Price Impact or Trading Volume: Why is the Amihud (2002) Illiquidity Measure Priced?

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The return premium associated with the widely used Amihud (2002) illiquidity measure is generally considered liquidity premium that compensates for price impact or transaction cost. We find that the pricing of the Amihud measure is not attributable to the construction of return-to-volume ratio that is intended to capture price impact, but entirely due to the trading volume component, the pricing of which has been explained in various ways unrelated to liquidity. Additionally, using the high-frequency measure of price impact, we find little evidence that stocks with greater price impact earn higher expected return as predicted by conventional theory.

The illiquidity measure developed by Amihud (2002) is one of the most widely used liquidity proxies 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 Amihud measure has two advantages over many other liquidity measures. First, the Amihud measure has a simple construction that uses the absolute value of the *daily* return-to-volume ratio to capture price impact. Second, the measure has a strong positive relation to expected stock return (see, e.g., Amihud (2002), Chordia, Huh, and Subrahmanyam (2009)). The positive return premium of the Amihud measure is generally considered to be a liquidity premium that compensates for price impact or transaction cost.

Despite the strong empirical evidence, it is not clear ex ante that the Amihud measure would be priced because of the compensation for price impact. 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).

Why is the Amihud (2002) illiquidity measure priced despite its lack of full theoretical support? Is it because the construct of the daily return-to-volume ratio captures price impact? This is an important research question for two reasons. First, because the Amihud illiquidity measure is widely used by researchers to examine liquidity premium, construct liquidity factor, or control for liquidity, it is necessary for us to know whether the pricing of the Amihud measure is indeed due to price impact (stock liquidity) or other reason(s).[2] Second, the answer to this question also has

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[1] We count only published papers and exclude any forthcoming papers.

[2] Besides the Amihud (2002) measure, the finance literature has also proposed many other liquidity measures (see Holden, Jacobsen, and Subrahmanyam (2014) for a survey).

important general implications for how we measure liquidity and how liquidity affects security prices. For example, the examination of this question can provide evidence on whether investors, as predicted by theory, demand compensation for the price-impact component of the transaction cost.

In this paper, we examine the pricing of the Amihud (2002) measure from a new perspective. Our study is motivated by the close connection between the Amihud 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 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]

Many studies have documented that stocks with higher trading volume earn lower returns subsequently, although they offer vastly different explanations (e.g., Brennan, Chordia, and Subrahmanyam (1998), Lee and Swaminathan (2000)). We therefore examine whether the pricing of the Amihud measure is due to its association with trading volume. Our sample includes NYSE/AMEX-listed companies from 1964 to 2012, and we first confirm the previously documented strong relation between the Amihud (2002) illiquidity measure and expected return.

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[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.

[4] The corresponding statistics are presented in Table I and discussed in Section I.B.

Stocks in the top quintile portfolio of the Amihud measure outperform those in the bottom quintile portfolio by 0.80 percent (t-stat 3.38) per month 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). We find that the *A_C* measure has a correlation of 0.94 with the 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. We further find that the *A_C* measure is priced similarly to the Amihud (2002) measure. Stocks in the top quintile of *A_C* outperform those in the bottom quintile by 0.83 percent (t-stat 3.95) per month in raw return and 0.50 percent (t-stat 3.50) in four-factor alpha. These return spreads are very similar to those using the Amihud illiquidity measure.

Next, we 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. In fact, stocks in the top quintile of the residual measure *underperform* those in the bottom quintile by

[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.

0.34 percent (t-stat 2.12) per month in raw return and 0.20 percent (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 by 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 portfolio of *A_C* minus that of the bottom tercile portfolio.[6] We then examine the return spread associated with the Amihud measure but report the IML^{A_C} alpha calculated by regressing return spread on the IML^{A_C} factor, and the five-factor alpha calculated by regressing return spread on 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 (t-stat -0.46) per month in terms of IML^{A_C} alpha, and -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 a multivariate analysis by estimating the firm-level Fama-MacBeth (1973) regressions of monthly stock returns on the Amihud measure controlling for 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" measure is significantly positive but the coefficient on the residual Amihud measure is either insignificant or significantly negative. Our results are robust when we use the turnover-based Amihud measure proposed by Brennan, Huh, and Subrahmanyam (2013) that is constructed using the absolute return-to-turnover ratio instead of the absolute return-to-volume ratio, or construct the Amihud measures monthly instead of annually. The results are also robust to using the sample of NASDAQ stocks, using the sub-periods, and controlling for idiosyncratic return volatility.

[6] The results are similar when we construct the factor by sorting stocks into two or four groups instead of three groups.

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 two metrics with expected return separately. We extend their analysis and decompose the Amihud (2002) measure further into the absolute return component, the turnover (volume) 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.

To further examine the role of price impact in the pricing of the Amihud measure, we follow the literature and construct a high-frequency price impact benchmark (Hasbrouck (2009), Goyenko, Holden, and Trzcinka (2009)). The price impact benchmark 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 construct the measure for NYSE/AMEX stocks from 1983 to 2012 using the ISSM and TAQ transaction data.

Previous studies document a strong positive relation between the Amihud (2002) measure and the high-frequency price impact benchmark (Hasbrouck (2009), Goyenko, Holden, and Trzcinka (2009)). We find that this relation is also mainly due to the trading volume component of the Amihud measure rather than the construct of return-to-volume ratio. Additionally, the high-frequency price impact measure has no significant relation with expected return, nor does it explain the pricing of the trading volume component of the Amihud measure.

We further examine the return premium of the "constant" Amihud (2002) measure (the trading volume component) in the earnings announcement period and non-earnings-announcement period separately. If the pricing of the trading volume component is liquidity premium, then we expect such premium to be relatively evenly distributed across the trading days. If, as suggested by the existing literature, the pricing of trading volume is due to high volume stocks initially being overpriced and therefore earning lower returns subsequently, then the return premium may concentrate in the earnings announcement window, as the release of earnings information helps correct mispricing (e.g., La Porta, Lakonishok, Shleifer, and Vishny (1997)). We examine stock returns of sample firms in the months of earnings announcements, and find that the return premium of the trading volume component is large and significant in the three-day earnings announcement window but much smaller and insignificant for the remaining period of the month. This result suggests that the pricing of the trading volume component is unlikely to be just liquidity premium unless investors demand liquidity premium *only* in the earnings announcement window.

Our paper makes three contributions to the finance literature. First, our findings provide a new understanding of why the widely used Amihud (2002) measure is priced. While the pricing of the Amihud (2002) measure is generally considered to result from price impact, we find that the pricing of the Amihud measure is explained by its association with trading volume. This finding is nontrivial because financial researchers have offered various explanations as to why trading volume is priced. 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 or the pricing of 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)), and investor sentiment (Baker and Wurgler (2006)).[7] Since the pricing of trading volume could be

[7] Some studies also document a weak or even negative relation between volume and stock liquidity (Foster and Viswanathan (1993), Lee, Mucklow, and Ready (1993), and Johnson (2008)). Bekaert, Harvey, and Lundblad (2007) show that volume is not strongly related to other liquidity measures in international markets. As another example, trading volume can be high when the markets are *illiquid* as seen in the flash crash of 2010.

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. On the other hand, our results show that the Amihud (2002) measure does well capturing price impact via its trading volume component.

Our findings also have general implications for the measurement of stock liquidity. Motivated by the rapidly growing literature of stock liquidity, a number of studies have proposed low-frequency liquidity proxies using daily stock market data, and the validity of these measures is usually assessed by whether these measures are correlated with expected returns. Our findings echo the argument of Chordia, Huh, and Subrahmanyam (2009) that it is important to develop liquidity measures based on explicit theoretical models rather than on empirical evidence about their correlations with expected returns.

Finally, the findings in this paper also help us understand how liquidity affects security prices. The novel model of Amihud and Mendelson (1986) shows that investors demand higher returns for the securities associated with higher transaction costs. Since then, a number of empirical studies have set out to examine whether the two major components of transaction cost, *spread* and *price impact*, affect asset returns. Since the Amihud illiquidity measure is constructed to capture price impact, its pricing is generally considered strong evidence that investors demand a return premium to compensate for price impact or transaction cost. Our findings, however, show that the pricing of the Amihud measure is not due to price impact. Moreover, the high-frequency price impact benchmark is not priced, either. These findings suggest that price impact does not seem to be associated with a return premium, which is a puzzling result that calls for more analysis.

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 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 from Brennan, Huh, and Subrahmanyam (2013)

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

  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.

- $|Ret|$: return component of the Amihud measure, calculated as the annual average 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. In addition to the turnover-based Amihud measure, we also examine the square-root version of the Amihud measure that is constructed as the Amihud (2002) measure but takes the square root of the daily absolute return-to-volume ratio. Hasbrouck (2009) proposes the square-root measure to control for skewness. We construct the "constant" measure corresponding to the square-root Amihud measure by replacing the numerator with a constant one, and repeat the tests in this paper. The results are not reported for brevity, but all our findings in this paper hold for the square-root version of the Amihud measure as well.

B. Sample Construction

Our sample stocks include ordinary common shares (share codes 10 and 11) listed on the NYSE and the AMEX.[8] We exclude NASDAQ stocks from our main analysis because the NASDAQ trading volume is inflated relative to the NYSE/AMEX trading volume because of different trading mechanisms.[9] 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 of 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 is from 1964 to 2012.

Panel A of Table 1 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 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

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

deferred taxes and investment tax credit, minus the book value of preferred stock.[10] Panel A shows that the trading volume component of the Amihud measure is much more volatile than the return component. The standard deviation of A_C is almost three times its mean, but the standard deviation of $|ret|$ is only half of the mean. Additionally, 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 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.[11] The monthly measures are constructed like annual measures but use 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 1 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.

Table 2 presents correlations among 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.

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[10] 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.

[11] 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.

Specifically, the correlations are 0.94 between *A* and *A_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 Panel B of Table 2, which reports the correlations for monthly measures.

II. Does the Trading Volume Component Explain the Pricing of the Amihud Illiquidity Measure?

In this section, we first motivate our analyses by examining the pricing of the components of the Amihud measure separately. Next, we formally test whether the pricing of the Amihud measure is attributable to its association with trading volume.

A. Decomposition of the Amihud (2002) Measure

To motivate our analyses, we first decompose the Amihud (2002) measure and examine the pricing of its components separately. Brennan, Huh, and Subrahmanyam (2013) decompose the Amihud (2002) measure into the turnover-based Amihud measure and firm size (market capitalization) as in equation (5) below. They examine these two metrics using multiple 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. Since our focus is the trading volume component of the Amihud measure, we decompose the Amihud (2002) measure into the trading volume component (the *A_C* measure) and the absolute return component, as in equation (6). We decompose the Amihud (2002) measure further into the absolute return component, the turnover component (the *AT_C* measure), and the firm size component as in equation (7):

$$\ln(A) = \ln(\frac{|ret|}{Dvol}) = \ln(\frac{|ret|}{TO} \times \frac{1}{S}) = \ln(AT) - \ln(S) \qquad (5)$$

$$\ln(A) = \ln(\frac{|ret|}{Dvol}) = \ln(|ret|) + \ln(\frac{1}{Dvol}) = \ln(|ret|) + \ln(A\_C) \quad (6)$$

$$\ln(A) = \ln(\frac{|ret|}{Dvol}) = \ln(|ret| \times \frac{1}{TO} \times \frac{1}{S}) = \ln(|ret|) + \ln(AT\_C) - \ln(S) \quad (7)$$

where *S* is market capitalization, and the remaining variables are as previously defined. We compute the natural logs of the annual averages of various daily components: |ret|, *A_C*, *AT*, *AT_C*, and *S*, and estimate regressions of stock returns on these components.

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

$$r_{it}^{ff3} = (r_{it} - r_{ft}) - (\hat{\beta}_{it}^{MKT} \times MKT_t + \hat{\beta}_{it}^{SMB} \times SMB_t + \hat{\beta}_{it}^{HML} \times HML_t) \quad (8)$$

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.[12] We require at least 24 observations in the estimation of factor loadings. We perform cross-sectional regressions and report the time-series averages of coefficients and the associated t-statistics using the Newey-West (1987) standard errors with six lags. We also include the usual control variables such as size, book-to-market ratio, and past stock returns that control for momentum and short-term price reversal.

Models (1) of Table 3 regresses returns on ln(*AT*) and ln(*S*) as in equation (5). Our results are consistent with Brennan, Huh, and Subrahmanyam (2013) in that the turnover-based Amihud measure is priced. Model (2) decomposes ln(*A*) into the volume component (ln(*A_C*)) and the absolute return component (ln(|*ret*|)) as in equation (6). The coefficient on ln(*A_C*) is positive and significant at the 0.01 level but the coefficient on ln(|*ret*|) is significantly negative. Model (3)

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

presents the full decomposition of the Amihud (2002) measure into ln(*AT_C*), ln(|*ret*|), and ln(*S*) as in equation (7). While the coefficient on ln(*AT_C*) is significantly positive at the 0.01 level, ln(*S*) has a significantly negative coefficient, and the coefficient on ln(|*ret*|) is negative and marginally insignificant. Overall, the results in Table 3 suggest that the trading volume component of the Amihud measure is positively related to expected return but the absolute return component is not. In the following sections, we will formally test whether the pricing of the Amihud measure is due to its association with trading volume.

B. 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).

In Panel A of Table 4, we first present the sorting analysis for the 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 (t-stat 2.83) per month, 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" measure, *A_C*, the return spread between the top and the bottom quintile portfolios is almost the same as that found for the Amihud measure. The spread is 0.83 percent (t-stat 3.95) per month 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 a 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.

We further examine *AT*, the turnover-based Amihud measure, in a similar fashion. Panel B of Table 4 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 5 shows that the results using monthly measures are similar to those in Table 4. 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. Panel B of Table 5 is similar to Panel A except that it examines the turnover-based Amihud measure. We also find results similar to those using annual measures in Table 4. 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.

C. 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.[13] 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 in Table 4 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). This approach is in the same spirit as using the SMB factor, for example, to examine if the return to a portfolio or a strategy can be attributed to the size effect. Panel A of Table 6 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

[13] The results are similar when we construct factor returns by sorting stocks into two or four portfolios instead of three portfolios.

percent (t-stat 3.38) spread of raw return in Table 4. 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 4. These results suggest that the pricing of the Amihud (2002) measure is explained by the IML^{A_C} factor.

We use the same approach to construct factor return IML^{AT_C} using the "constant" measure *AT_C*. Panel A of Table 6 presents the corresponding one- and five-factor alphas of portfolios sorted on the *AT* measure. The results in Table 4 show that the *AT* measure is associated with large and significant spreads in raw returns and four-factor alphas. In contrast, Panel A of Table 6 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 6, where the results are similar to those using the annual measures. Overall, the results in Table 6 confirm the findings of the residual approach that the pricing of the Amihud measure is due to its trading volume component.

D. Regression Analysis

In addition to the portfolio sorting approach, we use multiple 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 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 that control for momentum and short-term price reversal. We follow Brennan, Chordia, and Subrahmanyam (1998) and estimate the regressions using the FF3-adjusted return as discussed in Section II.A,.

In the left panel of Table 7, we regress FF3-adjusted return 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 4. 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 that 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. Additionally, the coefficient is 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 7 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 7 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.

III. Robustness Tests

A. Robustness Tests Using Monthly Measures

We repeat the Fama-MacBeth regressions using monthly Amihud measures instead of annual measures and present the results in Panel A of Table 8. Specifically, we now regress returns of month *t* on *monthly* Amihud measures of month *t*-2. As in Table 7, we first regress returns on ln(*A*) and ln(*A_C*) in the left panel and then regress returns on ln(*AT*) and ln(*AT_C*) in the right panel. These results generated with monthly measures are similar to those generated with annual measures in Table 7. 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.

Brennan, Huh, and Subrahmanyam (2013) propose two directional "half" Amihud measures constructed using the return-to-turnover ratio on the positive and negative return days separately. Specifically, they construct the negative (positive) directional monthly Amihud measure, *ATN* (*ATP*), using the return-to-turnover ratios on the negative (positive) return days:

$$ATN_{im} = \frac{1}{D_{im}} \sum_{t=1}^{Dim} \frac{-\min[r_{it}, 0]}{TO_{it}} \tag{9}$$

$$ATP_{im} = \frac{1}{D_{im}} \sum_{t=1}^{Dim} \frac{\max[r_{it}, 0]}{TO_{it}} \quad (10)$$

where the r_{it} and TO_{it} are daily return and daily turnover for stock *i* on day *t*; D_{im} is the number of days with available ratio in month *m*.[14] They find that, while both directional measures are associated with a return premium when examined separately, in the multiple return regressions framework only the negative half Amihud measure commands a return premium.

We construct the "constant" measures *ATN_C* and *ATP_C* corresponding to *ATN* and *ATP* by replacing the numerator of the daily ratio with a constant one when the ratio is non-zero. In Panel B of Table 8, we repeat the regression analyses using the directional Amihud measures (*ATN* and *ATP*), their corresponding constant measures (*ATN_C* and *ATP_C*), and the residual directional Amihud measures which are residuals from cross-section regressions of the directional Amihud measure on the corresponding "constant" measures. Panel B shows that, consistent with Brennan, Huh, and Subrahmanyam (2013), both *ATN* and *ATP* are associated with a return premium when examined separately. More importantly, the corresponding constant measures are priced similarly to the directional Amihud measures but the residual directional Amihud measures are not priced. These results suggest that the pricing of the directional Amihud measures is also due to their turnover components.[15]

We further include the directional Amihud measures simultaneously in return regressions in Panel C of Table 8. In Model (1), the coefficient on *ATN* remains significantly positive and that on *ATP* is insignificant and close to zero. This result verifies the finding in Brennan, Huh, and Subrahmanyam (2013) that the negative directional Amihud measure is priced but not the positive

[14] We require a stock to have at least 10 days with valid return and volume data to compute the ratios, and at least two positive return days and two negative return days in the estimation month.
[15] We also repeat the sorting and the factor analyses for the *ATN* and *ATP* measures, and the unreported results also show that their pricing is due to the turnover component.

measure when both are included in the same regression. Since Panel B of Table 8 suggests that the pricing of the directional Amihud measures is due to their turnover components, in Model (2), we re-estimate the regression in Model (1) but use the constant directional measures. We find that *ATN_C* is priced but *ATP_C* is not. This result suggests that the observed asymmetric relations between the directional Amihud measures and expected return also result from their turnover components.

B. 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 9.

Panel A of Table 9 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 9 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.

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. Panel C of Table 9 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 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 Panel D of Table 9. 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.

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.[16] 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 10 show that the coefficients on the original measure, the "constant" measure, and the residual measure are unaffected by the inclusion of return volatility in the model, suggesting that our results are robust after controlling for return volatility.

F. Robustness Test Using Trading Volume or Turnover Directly

For our main analyses, we use the "constant" measures that retain the volume component of the Amihud measures and exclude the return component. Since the "constant" measures are the annual or monthly averages of daily reciprocal of dollar trading volume or turnover, they could have distributions and properties different from the average dollar trading volume and turnover. We therefore repeat the regression analyses using the average of daily dollar volume or turnover directly.

In the left panel of Table 11, we estimate return regressions using the natural logarithm of annual average of daily dollar volume (ln(*VOLUME*)) and the corresponding residual ln(*A*) measure that is the residual of cross-sectional regression of ln(*A*) on ln(*VOLUME*). Model (1) shows that, consistent with the existing literature, the coefficient on ln(*VOLUME*) is significantly negative (t-stat -4.82), indicating that high volume stocks earn lower returns subsequently. More importantly, the coefficient on residual ln(*A*) is negative and insignificant (t-stat -1.45), suggesting that the Amihud (2002) measure is not priced after controlling for the dollar trading volume. Model (2)

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

repeats the analysis using the monthly measures instead of annual measures, and the results are similar. We further estimate return regressions of returns on the natural logarithm of average of daily turnover (ln(*TO*)), and the residual ln(*AT*) measure constructed as the residual of the cross-sectional regression of ln(*AT*) on ln(*TO*). The results are in the right panel of Table 11. The coefficient on ln(*TO*) is significantly negative, suggesting that turnover is also priced. The coefficient on the residual ln(*AT*), however, is negative and insignificant. Overall, the results in Table 11 show that our findings hold when we directly examine dollar trading volume or turnover.

IV. Does Price Impact Explain the Pricing of the Amihud Illiquidity Measure?

A. High-Frequency Price Impact Benchmark

Our findings so far show that the pricing of the Amihud illiquidity measure is completely explained by its association with trading volume. Although the existing literature proposes various explanations for why trading volume is priced, one may argue that compensation for price impact can drive the pricing of trading volume and in turn the pricing of the Amihud illiquidity measure. We therefore use the high-frequency benchmark of price impact (Hasbrouck (2009), Goyenko, Holden, and Trzcinka (2009)) to further examine the pricing of the Amihud illiquidity measure. Previous studies construct this high-frequency price impact benchmark using the intra-day high-frequency trading data and examine how well the low-frequency liquidity proxies capture price impact.

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 (Hasbrouck (2009), Goyenko, Holden, and Trzcinka (2009)) and construct the 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:

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

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 $SVol_n = \sum_{k=1}^{K_n} sign_k \times \sqrt{dvol_k}$, where $dvol_n$ is the dollar volume of the k^{th} trade in the n^{th} five-minute period, K_n is the number of trades in the n^{th} period, and $sign_k$ is the sign of the k^{th} trade assigned according to the Lee and Ready (1991) trading classification method or the tick test. We winsorize the λ measure at the 1 and 99 percentiles in each cross-section to control for outliers.[17]

We first examine the correlations between the price impact measure and the Amihud illiquidity measures in Table 12. 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 (λ), with a correlation coefficient of 0.803. 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 λ, with a correlation coefficient of 0.797. The residual *A* measure is positively correlated with price impact, but the correlation is only 0.161, 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 its return-volume ratio.

[17] Joel Hasbrouck estimated the high-frequency price impact measure for a sample of approximately 300 firms each year from 1993 to 2005. For this comparative sample, the correlation between our estimate and his estimate is 0.91. We thank Joel Hasbrouck for providing his estimates on his website.

Panel A of Table 12 also presents correlations between price impact and the turnover-based Amihud measures (*AT*). The correlation is 0.691 for the *AT* measure. While this correlation is higher than the 0.626 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 construct of return-to-turnover ratio. Panel B of Table 12 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 Panel C of Table 12. 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 0.957, indicating that one standard deviation increase in ln(*A*) is associated with a 0.957 standard deviation increase in ln(λ). In Models (2) and (3), the coefficient on ln(*A_C*) is 0.928, similar to that of ln(*A*). However, in Model (3), the coefficient on residual ln(*A*) is 0.254, i.e., about one-fourth of the coefficient on ln(*A*). These results are consistent with the correlations (Panel A of Table 12) in suggesting that the trading volume component explains the majority of the relation between the Amihud measure and the high-frequency price impact measure. Models (4)-(6) further show that the coefficient on residual ln(*AT*) is 0.532, also lower than the 0.680 coefficient on ln(*AT*). Panel D of Table 12 presents the corresponding regressions results 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 13 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(λ) is the natural log of the price impact measure λ 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(λ) is insignificant (t-stat 0.41), indicating that the price impact measure itself is not positively related to expected return. This result is puzzling, as it is inconsistent with the microstructure theory that predicts that investors will demand higher expected returns for stocks associated with greater price impact (transaction cost).

Notably, in Model (2) of Table 13, the coefficient on the "constant" Amihud measure ln(A_C) is significantly positive at the standard level (t-stat 2.98), 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 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 13 clearly demonstrate that the pricing of the trading volume component of the Amihud measure is not due to price impact.

B. *Examine Returns in the Earnings-Announcement and Non-Earnings-Announcement Periods*

One may argue that, despite the results using the high-frequency price impact benchmark, the pricing of the trading volume component of the Amihud (2002) measure is still liquidity premium that is unrelated to price impact. The current literature does not have a consensus as to why trading volume is priced. While some researchers believe that trading volume is priced as a (relatively noisy) liquidity proxy, there is a large literature that attributes the pricing of trading volume to non-liquidity factors such as mispricing. In this subsection, we make an attempt to distinguish between the liquidity and non-liquidity explanations.

We examine the relation between the trading volume component of the Amihud (2002) measure and future returns in the earnings announcement period and non-earnings-announcement period separately. If the return premium associated with the trading volume component is liquidity premium, then we expect such return premium to spread evenly over time. If, as suggested by previous studies, the return premium of the trading volume component is due to high volume stocks being overpriced and therefore earning low returns subsequently, then we expect the return premium to be more pronounced in the earnings announcement period than in the non-earnings-announcement period as the release of earnings information helps correct mispricing (e.g., La Porta, Lakonishok, Shleifer, Vishny (1997)).

We collect earnings announcement dates for the sample firms from COMPUSTAT. Since the announcement dates are available from 1972, the sample period for this test is from 1972 to 2012. At the beginning of month *t*, we examine the subset of sample firms with earnings announcement in month *t*, and sort these stocks into quintile portfolios according to the Amihud (2002) measure of the previous year. Then for each stock in month *t*, we calculate its buy-and-hold abnormal return in the three-day window [-1,1] surrounding the earnings announcement date (BHAR [-1,1]) as the three-day buy-and-hold raw return minus the three-day buy-and-hold value-weighted CRSP return.[18] We also calculate buy-and-hold abnormal returns for the days in month *t* other than the three-day earnings announcement window (BHAR in the non-announcement period). We then calculate the monthly average of BHARs for the quintile portfolios and report time-series average portfolio returns.

[18] We require that the whole three-day earnings announcement window [-1,1] fall in month *t*.

In Panel A of Table 14, we first examine BHAR [-1,1] sorted on the Amihud (2002) measure. BHAR [-1,1] is increasing in the Amihud (2002) measure, and the spread between the top and the bottom quintiles is a large 0.73 percent (t-stat 7.27). We observe very similar results when sorting stocks on the constant Amihud measure *A_C*, the turnover-based Amihud measure *AT*, and its constant measure *AT_C*. These results also hold when we use monthly measures instead of annual measures. [19]

In stark contrast, Panel B of Table 14 shows that BHAR for the non-earnings-announcement period does not vary much across the Amihud measures. Although the non-earnings-announcement period is a much longer window than the three-day earnings announcement window, the spread in BHAR for the non-earnings-announcement period is small and insignificant across the Amihud measures.[20] Overall, the results in Table 14 suggest that the return premium of the trading volume component is unlikely to be just liquidity premium unless investors demand liquidity premium *only* in the earnings announcement window. While pinning down the exact source of volume premium is beyond the scope of our paper, these results provide at least some suggestive evidence that the pricing of the trading volume component can be attributable to non-liquidity factors.

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 association with trading volume but not its construct of

[19] Our finding is consistent with Lee and Swaminathan (2000) who find that firms with higher trading volume experience more negative earnings surprise in the subsequent period.

[20] In unreported results, we also estimate Fama-MacBeth regressions of BHARs on the Amihud measures that control for size, book-to-market ratio, momentum, and reversal. The results also show that the Amihud measures are positively related to BHAR [-1,1] but not BHAR in the non-earnings-announcement period.

return-to-volume ratio to capture price impact. 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 show that the high-frequency measure of price impact does not seem to be priced, nor does it explain the pricing of the Amihud illiquidity measure. Additionally, the return premium associated with the trading volume component of the Amihud (2002) measure is concentrated in the earnings announcement window.

While the pricing of the Amihud (2002) measure is generally considered to result from the compensation for price impact, we provide a new understanding of why it is priced. Our findings are nontrivial because financial researchers are still debating why trading volume is priced. In fact, a large number of studies suggest or find evidence that trading volume and its pricing are related to non-liquidity factors. Our findings therefore 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.

Our findings also have important general implications for how to measure liquidity and how liquidity affects security prices. Our findings illustrate the importance of developing liquidity measures based on explicit theoretical models instead of empirical evidence, as pointed out by Chordia, Huh, and Subrahmanyam (2009). Additionally, using both the low-frequency Amihud measure and the high-frequency price impact benchmark, we find little evidence that price impact, a major component of transaction cost, is priced. This puzzling result seems to contradict the theory and calls for further analysis.

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Table 1: 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. *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 exactly as *A* 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. The liquidity measures, as well as |Ret|, 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.

	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
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
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
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
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
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

Table 2: Correlations among Various Versions of the Amihud Measure

Panel A presents the time-series averages of the cross-sectional correlation coefficients among the various versions 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. *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 exactly as *A* 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. 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 and |Ret| are winsorized at 1 and 99 percentage points in each cross-section.

	A	**AT**	**A_C**	**AT_C**	**|Ret|**
Panel A: Correlations Among Amihud Measures: Annual Measures					
A	1.000				
AT	0.682	1.000			
A_C	0.941	0.705	1.000		
AT_C	0.303	0.782	0.406	1.000	
|Ret|	0.610	0.422	0.549	0.004	1.000
Panel B: Correlations Among Amihud Measures: Monthly Measures					
A	1.000				
AT	0.691	1.000			
A_C	0.899	0.685	1.000		
AT_C	0.312	0.746	0.443	1.000	
|Ret|	0.489	0.347	0.394	-0.040	1.000

Table 3: 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 significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: FF3-Adjusted Return		
	(1)	(2)	(3)
ln(AT)	0.259***		
	(5.09)		
ln(A_C)		0.101***	
		(4.26)	
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	0.032	-0.007	0.006
	(0.75)	(-0.17)	(0.15)
Ret[-12,-2]	0.354*	0.322*	0.330*
	(1.66)	(1.65)	(1.68)
Ret[-1]	-6.946***	-7.226***	-7.232***
	(-13.24)	(-13.76)	(-13.78)
Adj. R^2	0.032	0.036	0.037
Ave. # obs	1,771	1,771	1,771
# Months	588	588	588

Table 4: 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 *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 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 5: 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 *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 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 6: 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. *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 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 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 7: 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 significance 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 8: Monthly Fama-MacBeth Regressions of Stock Returns on Amihud Measures: Monthly Measures

Panel A presents the estimation results of monthly Fama-MacBeth regressions of stock returns on the monthly Amihud (2002) measures from 1964 to 2012. The regressions are similar to those in Table 7 except that the Amihud measures are constructed on a monthly basis. *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 stock return of month *t*-1. Panel B is similar to Panel A except that the independent variables are directional turnover-based Amihud measures. *Ln*(*ATN*) is the natural log of the monthly directional Amihud measure for negative return days (*ATN*), which is constructed as *AT* but the absolute return-to-volume ratio is non-zero for only the return days. *Ln*(*ATN_C*) is the natural log of *ATN_C* which is constructed as *ATN* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*ATN*) is the residual from the monthly cross-sectional regression of *ln*(*ATN*) on *ln*(*ATN_C*). The right panel is similar to the left panel except that the liquidity measure is *ATP* which is the monthly directional turnover-based Amihud measure for positive return days, which is constructed as the *AT* but the absolute return-to-volume ratio is non-zero for only the positive return days. *ATP_C* is constructed as *ATP* but the numerator of the ratio is 1 instead of absolute return. *Res. ln*(*ATP*) is the residual from the monthly cross-sectional regression of *ln*(*ATP*) on *ln*(*ATP_C*). In Panel C, the regressions include *ln*(*ATN*) and *ln*(*ATP*) in the same regression (left panel), and *n*(*ATN_C*) and *ln*(*ATP_C*) in the same regression (right panel). The regressions in Panels B and C include the same control variables as in Panel A but are not reported for brevity. T-statistics are calculated using Newey-West robust standard errors with 6 lags. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: FF3-Adjusted Return

Panel A: Regressions on Amihud Measures: Monthly Measures

	(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

Panel B: Regressions on the Negative/Positive Amihud Measures: Monthly Measures

	(1)	(2)	(3)		(4)	(5)	(6)
ln(ATN)	0.219^{***}			**ln(ATP)**	0.264^{***}		
	(4.36)				(5.33)		
ln(ATN_C)		0.239^{***}	0.219^{***}	**ln(ATP_C)**		0.258^{***}	0.253^{***}
		(5.45)	(4.70)			(6.05)	(5.75)
Res. ln(ATN)			-0.137	**Res. ln(ATP)**			-0.034
			(-0.99)				(-0.25)
Controls	Yes	Yes	Yes	**Controls**	Yes	Yes	Yes
Adj. R^2	0.032	0.032	0.037	**Adj. R^2**	0.032	0.031	0.038
Ave. # obs	1,765	1,765	1,765	**Ave. # obs**	1,765	1,545	1,765
# Months	588	588	588	**# Months**	588	588	588

Panel C: Regressions on the Negative and Positive Amihud Measures: Horse Race

	(1)		(2)
ln(ATN)	0.166^{***}	**ln(ATN_C)**	0.164^{***}
	(4.18)		(5.60)
ln(ATP)	0.000	**ln(ATP_C)**	0.060
	(0.01)		(1.55)
Controls	Yes	**Controls**	Yes
Adj. R^2	0.032	**Adj. R^2**	0.032
Ave. # obs	1,763	**Ave. # obs**	1,763
# Months	588	**# Months**	588

Table 9: Monthly Fama-MacBeth Regressions of Stock Returns on Amihud Measures: ***Robustness Tests***

Panel A presents monthly Fama-MacBeth regressions of stock returns (%) on the Amihud measures. The regressions are similar to those in Table 7 except that they cover the sub-period of 1964-1988. The regressions in Panel B are similar those in Table 7 but for the sub-period of 1989-2012. The regressions in Panel C are similar to those in Table 7 but use the NASDAQ stocks from 1984-2012. The regressions in Panel D are similar to those in Table 7 but use the monthly raw returns as dependent variable instead of FF3-adjusted returns. The regressions in Panels B to D include the same control variables as in Panel A but are not reported for brevity. T-statistics are calculated using Newey-West robust standard errors with 6 lags. ***, **, and * represent statistical significance 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
Panel B: 1989-2012							
	(1)	(2)	(3)		(4)	(5)	(6)
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)
Controls	Yes	Yes	Yes	**Controls**	Yes	Yes	Yes
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

Panel C: NASDAQ Sample: 1984-2012							
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)
Controls	Yes	Yes	Yes	**Controls**	Yes	Yes	Yes
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

Panel D: Regressions of Raw Returns							
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)
Controls	Yes	Yes	Yes	**Controls**	Yes	Yes	Yes
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 10: 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 as defined in the heading of Table 7. 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; *B/M* is the ratio of book value of equity to market value of equity; *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. These control variables are defined in the heading of Table 7. *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 significance 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)
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 11: Monthly Fama-MacBeth Regressions of Stock Returns: Measures Using Average Dollar Trading Volume or Turnover

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 as defined in the heading of Table 7. For the dependent variables, *ln*(*VOLUME*) is the natural log of the dollar trading volume measure, defined as the average daily trading volume in the previous year. *Res. ln*(*A*) is the residual from the monthly cross-sectional regression of *ln*(*A*) on *ln*(*VOLUME*), where *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. The right panel is similar to the left panel except *ln*(*TO*) is the natural log of the turnover measure, defined as the average daily turnover in the previous year. *Res. ln*(*AT*) is the residual from the monthly cross-sectional regression of *ln*(*AT*) on *ln*(*TO*), where *ln*(*AT*) is the natural log of the turnover-based Amihud (2002) measure (*AT*), defined as the annual average of the daily ratio of absolute return to turnover. We also control for a number of firm characteristics. *ln(ME)* is the natural log of market capitalization; *B/M* is the ratio of book value of equity to market value of equity; *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. These control variables are defined in the heading of Table 7. 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 significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: FF3-Adjusted Return					
	Annual Measures	Monthly Measures		Annual Measures	Monthly Measures
	(1)	(2)		(3)	(4)
ln(VOLUME)	-0.248***	-0.158***	**ln(TO)**	-0.297***	-0.216***
	(-4.82)	(-3.65)		(-5.86)	(-5.09)
Res. ln(A)	-0.129	-0.167***	**Res. ln(AT)**	-0.102	-0.106*
	(-1.45)	(-2.74)		(-1.08)	(-1.69)
ln(ME)	0.186***	0.091**	**ln(ME)**	-0.057**	-0.067***
	(4.09)	(2.28)		(-2.25)	(-2.71)
B/M	0.007	0.026	**B/M**	-0.000	0.023
	(0.16)	(0.62)		(-0.01)	(0.55)
Ret[-12,-2]	0.363**	0.477**	**Ret[-12,-2]**	0.394**	0.468**
	(2.00)	(2.32)		(2.00)	(2.30)
Ret[-1]	-7.182***	-6.902***	**Ret[-1]**	-7.129***	-6.894***
	(-13.78)	(-13.15)		(-13.69)	(-13.18)
Adj. R^2	0.036	0.034	**Adj. R^2**	0.036	0.034
Ave. # obs	1,765	1,771	**Ave. # obs**	1,765	1,769
# Months	588	588	**# Months**	588	588

Table 12: Relations 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. λ 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. For each firm-year, the price impact measure λ is estimated as the slope coefficient of the regression: $r_n = \lambda \cdot Svol_n + u_n$, where r_n is the five-minute stock return calculated as the natural log of the price change over the n^{th} five-minute period. $SVol_n$ is the signed square-root dollar volume of the n^{th} period, and u_n is the error term. We require at least 100 valid observations for the regressions. We calculate $SVol_n$ as $\sum_{k=1}^{K_n} Sign_k \cdot \sqrt{dvol_k}$, where $dvol_k$ is the dollar volume of the k^{th} trade in the n^{th} five-minute period, K_n is the number of trades in the n^{th} period, and $sign_k$ is the sign of the k^{th} trade assigned according to the Lee and Ready (1991) trading classification method or the tick test. *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 λ 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. Panel C 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 λ. In the left panel, the independent variables include the natural logs of the contemporaneous annual measures including *ln*(*A*), *ln*(*A_C*), and *Res. ln*(*A*), which 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, *ln*(*AT*), *ln*(*AT_C*), and *Res. ln*(*AT*), which is the residual from the annual cross-sectional regression of *ln*(*AT*) on *ln*(*AT_C*). Panel D is similar to Panel C 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 significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Correlations between Price Impact Measure and Amihud Measures

	λ	**A**	**A_C**	**Res. A**	**AT**	**AT_C**
A	0.803					
A_C	0.797	0.938				
Res. A	0.161	0.343	0.000			
AT	0.691	0.748	0.774	0.059		
AT_C	0.378	0.393	0.514	-0.261	0.785	
Res. AT	0.626	0.702	0.586	0.444	0.606	0.000

Panel B: Correlations between Price Impact Measure and Amihud Measures: Monthly Measures

	λ	**A**	**A_C**	**Res. A**	**AT**	**AT_C**
A	0.557					
A_C	0.570	0.903				
Res. A	0.162	0.425	0.000			
AT	0.436	0.749	0.746	0.173		
AT_C	0.177	0.401	0.549	-0.223	0.761	
Res. AT	0.412	0.675	0.492	0.545	0.637	0.000

Panel C: Regressions of Price Impact Measure

	Dep. Variable: ln(λ)				**Dep. Variable: ln(λ)**		
	(1)	(2)	(3)		(4)	(5)	(6)
ln(A)	0.957***			**ln(AT)**	0.680***		
	(126.44)				(21.12)		
ln(A_C)		0.928***	0.929***	**ln(AT_C)**		0.563***	0.566***
		(119.84)	(111.43)			(34.58)	(34.76)
Res. ln(A)			0.251	**Res. ln(AT)**			0.532***
			(16.14)				(22.58)
Adj. R^2	0.899	0.847	0.912		0.646	0.423	0.706
Ave. # obs	1846	1846	1846		1846	1846	1846
# Years	29	29	29		29	29	29

Panel D: Regressions of Price Impact Measure: Monthly Measures

	Dep. Variable: ln(λ)				**Dep. Variable: ln(λ)**		
	(7)	(8)	(9)		(10)	(11)	(12)
ln(A)	1.152***			**ln(AT)**	0.707***		
	(117.89)				(106.94)		
ln(A_C)		1.122***	1.110***	**ln(AT_C)**		0.482***	0.539***
		(155.04)	(117.71)			(58.78)	(73.67)
Res. ln(A)			0.294***	**Res. ln(AT)**			0.612***
			(37.58)				(64.35)
Adj. R^2	0.859	0.793	0.865		0.462	0.22	0.517
Ave. # obs	1536	1536	1536		1536	1536	1536
# Months	358	358	358		358	358	358

Table 13: Monthly Fama-MacBeth Regressions of Stock Returns on the High-Frequency Price Impact Measure and Amihud Measures: 1984-2012

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*(λ) is the natural log of the annual price impact measure λ, which is estimated using five-minute return and trading volume summarized from the high frequency ISSM and TAQ transaction data. For each firm-year, the price impact measure λ is estimated as the slope coefficient of the regression: $r_n = \lambda \cdot Svol_n + u_n$, where r_n is the five-minute stock return calculated as the natural log of the price change over the n[th] five-minute period. $SVol_n$ is the signed square-root dollar volume of the n^{th} period, and u_n is the error term. We require at least 100 valid observations for the regressions. We calculate $SVol_n$ as $\sum_{k=1}^{K_n} Sign_k \cdot \sqrt{dvol_k}$, where $dvol_k$ is the dollar volume of the k^{th} trade in the n^{th} five-minute period, K_n is the number of trades in the n^{th} period, and $sign_k$ is the sign of the k^{th} trade assigned according to the Lee and Ready (1991) trading classification method or the tick test. *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 significance 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(λ)	0.058		-0.112		-0.177
	(0.41)		(-0.68)		(-1.10)
ln(A_C)		0.415***	0.474***		
		(2.98)	(2.88)		
ln(AT_C)				0.232***	0.272***
				(4.63)	(4.69)
ln(ME)	-0.059	0.255	0.224	0.002	-0.127
	(-0.52)	(1.57)	(1.45)	(0.02)	(-1.10)
B/M	-0.026	0.001	-0.022	-0.01	-0.038
	(-0.52)	(0.03)	(-0.44)	(-0.23)	(-0.77)
Ret[-12,-2]	0.088	0.078	0.078	0.081	0.083
	(0.83)	(0.78)	(0.80)	(0.76)	(0.80)
Ret[-1]	-0.758***	-0.773***	-0.764***	-0.777***	-0.772***
	(-6.77)	(-6.89)	(-6.82)	(-6.89)	(-6.87)
Adj. R^2	0.029	0.029	0.031	0.028	0.031
Ave. # obs	1667	1733	1667	1733	1667
# Months	348	348	348	348	348
Panel B: Regressions of Returns on Price Impact Measure: Monthly Measures					
	(1)	(2)	(3)	(4)	(5)
ln(λ)	-0.177*		-0.435***		-0.405***
	(-1.70)		(-3.30)		(-3.12)
ln(A_C)		0.346***	0.757***		
		(2.92)	(4.58)		
ln(AT_C)				0.197***	0.344***
				(4.26)	(4.79)
ln(ME)	-0.103	0.192	0.256**	-0.032	-0.241**
	(-1.18)	(1.40)	(2.21)	(-0.40)	(-2.56)
B/M	-0.054	0.001	-0.057	-0.002	-0.061
	(-1.05)	(0.02)	(-1.11)	(-0.06)	(-1.18)
Ret[-12,-2]	0.066	0.147	0.124	0.125	0.070
	(0.60)	(1.35)	(1.15)	(1.17)	(0.65)
Ret[-1]	-0.615***	-0.741***	-0.621***	-0.748***	-0.635***
	(-6.58)	(-6.88)	(-6.59)	(-6.89)	(-6.63)
Adj. R^2	0.029	0.028	0.033	0.028	0.033
Ave. # obs	1390	1751	1390	1751	1390
# Months	357	357	357	357	357

Table 14: Abnormal Returns Sorted on Amihud Measures: Decomposing Returns of Firms with Earnings Announcements: 1972-2012

This table presents abnormal returns in the earnings-announcement period and non-earnings announcement-period sorted on the Amihud measures. At the beginning of each month from 1972 to 2012, stocks with earnings announcement in the month are sorted into quintile portfolios according to the *A* measures of the previous year. *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. Then for each firm-month, we calculate buy-and-hold abnormal return in three-day window [-1,1] surrounding earnings announcement, where daily abnormal return is calculated as daily raw return minus value-weighted CRSP return. We also calculate monthly buy-and-hold returns for the days other than the [-1,1] earnings announcement window. In Panel A, we first calculate monthly average of BHAR [-1,1] for the quintile portfolios and report time-series average portfolio returns. 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, the *AT* measure, and the *AT_C* measure. *A_C* is constructed as *A* 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. *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 except that we report buy-and-hold abnormal returns in the non-earnings-announcement period instead of BHAR. 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: BHAR [-1, 1] Sorted on Amihud Measures							
Sorted on Annual Measures							
Sorted on A	0.11	0.20	0.09	0.20	0.84	0.73	(7.27)
Sorted on A_C	0.12	0.15	0.04	0.22	0.89	0.77	(7.88)
Sorted on AT	0.08	0.12	0.14	0.32	0.78	0.70	(7.40)
Sorted on AT_C	0.05	0.12	0.19	0.39	0.67	0.62	(7.38)
Sorted on Monthly Measures							
Sorted on A	0.11	0.15	0.10	0.25	0.70	0.59	(6.47)
Sorted on A_C	0.00	0.17	0.22	0.29	0.62	0.62	(7.36)
Sorted on AT	0.12	0.10	0.15	0.20	0.73	0.61	(6.61)
Sorted on AT_C	-0.03	0.15	0.28	0.37	0.53	0.56	(6.44)
Panel B: BHAR for Non-Earnings-Announcement Days Sorted on Amihud Measures							
Sorted on Annual Measures							
Sorted on A	0.34	0.31	0.42	0.27	0.65	0.32	(1.49)
Sorted on A_C	0.34	0.34	0.38	0.38	0.54	0.20	(1.02)
Sorted on AT	0.34	0.40	0.27	0.35	0.62	0.28	(1.71)
Sorted on AT_C	0.40	0.39	0.41	0.36	0.44	0.04	(0.29)
Sorted on Monthly Measures							
Sorted on A	0.33	0.43	0.45	0.27	0.37	0.04	(0.18)
Sorted on A_C	0.33	0.45	0.41	0.30	0.36	0.02	(0.13)
Sorted on AT	0.34	0.55	0.38	0.20	0.38	0.04	(0.27)
Sorted on AT_C	0.43	0.41	0.44	0.33	0.25	-0.17	(-1.20)