964*	*2.328*	*1.955*	*2.832*	*1.931*	*2.734*	*1.948*	*2.670*	*2.011*	*2.913*	*3.138*	*3.927*	*3.*
3FF	0.185	0.226	0.262	0.150	0.144	0.040	0.069	0.439	0.228	0.163	0.445	0.218	0.431	0.221	0.478	0.264	0.564	0.613	0.839	0.8
	1.699	*1.626*	*1.606*	*0.843*	*0.879*	*0.228*	*0.386*	*2.591*	*1.404*	*0.854*	*2.280*	*1.063*	*2.436*	*1.101*	*2.535*	*1.182*	*2.688*	*2.716*	*3.509*	*3.*
Carhart	0.184	0.195	0.335	0.262	0.279	0.108	0.107	0.549	0.374	0.301	0.628	0.351	0.565	0.367	0.643	0.555	0.825	0.885	1.101	1.
	1.657	*1.373*	*2.051*	*1.505*	*1.791*	*0.611*	*0.589*	*3.316*	*2.456*	*1.625*	*3.469*	*1.746*	*3.319*	*1.892*	*3.619*	*2.984*	*4.640*	*4.546*	*5.178*	*5.*
5FF	0.202	0.240	0.206	0.061	0.047	-0.064	-0.008	0.363	0.188	0.099	0.402	0.163	0.365	0.122	0.474	0.250	0.565	0.596	0.797	0.8
	1.807	*1.701*	*1.232*	*0.340*	*0.286*	*-0.363*	*-0.043*	*2.133*	*1.119*	*0.502*	*2.012*	*0.773*	*2.012*	*0.600*	*2.428*	*1.083*	*2.600*	*2.575*	*3.223*	*3.*
												Panel C: Jan 2008 to Dec 2017								
CAPM	0.130	0.136	0.095	0.117	0.131	0.100	0.129	0.121	0.232	0.274	0.303	0.123	0.166	0.199	0.301	0.564	0.362	0.723	0.601	0.9
	1.717	*1.506*	*0.915*	*0.856*	*0.894*	*0.625*	*0.747*	*0.708*	*1.131*	*1.230*	*1.441*	*0.503*	*0.688*	*0.809*	*1.220*	*2.100*	*1.277*	*2.469*	*2.059*	*2.9*
3FF	0.129	0.121	0.092	0.100	0.130	0.081	0.138	0.135	0.226	0.293	0.323	0.122	0.179	0.230	0.308	0.604	0.413	0.757	0.651	0.9
	1.789	*1.416*	*0.902*	*0.785*	*1.082*	*0.662*	*1.143*	*1.152*	*1.723*	*2.468*	*2.506*	*0.824*	*1.471*	*1.724*	*2.082*	*3.920*	*2.614*	*4.885*	*3.543*	*4.*
Carhart	0.128	0.122	0.094	0.102	0.133	0.085	0.144	0.137	0.229	0.296	0.324	0.128	0.185	0.234	0.316	0.608	0.418	0.764	0.659	0.9
	1.780	*1.433*	*0.925*	*0.805*	*1.113*	*0.708*	*1.282*	*1.184*	*1.757*	*2.559*	*2.519*	*0.890*	*1.601*	*1.807*	*2.321*	*4.010*	*2.689*	*5.246*	*3.801*	*4.8*
5FF	0.099	0.125	0.092	0.114	0.117	0.056	0.156	0.159	0.176	0.304	0.356	0.200	0.211	0.303	0.314	0.637	0.434	0.806	0.825	0.9
	1.342	*1.398*	*0.853*	*0.858*	*0.927*	*0.437*	*1.227*	*1.292*	*1.296*	*2.435*	*2.651*	*1.305*	*1.649*	*2.207*	*2.012*	*3.930*	*2.605*	*4.990*	*4.452*	*4.4*

Table 6: Alpha value of equal-weighted portfolio based on RtoTRF ratio

This table shows the post-ranking alpha of 25 equal-weighted decile portfolios constructed based on the RtoTRF ratio. At month t-1, all stocks are sorted and classified into 25 decile portfo level stocks whereas stock with lowest liquidity price impact ratio are assigned on P1. The sorting procedure at each month with all eligible stocks at that time. The excess sorted portfolio returns minus the monthly risk free rate. The alphas are estimated as intercepts from the regression of asset pricing model. CAPM alpha is monthly alpha estimated from CAPM, 3FF alp alpha is monthly alpha derived from Fama and French five factor model, and Carhart alpha is monthly alpha estimated from Carhart four factor model. P25-P1 is the difference of alphas of Gibbons, Ross and Shanken (1989) test under the null hypothesis that all 25 decile portfolios' alphas jointly equal zero. *, **, ***, denotes statistical significant at the 10%, 5%, and 1

Decile	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
												Panel A: Feb 1997 to Dec 2017							
CAPM	1.385	1.236	1.204	1.212	1.199	1.063	1.081	1.005	0.894	1.024	0.983	0.820	0.757	0.900	0.888	0.885	0.691	0.876	0.820
	8.368	*8.197*	*8.440*	*8.040*	*8.441*	*7.576*	*7.536*	*7.214*	*6.028*	*6.655*	*5.770*	*5.507*	*4.301*	*5.152*	*5.099*	*4.608*	*3.844*	*4.869*	*4.212*
3FF	1.281	1.130	1.102	1.092	1.103	0.951	0.967	0.885	0.795	0.892	0.847	0.691	0.604	0.757	0.752	0.723	0.526	0.724	0.645
	10.033	*9.370*	*10.959*	*9.800*	*9.348*	*9.122*	*9.448*	*10.067*	*7.360*	*8.603*	*7.444*	*6.786*	*5.293*	*6.264*	*5.852*	*5.900*	*4.254*	*5.672*	*5.026*
Carhart	1.388	1.200	1.145	1.164	1.165	1.001	1.026	0.923	0.882	0.963	0.934	0.743	0.718	0.853	0.872	0.821	0.636	0.792	0.720
	11.706	*10.238*	*11.492*	*10.851*	*10.075*	*9.760*	*10.310*	*10.617*	*8.741*	*9.713*	*8.696*	*7.439*	*7.053*	*7.547*	*7.459*	*7.155*	*5.609*	*6.340*	*5.779*
5FF	1.226	1.022	0.991	0.977	0.975	0.825	0.885	0.850	0.730	0.855	0.818	0.679	0.553	0.711	0.739	0.645	0.449	0.694	0.609
	9.241	*8.293*	*9.730*	*8.626*	*8.144*	*7.855*	*8.446*	*9.288*	*6.521*	*7.916*	*6.886*	*6.478*	*4.667*	*5.656*	*5.501*	*5.089*	*3.515*	*5.211*	*4.553*
												Panel B: Feb 1997 to Dec 2007							
CAPM	1.508	1.529	1.756	1.427	1.422	1.662	1.368	1.497	1.441	1.276	1.339	1.246	1.354	1.188	0.860	1.289	1.229	1.247	1.039
	5.738	*6.092*	*7.146*	*6.059*	*6.118*	*7.528*	*5.759*	*6.313*	*6.293*	*5.516*	*5.252*	*4.901*	*5.324*	*4.908*	*3.638*	*4.992*	*4.694*	*4.686*	*4.164*
3FF	1.378	1.309	1.483	1.193	1.173	1.400	1.139	1.244	1.177	0.948	0.995	0.917	1.036	0.857	0.488	0.902	0.822	0.861	0.671
	7.159	*7.290*	*8.539*	*6.756*	*7.147*	*9.308*	*6.105*	*7.011*	*6.868*	*5.797*	*5.665*	*5.239*	*5.040*	*4.924*	*2.919*	*4.717*	*4.516*	*4.677*	*3.661*
Carhart	1.560	1.426	1.596	1.380	1.293	1.473	1.333	1.387	1.307	1.106	1.175	1.087	1.294	1.036	0.633	1.108	0.971	1.020	0.866

Table 5: Alpha value of equal-weighted portfolio based on RtoTR ratio

This table shows the post-ranking alpha of 25 equal-weighted decile portfolios constructed based on the RtoTR ratio. At month t-1, all stocks are sorted and classified into 25 decile p liquidity level stocks whereas stock with lowest liquidity price impact ratio are assigned on P1. The sorting procedure at each month with all eligible stocks at that time. The excess so ranking portfolio returns minus the monthly risk free rate. The alphas are estimated as intercepts from the regression of asset pricing model. CAPM alpha is monthly alpha estimated f three factor model, 5FF alpha is monthly alpha derived from Fama and French five factor model, and Carhart alpha is monthly alpha estimated from Carhart four factor model. P25 portfolios. GRS test is the F-value of Gibbons, Ross and Shanken (1989) test under the null hypothesis that all 25 decile portfolios' alphas jointly equal zero. *, **, ***, denotes statis

Decile	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
												Panel A: Feb 1997 to Dec 2017							
CAPM	1.305	1.202	1.224	1.275	1.163	0.977	0.995	1.062	0.799	0.938	0.891	0.781	1.085	0.835	0.946	0.678	0.889	0.820	0.970
	8.085	*8.567*	*9.098*	*8.792*	*8.230*	*7.368*	*7.098*	*7.375*	*5.245*	*6.039*	*5.696*	*4.735*	*5.996*	*4.873*	*5.091*	*3.931*	*4.632*	*4.442*	*5.111*
3FF	1.206	1.106	1.114	1.166	1.054	0.880	0.871	0.965	0.671	0.818	0.760	0.636	0.931	0.695	0.785	0.532	0.711	0.667	0.804
	9.587	*10.461*	*11.080*	*10.142*	*10.071*	*9.008*	*9.317*	*8.845*	*6.644*	*7.340*	*7.202*	*5.879*	*7.649*	*5.536*	*6.312*	*4.478*	*6.036*	*5.098*	*6.243*
Carhart	1.284	1.156	1.177	1.211	1.116	0.941	0.914	1.050	0.745	0.898	0.831	0.730	1.027	0.773	0.915	0.647	0.776	0.759	0.897
	10.569	*11.092*	*12.119*	*10.608*	*10.978*	*9.986*	*9.892*	*10.236*	*7.778*	*8.471*	*8.217*	*7.327*	*8.995*	*6.372*	*8.352*	*6.040*	*6.739*	*6.079*	*7.338*
5FF	1.146	1.031	0.992	1.026	0.908	0.799	0.794	0.903	0.604	0.765	0.763	0.577	0.896	0.616	0.765	0.493	0.618	0.644	0.785
	1.146	*1.031*	*0.992*	*1.026*	*0.908*	*0.799*	*0.794*	*0.903*	*0.604*	*0.765*	*0.763*	*0.577*	*0.896*	*0.616*	*0.765*	*0.493*	*0.618*	*0.644*	*0.785*
												Panel B: Feb 1997 to Dec 2007							
CAPM	1.450	1.507	1.741	1.402	1.567	1.582	1.528	1.242	1.289	1.491	1.448	1.226	1.140	0.978	1.058	1.167	1.175	1.399	1.159
	5.366	*6.456*	*7.477*	*6.226*	*6.751*	*7.048*	*7.415*	*4.882*	*5.766*	*5.851*	*5.358*	*5.128*	*4.357*	*4.241*	*4.066*	*4.337*	*4.784*	*4.866*	*4.365*
3FF	1.311	1.301	1.511	1.129	1.278	1.376	1.335	0.959	0.996	1.171	1.089	0.888	0.791	0.657	0.652	0.781	0.846	0.983	0.775
	6.578	*7.560*	*8.783*	*7.517*	*8.918*	*7.604*	*8.699*	*5.187*	*5.787*	*6.087*	*5.920*	*4.574*	*3.947*	*3.766*	*3.689*	*4.203*	*4.523*	*4.795*	*4.209*
Carhart	1.467	1.384	1.618	1.261	1.359	1.576	1.455	1.130	1.192	1.381	1.252	1.040	1.026	0.821	0.812	0.953	1.003	1.166	0.983
	7.679	*8.055*	*9.582*	*8.927*	*9.569*	*9.799*	*9.901*	*6.561*	*7.869*	*8.047*	*7.244*	*5.593*	*5.892*	*5.074*	*4.919*	*5.501*	*5.658*	*6.055*	*6.053*
5FF	1.292	1.222	1.403	1.091	1.253	1.345	1.275	0.941	0.962	1.137	1.108	0.778	0.737	0.559	0.624	0.736	0.823	0.898	0.773
	6.261	*6.960*	*8.121*	*7.042*	*8.451*	*7.219*	*8.103*	*4.922*	*5.427*	*5.716*	*5.946*	*3.961*	*3.597*	*3.168*	*3.415*	*3.836*	*4.269*	*4.275*	*4.061*
												Panel C: Jan 2008 to Dec 2017							
CAPM	1.350	1.141	1.164	0.967	0.989	0.991	0.964	0.788	0.720	0.604	0.556	0.506	0.616	0.660	0.678	0.795	0.630	0.716	0.705
	5.756	*6.578*	*6.301*	*5.752*	*5.394*	*5.467*	*5.674*	*4.569*	*3.756*	*3.154*	*2.788*	*2.722*	*2.828*	*3.143*	*2.816*	*3.307*	*2.422*	*2.749*	*2.693*
3FF	1.348	1.127	1.154	0.967	0.998	0.973	0.971	0.791	0.736	0.622	0.574	0.526	0.640	0.682	0.710	0.804	0.654	0.742	0.752
	6.896	*7.844*	*7.432*	*7.846*	*6.707*	*7.264*	*7.966*	*6.469*	*5.349*	*4.649*	*3.860*	*4.191*	*4.916*	*4.815*	*4.839*	*5.250*	*4.034*	*4.788*	*4.454*
Carhart	1.356	1.134	1.159	0.972	1.003	0.978	0.975	0.797	0.742	0.628	0.579	0.530	0.643	0.687	0.713	0.809	0.661	0.749	0.755
	7.288	*8.473*	*7.713*	*8.189*	*6.891*	*7.633*	*8.172*	*6.962*	*5.682*	*4.987*	*3.965*	*4.335*	*5.019*	*4.961*	*4.954*	*5.382*	*4.248*	*5.193*	*4.480*
5FF	1.305	1.079	1.082	0.897	1.021	0.945	0.963	0.795	0.689	0.590	0.600	0.539	0.591	0.696	0.726	0.846	0.754	0.750	0.838
	6.383	*7.193*	*6.685*	*7.106*	*6.560*	*6.718*	*7.761*	*6.165*	*4.881*	*4.198*	*3.827*	*4.148*	*4.413*	*4.693*	*4.713*	*5.254*	*4.508*	*4.593*	*4.763*

	8.742	*8.106*	*9.390*	*8.691*	*8.143*	*9.808*	*7.907*	*8.196*	*7.926*	*7.329*	*7.360*	*6.740*	*7.442*	*6.558*	*4.024*	*6.474*	*5.598*	*5.874*	*5.248*
5FF	1.368	1.258	1.388	1.146	1.186	1.333	1.093	1.214	1.165	0.872	0.957	0.881	0.992	0.787	0.370	0.868	0.804	0.835	0.610
	6.877	*6.832*	*7.882*	*6.297*	*6.978*	*8.673*	*5.709*	*6.612*	*6.561*	*5.231*	*5.271*	*4.963*	*4.672*	*4.417*	*2.221*	*4.395*	*4.264*	*4.422*	*3.237*
Panel C: Jan 2008 to Dec 2017																			
CAPM	1.411	1.122	1.154	0.919	0.963	1.003	0.910	0.764	0.956	0.715	0.747	0.849	0.492	0.552	0.581	0.765	0.725	0.438	0.703
	6.277	*5.235*	*6.273*	*4.682*	*5.548*	*5.538*	*5.217*	*4.441*	*5.226*	*3.868*	*4.187*	*4.212*	*2.435*	*2.704*	*2.659*	*3.020*	*3.330*	*1.631*	*2.560*
3FF	1.402	1.112	1.154	0.915	0.954	0.989	0.912	0.760	0.973	0.733	0.760	0.872	0.525	0.577	0.609	0.793	0.752	0.457	0.729
	7.313	*6.787*	*7.737*	*5.797*	*7.257*	*6.873*	*7.758*	*6.366*	*8.035*	*5.484*	*6.604*	*6.066*	*3.985*	*4.352*	*4.772*	*4.533*	*5.685*	*2.804*	*4.244*
Carhart	1.412	1.118	1.162	0.922	0.959	0.992	0.917	0.763	0.977	0.739	0.765	0.877	0.529	0.581	0.611	0.799	0.755	0.461	0.737
	7.965	*7.034*	*8.527*	*6.169*	*7.534*	*7.030*	*8.331*	*6.441*	*8.375*	*5.833*	*7.053*	*6.321*	*4.163*	*4.532*	*4.805*	*4.771*	*5.760*	*2.891*	*4.672*
5FF	1.375	1.064	1.080	0.845	0.947	0.968	0.941	0.788	0.907	0.732	0.735	0.899	0.525	0.527	0.575	0.893	0.794	0.526	0.732
	6.802	*6.225*	*6.958*	*5.140*	*7.141*	*6.473*	*7.660*	*6.284*	*7.211*	*5.306*	*6.134*	*6.007*	*3.802*	*3.796*	*4.323*	*4.928*	*5.732*	*3.104*	*4.060*