Why is the Amihud (2002) Illiquidity Measure Priced?

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Abstract

This paper studies the widely used Amihud (2002) illiquidity measure using NYSE/AMEX firms from 1964 to 2012. While we confirm the previously documented strong relation between the Amihud measure and expected return, we find that the pricing of the Amihud measure is driven by its trading volume component instead of its construct of the ratio of absolute return to volume. This finding is robust to the use of alternative versions of the Amihud measure, the alternative frequencies of measure construction, the NASDAQ sample, and sub-period analyses. Further analyses using the high-frequency measure of price impact suggest that price impact does not seem to be either priced or explaining the pricing of the Amihud measure.

The rapidly growing literature on stock liquidity has motivated financial researchers to construct various liquidity proxies. Among the existing proxies, the illiquidity measure developed by Amihud (2002) is one of the most widely used in the finance literature. During 2009-2013, over one hundred papers published in the Journal of Finance, the Journal of Financial Economics, and the Review of Financial Studies use the Amihud (2002) measure for their empirical analyses.[1] The popularity of the Amihud measure is due to two advantages it has over many other liquidity measures. First, the measure is based on the absolute value of daily return-to-volume ratio, which can be easily constructed using daily stock data. Second, and more importantly, the measure has strong positive relations with high-frequency price impact measure and expected stock return (e.g., Amihud (2002), Chordia, Huh, and Subrahmanyam (2009)). The positive return premium not only justifies the Amihud measure as a credible liquidity proxy, but also allows researchers to examine liquidity premium, control for liquidity, and construct a liquidity factor.[2]

Despite the strong empirical evidence, it is not clear ex-ante that the Amihud measure would reliably capture price impact and lead to significant return spread. First, while the Amihud measure intends to capture price impact through the ratio of absolute return to trading volume, this construct is not precisely mapped to theory. As discussed in Chordia, Huh, and Subrahmanyam (2009), "Although many microstructure theories have been developed, extant economic models are unable to map precisely onto the Amihud (2002) construct of the ratio of absolute return to volume." (p. 3630).

Second, the construction of the Amihud measure uses daily return and volume. When there are both positive and negative price movements over a trading day, these movements can offset

[1] We count only those papers published from January 2009 to October 2013 and exclude any forthcoming papers.
[2] Besides the Amihud liquidity factor, the finance literature also uses two other liquidity factors developed by Pástor and Stambaugh (2003) and Sadka (2006).

each other and will therefore not be captured by the daily return. This effect can cause a potential mismatch between daily return (numerator of the Amihud measure) and trading volume (denominator of the Amihud measure). Examining returns over five-minute intervals for NYSE stocks from 1993 to 2012, we find that at least 95 percent of the firm-days have both positive and negative five-minute returns. For these firm-days, the amount of price movement reflected in daily return on average captures only 16.5 percent of the total intra-day price movement of a stock, suggesting that there can be substantial noise introduced by the use of daily data.

Therefore, the pricing of the Amihud measure deserves further investigation. Why is the Amihud (2002) illiquidity measure priced? The answer to this question is important not only because the Amihud measure is used extensively in the finance literature, but also because it improves our understanding of the nature and the measurement of liquidity and liquidity premium.

In this paper, we offer a new explanation for the pricing of the Amihud (2002) measure. Our study is motivated by the close connection between the Amihud (2002) measure and trading volume, which is illustrated by the construction of the measure:

$$A_{iy} = \frac{1}{D_{iy}} \sum_{t=1}^{Diy} \frac{|r_{it}|}{Dvol_{it}}, \tag{1}$$

where A_{iy} is the Amihud measure of firm *i* estimated in year *y*; r_{it} and $Dvol_{it}$ are daily return and daily dollar trading volume for stock *i* on day *t*; D_{iy} is the number of days with available ratio in year *y*.[3] Everything else equal, higher trading volume will lead to a lower Amihud illiquidity measure. This linkage is particularly strong because the trading volume component has a much greater cross-sectional variation than the stock return component. For example, the 75th percentile cutoff of the

[3] Some studies further adjust the Amihud measure for inflation. The approaches of our analyses are such that we need not to do so. For sorting analysis, we sort stocks into portfolios every month. For the Fama-MacBeth regression analysis that uses the Amihud measures as independent variables, we follow the literature (e.g., Brennan, Huh, and Subrahmanyam (2013)) and transform the measures into natural logs, which makes the scaling irrelevant.

trading volume component is over 100 times its 25th percentile cutoff, but the 75th percentile cutoff of the return component is just two times its 25th percentile cutoff.[4]

Since many studies have discovered that stocks with higher trading volume earn lower future returns (e.g., Brennan, Chordia, and Subrahmanyam (1998), Lee and Swaminathan (2000)), we examine whether the pricing of the Amihud measure is due to its trading volume component. Our empirical analyses use a large panel of firms comprised of all the NYSE/AMEX-listed companies from 1964 to 2012. Consistent with the existing literature, we first observe a strong relation between the Amihud (2002) illiquidity measure and expected stock return. The top quintile portfolio of the Amihud measure outperforms the bottom quintile portfolio by 0.80 percent per month (t-stat 3.38) in raw return and 0.43 percent (t-stat 2.83) in four-factor alpha that controls for the three Fama-French factors and the momentum factor.

To focus on the trading volume component of the Amihud measure, we construct a "constant" version of the Amihud measure, *A_C*, by replacing absolute return in the Amihud measure with one:

$$A\_C_{iy} = \frac{1}{D_{iy}} \sum_{t=1}^{Diy} \frac{1}{Dvol_{it}}, \qquad (2)$$

where A_C_{iy} is the "constant" measure of firm *i* estimated in year *y*, and all the other variables are as defined in equation (1). Interestingly, the annual *A_C* measure has a correlation of 0.94 with the annual original Amihud measure. This result suggests that the variation in the Amihud illiquidity measure is likely driven in large part by the variation in the trading volume component, implying in turn that the pricing of the Amihud measure could also be driven by the trading volume component. We further find that the *A_C* measure is also strongly related with expected stock return. Stocks in the top quintile of *A_C* outperform those in the bottom quintile by 0.83 percent per month (t-stat

[4] The corresponding statistics are presented in Table I.

3.95) in raw return and 0.50 percent per month (t-stat 3.50) in four-factor alpha. These return spreads are very similar to those using the Amihud illiquidity measure.

We next conduct several analyses to formally test whether it is the trading volume component that drives the pricing of the Amihud (2002) measure. For the first approach, we construct a residual Amihud measure as the residual from cross-sectional regressions of the *A* measure on the *A_C* measure. The residual measure is therefore the component of the Amihud measure that is orthogonal to the "constant" measure.[5] We find that the residual Amihud measure no longer leads to a positive return premium. As a matter of fact, stocks in the top quintile of the residual measure *underperform* those in the bottom quintile by 0.34 percent per month (t-stat 2.12) in raw return and 0.20 percent per month (t-stat 1.40) in four-factor alpha. These results indicate that the pricing of the Amihud measure is explained by its trading volume component but not its construct of return-to-volume ratio.

For the second approach, we construct a monthly factor, IML^{A_C} ("illiquid minus liquid"), as the return of the top tercile of *A_C* minus that of the bottom tercile. We then repeat the sorting analysis for the Amihud measure but report the one-factor alpha calculated using the IML^{A_C} factor, and the five-factor alpha calculated using the IML^{A_C} factor in addition to the four–factor model. The spread between the top and the bottom quintiles of the *A* measure is -0.02 percent per month (t-stat -0.46) in terms of one-factor alpha, and is -0.03 percent (t-stat -0.74) in terms of five-factor alpha. Therefore, the results of the factor approach are consistent with those of the residual approach in that the trading volume component drives the pricing of the Amihud (2002) measure.

We also conduct multivariate analysis by estimating the firm-level Fama-MacBeth regressions of monthly stock returns on various versions of the Amihud measure controlling for

[5] We do not use two-dimensional sorting because the very high correlation between the *A* and *A_C* measures leads to insufficient numbers of stocks in the two-dimensional portfolios.

size, book-to-market ratio, momentum, and short-term return reversal. The results of the regression analyses are consistent with the sorting analyses, in that the coefficient on the "constant" Amihud measure is significantly positive and that on the residual Amihud measure is either insignificant or significantly negative.

Brennan, Huh, and Subrahmanyam (2013) decompose the Amihud (2002) measure into the turnover-based Amihud measure and firm size (market capitalization) and examine the relations of these metrics with expected return separately. We extend their analysis and decompose the Amihud (2002) measure further into the absolute return component, the turnover component, and the firm size component. We estimate regressions of stock returns on these components. The coefficient on the turnover component is significantly positive, indicating that the trading volume component contributes to the pricing of the Amihud illiquidity measure. By contrast, the coefficient on the absolute return component is either insignificant or significantly negative in the regressions.

For robustness, we also examine two alternative versions of the Amihud measure, including the square-root Amihud measure (Hasbrouck (2009)) and the turnover-based Amihud measure (Brennan, Huh, and Subrahmanyam (2013)). We repeat the tests by constructing corresponding "constant" measures which replace the absolute return component with one and observe similar results as those using the Amihud (2002) measure.

We also repeat the sorting and regression analyses using the Amihud measures that are constructed monthly instead of annually. Specifically, we follow the literature (e.g., Brennan, Huh, and Subrahmanyam (2013)) and examine the relations between returns of month t and the Amihud measures constructed in month t-2. The results of sorting and regression analyses using the annual measures hold for the monthly measures. Our findings are also robust to using the sample of NASDAQ stocks, using the sub-periods, and controlling for idiosyncratic return volatility.

The novel model of Amihud and Mendelson (1986) predicts that investors will demand higher expected returns for the securities associated with higher transaction costs. In the meantime, previous studies have documented that the Amihud measure does well capturing price impact (e.g., Hasbrouck (2009), Goyenko, Holden, and Trzcinka (2009)). For these reasons, one would well expect that the Amihud measure is priced due to the fact that it captures price impact, which seems contradicting our finding that the pricing of the Amihud measure is due to its trading volume component. To examine this potential discrepancy, we investigate the role of price impact in the pricing of the Amihud measure.

We follow Hasbrouck (2009) and construct a high-frequency price impact benchmark using the ISSM and TAQ transaction data for all NYSE/AMEX stocks from 1983 to 2012. The price impact measure is estimated as the slope coefficient of five-minute stock return regressed on signed square-rooted five-minute trading volume for a firm-year. We first revisit and confirm the previously documented strong relation between the Amihud (2002) measure and the high-frequency price impact measure. However, we find that the majority of this relation is also due to the trading volume component of the Amihud measure instead of the return-volume construction. We also find that the pricing of the trading volume component is robust after controlling for the price impact measure, suggesting that the pricing of the Amihud illiquidity measure is due to its trading volume component but not price impact. Interestingly, we do not find a significant relation between the price impact measure and expected return, which is puzzling given the aforementioned expectation about investors.

Our findings provide a new explanation as to why the Amihud (2002) measure is priced despite its lack of full theoretical support and the potential noise introduced by daily data. We find evidence that the pricing of the Amihud measure is due to its association with the trading volume instead of the construct of the ratio of absolute return to volume. Our findings echo the argument of Chordia, Huh, and Subrahmanyam (2009) that it is important to develop liquidity measures based on explicit theoretical models. In the meantime, we do not find a significant relation between price impact and expected return, a puzzling discovery that calls for further analyses.

Our findings have important implications for the finance literature as the Amihud (2002) measure is very widely used by financial researchers. On the one hand, our results show that the Amihud (2002) measure is a credible measure of liquidity as it does well capturing price impact via its trading volume component. On the other hand, our findings suggest a need for caution in the use of the Amihud measure in asset pricing tests. This is because although trading volume is also a widely used liquidity proxy, it can capture many other non-liquidity factors. For example, Lee and Swaminathan (2000) attribute the pricing of volume to investors' value-investing as the volume premium is most pronounced among winner and loser stocks. Researchers have also related volume to investor disagreement (e.g., Harris and Raviv (1993), Blume, Easley, and O'Hara (1994)), stock visibility (Gervais, Kaniel, and Mingelgrin (2001)), information uncertainty (Jiang, Lee, and Zhang (2004), Barinov (2014)), or investor sentiment (Baker and Wurgler (2006)). Bekaert, Harvey, and Lundblad (2007) show that volume is not strongly related to other liquidity measures in international markets.[6] Since the pricing of trading volume can be associated with various non-liquidity factors, our findings call for caution in the use of the Amihud measure to examine liquidity premium, control for liquidity in the tests of asset pricing, or construct liquidity factor.

The outline of our paper is as follows. Section I describes the construction of the liquidity measures and the sample. Section II examines the relations between the components of Amihud illiquidity measures and expected return. Section III conducts robustness tests. Section IV analyzes

[6] Some studies also document slight or even negative relations between volume and stock liquidity in a number of cases (Foster and Viswanathan (1993), Lee, Mucklow, and Ready (1993), and Johnson (2008)). As another example, trading volume can be high when the markets are *illiquid* as seen in the flash crash of 2010.

the relation between the Amihud illiquidity measure and a high-frequency price impact measure, and Section V concludes.

I. Measure Construction and Sample Selection

A. Measure Construction.

The measures used in this paper are constructed as below:

- A: the Amihud (2002) measure, defined by equation (1).
- A_C: the "constant" Amihud measure corresponding to A, defined by equation (2).
- AT: the turnover-based Amihud illiquidity measure

$$AT_{iy} = \frac{1}{D_{iy}} \sum_{t=1}^{Diy} \frac{|r_{it}|}{TO_{it}}, \tag{3}$$

where AT_{iy} is the turnover-based Amihud measure for stock i in estimation year y, and TO_{it} is the turnover of stock i on day t, calculated as daily share volume divided by total shares outstanding. The other variables are as defined in equation (1).

- AT_C: the "constant" turnover-based Amihud measure corresponding to AT

$$AT\_C_{iy} = \frac{1}{D_{iy}} \sum_{t=1}^{Diy} \frac{1}{TO_{it}}, \tag{4}$$

which differs from equation (3) only in replacing the numerator of the ratio $|r_{it}|$ with a constant 1.

- $A^{1/2}$: the square-root version of the Amihud (2002) measure

$$A^{1/2}{}_{iy} = \frac{1}{D_{iy}} \sum_{t=1}^{Diy} \sqrt{\frac{|r_{it}|}{Dvol_{it}}}, \tag{5}$$

which differs from equation (1) only in using the square-root of the daily ratio instead of the ratio itself.

- $A^{1/2}\_C$: the "constant" square-root Amihud measure

$$A^{1/2}\_C_{iy} = \frac{1}{D_{iy}}\sum_{t=1}^{Diy}\sqrt{\frac{1}{Dvol_{it}}},\tag{6}$$

which differs from equation (5) only in replacing the numerator of the ratio $|r_{it}|$ with a constant 1.

- $|Ret|$: return component of the Amihud measure, calculated as the annual average of daily absolute returns over the estimation year.
- $|Ret|^{1/2}$: return component of the square-root Amihud measure, calculated as the annual average of the square-root of daily absolute returns over the estimation year.

We follow the literature and winsorize all the above measures at the 1 and 99 percentage points in each cross-section to control for outliers.

B. Sample Construction

Our sample stocks include ordinary common shares (share codes 10 and 11) listed on the NYSE and the AMEX.[7] We exclude NASDAQ stocks from our main analysis because the NASDAQ trading volume is inflated relative to that of the NYSE/AMEX trading volume due to different trading mechanisms.[8] We obtain the data on stock price, return, trading volume, and shares outstanding from the CRSP daily file and construct annual Amihud measures from 1963 to 2011. We require a stock to have at least 100 days with valid return and volume data to compute the ratios in the estimation year. Since we match the Amihud measures estimated in year *y*-1 to monthly stock returns in year *y*, the period of our return analysis covers from 1964 to 2012.

Panel A of Table I presents summary statistics of the Amihud illiquidity measure and its various components for the 98,244 firm-years in our sample. Panel A also presents summary

[7] A firm-year is dropped from the sample if the firm's stock is traded in a non-NYSE/AMEX exchange on any day of the year.

[8] We nevertheless conduct robustness tests using the NASDAQ sample and report the results in Section III.

statistics of the firm size and book-to-market ratio. Firm size is the market capitalization at the end of the estimation year. Book-to-market ratio is the ratio of the book value of equity to the market value of equity, where the book value of equity is defined as stockholders' equity plus balance-sheet deferred taxes and investment tax credit, minus the book value of preferred stock.[9] Panel A shows that the trading volume component of the Amihud measure is much more volatile than the return component. Specifically, the standard deviation of A_C is almost three times its mean, but the standard deviation of $|ret|$ is only half of the mean. This pattern is also reflected in the various percentiles. For example, the 75th percentile cutoff of A_C is over 100 times its 25th percentile cutoff, but the 75th percentile cutoff of $|ret|$ is only twice as much its 25th percentile cutoff. This contrast is also true for either the square-root version of the Amihud measure or the turnover-based Amihud measure. These results suggest that the variation of the trading volume component can account for the majority of the variation in the Amihud illiquidity measure.

For robustness, we also examine monthly measures for the sample firms from November 1963 to October 2012.[10] The monthly measures are constructed similarly as annual measures but using monthly average of daily metrics (we require a stock to have at least 10 days with valid return and volume data to compute the ratios in the estimation month). Panel B of Table I reports summary statistics of the monthly measures for the 1,197,252 firm-months in our sample, where the patterns are very similar to those for the annual measures.

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[9] Balance-sheet deferred taxes is the Compustat item TXDB, and investment tax credit is item ITCB. We use redemption value (PSTKRV), liquidation value (PSTKL), or par value (PSTK), in that order, for the book value of preferred stock. Stockholders' equity is what is reported by Moody's (see Davis, Fama, and French (2000)), or Compustat (SEQ). If neither is available, we then use the book value of common equity (CEQ) plus the book value of preferred stock. If common equity is not available, stockholders' equity is then defined as the book value of assets (AT) minus total liabilities (LT). We use the book value of the fiscal year ending in calendar year y and market value at the end of year y to calculate book-to-market ratio and match it to stock returns in the one-year period from July of y+1 to June of year y+2. We winsorize the book-to-market ratio in each month at the 0.5% and 99.5% level to reduce the influences of data error and extreme observations.

[10] Since we follow the literature and skip a month between the estimation period of monthly measure and the period of return measurement, the monthly Amihud measures are matched to the monthly returns from January 1964 to December 2012, which is in line with the analyses using annual measures.

Table II presents correlations between the various versions of the Amihud measure. We first calculate cross-sectional correlation coefficients among the variables in each year and then report the time-series averages. Panel A shows that the Amihud illiquidity measures are highly correlated with the corresponding "constant" measures constructed with only the trading volume components. Specifically, the correlations are 0.94 between A and A_C, 0.96 between $A^{1/2}$ and $A^{1/2}\_C$, and 0.78 between AT and AT_C. These results confirm that the trading volume component alone accounts for a vast majority of the variations in the Amihud illiquidity measures. In contrast, the correlations between the return components and the Amihud measures are only half as strong. These results also hold in the Panel B of Table II which reports the correlations for monthly measures.

II. Examine the Pricing of the Amihud (2002) Illiquidity Measure

In this section, we perform both sorting analyses and multivariate regression analyses to examine the pricing of the Amihud illiquidity measures and their components.

A. Sorting Analysis

We sort stocks at the beginning of each month from 1964 to 2012 into quintiles based on their annual Amihud measures from the prior calendar year. We then calculate the equal-weighted returns of these portfolios each month, and report time-series averages of the portfolio returns. We also report the return spread between the top and bottom quintiles as well as the associated t-statistics calculated using Newey-West (1987) standard errors with six lags. In addition to raw returns, we also report the corresponding four-factor alphas calculated using the three Fama-French factors (MKT, SMB, HML) and the momentum factor (UMD).[11]

[11] We thank Kenneth French for making the data available in his data library.

In Panel A of Table III, we first present the sorting analysis for the original Amihud (2002) measure (*A*). The raw return is increasing in the *A* measure, with the spread between the extreme quintiles being 0.80 percent per month. This spread is not only economically significant but also statistically significant at the standard level (t-stat 3.38). The four-factor alpha is 0.43 percent per month (t-stat 2.83), which translates to an annual profit of 5.16 percent. These results show that, consistent with the existing literature, the Amihud (2002) measure is strongly related to expected returns.

When we sort stocks by the "constant" Amihud measure, *A_C*, the return spread between the top and the bottom quintile portfolios is almost the same as that found for the original Amihud measure. The spread is 0.83 percent per month (t-stat 3.95) in raw return and 0.50 percent (t-stat 3.50) in four-factor alpha. These results indicate that excluding the return component has no significant impact on the pricing of the Amihud measure.

Next, we use a residual approach to examine whether the *A* measure is still priced after controlling for the *A_C* measure. We estimate monthly cross-sectional regressions of the *A* measure on *A_C*, and obtain the residuals as the residual *A* measure. The residual measure therefore represents the variation in the Amihud (2002) measure that is not due to *A_C*. We sort stocks based on the residual measures and examine whether there is any return spread between stock portfolios with high and low residual measures. The results show that higher residual Amihud measure does not lead to higher expected return. As a matter of fact, the return spread between the top and the bottom quintiles of the residual measure is significantly negative for raw returns (-0.34 percent, t-stat -2.12) and insignificantly negative for four factor alpha (-0.20 percent, t-stat -1.40). This result also suggests that the pricing power of the Amihud (2002) measure comes entirely from the trading volume component.

In Panel B of Table III, we examine the square-root version of the Amihud measure, $A^{1/2}$, and its "constant" version $A^{1/2}\_C$. Researchers often take the square root of the return-to-volume ratio because the original Amihud measure is highly positively skewed (e.g., Hasbrouck (2009)). Panel B shows that the differences between the highest and the lowest $A^{1/2}$ quintiles in raw returns and the four-factor alphas are almost the same as those using the original Amihud measure. More importantly, sorting on the "constant" measure $A^{1/2}\_C$ even generates a slightly higher return spread than $A^{1/2}$. We also remove the variation in $A^{1/2}$ that is due to $A^{1/2}\_C$ using the residual measure approach, and find that the residual $A^{1/2}$ measure does not have a clear relation with stock returns.

We further examine *AT*, the turnover-based Amihud measure proposed by Brennan, Huh, and Subrahmanyam (2013), in a similar fashion. Panel C of Table III shows that, consistent with Brennan, Huh, and Subrahmanyam (2013), *AT* has a significantly positive relation with expected stock return. In the meantime, the corresponding constant measure *AT_C* is priced similarly to the *AT* measure. We then construct a residual *AT* measure as residuals from monthly cross-sectional regressions of *AT* on *AT_C*. When we sort stocks on the residual *AT* measure, the difference in raw return between the highest and the lowest quintiles is much smaller than using *AT*, and is in fact only statistically significant at the 10% level. The corresponding difference in four-factor alpha is no longer significant (0.14 percent, t-stat 0.74).

As a robustness check, we repeat the sorting analysis using the monthly Amihud measures. At the beginning of each month *t* from 1964 to 2012, stocks are sorted into quintile portfolios according to these measures estimated in month *t*-2. We follow the literature and skip one month before return measurement to control for microstructure effects. Panel A of Table IV shows that the results using monthly measures are similar to those in Table III. Specifically, sorting on either *A* or *A_C* generates significant return spreads, but after we remove the variation in *A* that is due to *A_C*, we do not find a significant relation between the residual *A* measure and expected stock return. Panels B and C of Table IV are similar to Panel A except that they examine the square-root Amihud measure and the turnover-based Amihud measure, respectively. We also find similar results as those using annual measures in Table III. To summarize, the results of the residual analyses indicate that the pricing of the Amihud illiquidity measure is explained entirely by its trading volume component.

B. Factor Analysis

In addition to the residual approach, we make use of factor returns to examine whether the pricing of the Amihud (2002) measure is explained by its trading volume component. We first construct a monthly factor based on the "constant" Amihud measure, *A_C*. For each month from 1964 to 2012, we sort stocks into terciles according to the "constant" measure *A_C* estimated in the previous calendar year. We then calculate the monthly factor return IML^{A_C} as the equal-weighted return of the top *A_C* tercile minus that of the bottom *A_C* tercile.

We then repeat the sorting analysis of the Amihud (2002) measure as in Table III but report the one-factor alpha calculated using the IML^{A_C} ("illiquid minus liquid") factor, and the five-factor alpha calculated using the IML^{A_C} factor, the three Fama-French factors, and the momentum factor (UMD). Panel A of Table V shows that the spread in one-factor alpha between the top and the bottom quintiles of the Amihud (2002) measure is a very small -0.02 percent (t-stat -0.46). This spread is in stark contrast with the 0.80 percent (t-stat 3.38) spread of raw return in Table III. Similarly, the spread in five-factor alpha is an insignificant -0.03 percent (t-stat -0.74), much smaller than the 0.43 percent (t-stat 2.83) spread in four-factor alpha in Table III. These results suggest that the pricing of the Amihud (2002) measure is explained by the IML^{A_C} factor.

We also use the same approach to construct factor returns $IML^{A1/2\_C}$ and IML^{AT_C} using the "constant" measures $A^{1/2}\_C$ and *AT_C*, respectively. Panel A of Table V presents the corresponding one- and five-factor alphas of portfolios sorted on the $A^{1/2}$ or *AT* measure. The previous results in Table III show that the $A^{1/2}$ and AT measures are both associated with large and significant spreads in raw returns and four-factor alphas. In contrast, Panel A of Table V shows that the spreads in the corresponding one-factor and five-factor alphas become very small and insignificant. For robustness, we repeat the factor analysis for monthly measures in Panel B of Table V, where the results are similar to those using the annual measures. Overall, the results in Table V confirm the findings of the residual approach that the pricing of the Amihud measure is due to its trading volume component.

C. Regression Analysis

In addition to the portfolio sorting approach, we use multivariate Fama-MacBeth (1973) regressions to examine the pricing of the Amihud (2002) measure. We perform cross-sectional regressions of returns on various versions of the Amihud measure, and report the time-series averages of cross-sectional regression coefficients and the associated t-statistics using the Newey-West (1987) standard errors with six lags. To alleviate the impact of extreme values, we follow the literature (e.g., Brennan, Huh, and Subrahmanyam (2013)) and take natural logs of the Amihud measure and its components. We also include the usual control variables such as size, book-to-market ratio, and past stock returns.

We follow Brennan, Chordia, and Subrahmanyam (1998) and estimate the regressions using the Fama-French three-factor adjusted return (henceforth FF3-adjusted return) as the dependent variables. FF3-adjusted return of firm *i* in month *t* is defined as:

$$r_{it}^{ff3} = (r_{it} - r_{ft}) - (\hat{\beta}_{it}^{MKT} \times MKT_t + \hat{\beta}_{it}^{SMB} \times SMB_t + \hat{\beta}_{it}^{HML} \times HML_t) \tag{7}$$

where the three factor loadings, $\hat{\beta}_{it}^{MKT}$, $\hat{\beta}_{it}^{SMB}$, and $\hat{\beta}_{it}^{HML}$ are estimated for each firm using the monthly excess returns and Fama-French three factors in the previous sixty-month window from t-60 to t-1. We require at least 24 observations in the estimation of factor loadings.

In the left panel of Table VI, we regress FF3-adjusted returns on the logarithms of the Amihud (2002) measure, ln(*A*), and its corresponding "constant" measure, ln(*A_C*), in Models (1) and (2), respectively. We also control for firm size, book-to-market ratios, momentum, and lagged monthly returns (short-term reversal). The coefficient on ln(*A*) is significantly positive in Model (1), confirming the positive return premium associated with the Amihud (2002) measure in Table III. The coefficient on the "constant" Amihud measure (ln(*A_C*)) is also significantly positive in Model (2), indicating that this measure also leads to a return premium. In Model (3), we regress returns on ln(*A_C*) and the residual ln(*A*) measure, which is the residual from the monthly cross-sectional regressions of ln(*A*) on ln(*A_C*). The coefficient on ln(*A_C*) continues to be significantly positive, but that for the residual ln(*A*) is insignificantly negative. These results are consistent with the sorting analyses that the pricing of the Amihud measure is due to its trading volume component.

We observe a significantly positive coefficient on firm size, a finding similar to what is reported in Brennan, Huh, and Subrahmanyam (2013). This positive coefficient does not mean that larger firms have higher returns because firm size is also a part of the *A* or *A_C* measure. To illustrate this point, the coefficients on firm size become insignificant in Models (4) to (6) where the independent variable is the turnover-based Amihud measure that excludes the firm-size component. The coefficients are significantly negative for the one-month lagged return but significantly positive for intermediate-term returns, reflecting a short-term return reversal and intermediate-term momentum.

The right panel of Table VI reports the results for the turnover-based Amihud measure (ln(*AT*)), the "constant" turnover-based Amihud measures (ln(*AT_C*)), and the residual ln(*AT*) measure obtained by regressing ln(*AT*) on ln(*AT_C*) each month. In these regressions, ln(*AT*) and ln(*AT_C*) have significantly positive coefficients when they enter the regressions separately. When both ln(*AT_C*) and the residual ln(*AT*) are included in the regression, the coefficient on ln(*AT_C*) is positive and significant at the 0.01 level, but that on the residual ln(*AT*) is insignificantly negative.

In sum, the results in Table VI show that both the original Amihud (2012) measure and the turnover-based Amihud (2002) measure are priced. However, when we keep only the trading volume components in these ratios, the resulting "constant" measures are also priced. The original or the turnover-based Amihud (2012) measure is no longer priced after we remove the variation due to its trading volume component. These results suggest that the volume component is the principle driving force for the pricing of the Amihud measure.

D. Decomposition of the Amihud (2002) Measure

Brennan, Huh, and Subrahmanyam (2013) decompose the Amihud (2002) measure into the turnover-based Amihud measure and firm size (market capitalization). They examine these two metrics using multivariate regressions of stock return, and suggest that the turnover-based Amihud measure clarifies the effect of illiquidity on stock returns by removing the impact of firm size. We extend their regression analyses and decompose the Amihud (2002) measure further into the absolute return component, the turnover component (the *AT_C* measure), and the firm size component as below:

$$\ln(A) = \ln\left(\frac{|ret|}{Dvol}\right) = \ln(|ret|) + \ln\left(\frac{1}{Dvol}\right) = \ln(|ret|) + \ln(A\_C) \tag{8}$$

$$\ln(A) = \ln\left(\frac{|ret|}{Dvol}\right) = \ln\left(\frac{|ret|}{TO} \times \frac{1}{S}\right) = \ln(AT) - \ln(S) \tag{9}$$

$$\ln(A) = \ln\left(\frac{|ret|}{Dvol}\right) = \ln\left(|ret| \times \frac{1}{TO} \times \frac{1}{S}\right) = \ln(|ret|) + \ln(AT\_C) - \ln(S), \tag{10}$$

where *S* is market capitalization, and the remaining variables are as previously defined. We go on to compute the natural logs of the annual averages of various daily components: |ret|, *A_C*, *AT*, *AT_C*, and *S*, and examine their associations with expected return.

Table VII reports the results of Fama-MacBeth regressions corresponding to the decompositions (8) through (10). Model (1) decomposes ln(*A*) into ln(*A_C*) and ln(|*ret*|) as in equation (8). The coefficient on ln(*A_C*) is positive and significant at the 0.01 level but the coefficient on ln(|*ret*|) is significantly negative. These results are consistent with those in Table VI in that the trading volume component is priced, but the return component is not. Models (2) regresses returns on ln(*AT*) and ln(*S*) as in equation (9) proposed by Brennan, Huh, and Subrahmanyam (2013). Our results are consistent with their finding in that the turnover-based Amihud measure is priced. Models (3) presents the full decomposition of the Amihud (2002) measure into ln(*AT_C*), ln(|*ret*|), and ln(*S*) as in equation (10). While the coefficient on ln(*AT_C*) is significantly positive at the 0.01 level, ln(*S*) has significantly negative coefficient, and ln(|*ret*|) is in fact negative and marginally insignificant. These results suggest that the pricing of the Amihud (2002) measure is due to a combination of the volume component and the size component, but does not stem from the absolute return component.

III. Robustness Tests

A. Robustness Test Using Monthly Measures

We repeat the Fama-MacBeth regressions using monthly measures instead of annual measures and present the results in Table VIII. Specifically, we now regress returns of month *t* on *monthly* Amihud measures of month *t*-2. As in Table VI, we first regress returns on ln(*A*) and ln(*A_C*) in the left panel of Table VIII and then regress returns on ln(*AT*) and ln(*AT_C*) in the right panel. These results generated with monthly measures are also similar to those generated with annual measures in Table VI. There is a positive premium associated with both ln(*A*) and ln(*A_C*), but not with the residual ln(*A*) measure. Similarly, for turnover-based measures, both ln(*AT*) and ln(*AT_C*) are priced but the residual ln(*AT*) measure is no longer priced. These results confirm the conclusions drawn from using annual measures.

B. Robustness Test Using Raw Returns

In the regression analyses, we follow the literature and use the Fama-French three-factor adjusted return to thoroughly control for the effects of price factors. For robustness, we now repeat the regression analysis but use raw return as the dependent variable and present the results in Table IX. The coefficients on *ln*(*A*) and *ln*(*A_C*) are significantly positive but that on the residual *ln(A)* is insignificant (t-stat 0.82). As expected, the coefficient on the book-to-market ratio becomes significantly positive as the dependent variable does not adjust for the three Fama-French factors. The right panel shows similar patterns for the turnover-based Amihud measures. These results suggest that the findings of our regression analyses are robust to the use of raw return as the dependent variable.

C. Robustness Test Using NASDAQ Sample

Our main analysis uses NYSE- and AMEX-listed stocks because the NASDAQ trading volume includes the inter-dealer volume. In this subsection, we also examine the pricing of the Amihud measure for NASDAQ stocks using the firm-level Fama-MacBeth regression methodology. Table X shows that the regression results are similar to our previous results using the NYSE/AMEX sample. While ln(*A*) and ln(*A_C*) are positively associated with expected returns, the residual ln(*A*) measure is not. Similarly, the turnover-based Amihud measure ln(*AT*) and its "constant" measure ln(*AT_C*) are both priced among NASDAQ stocks, but the residual component of ln(*AT*) does not have a significant premium. For example, the *t*-statistic is -0.12 for the coefficient on the residual ln(*AT*) measure. Our conclusions regarding the pricing of the Amihud measures are therefore further supported by the analysis of NASDAQ stocks.

D. Robustness Test Using Sub-Periods

Since the market environment and transaction costs have changed over time, we divide our sample period into two equal sub-periods (1964-1988 and 1989-2012) and re-examine our findings for each sub-period. We repeat the Fama-MacBeth regressions of monthly stock return and present the results in Table XI.

Panel A of Table XI presents the regressions for 1964-1988. In Model (1), the coefficient on the Amihud (2002) measure is significantly positive. Model (2) further shows that the "constant" measure, *ln(A_C)*, also has a positive and significant association with expected stock return. In Model (3), the coefficient on *ln(A_C)* remains significantly positive but that on the residual *ln(A)* measure is insignificantly negative (t-stat -1.34). Models (4)-(6) examine the turnover-based Amihud measures. The turnover-based Amihud measure (*AT*) is also priced, consistent with the findings in Brennan, Huh, and Subrahmanyam (2013). In Model (6), we find a positive premium for the "constant" turnover-based Amihud measure (*ln(AT_C)*) but the residual *ln(AT)* measure is no longer priced. Panel B of Table XI presents the same regression analysis for the 1989-2012 subperiod, and the results are similar to those detailed in Panel A. The sub-period analysis thus confirms the conclusions of the full sample analysis that the pricing of the Amihud illiquidity measure is due to its trading volume component.

E. Robustness Test Controlling for Return Volatility

The numerator of the Amihud measure is absolute return, which by construction is positively correlated with stock return volatility. Since a large number of studies have documented that idiosyncratic stock volatility is negatively related to future returns (e.g., Ang, Hodrick, Xing, and

Zhang (2006)), we further control for idiosyncratic volatility in the regression analysis.[12] We repeat the Fama-MacBeth regressions but further control for idiosyncratic return volatility, defined as standard deviation of residuals from regressions of the firm's daily returns on the daily Fama-French three factors in the previous year. The results in Table XII show that the coefficients on the original measure, the "constant" measure, and the residual measure are largely unaffected by the inclusion of return volatility into the model, suggesting that our results are robust after controlling for return volatility.

IV. Price Impact and the Pricing of the Amihud Illiquidity Measure

Previous studies have shown that the Amihud measure does a good job capturing price impact (Goyenko, Holden, and Trzcinka (2009), Hasbrouck (2009)). Since investors are expected to demand higher returns for the securities associated with higher transaction costs (Amihud and Mendelson (1986)), one might expect the Amihud measure to be priced because it captures price impact. Our results, however, show that the pricing of the Amihud measure is due instead to its trading volume component. To examine this potential discrepancy, we study the relations between the Amihud measure, its trading volume component, and a high-frequency price impact measure.

We obtain the transaction data for all NYSE/AMEX stocks from 1983 to 2012, using ISSM data to cover the period from 1983 to 1992 and the TAQ data to cover the period from 1993 to 2012. We then follow the literature (Goyenko, Holden, and Trzcinka (2009), Hasbrouck (2009)) and construct a high-frequency benchmark of price impact using five-minute return and five-minute trading volume. Specifically, for each firm-year, we estimate the price impact measure as the slope coefficient λ of the following regression:

[12] The results are similar if we use total return volatility constructed as standard deviation of the firm's daily returns in the previous year.

$$r_n = \lambda \times SVol_n + u_n, \tag{11}$$

where for the n^{th} five-minute period, r_n is the five-minute stock return calculated as the natural log of the price change over the n[th] period. $SVol_n$ is the signed square-root dollar volume of the n^{th} period, and u_n is the error term. We calculate signed square-root dollar volume as $SVol_n = sign(vol_n)\sqrt{vol_n}$, where vol_n is the dollar volume in the n^{th} five-minute period, and $sign(vol_n)$ is the sign of the trading volume assigned according to the corresponding change in price. When price does not change over a five-minute interval, we sign the trading volume using the price change of the previous five-minute interval. We winsorize the λ measure at the 1 and 99 percentiles in each cross-section to control for outliers.

We first examine the correlations between the price impact measure and the Amihud illiquidity measures in Table XIII. We calculate cross-sectional correlation coefficients each year, and then report their time-series averages. Panel A shows that the Amihud (2002) illiquidity measure (*A*) is highly correlated with price impact (γ), with a correlation coefficient of 0.783. This result is consistent with what was documented in previous studies (Hasbrouck (2009), Goyenko, Holden, and Trzcinka (2009)), indicating that the Amihud illiquidity measure does well capturing price impact. Interestingly, the constant measure *A_C* is also highly correlated with the price impact γ, with a correlation coefficient of 0.710. The residual *A* measure is positively correlated with price impact, but the correlation is only 0.329, much lower than that of *A*. These results suggest that the majority of the correlation between the Amihud illiquidity measure and price impact is due to its trading volume component, not the return-volume ratio.

Panel A of Table XIII also presents correlations between price impact and the turnover-based Amihud measures (*AT*). The correlation is 0.602 for the *AT* measure. While this correlation is higher than the 0.528 correlation for the residual *AT* measure, the difference is much smaller than that between the *A* measure and the residual *A* measure. These results suggest that the trading volume component also explains a portion of the relation between the turnover-based Amihud measure and price impact, but the majority of such relation is due to the return-to-turnover-ratio construction of the turnover-based Amihud measure. Panel B of Table XIII further reports correlations between monthly price impact measures and monthly Amihud measures, where the patterns are similar to those using annual measures in Panel A.

To corroborate the correlation analysis, we estimate annual Fama-MacBeth regressions of the price impact measure on the contemporaneous Amihud illiquidity measures and present the results in Table XIV. For Panel A, we perform cross-sectional regressions in each year, and report the time-series averages of cross-sectional regression coefficients and the associated t-statistics using the Newey-West (1987) standard errors with six lags. To alleviate the impact of extreme values, we follow the literature and take natural logs of the price impact measure and Amihud measures. We also standardize the dependent and independent variables in order to compare the economic magnitude of the coefficients. In Model (1), the coefficient on *ln*(*A*) is 0.955, indicating that one standard deviation increase in *ln*(*A*) is associated with a 0.955 standard deviation increase in ln(γ). In Models (2) and (3), the coefficient on *ln*(*A_C*) is 0.915, similar to that of *ln*(*A*). However, in Model (3), the coefficient on residual *ln*(*A*) is 0.310, i.e., about one-third of the coefficient on *ln*(*A*). These results are consistent with the correlations (Panel A of Table XIII) in suggesting that the trading volume component explains the majority of the relation between the Amihud measure and high-frequency price impact measure. Models (4)-(6) further show that the coefficient on residual *ln*(*AT*) is 0.590, also lower than the 0.846 coefficient on *ln*(*AT*). Panel B of Table XV further presents the corresponding regressions for monthly price impact measures and monthly Amihud measures, and the results are very close to those using annual measures.

Since the trading volume component of the Amihud measure is highly correlated with the high-frequency price impact measure, it is important to examine whether the observed pricing of the trading volume component is due to the pricing of price impact. Table XV presents the Fama-MacBeth regressions of monthly returns on the high-frequency price impact measure and Amihud measures. In Model (1), the main independent variable $ln(\gamma)$ is the natural log of the price impact measure γ estimated in the previous calendar year. We also include the usual control variables such as size, book-to-market ratio, and past stock returns. The coefficient on $ln(\gamma)$ is insignificantly negative (t-stat -0.96), indicating that the price impact measure itself is not priced. This result is puzzling, as it suggests that investors do not seem to demand higher expected returns for stocks associated with greater price impact (transaction costs).

Notably, in Model (2) of Table XV, the coefficient on the "constant" Amihud measure $ln(A\_C)$ is significantly positive at the standard level (t-stat 2.96), and this finding is robust after controlling for the price impact measure in Model (3). Models (4) and (5) further examine the turnover-based Amihud measure, and the results also show that the pricing of the turnover component, $ln(AT\_C)$, is robust after controlling for the price impact measure. Overall, the results in Table XV clearly demonstrate that the pricing of the trading volume component of the Amihud measure is not due to price impact.

V. Conclusion

We examine the pricing of the Amihud (2002) measure, one of the most widely used liquidity proxies in the current finance literature. We find that the return premium associated with the Amihud (2002) measure is driven by its trading volume component but not its construct of return-to-volume ratio. A "constant" measure using only the trading volume component exhibits a return predictability matching that of the Amihud (2002) measure, and the return premium associated with the Amihud (2002) measure disappears once the variation of the trading volume component is removed. These findings survive a broad set of robustness tests, including the use of alternative versions of the Amihud measure, construction of the Amihud measures on a monthly basis, use of an alternative sample of NASDAQ stocks, and division of our sample period into sub-periods. Further analyses also confirm a previously documented relation between the Amihud measure and price impact. However, we find that the majority of this relation is also accounted for by the trading volume component of the Amihud (2002) measure. Additionally, the price impact measure does not seem to be priced, nor does it explain the pricing of the trading volume component of the Amihud measure.

Our findings provide a new explanation as to why the Amihud (2002) measure is priced despite its lack of a perfect match to theory and the noise introduced by the daily data. Our findings lend support to the argument of Chordia, Huh, and Subrahmanyam (2009) that it is important to develop liquidity measures based on explicit theoretical models instead of empirical reasoning. Additionally, our empirical results show that price impact is not priced, a puzzling finding that demands further analyses.

Our findings also have important implications for the finance literature, as a large number of studies use the Amihud (2002) measure for their empirical analyses. Our results confirm that the Amihud (2002) measure reliably measures the level of stock illiquidity as it captures price impact well through its trading volume component. However, since the finance literature relates trading volume and its pricing to various non-liquidity factors, our findings also call for caution in the use of the Amihud measure to examine liquidity premium.

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Table I
Summary Statistics

Panel A presents summary statistics of the liquidity measures for the 98,244 firm-years in our sample. Our sample contains ordinary common shares (share codes 10 or 11) listed in NYSE or AMEX. The liquidity measures are constructed annually for firms from 1963 to 2011. *A* is the original Amihud (2002) measure, defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in a year. $A^{1/2}$ is the square-root version of the Amihud (2002) measure, defined as the annual average of the square root of daily ratio of absolute return to dollar trading volume. *AT* is the turnover-based Amihud (2002) measure, defined as the annual average of the daily ratio of absolute return to turnover, where turnover is daily share volume divided by the shares outstanding. *A_C*, $A^{1/2}$*_C,* and *AT_C* are constructed exactly as *A,* $A^{1/2}$*,* and *AT*, respectively, but the numerators of the ratios are 1 instead of the absolute return. |Ret| is the annual average of daily absolute return. $|\text{Ret}|^{1/2}$ is the annual average of the square-root of daily absolute return. The liquidity measures, as well as |Ret|, and $|\text{Ret}|^{1/2}$ are winsorized at 1 and 99 percentage points in each cross-section. *Market Cap* for a firm is the firm's market capitalization at the end of the estimation year (in millions of dollars). *B/M* is the book-to-market ratio calculated as a firm's book value divided by the firm's market capitalization. The B/M ratio is winsorized at the 0.5% and 99.5% level in each cross-section. Panel B presents summary statistics of the corresponding measures that are constructed monthly from November 1963 to October 2012 for the 1,197,252 firm-months in our sample. To ease reading, we multiply *A* and *A_C* by 10^6, and multiply $A^{1/2}$ and $A^{1/2}$*_C* by 10^3.

	Mean	STD	Q10	Q25	Q50	Q75	Q90
Panel A: Summary Statistics: Annual Measures							
A	3.563	14.923	0.001	0.010	0.138	1.123	6.120
$A^{1/2}$	0.692	1.096	0.030	0.086	0.297	0.803	1.779
AT	37.53	64.55	3.11	7.04	17.47	39.89	84.14
A_C	127.70	331.88	0.09	0.82	11.50	91.88	345.47
$A^{1/2}$**_C**	5.99	7.66	0.29	0.84	2.99	8.12	15.86
AT_C	2,504.00	3,111.84	220.65	529.64	1,450.31	3,276.76	5,881.28
|RET|	0.020	0.011	0.009	0.012	0.017	0.024	0.033
$\|\text{RET}\|^{1/2}$	0.115	0.028	0.083	0.095	0.111	0.131	0.151
Market Cap ($M)	2,303.2	11,717.0	10.8	35.1	179.9	964.3	3,712.9
B/M	0.987	0.976	0.249	0.438	0.747	1.218	1.889
Panel B: Summary Statistics: Monthly Measures							
A	3.133	14.978	0.001	0.008	0.101	0.861	4.908
$A^{1/2}$	0.656	1.108	0.027	0.076	0.263	0.735	1.678
AT	35.87	70.75	2.46	5.68	14.46	35.87	80.97
A_C	116.35	329.34	0.07	0.62	8.29	72.29	302.82
$A^{1/2}$**_C**	5.69	7.64	0.26	0.75	2.66	7.50	15.33
AT_C	2427.22	3451.93	180.74	423.06	1169.49	2989.59	5993.75
|RET|	0.020	0.014	0.008	0.011	0.016	0.024	0.035
$\|\text{RET}\|^{1/2}$	0.115	0.036	0.075	0.090	0.110	0.134	0.161

Table II

Correlations among Various Versions of the Amihud Measure

Panel A presents the time-series averages of the cross-sectional correlation coefficients among the various version of the Amihud measure constructed annually from 1963 to 2011. We first calculate cross-sectional correlation coefficients among the variables for each year, and then report the time-series averages of the cross-sectional correlation coefficients. *A* is the original Amihud (2002) measure, defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in a year. $A^{1/2}$ is the square-root version of the Amihud (2002) measure, defined as the annual average of the square root of daily ratio of absolute return to dollar trading volume. *AT* is the turnover-based Amihud (2002) measure, defined as the annual average of the daily ratio of absolute return to turnover, where turnover is daily share volume divided by the shares outstanding. *A_C*, $A^{1/2}$*_C,* and *AT_C* are constructed exactly as *A,* $A^{1/2}$*,* and *AT*, respectively, but the numerators of the ratios are 1 instead of the absolute return. |Ret| is the annual average of daily absolute return. $|\text{Ret}|^{1/2}$ is the annual average of the square-root of daily absolute return. Panel B presents the time-series averages of the cross-sectional correlation coefficients among the monthly Amihud measures which are constructed in each month from November 1963 to October 2012. All the liquidity measures, |Ret|, and $|\text{Ret}|^{1/2}$ are winsorized at 1 and 99 percentage points in each cross-section.

	A	$\mathbf{A^{1/2}}$	**AT**	**A_C**	$\mathbf{A^{1/2}}$**_C**	**AT_C**	**|Ret|**	$\mathbf{\|Ret\|^{1/2}}$
Panel A: Correlations Among Amihud Measures: Annual Measures								
A	1.000							
$\mathbf{A^{1/2}}$	0.907	1.000						
AT	0.682	0.721	1.000					
A_C	0.941	0.955	0.705	1.000				
$\mathbf{A^{1/2}}$**_C**	0.810	0.964	0.708	0.930	1.000			
AT_C	0.303	0.404	0.782	0.406	0.499	1.000		
|Ret|	0.610	0.658	0.422	0.549	0.531	0.004	1.000	
$\mathbf{\|Ret\|^{1/2}}$	0.480	0.534	0.303	0.423	0.400	-0.099	0.952	1.000
Panel B: Correlations Among Amihud Measures: Monthly Measures								
A	1.000							
$\mathbf{A^{1/2}}$	0.894	1.000						
AT	0.691	0.729	1.000					
A_C	0.899	0.904	0.685	1.000				
$\mathbf{A^{1/2}}$**_C**	0.777	0.932	0.688	0.920	1.000			
AT_C	0.312	0.401	0.746	0.443	0.524	1.000		
|Ret|	0.489	0.567	0.347	0.394	0.393	-0.040	1.000	
$\mathbf{\|Ret\|^{1/2}}$	0.364	0.453	0.263	0.266	0.257	-0.117	0.935	1.000

Table III
Monthly Stock Returns of Portfolios Sorted on Amihud Measures

Panel A presents monthly returns (%) of portfolios sorted on the Amihud measures. A is the Amihud (2002) measure, defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in a year. At the beginning of each month from 1964 to 2012, stocks are sorted into quintile portfolios according to the A measures of the previous year. We then calculate monthly equal-weighted portfolio returns for the quintile portfolios and report time-series average portfolio returns or four-factor alphas, where the four-factor alpha is constructed using the three Fama-French factors and the momentum factor (UMD). The differences between the top and bottom quintiles are also reported with associated t-statistics. We then repeat the sorting using the A_C measure and the residual A measure, where A_C is constructed as A but the numerator of the ratio is 1 instead of absolute return, and the residual A measure is the residual from the monthly cross-sectional regression of the A measure on the A_C measure. Panel B is similar to Panel A except that we sort stocks based on $A^{1/2}$, $A^{1/2}\_C$ and residual $A^{1/2}$, where $A^{1/2}$ is the square-root version of the Amihud (2002) measure, defined as the annual average of the square root of daily ratio of absolute return to dollar trading volume. $A^{1/2}\_C$ is constructed as $A^{1/2}$ but the numerator of the ratio is 1 instead of absolute return, and the residual $A^{1/2}$ measure is the residual from the monthly cross-sectional regression of the $A^{1/2}$ measure on the $A^{1/2}\_C$ measure. Panel C is similar to Panel A except that we sort stocks based on AT, AT_C, and residual AT, where AT is the turnover-based Amihud (2002) measure, defined as the annual average of the daily ratio of absolute return to turnover. AT_C is constructed as AT but the numerator of the ratio is 1 instead of absolute return, and the residual AT measure is the residual from the monthly cross-sectional regression of the AT measure on the AT_C measure. The t-statistics (in parentheses) are calculated using Newey-West robust standard errors with 6 lags.

	Portfolios Sorted on Amihud Measures						
	Liquid	**2**	**3**	**4**	**Illiquid**	**Illiq – Liq**	**t-stat**
Panel A: Sorted on Original Amihud Measures							
Sorted on A							
Raw Return	0.96	1.07	1.17	1.27	1.76	0.80	(3.38)
Four-Factor Alpha	0.04	-0.01	-0.02	0.04	0.47	0.43	(2.83)
Sorted on A_C							
Raw Return	0.95	1.06	1.15	1.30	1.78	0.83	(3.95)
Four-Factor Alpha	0.01	-0.04	-0.02	0.07	0.51	0.50	(3.50)
Sorted on Res. A Measure							
Raw Return	1.53	1.34	1.14	1.04	1.19	-0.34	(-2.12)
Four-Factor Alpha	0.33	0.12	-0.02	-0.04	0.14	-0.20	(-1.40)
Panel B: Sorted on Square-Root Amihud Measures							
Sorted on $A^{1/2}$							
Raw Return	0.96	1.08	1.18	1.26	1.76	0.80	(3.42)
Four-Factor Alpha	0.04	-0.01	-0.01	0.01	0.49	0.45	(2.96)
Sorted on $A^{1/2}$_C							
Raw Return	0.95	1.06	1.16	1.30	1.77	0.82	(3.95)
Four-Factor Alpha	0.01	-0.05	-0.01	0.06	0.51	0.51	(3.52)
Sorted on Res. $A^{1/2}$ Measure							
Raw Return	1.44	1.30	1.18	1.04	1.28	-0.15	(-0.72)
Four-Factor Alpha	0.32	0.11	0.03	-0.08	0.14	-0.18	(-1.00)

	Portfolios Sorted on Amihud Measures						
	Liquid	**2**	**3**	**4**	**Illiquid**	**Illiq – Liq**	**t-stat**
Panel C: Sorted on Turnover-Based Amihud Measures							
Sorted on AT							
Raw Return	0.94	1.11	1.21	1.27	1.69	0.76	(4.84)
Four-Factor Alpha	-0.16	0.02	0.09	0.08	0.49	0.65	(4.23)
Sorted on AT_C							
Raw Return	0.94	1.18	1.23	1.38	1.50	0.55	(3.88)
Four-Factor Alpha	-0.23	0.03	0.08	0.23	0.41	0.63	(4.98)
Sorted on Res. AT Measure							
Raw Return	1.16	1.11	1.13	1.22	1.61	0.46	(1.74)
Four-Factor Alpha	0.18	0.06	-0.02	-0.02	0.32	0.14	(0.74)

Table IV

Monthly Stock Returns of Portfolios Sorted on Amihud Measures: *Monthly* Measures

Panel A presents monthly returns (%) of portfolios sorted on the monthly Amihud measures. *A* is the monthly Amihud (2002) measure, defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in a month. At the beginning of each month *t* from 1964 to 2012, stocks are sorted into quintile portfolios according to the *A* measures of month *t*-2. We then calculate monthly equal-weighted portfolio returns for the quintile portfolios and report time-series average portfolio returns or four-factor alphas, where the four-factor alpha is constructed using the three Fama-French factors and the momentum factor (UMD). The differences between the top and bottom quintiles are also reported with associated t-statistics. We then repeat the sorting for the *A_C* measure and the residual *A* measure, where *A_C* is constructed as *A* but the numerator of the ratio is 1 instead of absolute return, and the residual *A* measure is the residual from the monthly cross-sectional regression of the *A* measure on the *A_C* measure. Panel B is similar to Panel A except that we sort stocks based on $A^{1/2}$, $A^{1/2}$_*C* and residual $A^{1/2}$, where $A^{1/2}$ is the square-root version of the Amihud (2002) measure, defined as the monthly average of the square root of daily ratio of absolute return to dollar trading volume. $A^{1/2}$_*C* is constructed as $A^{1/2}$ but the numerator of the ratio is 1 instead of absolute return, and the residual $A^{1/2}$ measure is the residual from the monthly cross-sectional regression of the $A^{1/2}$ measure on the $A^{1/2}$_*C* measure. Panel C is similar to Panel A except that we sort stocks based on *AT*, *AT_C*, and residual *AT*, where *AT* is the turnover-based Amihud (2002) measure, defined as the monthly average of the daily ratio of absolute return to turnover. *AT_C* is constructed as *AT* but the numerator of the ratio is 1 instead of absolute return, and the residual *AT* measure is the residual from the monthly cross-sectional regression of the *AT* measure on the *AT_C* measure. The t-statistics (in parentheses) are calculated using Newey-West robust standard errors with 6 lags.

	Portfolios Sorted on Amihud Measures						
	Liquid	**2**	**3**	**4**	**Illiquid**	**Illiq – Liq**	**t-stat**
Panel A: Sorted on Original Amihud Measures: Monthly Measures							
Sorted on A							
Raw Return	0.96	1.16	1.23	1.29	1.53	0.56	(2.36)
Four-Factor Alpha	-0.03	0.04	0.03	0.10	0.32	0.35	(2.31)
Sorted on A_C							
Raw Return	0.96	1.13	1.23	1.28	1.57	0.61	(2.95)
Four-Factor Alpha	-0.05	-0.01	0.03	0.11	0.39	0.44	(3.20)
Sorted on Res. A Measure							
Raw Return	1.39	1.29	1.19	1.10	1.21	-0.17	(-1.05)
Four-Factor Alpha	0.25	0.14	0.04	-0.05	0.09	-0.16	(-0.96)
Panel B: Sorted on Square-Root Amihud Measures: Monthly Measures							
Sorted on $A^{1/2}$							
Raw Return	0.96	1.15	1.25	1.30	1.51	0.55	(2.28)
Four-Factor Alpha	-0.03	0.04	0.05	0.10	0.31	0.34	(2.23)
Sorted on $A^{1/2}$_C							
Raw Return	0.97	1.13	1.23	1.27	1.58	0.61	(2.96)
Four-Factor Alpha	-0.05	-0.01	0.02	0.10	0.40	0.45	(3.22)
Sorted on Res. $A^{1/2}$ Measure							
Raw Return	1.40	1.29	1.16	1.13	1.20	-0.19	(-1.05)
Four-Factor Alpha	0.31	0.18	0.02	-0.06	0.02	-0.29	(-1.93)

	Portfolios Sorted on Amihud Measures						
	Liquid	**2**	**3**	**4**	**Illiquid**	**Illiq – Liq**	**t-stat**
Panel C: Sorted on Turnover-Based Amihud Measures: Monthly Measures							
Sorted on AT							
Raw Return	1.02	1.18	1.25	1.31	1.41	0.39	(2.64)
Four-Factor Alpha	-0.19	0.04	0.13	0.19	0.30	0.49	(3.65)
Sorted on AT_C							
Raw Return	1.00	1.26	1.23	1.36	1.33	0.33	(2.39)
Four-Factor Alpha	-0.26	0.07	0.10	0.26	0.30	0.55	(4.47)
Sorted on Res. AT Measure							
Raw Return	1.17	1.18	1.23	1.25	1.35	0.18	(0.74)
Four-Factor Alpha	0.19	0.06	0.03	0.03	0.16	-0.03	(-0.21)

Table V
Monthly Stock Returns of Portfolios Sorted on Amihud Measures: Alphas using the Return Factors Based on Trading Volume Components

Panel A presents monthly one-factor and five-factor alphas (%) of portfolios sorted on the Amihud measures. *A* is the original Amihud (2002) measure, defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in a year. At the beginning of each month from 1964 to 2012, stocks are sorted into quintile portfolios according to the *A* measures of the previous year. We then calculate monthly equal-weighted portfolio returns for the quintile portfolios and report time-series one-factor alpha and five-factor alpha. One-factor alpha is constructed using the IML^{A_C} factor, where the monthly factor return of IML^{A_C} ("illiquid minus liquid") is the monthly equal-weighted returns of the top *A_C* tercile minus that of the bottom *A_C* tercile. *A_C* is constructed as *A* but the numerator of the ratio is 1 instead of absolute return. Five-factor alpha is constructed using the IML^{A_C} factor together with the three Fama-French factors and the momentum factor (UMD). We also report the differences between the top and bottom quintiles and associated t-statistics. We then repeat the sorting analysis using the $A^{1/2}$ measure (*AT* measure) and report the one- and five-factor alphas using the $IML^{A1/2\_C}$ (IML^{AT_C}) factor returns. $A^{1/2}$ is the square-root version of the Amihud (2002) measure, defined as the annual average of the square root of daily ratio of absolute return to dollar trading volume, and $A^{1/2}\_C$ is constructed as $A^{1/2}$ but the numerator of the ratio is 1 instead of absolute return. *AT* is the turnover-based Amihud (2002) measure, defined as the annual average of the daily ratio of absolute return to turnover, and *AT_C* is constructed as *AT* but the numerator of the ratio is 1 instead of absolute return. Panel B is similar to Panel A but uses monthly measures. The corresponding Amihud measures are constructed each month, and stocks in month *t* are sorted by Amihud measures constructed in month *t*-2. The t-statistics (in parentheses) are calculated using Newey-West robust standard errors with 6 lags.

	Portfolios Sorted on Amihud Measures						
	Liquid	**2**	**3**	**4**	**Illiq.**	**Illiq– Liq**	**t-stat**
Panel A: Sorted on Original and Turnover-Based Amihud Measures							
Sorted on A							
One-Factor Alpha: IML^{A_C}	0.59	0.58	0.53	0.44	0.57	-0.02	(-0.46)
Five-Factor Alpha: IML^{A_C} & 4 Factors	0.10	0.04	0.00	-0.07	0.06	-0.03	(-0.74)
Sorted on $A^{1/2}$							
One-Factor Alpha: $IML^{A1/2\_C}$	0.60	0.59	0.55	0.43	0.59	-0.01	(-0.14)
Five-Factor Alpha: $IML^{A1/2\_C}$ & 4 Factors	0.10	0.05	0.00	-0.10	0.09	-0.01	(-0.27)
Sorted on AT							
One-Factor Alpha: IML^{AT_C}	1.03	1.12	1.15	1.13	1.34	0.31	(1.05)
Five-Factor Alpha: IML^{AT_C} & 4 Factors	0.07	0.16	0.14	0.02	0.15	0.08	(0.87)
Panel B: Sorted on Original and Turnover-Based Amihud Measures: Monthly Measures							
Sorted on A							
One-Factor Alpha: IML^{A_C}	0.57	0.68	0.64	0.56	0.53	-0.04	(-0.77)
Five-Factor Alpha: IML^{A_C} & 4 Factors	0.03	0.10	0.06	0.00	-0.05	-0.08	(-1.66)
Sorted on $A^{1/2}$							
One-Factor Alpha: $IML^{A1/2\_C}$	0.57	0.67	0.66	0.57	0.53	-0.04	(-0.73)
Five-Factor Alpha: $IML^{A1/2\_C}$ & 4 Factors	0.03	0.09	0.07	0.00	-0.05	-0.08	(-1.79)
Sorted on AT							
One-Factor Alpha: IML^{AT_C}	0.89	1.00	1.03	1.05	1.05	0.16	(1.44
Five-Factor Alpha: IML^{AT_C} & 4 Factors	0.02	0.17	0.17	0.13	0.01	-0.02	(-0.20)

Table VI

Monthly Fama-MacBeth Regressions of Stock Returns on Amihud Measures

This table presents the estimation results of monthly Fama-MacBeth regressions of stock returns on the Amihud (2002) measures from 1964 to 2012. The dependent variable is the monthly FF3-adjusted return. FF3-adjusted return of month *t* is calculated based on the three-factor model where the factor loadings are estimated over the preceding sixty months [t-60,t-1] with at least 24 observations for each firm-level time-series regression. The independent variables include the natural logs of the Amihud measures. *Ln*(*A*) is the natural log of the annual Amihud (2002) measure (*A*), defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in the previous calendar year. *Ln*(*A_C*) is the natural log of *A_C* which is constructed as *A* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*A*) is the residual from the monthly cross-sectional regression of *ln*(*A*) on *ln*(*A_C*). The right panel is similar to the left panel except that the liquidity measure is *AT* which is the turnover-based Amihud measure, defined as the annual average of the daily ratio of absolute return to turnover. *AT_C* is constructed as *AT* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*AT*) is the residual from the monthly cross-sectional regression of *ln*(*AT*) on *ln*(*AT_C*). We also control for a number of firm characteristics. *Ln(ME)* is the natural log of market capitalization at the end of the previous year. B/M is the ratio of book value of equity to market value of equity. For the regression of month *t*, *Ret*[-12,-2] is the cumulative return from month *t*-12 to month *t*-2, and *Ret*[-1] is stock return of month *t*-1. We estimate a cross-sectional regression in each month and then report the time-series means and t-statistics (in parentheses). We also report the time-series average of the number of observations and adjusted R^2 of the cross-sectional regressions. All the regressions include a constant which is not reported for brevity. T-statistics are calculated using Newey-West robust standard errors with 6 lags. ***, **, and * represent statistical significances at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: FF3-Adjusted Return							
	(1)	(2)	(3)		(4)	(5)	(6)
ln(A)	0.200***			**ln(AT)**	0.246***		
	(4.12)				(4.86)		
ln(A_C)		0.209***	0.183***	**ln(AT_C)**		0.244***	0.238***
		(4.74)	(3.78)			(5.60)	(5.14)
Res. ln(A)			-0.158	**Res. ln(AT)**			-0.099
			(-1.15)				(-0.70)
ln(ME)	0.185***	0.178***	0.138***	**ln(ME)**	0.007	-0.015	-0.025
	(3.73)	(3.44)	(3.06)		(0.27)	(-0.50)	(-1.06)
B/M	0.045	0.038	0.024	**B/M**	0.034	0.022	0.015
	(1.08)	(0.93)	(0.57)		(0.82)	(0.53)	(0.37)
Ret[-12,-2]	0.327*	0.332*	0.323*	**Ret[-12,-2]**	0.377*	0.365*	0.360*
	(1.68)	(1.78)	(1.77)		(1.87)	(1.85)	(1.86)
Ret[-1]	-6.965***	-6.917***	-7.197***	**Ret[-1]**	-6.914***	-6.906***	-7.148***
	(-13.27)	(-13.24)	(-13.70)		(-13.19)	(-13.24)	(-13.65)
Adj. R^2	0.032	0.033	0.037	**Adj. R^2**	0.032	0.032	0.037
Ave. # obs	1,771	1,771	1,771	**Ave. # obs**	1,771	1,771	1,771
# Months	588	588	588	**# Months**	588	588	588

Table VII
Monthly Fama-MacBeth Regressions of Stock Returns:
Decomposition of the Amihud Measure

This table presents monthly Fama-MacBeth regressions of stock returns on the components of the Amihud (2002) measure from 1964 to 2012. The dependent variable is the monthly FF3-adjusted return. FF3-adjusted return is calculated based on the three-factor model where the factor loadings are estimated in the preceding sixty months. The independent variables include the natural logs of the components of the Amihud measure. *A_C* is defined as the daily ratio of 1 to dollar trading volume, averaged across all days in a year. *AT* is the turnover-based Amihud (2002) measure, defined as the annual average of the daily ratio of absolute return to turnover, where turnover is daily share volume divided by the shares outstanding. *AT_C* is constructed as *AT* but the numerator of the ratio is 1 instead of absolute return. |*Ret*| is the annual average of daily absolute return over the estimation year. *S* is the annual average of market capitalization over the estimation year. We also control for a number of firm characteristics. *B/M* is the book-to-market ratio calculated as a firm's book value divided by the firm's market capitalization. For the regression of month *t*, *Ret*[-12,-2] is the cumulative stock return from month *t*-12 to month *t*-2, and *Ret*[-1] is the stock return of month *t*-1. We estimate a cross-sectional regression in each month and then report the time-series means and t-statistics (in parentheses). We also report the time-series average of the number of observations and adjusted R^2 of the cross-sectional regressions. All the regressions include a constant which is not reported for brevity. T-statistics are calculated using Newey-West robust standard errors with 6 lags. ***, **, and * represent statistical significances at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: FF3-Adjusted Return		
	(1)	(2)	(3)
ln(A_C)	0.101***		
	(4.26)		
ln(AT)		0.259***	
		(5.09)	
ln(AT_C)			0.206***
			(4.69)
ln|Ret|	-0.426***		-0.252
	(-2.95)		(-1.59)
ln(S)		0.017	-0.047*
		(0.71)	(-1.86)
B/M	-0.007	0.032	0.006
	(-0.17)	(0.75)	(0.15)
Ret[-12,-2]	0.322*	0.354*	0.330*
	(1.65)	(1.66)	(1.68)
Ret[-1]	-7.226***	-6.946***	-7.232***
	(-13.76)	(-13.24)	(-13.78)
Adj. R^2	0.036	0.032	0.037
Ave. # obs	1,771	1,771	1,771
# Months	588	588	588

Table VIII
Monthly Fama-MacBeth Regressions of Stock Returns on Amihud Measures:
Monthly Measures

This table presents the estimation results of monthly Fama-MacBeth regressions of stock returns on the monthly Amihud (2002) measures from 1964 to 2012. The dependent variable is the monthly FF3-adjusted return. FF3-adjusted return of month *t* is calculated based on the three-factor model where the factor loadings are estimated over the preceding sixty months [t-60,t-1] with at least 24 observations for each firm-level time-series regression. The independent variables include the natural logs of the Amihud measures. *Ln*(*A*) is the natural log of the monthly Amihud measure (*A*), defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in month t-2. *Ln*(*A_C*) is the natural log of *A_C* which is constructed as *A* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*A*) is the residual from the monthly cross-sectional regression of *ln*(*A*) on *ln*(*A_C*). The right panel is similar to the left panel except that the liquidity measure is *AT* which is the turnover-based Amihud measure, defined as the monthly average of the daily ratio of absolute return to turnover in month *t*-2. *AT_C* is constructed as *AT* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*AT*) is the residual from the monthly cross-sectional regression of *ln*(*AT*) on *ln*(*AT_C*). We also control for a number of firm characteristics. *ln(ME)* is the natural log of market capitalization at the end of the previous year. *B/M* is the ratio of book value of equity to market value of equity. For the regression of month *t*, *Ret*[-12,-2] is the cumulative return from month *t*-12 to month *t*-2, and *Ret*[-1] is the stock return of month *t*-1. We estimate a cross-sectional regression in each month and then report the time-series means and t-statistics (in parentheses). We also report the time-series average of the number of observations and adjusted R^2 of the cross-sectional regressions. All the regressions include a constant which is not reported for brevity. T-statistics are calculated using Newey-West robust standard errors with 6 lags. ***, **, and * represent statistical significances at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: FF3-Adjusted Return							
	(1)	(2)	(3)		(4)	(5)	(6)
ln(A)	0.119***			**ln(AT)**	0.163***		
	(3.01)				(3.95)		
ln(A_C)		0.183***	0.130***	**ln(AT_C)**		0.223***	0.198***
		(4.79)	(3.31)			(5.77)	(5.10)
Res. ln(A)			-0.248	**Res. ln(AT)**			-0.207**
			(-3.14)				(-2.53)
ln(ME)	0.080**	0.144***	0.069*	**ln(ME)**	-0.025	-0.027	-0.053**
	(2.04)	(3.14)	(1.82)		(-0.99)	(-0.91)	(-2.15)
B/M	0.044	0.034***	0.026	**B/M**	0.041	0.027	0.025
	(1.04)	(0.81)	(0.61)		(0.97)	(0.65)	(0.58)
Ret[-12,-2]	0.430**	0.542***	0.423**	**Ret[-12,-2]**	0.453**	0.505**	0.429**
	(2.05)	(2.63)	(2.09)		(2.18)	(2.49)	(2.13)
Ret[-1]	-6.755***	-6.716***	-6.915***	**Ret[-1]**	-6.725***	-6.734***	-6.897***
	(-12.88)	(-12.83)	(-13.23)		(-12.86)	(-12.91)	(-13.23)
Adj. R^2	0.031	0.032	0.035	**Adj. R^2**	0.031	0.032	0.035
Ave. # obs	1,775	1,775	1,775	**Ave. # obs**	1,775	1,775	1,775
# Months	588	588	588	**# Months**	588	588	588

Table IX
Monthly Fama-MacBeth Regressions of Returns on Amihud Measures:
Raw Returns

This table presents the estimation results of monthly Fama-MacBeth regressions of stock returns on the Amihud (2002) measures from 1964 to 2012. The dependent variable is the monthly raw return. The independent variables include the natural logs of the Amihud measures. *Ln*(*A*) is the natural log of the annual Amihud (2002) measure (*A*), defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in the previous calendar year. *Ln*(*A_C*) is the natural log of *A_C* which is constructed as *A* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*A*) is the residual from the monthly cross-sectional regression of *ln*(*A*) on *ln*(*A_C*). The right Panel is similar to the left panel except that the liquidity measure is *AT* which is the turnover-based Amihud (2002) measure, defined as the annual average of the daily ratio of absolute return to turnover. *AT_C* is constructed as *AT* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*AT*) is the residual from the monthly cross-sectional regression of *ln*(*AT*) on *ln*(*AT_C*). We also control for a number of firm characteristics. *ln(ME)* is the natural log of market capitalization at the end of the previous year. *B/M* is the ratio of book value of equity to market value of equity. For the regression of month *t*, *Ret*[-12,-2] is the cumulative return from month *t*-12 to month *t*-2, and *Ret*[-1] is the stock return of month *t*-1. We estimate a cross-sectional regression in each month and then report the time-series means and t-statistics (in parentheses). We also report the time-series average of the number of observations and adjusted R^2 of the cross-sectional regressions. All the regressions include a constant which is not reported for brevity. T-statistics are calculated using Newey-West robust standard errors with 6 lags. ***, **, and * represent statistical significances at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: Raw Return							
	(1)	(2)	(3)		(4)	(5)	(6)
ln(A)	0.159***			**ln(AT)**	0.202***		
	(3.36)				(4.00)		
ln(A_C)		0.112**	0.157***	**ln(AT_C)**		0.144**	0.179***
		(2.00)	(3.62)			(2.49)	(3.44)
Res. ln(A)			0.159	**Res. ln(AT)**			0.222
			(0.82)				(1.14)
ln(ME)	0.075	0.001	0.052	**ln(ME)**	-0.067	-0.099**	-0.064*
	(1.03)	(0.01)	(0.92)		(-1.48)	(-2.02)	(-1.88)
B/M	0.166***	0.157***	0.139**	**B/M**	0.158***	0.144**	0.135**
	(2.71)	(2.67)	(2.45)		(2.62)	(2.50)	(2.37)
Ret[-12,-2]	0.545**	0.574***	0.575***	**Ret[-12,-2]**	0.593**	0.584***	0.595***
	(2.44)	(2.75)	(2.89)		(2.57)	(2.62)	(2.79)
Ret[-1]	-5.656***	-5.638***	-5.951***	**Ret[-1]**	-5.626***	-5.671***	-5.922***
	(-11.45)	(-11.49)	(-12.08)		(-11.40)	(-11.50)	(-12.04)
Adj. R^2	0.050	0.053	0.062	**Adj. R^2**	0.050	0.054	0.062
Ave. # obs	1,771	1,771	1,771	**Ave. # obs**	1,771	1,771	1,771
# Months	588	588	588	**# Months**	588	588	588

Table X
Monthly Fama-MacBeth Regressions of Stock Returns on Amihud Measures: *NASDAQ Stocks*

This table presents monthly Fama-MacBeth regressions of stock returns (%) for NASDAQ stocks from 1984 to 2012. The dependent variable is the monthly FF3-adjusted return. FF3-adjusted return of month *t* is calculated based on the three-factor model where the factor loadings are estimated in the preceding sixty months [*t*-60,*t*-1] with at least 24 observations for each firm-level time-series regression. The independent variables include the natural logs of the Amihud measures. *ln*(*A*) is the natural log of the annual Amihud (2002) measure (*A*), defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in the previous calendar year. *ln*(*A_C*) is the natural log of the *A_C* measure which is constructed as *A* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*A*) is the residual from the monthly cross-sectional regression of *ln*(*A*) on *ln*(*A_C*). The right panel is similar to the left panel except that the liquidity measure is *AT* which is the turnover-based Amihud (2002) measure, defined as the annual average of the daily ratio of absolute return to turnover. *AT_C* is constructed as *AT* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*AT*) is the residual from the monthly cross-sectional regression of *ln*(*AT*) on *ln*(*AT_C*). We also control for a number of firm characteristics. *ln(ME)* is the natural log of market capitalization (in millions) at the end of previous year. *B/M* is the book-to-market ratio calculated as a firm's book value divided by the firm's market capitalization. For return of month *t*, *Ret*[-12,-2] is the cumulative return from month *t*-12 to month *t*-2, and *Ret*[-1] is stock return of month *t*-1. We estimate a cross-sectional regression in each month and then report the time-series means and t-statistics (in parentheses). We also report the time-series average of the number of observations and adjusted R^2 of the cross-sectional regressions. All the regressions include a constant which is not reported for brevity. T-statistics are based on Newey-West robust standard errors with 6 lags. ***, **, and * represent statistical significances at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: FF3-Adjusted Return							
	(1)	(2)	(3)		(4)	(5)	(6)
ln(A)	0.090*			**ln(AT)**	0.164***		
	(1.85)				(3.41)		
ln(A_C)		0.113**	0.113**	**ln(AT_C)**		0.183***	0.185***
		(2.00)	(2.29)			(3.21)	(3.62)
Res. ln(A)			-0.076	**Res. ln(AT)**			-0.016
			(-0.51)				(-0.12)
ln(ME)	-0.067	-0.052	-0.059	**ln(ME)**	-0.112	-0.130	-0.127*
	(-0.61)	(-0.44)	(-0.59)		(-1.40)	(-1.60)	(-1.85)
B/M	0.192**	0.177**	0.167**	**B/M**	0.168**	0.149*	0.141*
	(2.25)	(2.16)	(2.09)		(1.97)	(1.83)	(1.76)
Ret[-12,-2]	0.104	0.088	0.084	**Ret[-12,-2]**	0.097	0.079	0.072
	(0.67)	(0.60)	(0.59)		(0.58)	(0.49)	(0.45)
Ret[-1]	-5.963***	-6.011***	-6.160***	**Ret[-1]**	-6.015***	-6.095***	-6.209***
	(-11.15)	(-11.28)	(-11.65)		(-11.15)	(-11.33)	(-11.60)
Adj. R^2	0.024	0.025	0.027	**Adj. R^2**	0.024	0.025	0.027
Ave. # obs	2,522	2,522	2,522	**Ave. # obs**	2,522	2,522	2,522
# Months	348	348	348	**# Months**	348	348	348

Table XI

Monthly Fama-MacBeth Regressions of Stock Returns on Amihud Measures:

Sub-Period Analysis

This table presents monthly Fama-MacBeth regressions of stock returns (%) on the Amihud measures for the two sub-periods, 1964-1988 (Panel A) and 1989-2012 (Panel B). The dependent variable is the monthly FF3-adjusted return. FF3-adjusted return of month *t* is calculated based on the three-factor model where the factor loadings are estimated in the preceding sixty months [t-60,t-1] with at least 24 observations for each firm-level time-series regression. The independent variables include the natural logs of the Amihud measures. *ln*(*A*) is the natural log of the annual Amihud (2002) measure (*A*), defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in the previous calendar year. *ln*(*A_C*) is the natural log of the *A_C* measure, which is constructed as *A* except but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*A*) is the residual from the monthly cross-sectional regression of *ln*(*A*) on *ln*(*A_C*). The right panel is similar to the left panel except that the liquidity measure is *AT* which is the turnover-based Amihud (2002) measure, defined as the annual average of the daily ratio of absolute return to turnover. *ln*(*AT_C*) is the natural log of the *AT_C* measure constructed as *AT* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*AT*) is the residual from the monthly cross-sectional regression of *ln*(*AT*) on *ln*(*AT_C*). We also control for a number of firm characteristics. *ln(ME)* is the natural log of market capitalization (in millions) at the end of previous year. *B/M* is the book-to-market ratio calculated as a firm's book value divided by the firm's market capitalization. For the regression of month *t*, *Ret*[-12,-2] is the cumulative return from month *t*-12 to month *t*-2, and *Ret*[-1] is stock return of month *t*-1. We estimate a cross-sectional regression in each month and then report the time-series means and t-statistics (in parentheses). We also report the time-series average of the number of observations and adjusted R^2 of the cross-sectional regressions. All the regressions include a constant which is not reported for brevity. T-statistics are calculated using Newey-West robust standard errors with 6 lags. ***, **, and * represent statistical significances at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: FF3-Adjusted Return							
Panel A: 1964-1988							
	(1)	(2)	(3)		(4)	(5)	(6)
ln(A)	0.272***			**ln(AT)**	0.274***		
	(3.47)				(3.21)		
ln(A_C)		0.300***	0.242***	**ln(AT_C)**		0.298***	0.275***
		(4.44)	(3.08)			(4.19)	(3.60)
Res. ln(A)			-0.251	**Res. ln(AT)**			-0.223
			(-1.34)				(-1.17)
ln(ME)	0.265***	0.276***	0.194***	**ln(ME)**	-0.003	-0.017	-0.042
	(4.05)	(4.68)	(3.30)		(-0.07)	(-0.41)	(-1.20)
B/M	0.113**	0.097*	0.073	**B/M**	0.101*	0.080	0.065
	(2.00)	(1.73)	(1.28)		(1.81)	(1.43)	(1.13)
Ret[-12,-2]	0.626***	0.590***	0.568***	**Ret[-12,-2]**	0.710***	0.674***	0.648***
	(3.30)	(3.18)	(3.14)		(3.81)	(3.65)	(3.62)
Ret[-1]	-8.886***	-8.826***	-9.139***	**Ret[-1]**	-8.814***	-8.771***	-9.070***
	(-13.47)	(-13.43)	(-13.81)		(-13.40)	(-13.38)	(-13.76)
Adj. R^2	0.035	0.036	0.041	**Adj. R^2**	0.036	0.036	0.041
Ave. # obs	1,817	1,817	1,817	**Ave. # obs**	1,817	1,817	1,817
# Months	300	300	300	**# Months**	300	300	300

Dependent Variable: FF3-Adjusted Return							
Panel B: 1989-2012							
	(7)	(8)	(9)		(10)	(11)	(12)
ln(A)	0.125**			**ln(AT)**	0.217***		
	(2.32)				(4.10)		
ln(A_C)		0.114**	0.121**	**ln(AT_C)**		0.187***	0.199***
		(2.19)	(2.26)			(3.92)	(3.95)
Res. ln(A)			-0.062	**Res. ln(AT)**			0.031
			(-0.31)				(0.15)
ln(ME)	0.102	0.075	0.081	**ln(ME)**	0.016	-0.013	-0.007
	(1.40)	(0.90)	(1.19)		(0.45)	(-0.29)	(-0.24)
B/M	-0.025	-0.023	-0.028	**B/M**	-0.035	-0.039	-0.036
	(-0.42)	(-0.39)	(-0.48)		(-0.58)	(-0.65)	(-0.61)
Ret[-12,-2]	0.016	0.063	0.067	**Ret[-12,-2]**	0.029	0.043	0.059
	(0.05)	(0.20)	(0.21)		(0.08)	(0.12)	(0.17)
Ret[-1]	-4.964***	-4.927***	-5.174***	**Ret[-1]**	-4.934***	-4.963***	-5.147***
	(-7.13)	(-7.11)	(-7.47)		(-7.05)	(-7.10)	(-7.42)
Adj. R^2	0.028	0.029	0.033	**Adj. R^2**	0.028	0.029	0.033
Ave. # obs	1,723	1,723	1,723	**Ave. # obs**	1,723	1,723	1,723
# Months	288	288	288	**# Months**	288	288	288

Table XII
Monthly Fama-MacBeth Regressions of Stock Returns on Amihud Measures: *Control for Idiosyncratic Volatility*

This table presents the estimation results of monthly Fama-MacBeth regressions of stock returns on the Amihud (2002) measures from 1964 to 2012. The dependent variable is the monthly FF3-adjusted return. FF3-adjusted return of month *t* is calculated based on the three-factor model where the factor loadings are estimated over the preceding sixty months [t-60,t-1] with at least 24 observations for each firm-level time-series regression. The independent variables include the natural logs of the Amihud measures. *Ln*(*A*) is the natural log of the annual Amihud (2002) measure (*A*), defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in the previous calendar year. *Ln*(*A_C*) is the natural log of *A_C* which is constructed as *A* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*A*) is the residual from the monthly cross-sectional regression of *ln*(*A*) on *ln*(*A_C*). The right pane is similar to the left panel except the liquidity measure used is *AT*, which is the turnover-based Amihud (2002) measure, defined as the annual average of the daily ratio of absolute return to turnover. *AT_C* is constructed as *AT* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*AT*) is the residual from the monthly cross-sectional regression of *ln*(*AT*) on *ln*(*AT_C*). We also control for a number of firm characteristics. *ln(ME)* is the natural log of market capitalization at the end of the previous year. *B/M* is the ratio of book value of equity to market value of equity. For the regression of month *t*, *Ret*[-12,-2] is the cumulative return from month *t*-12 to month *t*-2, and *Ret*[-1] is the stock return of month *t*-1. *Idio. Vol.* is idiosyncratic return volatility, defined as the standard deviation of residuals from the regression of the firm's daily excess returns on daily Fama-French three factors in the previous year. We estimate a cross-sectional regression in each month and then report the time-series means and t-statistics (in parentheses). We also report the time-series average of the number of observations and adjusted R^2 of the cross-sectional regressions. All the regressions include a constant which is not reported for brevity. T-statistics are calculated using Newey-West robust standard errors with 6 lags. ***, **, and * represent statistical significances at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: FF3-Adjusted Return							
	(1)	(2)	(3)		(4)	(5)	(6)
ln(A)	0.194***			**ln(AT)**	0.231***		
	(4.30)				(4.97)		
ln(A_C)		0.200***	0.181***	**ln(AT_C)**		0.228***	0.209***
		(4.78)	(3.80)			(5.28)	(4.85)
Res. ln(A)			-0.115	**Res. ln(AT)**			-0.018
			(-0.87)				(-0.14)
ln(ME)	0.141***	0.157***	0.132***	**ln(ME)**	-0.033	-0.026	-0.034
	(3.14)	(3.55)	(2.92)		(-1.35)	(-1.07)	(-1.41)
B/M	0.013	0.015	0.009	**B/M**	0.003	0.004	0.001
	(0.30)	(0.34)	(0.22)		(0.08)	(0.09)	(0.02)
Ret[-12,-2]	0.343*	0.337*	0.334*	**Ret[-12,-2]**	0.385**	0.377**	0.378**
	(1.86)	(1.86)	(1.81)		(2.01)	(1.98)	(1.97)
Ret[-1]	-7.220***	-7.217***	-7.260***	**Ret[-1]**	-7.186***	-7.179***	-7.226***
	(-13.78)	(-13.79)	(-13.87)		(-13.71)	(-13.74)	(-13.82)
Idio. Vol.	-12.062**	-6.535	-5.471	**Idio. Vol.**	-11.712**	-5.802	-7.008
	(-2.40)	(-1.32)	(-0.93)		(-2.36)	(-1.16)	(-1.25)

Dependent Variable: FF3-Adjusted Return							
	(1)	(2)	(3)		(4)	(5)	(6)
Adj. R^2	0.039	0.039	0.041	**Adj. R^2**	0.039	0.040	0.041
Ave. # obs	1,771	1,771	1,771	**Ave. # obs**	1,771	1,771	1,771
# Months	588	588	588	**# Months**	588	588	588

Table XIII

Correlations between the High-Frequency Price Impact Measure and Amihud Measures

Panel A presents the time-series averages of the cross-sectional correlation coefficients between the high-frequency price impact measure and the Amihud measures for NYSE/AMEX stocks from 1983 to 2011. We first calculate cross-sectional correlation coefficients each year, and then report the time-series averages of the cross-sectional correlation coefficients. γ is the price impact measure estimated using the five-minute return and trading volume for each firm-year. The five-minute return and trading volume are summarized using the high-frequency transaction data from ISSM and TAQ. *A* is the Amihud (2002) measure, defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in a year. *AT* is the turnover-based Amihud (2002) measure, defined as the annual average of the daily ratio of absolute return to turnover, where turnover is daily share volume divided by the shares outstanding. *A_C* and *AT_C* are constructed as *A* and *AT*, respectively, but the numerators of the ratios are 1 instead of absolute return. *Res. A* is the residual from the cross-sectional regression of the *A* measure on the *A_C* measure. *Res. AT* is the residual from the cross-sectional regression of the *AT* measure on the *AT_C* measure. To control for outliers, we winsorize γ and the Amihud measures at the 1 and 99 percentage points in each cross-section. Panel B is similar to Panel A except that the price impact measure and Amihud measures are constructed monthly instead of annually.

	γ	**A**	**A_C**	**Res. A**	**AT**	**AT_C**	**Res. AT**
Panel A: Correlations between Price Impact Measure and Amihud Measures							
γ	1.000						
A	0.783	1.000					
A_C	0.710	0.914	1.000				
Res. A	0.329	0.389	0.000	1.000			
AT	0.602	0.692	0.745	0.005	1.000		
AT_C	0.366	0.447	0.604	-0.275	0.837	1.000	
Res. AT	0.528	0.546	0.385	0.476	0.523	0.000	1.000
Panel B: Correlations between Price Impact Measure and Amihud Measures: Monthly Measures							
γ	1.000						
A	0.496	1.000					
A_C	0.546	0.800	1.000				
Res. A	0.104	0.578	0.000	1.000			
AT	0.452	0.482	0.557	0.063	1.000		
AT_C	0.222	0.241	0.461	-0.213	0.779	1.000	
Res. AT	0.436	0.453	0.287	0.390	0.613	0.000	1.000

Table XIV
Fama-MacBeth Regressions of the High-Frequency Price Impact Measure on Contemporaneous Amihud Measures

Panel A presents annual Fama-MacBeth regressions of the price impact measure for NYSE/AMEX stocks from 1983 to 2011. The dependent variable is the natural log of the annual price impact measure γ, which is estimated using five-minute return and trading volume from the high frequency ISSM and TAQ transaction data. In the left panel, the independent variables include the natural logs of the contemporaneous annual Amihud measures. *ln*(*A*) is the natural log of the annual Amihud (2002) measure (*A*), defined as the daily ratio of absolute return to dollar trading volume, averaged across all days in a year. *ln*(*A_C*) is the natural log of the *A_C* measure, which is constructed as *A* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*A*) is the residual from the annual cross-sectional regression of *ln*(*A*) on *ln*(*A_C*). The right panel is similar to the left panel except that the Amihud measure is the turnover-based Amihud measure, *AT*, defined as the annual average of the daily ratio of absolute return to turnover. *ln*(*AT_C*) is the natural log of the *A_C* measure, which is constructed as *AT* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*AT*) is the residual from the annual cross-sectional regression of *ln*(*AT*) on *ln*(*AT_C*). Panel B is similar to Panel A except that the price impact measure and Amihud measures are constructed monthly instead of annually. To facilitate the comparison of coefficients, we standardize the dependent and independent variables in each cross-section. T-statistics are based on Newey-West robust standard errors with 6 lags. ***, **, and * represent statistical significances at the 1%, 5%, and 10% levels, respectively.

Panel A: Regressions of Price Impact Measure							
	Dep. Variable: ln(γ)				Dep. Variable: ln(γ)		
	(1)	(2)	(3)		(4)	(5)	(6)
ln(A)	0.955***			**ln(AT)**	0.846***		
	(89.55)				(35.11)		
ln(A_C)		0.915***	0.915***	**ln(AT_C)**		0.587***	0.587***
		(67.30)	(67.30)			(60.48)	(60.48)
Res. ln(A)			0.310***	**Res. ln(AT)**			0.590***
			(21.74)				(17.20)
Adj. R^2	0.889	0.813	0.918		0.527	0.277	0.636
Ave. # obs	1,386	1,386	1,386		1,386	1,386	1,386
# Years	29	29	29		29	29	29

Panel B: Regressions of Price Impact Measure: Monthly Measures							
	Dep. Variable: ln(γ)				Dep. Variable: ln(γ)		
	(7)	(8)	(9)		(10)	(11)	(12)
ln(A)	0.942***			**ln(AT)**	0.803***		
	(225.26)				(104.51)		
ln(A_C)		0.892***	0.892***	**ln(AT_C)**		0.469***	0.469***
		(198.09)	(198.09)			(40.90)	(40.90)
Res. ln(A)			0.322***	**Res. ln(AT)**			0.566***
			(109.05)				(50.26)
Adj. R^2	0.889	0.801	0.903		0.398	0.152	0.476
Ave. # obs	1,290	1,290	1,290		1,290	1,290	1,290
# Months	358	358	358		358	358	358

Table XV
Monthly Fama-MacBeth Regressions of Stock Returns on the High-Frequency Price Impact Measure and Amihud Measures

Panel A presents monthly Fama-MacBeth regressions of stock returns for NYSE/AMEX stocks from 1984 to 2012. The dependent variable is the monthly FF3-adjusted return. FF3-adjusted return of month *t* is calculated based on the three-factor model in which the factor loadings are estimated in the preceding sixty months [*t*-60,*t*-1] with at least 24 observations for each firm-level time-series regression. The independent variables include the natural logs of the price impact measure and the Amihud measures estimated in the previous calendar year. *ln*(γ) is the natural log of the annual price impact measure γ, which is estimated using five-minute return and trading volume summarized from the high frequency ISSM and TAQ transaction data. *ln*(*A_C*) is the natural log of the *A_C* measure, which is constructed as the annual average of the daily ratio of 1 to dollar trading volume. *AT_C* is constructed as the annual average of the daily ratio of 1 to turnover, where turnover is share volume divided by total shares outstanding. We also control for a number of firm characteristics. *ln(ME)* is the natural log of market capitalization at the end of previous year. *B/M* is the book-to-market ratio calculated as a firm's book value divided by the firm's market capitalization. For the regression of month *t*, *Ret*[-12,-2] is the cumulative return from month *t*-12 to month *t*-2, and *Ret*[-1] is the stock return of month *t*-1. We estimate a cross-sectional regression in each month and then report the time-series means and t-statistics (in parentheses). We also report the time-series average of the number of observations and adjusted R^2 of the cross-sectional regressions. Panel B is similar to Panel A except that the price impact measure and the Amihud measures are estimated monthly instead of annually. In Panel B, returns of month *t* is regressed on price impact measure and Amihud measures estimated in month *t*-2. All regressions include a constant which is not reported for brevity. T-statistics are calculated using Newey-West robust standard errors with 6 lags. ***, **, and * represent statistical significances at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: FF3-Adjusted Return					
Panel A: Regressions of Returns on Price Impact Measure					
	(1)	(2)	(3)	(4)	(5)
ln(γ)	-0.109		-0.373**		-0.373**
	(-0.96)		(-2.42)		(-2.39)
ln(A_C)		0.170***	0.272***		
		(2.96)	(3.70)		
ln(AT_C)				0.221***	0.318***
				(4.23)	(4.42)
ln(ME)	-0.075	0.190**	0.080	0.035	-0.174**
	(-1.09)	(2.31)	(0.98)	(1.05)	(-2.00)
B/M	-0.172**	-0.154**	-0.146*	-0.168**	-0.166**
	(-2.32)	(-2.06)	(-1.99)	(-2.25)	(-2.22)
Ret[-12,-2]	0.309	0.236	0.274	0.238	0.305
	(0.94)	(0.74)	(0.86)	(0.69)	(0.94)
Ret[-1]	-3.883***	-3.849***	-3.945***	-3.867***	-3.989***
	(-6.58)	(-6.50)	(-6.66)	(-6.52)	(-6.70)
Adj. R^2	0.033	0.034	0.037	0.033	0.037
Ave. # obs	1,276	1,276	1,276	1,276	1,276
# Months	348	348	348	348	348

Dependent Variable: FF3-Adjusted Return					
Panel B: Regressions of Returns on Price Impact Measure: Monthly Measures					
	(6)	(7)	(8)	(9)	(10)
ln(γ)	-0.183**		-0.398***		-0.361***
	(-1.99)		(-3.07)		(-2.89)
ln(A_C)		0.204***	0.303***		
		(4.05)	(4.21)		
ln(AT_C)				0.243***	0.316***
				(4.89)	(4.35)
ln(ME)	-0.103***	0.226***	0.088	0.031	-0.184***
	(-2.14)	(3.34)	(1.59)	(1.04)	(-3.22)
B/M	-0.178***	-0.182**	-0.165**	-0.186***	-0.176**
	(-2.59)	(-2.55)	(-2.44)	(-2.61)	(-2.59)
Ret[-12,-2]	0.100	0.375	0.268	0.277	0.108
	(0.30)	(1.08)	(0.86)	(0.80)	(0.34)
Ret[-1]	-3.346***	-3.182***	-3.412***	-3.237***	-3.505***
	(-6.45)	(-6.25)	(-6.53)	(-6.34)	(-6.66)
Adj. R^2	0.032	0.033	0.038	0.033	0.038
Ave. # obs	1,188	1,188	1,188	1,188	1,188
# Months	357	357	357	357	357