Asymmetric Price Impact and the Cross-Section of Stock Returns

Yongsik Kim*

Abstract

This paper investigates which component of price impact plays a main role for asset pricing. To find a main component, we decompose the price impacts measured by turnover-version Amihud illiquidity into the permanent and transitory price impacts. We then further decompose each of these price impacts into half-price impact measures that correspond 1) positive and negative return days, and 2) good and bad news days. We find that, among the eight decomposed half-price impact measures, the *"transitory half-price impact associated with bad news days"* is the main component of the turnover-version Amihud illiquidity measure. Based on this finding, we suggest a new price impact measure, "*Net price impact*", defined as the average net ratio of the daily transitory deviation to share turnover. With this suggested measure, we find that the price impact measure that takes into account the investors' asymmetric response to not only the good and bad news days but also the asymmetric effect of transitory deviation associated with the news is better in explaining future stock returns.

JEL classification: G12, G14

Keywords: liquidity; price impact; cross-section of stock returns

* School of Management Engineering, KAIST College of Business, 85 Hoegiro, Dongdaemun-gu, Seoul, Korea, 02455, Tel.: +82 2-958-3150; Email: yskim83@business.kaist.ac.kr

1. Introduction

Many recent empirical studies have shown that stock market illiquidity has a significant positive relationship with stock returns. The level of stock market illiquidity can be captured by various measures of several dimensions such as depth, breadth, and resiliency (Bernstein, 1987). Among the measures, the Amihud (2002) illiquidity is one of the most widely used illiquidity measures since it was developed, which represents the average daily ratio of absolute stock return to its dollar trading volume, or *price impact* associated with unit dollar of trading volume. While numbers of studies find strong evidence that the price impact captured by Amihud illiquidity has a predictive power for the future stock returns, some recent papers also report on the limitation to this measure. Cochrane (2005a) argues that the Amihud illiquidity measure is expected to be much higher for small firm that draws conclusion that the size premium is due to illiquidity. Florakis, Gregoriou, and Kostakis (2011) mention that the Amihud illiquidity measure carries a significant size bias and neglects investors' stock holding horizons. Lou and Shu (2016) also argue that the pricing capability of the Amihud measure is driven by trading volume component.

To overcome the shortcomings of Amihud illiquidity measure, Florakis, Gregoriou, and Kostakis (2011) suggest *turnover version of Amihud illiquidity*, which is defined as the monthly average ratio of the daily absolute returns to the daily share turnover ratio to avoid size biases. Brennan, Huh, and Subrahmanyam (2013) also show that *turnover version of Amihud illiquidity in negative return days* that represents the price impact calculating in negative return days is strongly priced, while the coefficient of the price impact in positive return days is statistically insignificant. Several studies support the empirical results of Brennan et al. (2013). Anshuman and Viswanathan (2005) and Brunnermeier and Pedersen (2009) provide collateral-based models which present that the intermediaries are forced to liquidate their holding securities when stock prices decline considerably and accordingly they hit the margin constraints. Garleanu and Pedersen (2007) show that in a market downturn with high volatilities, institutions tend to implement tighter risk management that reduces their risk bearing capacity and lowers market liquidity. Hameed, Kang, and Viswanathan (2010) also find that negative returns decrease stock liquidity at the individual firm level in their empirical work.

Motivated by the Florakis, Gregoriou, and Kostakis (2011) and Brennan, Huh, and Subrahmanyam (2013), we investigate which component of the price impacts mainly drives cross-sectional variation in stock returns using turnover version of Amihud illiquidity measure. To find main component, we focus on the effect of transitory price. A number of studies mention that market illiquidity is related to transitory price effect: Roll (1984) derives bid-ask spread using the characteristics of the negative autocovariance of the transitory price change. Hasbrouck (1993) and Boehmer and Kelley (2009) mention that temporary deviations from the efficient price may arise from the transaction cost or dealer inventory effects. Easley, Hvidkjaer, and O'Hara (2010) explain that total price effect can be divided into a permanent component attributable to information and a temporary component attributable to liquidity. Bao, Pan, and Wang (2011) also argue that the magnitude of transitory price movements reflects the degree of illiquidity because the lack of liquidity causes transitory components in asset prices. Following previous literatures, we first decompose stock price into the permanent and transitory price using the trend-cycle decomposition methodologies developed by Beveridge and Nelson (1981) to extract the liquidity component. We then decompose the price impact measure, turnover version of Amihud illiquidity, into four components: the fundament price impact associated with positive and negative return days and the transitory price impact associated with positive and negative return days, and implement the cross-sectional analysis using Fama-MacBeth (1973) regression.

In addition, we further investigate whether the decomposed half-price impact associated with negative permanent return days is more proper than the decomposed half-price impact associated with negative observed return days to capture the cross-sectional variations in stock returns. Since the permanent price follows random walk process, a firm's positive (negative) permanent return implies that the firm has good (bad) news on the day. As we previously discussed, several literatures show that the funding constraints or tighter risk management of institutions cause the investors' asymmetric response to the change in stock returns. Given that institutional investors are generally regarded as informed traders, measuring stock market illiquidity based on the change in fundamental value, that is, permanent returns might be more appropriate to predict future returns rather than measuring based on observable returns.

To compare the pricing capability of the decomposed half-price impact estimated on the basis of the observed return data and permanent return data, we decompose the price impact measure again as follows: the fundament price impact for good and bad news days and the transitory price impact for good and bad news days. If investors react more sensitively to firm's negative news rather than negative observed return, the decomposed half-price impacts associated with negative news days would have better predictive capability for the expected stock returns than the price impacts associated with negative observed return days. With these decomposed half-price impact measures, we perform the Fama-MacBeth cross-sectional regression analysis at the individual stock level during the sample period from 1981 to 2015. The empirical finding shows that, among the eight decomposed half-price impacts of turnover-version Amihud illiquidity measure, the *"transitory half-price impact associated with bad news days"* has the best predictive power for the future stock returns.

Based on these findings, we suggest new price impact measure, "*Net price impact*", which is defined as the average net ratio of the daily transitory price shock to the turnover ratio. The contribution point of the *Net price impact* measure is that the measure directly reflects the asymmetric effect of the transitory deviation in the view point of investors. Specifically, the asymmetric response of the investors to the transitory deviation is fully reflected in the *Net price impact* that, while positive transitory shock would be regarded as illiquidity for good news day, negative transitory shock would be regarded as illiquidity for bad news days. Therefore we add the ratio of the daily transitory deviation to the share turnover with negative sign for bad news days to calculate the average net value rather than taking an absolute value en bloc for constructing *Net price impact* measure. With this suggested new price impact measure, we further implement the cross-sectional regression analyses at the individual stock level to investigate whether the *Net price impact* measure can capture the cross-sectional variations in expected stock returns. The results show that the *Net price impact* measure has predictive power for the future stock returns even after controlling for *the transitory half-price impact associated with bad news days* which is verified as the main component for pricing of the turnover-version Amihud illiquidity measure. This result implies that the price impact measure that takes into account the investors' asymmetric response to not only the good and bad news days but also the asymmetric effect of transitory deviation associated with the has better predictive power for the future stock returns.

This paper proceeds as follows. In Section 2, we introduce the procedure of the decomposition of the turnover version of price impacts, and Section 3, we present the empirical methodology and report the empirical findings with decomposed half-price impact measures. In section 4, we introduce the construction procedure of *Net price impact* measure and report the empirical results. We offer concluding remarks in Section 5.

2. Decomposition of the price impact

As previously discussed, the original Amihud illiquidity measure causes significant size bias in the asset pricing test (Cochrane, 2005a; Florakis, Gregoriou, and Kostakis, 2011). In order to distinguish the effect of market illiquidity from the size effect, Florakis, Gregoriou, and Kostakis (2011) develop the turnover version of Amihud illiquidity, which is defined as the monthly average ratio of the daily absolute returns $|r_{i,d,t}|$ to the daily share turnover ratio $TO_{i,d,t}$ on the day d,

$$A_{i,t} = \frac{1}{N_{i,t}} \sum\nolimits_{d} \frac{|r_{i,d,t}|}{TO_{i,d,t}}, \tag{1}$$

where $N_{i,t}$ is the number of trading days in which data are available for stock i in month t and the daily share turnover ratio is defined as the number of shares traded on the day d divided by the number of shares outstanding. They show that the turnover version of Amihud illiquidity generate abnormal return after controlling for the risk factors with free of the size bias. Brennan, Huh, and Subrahmanyam (2013) also develop "half-price impact" measures, A^{+} and A^{-} that denote turnover version of Amihud illiquidity associated with positive and negative return days, respectively. Their empirical analysis shows that only the half-price impact with negative return days (A^{-}) is strongly priced, while the coefficient of half-price impact estimated during positive return days is insignificant. Based on the empirical results of Florakis, Gregoriou, and Kostakis (2011) and Brennan, Huh, and Subrahmanyam (2013), we re-examine the turnover version of half-price impact measure is priced using Fama-MacBeth cross-sectional regression. And then we further decompose the half-price impact measures into four components (hereafter decomposed half-price impact measures): transitory price impacts that correspond to positive and negative return days ($Tran\_A^{+}_{i,t}$, $Tran\_A^{-}_{i,t}$) and permanent price impacts that correspond to positive and negative return days ($Perm\_A^{+}_{i,t}$, $Perm\_A^{-}_{i,t}$), and then investigate which component of the price impacts mainly drives cross-sectional variation in stock returns. To obtain four components, we first decompose stock price into permanent and transitory price that represent the fundamental value of the stock and temporary deviation from the fundamental value, respectively. Following Hasbrouck (1993), Boehmer and Kelley (2009), Bao, Pan, and Wang (2010), we model the daily stock price, p_d, as the sum of a random walk component with drift, q_d, and a zero-mean stationary process follows AR(1) process, z_d, as follows:

$$p_d = q_d + z_d \,, \tag{2}$$

$$q_d = q_{d-1} + \mu + \eta_d \,, \tag{3}$$

$$z_d = \phi z_{d-1} + \varepsilon_d \,, \tag{4}$$

where p_d is the natural logarithm of a stock price, μ is an expected drift, and η_d is informational shock which follows $E(\eta_d) = 0,\ E\left(\eta_d^2\right) = \sigma_\eta^2,\ and\ E(\eta_d \eta_\delta) = 0\ for\ d \neq \delta$. Similarly ε_d denotes transitory shock which follows $E(\varepsilon_d) = 0,\ E\left(\varepsilon_d^2\right) = \sigma_\varepsilon^2,\ and\ E(\varepsilon_d \varepsilon_\delta) = 0\ for\ d \neq \delta$. From the equation (2)–(4), we derive the demeaned return series, $r_d = \Delta p_d - \mu$, follows an ARMA(1,1) process

$$r_d = \phi r_{d-1} + \epsilon_d + \theta \epsilon_{d-1} \,, \tag{5}$$

where r_d=$\Delta\, p_d - \mu$. For extracting the permanent price from the observed stock price, we use the trend-cycle decomposition methodologies developed by Beveridge and Nelson (1981, hereafter the B-N decomposition) and Morley (2002).[1] Using the estimated coefficients in equation (5) and the B-N decomposition methodology, we can obtain the permanent component, q_t,

$$q_d = p_d + [1\ 0]\sum_{j=1}^{\infty} F^j v_d = p_d + [1\ 0]F(I-F)^{-1}v_d, \tag{6}$$

where $F = \begin{bmatrix} \phi & \theta \\ 0 & 0 \end{bmatrix}$, $v_d = \begin{bmatrix} r_d \\ \epsilon_d \end{bmatrix}$, and I is an identity matrix. The stationary component, z_d, can be obtained by subtracting q_d from p_d.

We then develop "decomposed half-price impact" measures associated with positive and negative return days by applying the estimated z_d and q_d to the equation (1). For the transitory price, $Tran\_A_{i,t}^{+}$ and $Tran\_A_{i,t}^{-}$ denote the transitory half-price impacts that correspond positive and negative return days, respectively. Similarly, $Perm\_A_{i,t}^{+}$ and $Perm\_A_{i,t}^{-}$ denote the permanent half-price impacts for positive and negative return days. These four decomposed half-price impacts can be obtained by equation (7) and (8) as follows:

$$Tran\_A_{i,t}^{s} = \frac{1}{N_{i,t}}\sum\nolimits_d \frac{|\Delta z_{i,d,t}|}{TO_{i,d,t}} \qquad \begin{cases} s = + & \text{for } \Delta p_{i,d,t} \geq 0 \\ s = - & \text{for } \Delta p_{i,d,t} < 0 \end{cases}, \tag{7}$$

$$Perm\_A_{i,t}^{s} = \frac{1}{N_{i,t}}\sum\nolimits_d \frac{|\Delta q_{i,d,t}|}{TO_{i,d,t}} \qquad \begin{cases} s = + & \text{for } \Delta p_{i,d,t} \geq 0 \\ s = - & \text{for } \Delta p_{i,d,t} < 0 \end{cases}, \tag{8}$$

where $\Delta z_{i,d,t}$ and $\Delta q_{i,d,t}$ represent daily return for stock i on day d in month t that are estimated by taking first difference of the transitory price and the permanent price, respectively. Using decomposed half-price impacts estimated from equation (7) and (8), we implement Fama-MacBeth regression in the following section to investigate which component of the price impacts mainly drives cross-sectional variation in stock returns.. As previously discussed, since stock market illiquidity

[1] Morley (2002) introduces a convenient way to implement B-N decomposition using state-space representations.

would arise from the transitory price effects, we expect that the return predictive power of the Amihud illiquidity mainly depends on the transitory half-price impacts rather than permanent half-price impacts.

In addition, we further investigate whether the decomposed half-price impact associated with negative permanent return days ($\Delta q_{i,d,t} < 0$) is more proper than the decomposed half-price impact associated with negative observed return days ($\Delta p_{i,d,t} < 0$) to capture the cross-sectional variations in stock returns. Since the permanent price follows random walk process as described in the equation (3), the meaning of permanent return is obvious in terms of informational shock. That is, a firm's positive (negative) permanent return on day t implies that the firm has good (bad) news on the day.[2] Therefore, if investors react more sensitively to firm's negative news rather than negative observed return, the half-price impacts associated with negative news would show more powerful predictive capability for the future stock returns than the impacts associated with negative observed return days. To test this hypothesis, we construct another four decomposed half-price impact measures associated with positive and negative permanent return days as follows:

$$Tran\_A_{i,t}^{s} = \frac{1}{N_{i,t}} \sum_{d} \frac{|\Delta z_{i,d,t}|}{TO_{i,d,t}} \qquad \begin{cases} s = GN & \text{for } \Delta q_{i,d,t} \geq 0 \\ s = BN & \text{for } \Delta q_{i,d,t} < 0 \end{cases}, \tag{9}$$

$$Perm\_A_{i,t}^{s} = \frac{1}{N_{i,t}} \sum_{d} \frac{|\Delta q_{i,d,t}|}{TO_{i,d,t}} \qquad \begin{cases} s = GN & \text{for } \Delta q_{i,d,t} \geq 0 \\ s = BN & \text{for } \Delta q_{i,d,t} < 0 \end{cases}, \tag{10}$$

where $Tran\_A_{i,t}^{GN}$ and $Tran\_A_{i,t}^{BN}$ indicate transitory half-price impacts for good and bad news days, respectively. In a similar way, permanent half-price impacts for good and bad news days are denoted

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[2] While we need to subtract drift term from the permanent return to extract informational shock more precisely, we left it for the following reasons: First, we take account of the possibility that the drift of the stock price movement can also affect asymmetric response of the investors to the market. For example, downward trend of the stock price might offset firm's good news from an investor's perspective if the impact of the good news is not enough. Secondly, since the average absolute value of drift term is much smaller than that of permanent return, the results are qualitatively similar even if we deduct the drift term from the permanent return. The results are not reported in this paper for the brevity.

by $Perm\_A_{i,t}^{GN}$ and $Perm\_A_{i,t}^{BN}$, respectively. In the following section, we further implement firm level Fama-MacBeth regressions to investigate return predictive power of these four decomposed half-price impacts and compared the results with that of price impacts measured based on the observed return data in the equation (7) and (8).

3. Empirical methodology and results

3.1. Data and variable descriptions

Our sample includes the ordinary common shares (share code 10 and 11) listed on the NYSE and AMEX. Data on stock prices, shares outstanding, and trading volume are obtained from the Center for Research in Securities Prices (CRSP) database. We also obtain accounting and analyst coverage data from the COMPUSTAT database and the I/B/E/S, respectively. Our samples cover the period from 1980 to 2015. For the decomposition of stock price into the transitory and permanent stock price for the individual firm, we perform the B-N decomposition repeatedly using all available past return data at the end of each month to avoid any look-ahead biases. We then calculate suggested half-price impact measures month by month using the estimated daily transitory and permanent stock price as well as observed stock data. To be included in the sample, a stock is required to have at least five trading days for all decomposed half-price impact measures and the daily observations do not need to be consecutive. In the regression analysis, we take natural log-transformation to all of the price impact measures to avoid the influence of outliers and lag by two months following Brennan, Chordia, and Subrahmanyam (1998), Brennan, Huh, and Subrahmanyam (2013), and Lou and Shu (2016),

With the estimated measures described above, we proceed to examine which component of price impact captures the cross-sectional variations in expected stock returns using firm level Fama-MacBeth regression and the control variables are also included in the regression model as follows: First, we include firm size, book-to-market ratio, and cumulative lagged returns. For the firm size (*Size*), we use the natural logarithm of a firm's market capitalization for June of year y. For the book-to-market ratio (*BTM*), we calculate the natural logarithm of a firm's book value of stockholders' equity plus deferred taxes and investment tax credit minus the book value of preferred stock for the last fiscal year divided by the market value of equity at the end of December of year $y-1$. We also control for the momentum effect of Jegadeesh and Titman (1993), by including the compounding holding period return over the most recent three months ($RET_{t-3,t-1}$), from month $t-6$ to month $t-4$ ($RET_{t-6,t-4}$), from month $t-9$ to month $t-7$ ($RET_{t-9,t-7}$), and from month $t-12$ to month $t-10$ ($RET_{t-12,t-10}$). These control variables are employed in the regression model following Brennan, Huh, and Subrahmanyam (2013) to replicate their empirical results and compare them with our analysis that use decomposed price impact measures defined in the equation (7)–(10).

In addition to these control variables, we additionally include other variables such as market beta (*Beta*), stock return volatility (*Vol*) and skewness (*Skew*) to set the second regression model. To obtain *Beta*, we follow the constructing procedure suggested by Fama and French (1992). First, pre-ranking betas are estimated on 60 monthly returns (minimum 24 monthly returns) in June of year y, and we double sort the individual stocks into the deciles of pre-ranking beta and size using NYSE break points. We then calculate the post-ranking monthly returns of the 10-by-10 portfolios for the next 12 months, from July of year y to June of year $y+1$. Finally, we estimate post-ranking betas on these portfolios using the full sample period with the CRSP value-weighted portfolio market index. *Vol* and *Skew* are calculated as the standard deviation and the skewness of monthly stock returns for the past 60 months (minimum 24 months), respectively.

We also include short-term reversal and analyst coverage to control for the mean reversion of stock returns. While suggested price impact measures are designed to capture the liquidity cost per unit trade that investor should bear when executing market orders, they might be related to over-reaction of the stock price especially for the half-price impacts because they are estimated in one direction only such as positive or negative return days. Therefore we control for the effect of short-term reversal (*Rev*) by including one-month lagged return as defined by Jegadeesh (1990) to examine the independent return predictive power of price impact as a market illiquidity measure. In addition, since mean reversion of stock price can be driven by informed traders when the stock price move away from its fundamental value (Kyle, 1985; Bernstein, 1987; Harris, 2003), we additionally include analyst coverage (*Analyst*) as a proxy for the informed traders, which is defined as natural logarithm of one plus the number of analysts. Since we match *Analyst* of year $y-1$ to the excess stock return of year y, the period of our regression analysis is from 1981 to 2015.

< Table 1 here >

Table 1 reports the descriptive statistics of the explanatory variables used in this paper. Panel A of Table1 presents summary statistics including 5^{th}, 25^{th}, 50^{th}, 75^{th}, and 95^{th} percentile values, as well as the mean and the standard deviation of each variable. All the price impact measures are reported in natural logarithm form. Panel A shows that the estimated standard deviations of the transitory half-price impacts are higher than those of the permanent half-price impacts for all cases, while the ratio of the permanent half-price impacts to the total impacts are much bigger than those of the transitory half-price impacts. This implies the possibility that the variation of the transitory price can mainly capture the cross-sectional variation in the expected stock returns rather than that of permanent price. Panel B reports the time-series averages of monthly cross-section correlation of the main variables. The estimated correlation coefficients between the permanent half-price impacts and non-decomposed half-price impacts are extremely high. For example, the correlation coefficients between A^{-} and $Perm\_A^{-}$, and A^{-} and $Perm\_A^{BN}$ are 0.988 and 0.982, respectively. In contrast, the correlation coefficients between the transitory half-price impacts and non-decomposed half-price impacts are relatively low with the range from 0.764 to 0.809, even though the absolute values are still high because they share the same element, turnover ratio, in the denominator. The correlation coefficients between the analyst coverage and price impact measures are negative with the range from -0.431 to -0.410. This implies the possibility that the existence of informed trader might alleviate the level of price impacts.

3.2. Cross-sectional analysis with half-price impact measures

In this section, we replicate the Brennan, Huh, and Subrahmanyam (2013) tests on our sample to confirm that the half-price impact for negative return days play a main role for asset pricing with expanded control variables. The test procedure follows the standard Fama-MacBeth cross-sectional regression at the individual firm level. We regress two-month ahead monthly excess stock return on the half-price impact measures with control variables, and then report the time-series averages of coefficients and the associated Newey-West (1987) t-statistics with six-lags in Table 2.[3] The group of control variables are classified into two regression model: One group of control variables includes *Size*, *BTM*, $RET_{t-3,t-1}$, $RET_{t-6,t-4}$, $RET_{t-9,t-7}$, and $RET_{t-12,t-10}$ as control variables following Brennan, Huh, and Subrahmanyam (2013). This group is employed in Model 1, 3, 5, and 7. The other group additionally incorporates *Beta, Vol, Skew, Rev, and Analyst* that is employed in Model 2, 4, 6, and 8.

< Table 2 here >

Table 2 shows the regression results using half-price impact measures, A^{+} and A^{-}. While the estimated coefficient on A^{-} is positive and significant for two control groups (Model 3 and Model 4), the coefficient on A^{+} is significant in Model 2 but insignificant in Model 1. In addition, we use a residual approach to further examine that the return predictive power of A^{-} is remained after controlling for the effect of A^{+}, and vice versa.[4] We first regress A^{+} on A^{-} to obtain residual measure of A^{+} ($Res\_A^{+}\_A^{-}$) that does not contain the information of A^{-}. Similarly we obtain $Res\_A^{-}\_A^{+}$ that represents the residual measure of A^{-} by regressing A^{-} on A^{+}. The

[3] We use one-month Treasury bill rate as a proxy for the risk-free rate to calculate the excess return of individual firm.

[4] While Brennan, Huh, and Subrahmanyam (2013) include A^{+} and A^{-} simultaneously in the regression model, extremely high correlation coefficients between two measures as reported in Panel B of Table2 might cause multicollinearity problems. Therefore we use a residual approach following Chapman and Pearson (2000) and Lou and Shu (2016). In addition, we also implement the regression analyses by including (decomposed) half-price impact measures simultaneously and the corresponding results are qualitatively similar to those of residual approach. We do not report the results in this paper for brevity.

corresponding results are reported in Model 5–8 and also support the previous results. Both of the estimated coefficients on $Res\_A^{+}\_A^{-}$ are insignificant (Model 5 and Model 6), and the t-statistics also drop substantially. For example, the estimated t-statistic of the coefficient drops from 1.993 (Model 2) to 0.078 (Model 6) that imply that the return predictive power of A^{+} is disappeared after controlling for the effect of A^{-}. On the other hand, both of the coefficients on $Res\_A^{-}\_A^{+}$ are positive with significance (Model 7 and Model 8). These results indicate that the half-price impact that corresponds negative return days mainly captures the cross-sectional variation in expected stock returns and also support the result of Brennan, Huh, and Subrahmanyam (2013). Regarding control variables, while the coefficient on *BTM* is positively significant for all regression models, those of *Size* and $RET_{t-3,t-1}$, $RET_{t-6,t-4}$, $RET_{t-9,t-7}$ are significant when we control for the additional control variables such as *Beta*, *Vol*, *Skew*, *Rev*, and *Analyst*. The coefficient on Rev is negative and significant that is consistent with Jegadeesh (1990) and the coefficient on Analyst is also significant which is consistent with Hou and Moskowith (2005). The significances of coefficients on *Beta*, *Vol*, *Skew* are limited.

3.3. Cross-sectional analysis with decomposed half-price impact measures

In addition to the replication of the Brennan, Huh, and Subrahmanyam (2013), we further perform the cross-sectional analysis with decomposed half-price impact measures to investigate which component of price impact has return predictive power for the future stock returns. We first implement the firm level Fama-MacBeth cross-sectional regression using four decomposed half-price impact measures estimated during positive and negative return days ($Perm\_A^{+}$, $Perm\_A^{-}$, $Tran\_A^{+}$, $Tran\_A^{-}$) that are defined in the equation (7) and (8). Panel A of Table 3 reports the regression results when we include the decomposed half-price impact measures in the regression model separately. The estimated coefficients on four measures are all positive and significant except for Model 1that includes $Perm\_A^{+}$. This implies that turnover ratio which is the denominator of the impact measures has a role in explaining future stock returns. Lou and Shu (2016) also argue that the volume (turnover) component in the denominator is the principle component for the pricing of the (turnover version of) Amihud illiquidity measure. However, the estimated results in Panel B of Table 3 show that the numerator component, which denotes the absolute decomposed return, also has an important role in asset pricing. In Panel B, the estimated coefficients are positive and significant only for the residual measures of $Tran\_A^{-}$, specifically $Res\_Tran^{-}\_Tran^{+}$ and $Res\_Tran^{-}\_Perm^{+}$. Even though the coefficient on $Res\_Tran^{-}\_Perm^{-}$ is insignificant, the t-statistic is 1.639 which implies that its significance is at the marginal level with p-value of 0.102. The coefficients on all other residual measures such as $Res\_Tran^{+}\_Tran^{-}$, $Res\_Perm^{+}\_Tran^{-}$, and $Res\_Perm^{-}\_Tran^{-}$ that are residuals obtained by respectively regressing $Tran\_A^{+}$, $Perm\_A^{+}$, $Perm\_A^{-}$, on $Tran\_A^{-}$ are all insignificant and even negative in Model 5.

< Table 3 here >

We obtain another decomposed half-price impact measures based on the sign of permanent return (Δq_d) rather than that of observed return (Δp_d) to examine the investors' asymmetric response to the good and bad news in terms of liquidity compensation.. As previously discussed, since the permanent price follows random walk process, positive (negative) permanent return indicates good (bad) news. Using this point, we obtain $Perm\_A^{GN}$,$Perm\_A^{BN}$, $Tran\_A^{GN}$, and $Tran\_A^{BN}$ from the equation (9) and (10) and then perform similar regression test with previous one. Panel A of Table 4 shows regression results when the decomposed half-price impact measures are included separately. In Panel A, the coefficients on $Perm\_A^{BN}$, $Tran\_A^{GN}$, and $Tran\_A^{BN}$ are positive and significant (Model 3–Model 8), while those on $Perm\_A^{GN}$ are not significant (Model 1 and Model 2). We further implement cross-sectional regression test using residual measures of decomposed half-price impacts to examine which component of price impacts mainly capture the cross-sectional variation in stock returns, and report the results in Panel B of Table 4. The results in Panel B show that the role of numerator component, absolute transitory return ($|\Delta z_{i,d,t}|$), becomes more apparent when we use news based price impact measures. All the estimated coefficients on residual measures of $Tran\_A^{BN}$

are positive and significant (Model 1–Model 3), and we also find significant return predictive power of $Tran\_A^{BN}$ in particular even after controlling for the effect of $Perm\_A^{BN}$, that is $Res\_Tran^{BN}\_Perm^{BN}$. Since $Res\_Tran^{BN}\_Perm^{BN}$ represents the regression residual without containing any information of $Perm\_A^{BN}$ as well as the turnover ratio of bad news days, especially the estimated coefficient on this residual measure shows the independent role of the absolute transitory return for the pricing. Considering that the coefficient on $Res\_Tran^{-}\_Perm^{-}$ is insignificant as reported in Panel B of Table 3, we can clearly distinguish the pricing capability of transitory half-price impact from other suggested measures when we obtain the decomposed measures on the basis of news rather than observed return. Any other residual measures after controlling for the effect of $Tran\_A^{BN}$ have insignificant predictive power for the future stock returns (Model 4–Model 6).

< Table 4 here >

We also implement the cross-sectional regression using a residual approach with $Tran\_A^{BN}$ with respect to $Tran\_A^{-}$, A^{-}, and A to further examine the return predictive power of $Tran\_A^{BN}$, and report the results in Table 5. A denotes the turnover based Amihud illiquidity measure developed by Florakis, Gregoriou, and Kostakis (2011) which is obtained for all available trading days. Table 5 shows that while the residual measures of $Tran\_A^{BN}$ still have return predictive power after controlling for the effect of $Tran\_A^{-}$ (Model 1–Model 3), A^{-}, and A, but not vice versa (Model 4–Model 6). Especially, the result in Model 1 directly shows that the decomposed half-price impact associated with bad news days is more proper than the decomposed half-price impacts associated with negative observed return days to predict future stock returns. In this regard, we can conclude that the transitory half-price impact associated with bad news days is the main component for the pricing of the turnover-version Amihud illiquidity measure that are consistent with the common understanding that market illiquidity is related to the transitory price effects (Roll, 1984; Hasbrouck 1993, Boehmer and Kelly 2009; Easley, Hvidkjaer, and O'Hara, 2010; Bao, Pan, and Wang, 2011).

< Table 5 here >

4. Net price impact measure

4.1. Constructing a net price impact measure

In the previous section, we find that the “transitory price return” and “bad news days” are the main components to capture the cross-sectional variation in expected stock returns. Based on this finding, we introduce a new price impact measure that we term “*Net price impact*”. The net price impact measure (*NPI*) is defined as the average net ratio of the daily transitory deviation, i.e. transitory price, to the turnover ratio as follows[5]:

$$NPI_{i,t} = \begin{cases} \frac{1}{N_{i,t}} \sum_d \frac{z_{i,d,t}}{TO_{i,d,t}} & if\ \Delta q_{i,d,t} \geq 0 \\ \frac{1}{N_{i,t}} \sum_d \frac{-z_{i,d,t}}{TO_{i,d,t}} & if\ \Delta q_{i,d,t} < 0 \end{cases}. \tag{11}$$

< Figure 1 here >

Figure 1 shows how *NPI* directly reflects the asymmetric effect of the transitory deviation in the view point of investors. For example, a firm has good news on day $d+1$, then the permanent price will rise from q_d to q_{d+1}. In this circumstance, at the day $d+1$, if observed stock price is higher (lower) than its permanent price (or fundamental value), this indicates that transitory shock (z_d) is higher (lower) than zero. Therefore investors will consider that the positive transitory shock elevates the level of price impacts, but the negative transitory shock alleviates the impacts. On the other hand, this relationship will change in the opposite direction. That is, if a firm has bad news on day $d+1$, then investors regard negative transitory shock as positive price impacts. The asymmetric response of the investors to the transitory price shock is fully reflected in the *NPI* measure that while positive

[5] As previously discussed in the section 2, the transitory price indicates a transitory deviation from the fundamental value (permanent price). Since *NPI* measure take into account for the net effect of transitory deviations per unit trading, we term transitory price as transitory deviation for intuitive interpretation.

transitory shock would be regarded as illiquidity in good news day, negative transitory shock would be regarded as illiquidity in bad news days. Therefore we should add the ratio of the daily transitory price shock to the turnover ratio with negative sign to calculate the average net value on bad news days rather than taking an absolute value en bloc. We construct the *NPI* measure using same data sample described in the section 3.1 and also construct the half-*NPI* measures that correspond good and bad news days, denoted by NPI^{GN} and NPI^{BN}, respectively.[6]

< Figure 2 here >

Figure 2(a) presents the time-series plot of the monthly average for the NPI^{GN} and NPI^{BN}. This figure shows the evidence of investors' asymmetric response to the informational shock. The level of NPI^{BN} is higher and more volatile than that of NPI^{GN} for most of the period, which is similar to the result of the Brennan, Huh, and Subrahmanyam (2013) shows that the half-Amihud measure for negative return days is larger and more volatile than that of the half-Amihud measure for positive return days. The time-series for the NPI^{BN} also capture the several stock market crashes such as the Black Monday of 1987, the early 1990s recession, the dot-com bubble of early 2000s, and the financial crisis of 2007–2008. We further plot the time-series of the transitory half-price impact ($Tran\_A^{GN}$, $Tran\_A^{BN}$) for the comparison in figure 2(b). Compared with figure 2(a), the time-series of the transitory half-price impacts show a relatively clear decreasing trend due to the increasing trend of turnover ratio. Considering that the *Net price impact* measure for good (bad) news days and the transitory half-price impact measure for good (bad) news days share the same turnover ratio as denominators, we can conclude that the *Net price impact* is a measure that contains more variation of numerator, that is, transitory deviation. In the subsequent subsection, we investigate that *NPI* can capture the cross-sectional variation in future stock returns and then compare the predictive power of *NPI* with that of price impact measures that are discussed in the previous section.

[6] Since the estimated NPI measure has symmetrical distribution with negative and positive values, we eliminate the observations at the highest or lowest 0.5% tails of each type of NPI measure to avoid any outlier effect instead of taking logarithm.

4.2. Cross-sectional analysis with *Net price impact* measures

Table 6 reports the result of cross-sectional regression with NPI measure. In Panel A, we first examine the return predictive power of NPI, NPI^{GN}, and NPI^{BN}, separately and then investigate which component of half-NPI measure has principle role in explaining future expected stock returns. The coefficient on NPI, NPI^{GN}, and NPI^{BN} are all positive and significant at the one percent level except for Model 1 that are improved compared to those of decomposed half-price impact measures. We further compare the return predictive power of NPI^{GN} and NPI^{BN}. Since the correlation coefficient of these two variables relatively low with 0.554 compared to the coefficients between the decomposed half-price impact measures as reported in Panel B of Table 1, we include NPI^{GN} and NPI^{BN} in the regression model simultaneously (Model 7 and Model 8). The results show that, while the predictive power of NPI^{GN} is disappeared, the significance of the coefficients on NPI^{BN} is still remained. This result also

< Table 6 here >

Based on the results in Panel A, we further examine the return predictive power of NPI^{BN} after controlling for $Tran\_A^{BN}$ which is verified as the main component for pricing of the turnover-version Amihud illiquidity measure in the previous analyses. We also include A^{-} and A to control for the possible remaining effects of other price impact components. Since all the correlation coefficients between NPI^{BN} and other price impact variables are less than 0.4, we include the price impact variables in the regression model simultaneously. Panel B shows that while the coefficient on NPI^{BN} are all positive and significant at the one percent level except for Model 1 of which the t-static is also above 2.5 (p-value of 0.013), the estimated coefficients on $Tran\_A^{BN}$ are insignificant. The significance of the coefficients on A^{-} and A are also limited. The results in Table 6 imply that the price impact measure that takes into account the investors' asymmetric response to not only the good and bad news days but also the transitory shock itself associated with the news would show better predictive power for the future stock returns.

< Table 7 here >

Asparaouhova, Bessembinder, and Kalcheva (2010) suggest that the Fama-MacBeth regression by weighted least squares (WLS) with the prior-month gross return as a weighting variable can alleviate the effect of bias due to the market microstructure noise. Accordingly we implement the Fama-MacBeth regression with WLS and then report the estimation results in Table 7. Consistently with the results of Table 6, the estimated coefficients on NPI^{BN} in Table 7 are significantly positive for the entire regression model. Given the results, we can still conclude that NPI^{BN} has a predictive power for the expected stock returns after correcting for a potential bias from the market microstructure noise.

4.3. Portfolio analysis with *Net price impact* measure for bad news days

In addition to the Fama-MacBeth regression tests at the individual stock level, we further implement portfolio analyses to confirm the effect of half-*NPI* measures that correspond bad news days, NPI^{BN}, on expected stock returns. At the end of each month, all ordinary common stocks (share code 10 and 11) in NYSE and AMEX are sorted into decile portfolios based on NPI^{BN}, and then we obtain monthly equal-weighted and value-weighted return of each portfolio. To investigate whether the decile portfolios sorted by NPI^{BN} have abnormal returns, we regress the time-series of the decile portfolio returns in excess of the risk free rate on widely adopted risk factors. We use the Fama-French three-factor (MKT, SMB, and HML) model and the Carhart (1997) four-factor model that includes momentum factor (MOM) as well as Fama-French three-factor. In addition to the four factors, we also include liquidity risk factor (LIQ) suggested by Pastor and Stambaugh (2003) as five-factor model. The NPI^{BN}-sorted portfolio return in excess of risk-free rate, $R_{i,t}$, is regressed on the selected factors as follows:

$$R_{i,t} = \alpha_i + \beta_i MKT_t + s_i SMB_t + h_i HML_t + m_i MOM_t + l_i LIQ_t + \epsilon_{i,t}\,. \tag{12}$$

We report the estimation results in Table 8. Panel A of Table 8 show the average value of the firm characteristics of each portfolio. This panel shows that *Size* decreases almost monotonically as NPI^{BN} increases. In contrast, neither *BTM* nor *Beta* has a consistent pattern with the level of NPI^{BN}. Panel B and C report the monthly returns of the decile portfolio and estimated alphas of the equal-weighted and value-weighted portfolio, respectively. The time-series regression results of a zero-investment portfolio that is long in the highest-NPI^{BN} (decile 10) portfolio and short in the lowest-NPI^{BN} (decile 1) portfolio are also shown in 'High-Low' column. The zero-investment portfolios have average monthly returns of 0.617 percent for the equal-weighted case and 0.204 percent for the value-weighted case with significance. The estimated alphas of the zero-investment portfolios are also positively significant with the range from 0.757 to 0.816 percent per month for equal-weighted case and 0.206 to 0.238 percent per month for value-weighted case. In summary, the results in Table 8 show that NPI^{BN}-based strategy can provide abnormal returns after controlling for the five risk factors.

< Table 8 here >

We further implement double-sorts analyses to examine whether NPI^{BN} can generate abnormal returns after controlling for other firm characteristics. The dependently double sorts based on the selected control variables and NPI^{BN} are implement to avoid the effect of high correlation. Table 9 reports the alphas of the NPI^{BN} decile portfolios that are averaged across the tercile portfolios sorted by control variables. The results show that zero-investment portfolio gives abnormal returns with respect to the five-factor models with range from 0.409 to 0.517 percent per month for the equal-weighted case and 0.122 to 0.212 percent for the value-weighted case after controlling for possibly related firm characteristics. Especially, even after controlling for the *Turnover* which denotes the turnover ratio, we can find that the effect of NPI^{BN} is still significant. This result implies that the asymmetric effect of the transitory deviation, which is numerator of *Net price impact* measure, plays an important role for asset pricing as well as the turnover ratio, which in on the denominator.

< Table 9 here >

Table 10 shows the estimation results of sub-period analysis. We divided the full sample period into two sub-periods: Sub-period 1 is from January 1981 to December 1999 and sub-period 2 is from January 2000 to December 2015. The results show that the effect of NPI^{BN} on expected stock returns in sub-period 1 is much higher than that in the sub-period 2. In the equal-weighed case, NPI^{BN}-based strategy gives zero-investment abnormal return of more than 0.9 percent per month in the sub-period 2, while that in the sub-period 1 are less than 0.55 percent per month. Similarly, in the value-weighted case, we can earn the abnormal return of almost 0.3 percent per month with significance in the sub-period 2, whereas the abnormal returns in the sub-period 1 are insignificant. While the alphas of the zero-investment portfolio for the sub-period 1 are insignificant in the sub-period 1, all of each decile portfolio has significant abnormal returns regardless of the factor models. With the results in Table 10, we can conclude that effect of NPI^{BN} has strengthened in explaining the cross-sectional variation in expected stock return in more recent period.

< Table 10 here >

5. Conclusion

This paper investigates which component of price impacts measured by turnover version of Amihud illiquidity plays a main role for asset pricing, motivated by Florakis, Gregoriou, and Kostakis (2011) and Brennan, Huh, and Subrahmanyam (2013). To find main component we first decompose stock price into the permanent and transitory price using B-N decomposition methodology. Using the estimated decomposed-price series, we obtain the permanent and transitory price impacts of turnover-version Amihud illiquidity. We then further decompose each of these price impacts into half-price impact measures that correspond positive and negative return days, and good and bad news days. We find that, among the eight decomposed half-price impact measures, the *"transitory half-price impact associated with bad news days"* is the main component of the turnover-version Amihud illiquidity measure using the firm level Fama-MacBeth cross-sectional regression.

Based on this finding, we suggest a new price impact measure, "*Net price impact*", defined as the average net ratio of the daily transitory price deviation to the share turnover. With this suggested price impact measure, we further implement the cross-sectional regression analysis at the individual stock level to investigate whether the *Net price impact* measure can capture the cross-sectional variations in expected stock returns. The results show that the *Net price impact* that correspond bad news days has predictive power for the future stock returns even after controlling for *the transitory half-price impact associated with bad news days*. The portfolio sort analyses also support the results that *NPI* for bad news days generates positively significant abnormal returns with respect to various risk factors. This result implies that the price impact measure that takes into account the investors' asymmetric response to not only the good and bad news days but also the asymmetric effect of transitory deviation associated with the has better predictive power for the future stock returns.

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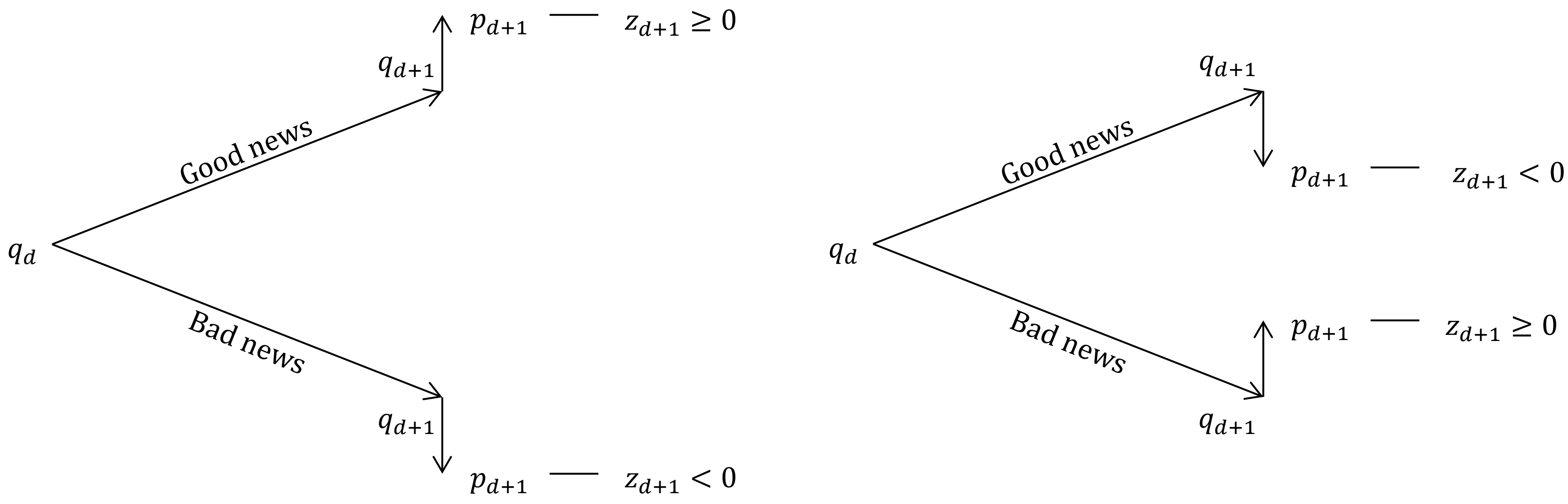
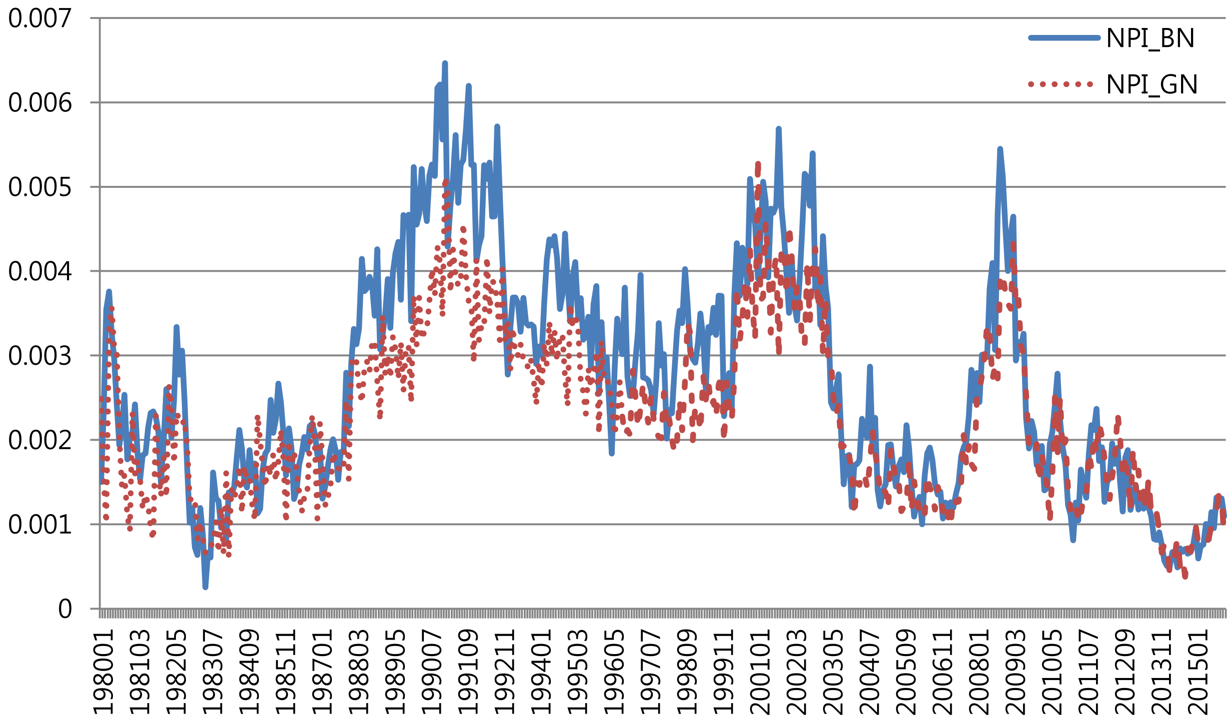
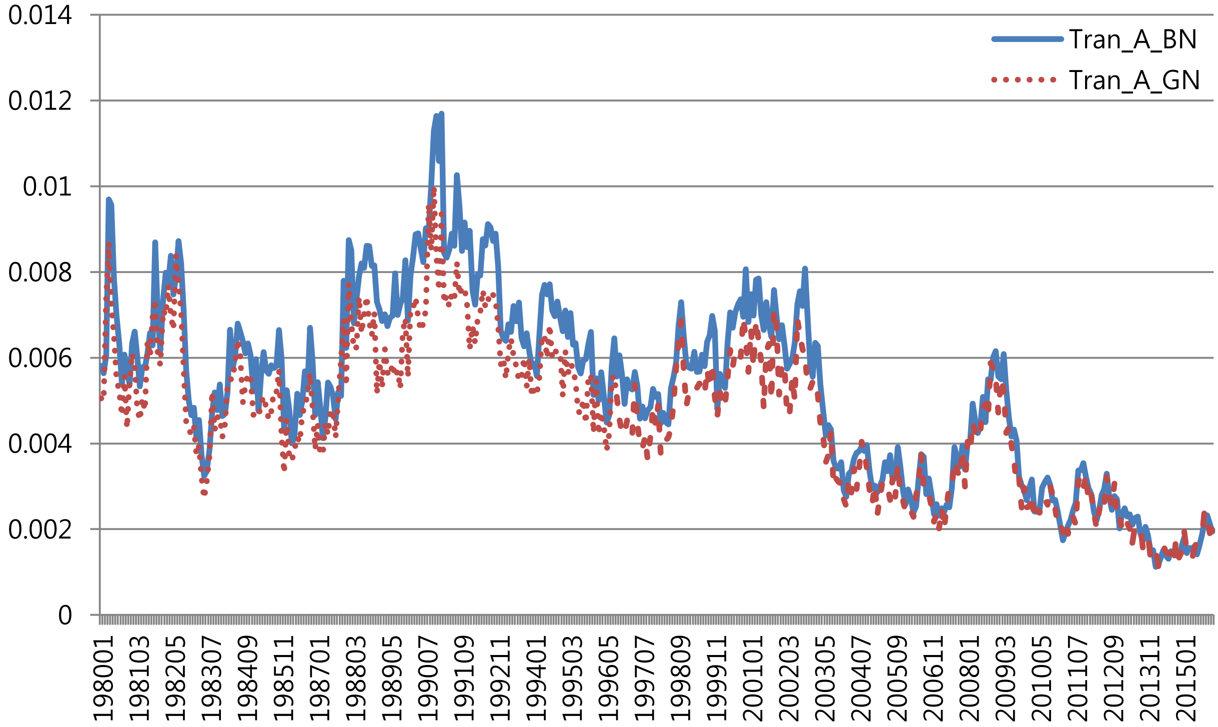


(a) Increasing price impact (b) Decreasing price impact

Fig. 1. Transitory shock associated with good and bad news. Figure 1(a) describes the permanent price change from day d to day $d+1$, and the corresponding transitory deviation for the increasing price impact case. Figure 2(a) plots for the decreasing price impact case. p_d represents the observed stock price, q_d represents the permanent price which follows random walk process, and z_d denotes the transitory deviation which follows stationary AR process. Good and bad news indicate the positive and negative informational shock, respectively.



(a) Times series of the *Net price impact* for good and bad news days



(b) Time series of the transitory half-price impact for good and bad news days

Fig. 2. Time-series plots of the *Net price impact* and the transitory half-price impact. Figure 2(a) plots the monthly average of the *Net price impact* for good and bad news days denoted by NPI_GN and NPI_BN, and figure 2(b) shows the monthly average of the transitory half-price impacts for good and bad news days denoted by Tran_A_GN and Tran_A_BN, respectively. The observations are obtained by averaging the individual-stock measures for each month. The samples are covered from January 1980 to December 2015.

Table 1.

Descriptive statistics.

Panel A reports the summary statistic of the explanatory variables. The summary statistics of the (decomposed) half-price impacts are reported in Panel A-1 and the control variables are reported in Panel A-2. A^+ and A^- denote the turnover-version Amihud illiquidity (2002) measure for positive and negative return days, respectively. $Tran\_A^+$, and $Tran\_A^-$ represent transitory price impacts for positive and negative return days. $Perm\_A^+$, and $Perm\_A^-$ represent permanent price impact for positive and negative return days. $Tran\_A^{GN}$, and $Tran\_A^{BN}$ represent transitory price for good and bad news days. $Perm\_A^{GN}$, and $Perm\_A^{BN}$ represent permanent price impact for good and bad news days. All of the price impact measures are reported in natural logarithm form. *Size* and *BTM* denote the natural logarithm of the market capitalization and the book-to-market equity ratio, respectively. The compounding holding period return over the most recent three months ($RET_{t-3,t-1}$), from month *t-6* to month *t-4* ($RET_{t-6,t-4}$), from month *t-9* to month *t-7* ($RET_{t-9,t-7}$), and from month *t-12* to month *t-10* ($RET_{t-12,t-10}$) are included. *Vol and Skew* are the standard deviation and the skewness of monthly return for the past 60 months, respectively. *REV* denotes short-term reversal and *Analyst* represents the natural logarithm of one plus the number of analyst. Panel B reports the time-series average of monthly cross-section correlations between the explanatory variables. The samples cover the period from January 1981 to December 2015.

A. Summary statistics

Variable	Mean	Std. Dev.	Percentile				
			5th	25th	50th	75th	95th
A-1. Price impact measures							
A^+	2.042	1.362	0.097	1.070	1.897	2.854	4.510
A^-	2.113	1.418	0.047	1.095	1.982	2.991	4.644
$Tran\_A^+$	0.004	1.915	-2.943	-1.302	-0.109	1.210	3.347
$Tran\_A^-$	0.070	1.930	-2.913	-1.245	-0.034	1.291	3.427
$Perm\_A^+$	2.033	1.360	0.051	1.064	1.911	2.869	4.464
$Perm\_A^-$	2.120	1.418	0.011	1.106	2.014	3.020	4.615
$Tran\_A^{GN}$	-0.030	1.905	-2.960	-1.327	-0.140	1.162	3.296
$Tran\_A^{BN}$	0.070	1.940	-2.918	-1.253	-0.035	1.291	3.447
$Perm\_A^{GN}$	2.106	1.388	0.066	1.110	1.993	2.969	4.571
$Perm\_A^{BN}$	2.214	1.449	0.041	1.169	2.116	3.148	4.750
A-2. Control variables							
Size	12.849	2.201	9.271	11.207	12.930	14.410	16.438
BTM	-0.448	0.841	-1.865	-0.908	-0.390	0.075	0.761
$RET_{t-3,t-1}$	0.031	0.590	-0.349	-0.103	0.011	0.127	0.396
$RET_{t-6,t-4}$	0.032	0.617	-0.344	-0.101	0.012	0.128	0.396
$RET_{t-9,t-7}$	0.032	0.607	-0.342	-0.102	0.012	0.128	0.396
$RET_{t-12,t-10}$	0.033	0.603	-0.339	-0.102	0.012	0.129	0.400
Beta	1.090	0.308	0.581	0.851	1.070	1.276	1.674
Vol	2.391	0.460	1.655	2.081	2.374	2.683	3.178
Skew	0.394	0.841	-0.682	-0.101	0.274	0.735	1.890
Rev	0.011	0.150	-0.188	-0.056	0.005	0.068	0.219
Analyst	1.252	1.159	0.000	0.000	1.099	2.303	3.135

B. Correlation Matrix

	A^+	A^-	$Tran\_A^+$	$Tran\_A^-$	$Perm\_A^+$	$Perm\_A^-$	$Tran\_A^{GN}$	$Tran\_A^{BN}$	$Perm\_A^{GN}$	$Perm\_A^{BN}$	*Size*	*BTM*	*Rev*
A^-	0.887												
$Tran\_A^+$	0.807	0.770											
$Tran\_A^-$	0.763	0.809	0.956										
$Perm\_A^+$	0.986	0.883	0.797	0.754									
$Perm\_A^-$	0.882	0.988	0.759	0.795	0.897								
$Tran\_A^{GN}$	0.806	0.764	0.993	0.948	0.792	0.750							
$Tran\_A^{BN}$	0.757	0.808	0.948	0.994	0.746	0.790	0.937						
$Perm\_A^{GN}$	0.982	0.881	0.795	0.751	0.991	0.893	0.796	0.741					
$Perm\_A^{BN}$	0.876	0.982	0.754	0.791	0.892	0.992	0.744	0.791	0.885				
Size	-0.562	-0.585	-0.556	-0.559	-0.545	-0.568	-0.555	-0.560	-0.565	-0.585			
BTM	0.157	0.164	0.139	0.143	0.154	0.159	0.139	0.145	0.164	0.169	-0.275		
Rev	-0.009	-0.003	-0.005	-0.004	-0.009	-0.004	-0.005	-0.004	-0.009	-0.004	0.008	0.015	
Analyst	-0.431	-0.441	-0.410	-0.411	-0.416	-0.427	-0.410	-0.412	-0.429	-0.438	0.596	-0.194	0.007

Table 2.

Half-price impacts associated with positive and negative return days and Fama-MacBeth cross-section regression

This table reports the results of Fama-MacBeth cross-sectional regression of excess stock return on the half-price impacts for positive and negative return days. A^+, and A^- denote the turnover-version Amihud illiquidity (2002) measure for positive and negative return days, respectively. $Res\_A^+\_A^-$ is the regression residual obtained by regressing A^+ on A^-, and $Res\_A^-\_A^+$ is regressing residual obtained by regressing A^- on A^+. All of the price impact measures are transformed in the natural logarithm form. *Size* and *BTM* denote the natural logarithm of the market capitalization and the book-to-market equity ratio, respectively. The compounding holding period return over the most recent three months ($RET_{t-3,t-1}$), from month *t-6* to month *t-4* ($RET_{t-6,t-4}$), from month *t-9* to month *t-7* ($RET_{t-9,t-7}$), and from month *t-12* to month *t-10* ($RET_{t-12,t-10}$) are included. *Vol and Skew* are the standard deviation and the skewness of the monthly return for the past 60 months, respectively. *REV* denotes the short-term reversal and *Analyst* represents the natural logarithm of one plus the number of analyst. The samples cover the period from January 1981 to December 2015. The Newey-West (1987) t-statistics with six-lags are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
A^+	0.057	0.063**						
	(1.629)	(1.993)						
A^-			0.074**	0.089***				
			(2.209)	(2.941)				
$Res\_A^+\_A^-$					0.010	0.004		
					(0.185)	(0.0781)		
$Res\_A^-\_A^+$							0.083*	0.119***
							(1.798)	(2.762)
Size	-0.029	-0.119***	-0.023	-0.109***	-0.038	-0.132***	-0.030	-0.121***
	(-0.625)	(-3.591)	(-0.508)	(-3.449)	(-0.865)	(-3.958)	(-0.703)	(-3.693)
BTM	0.192***	0.132**	0.179***	0.116*	0.193***	0.128**	0.191***	0.126**
	(2.804)	(2.047)	(2.622)	(1.818)	(2.815)	(2.007)	(2.786)	(1.978)
$RET_{t-3,t-1}$	0.320	0.412**	0.306	0.400**	0.298	0.390**	0.299	0.396**
	(1.647)	(2.187)	(1.590)	(2.132)	(1.545)	(2.068)	(1.559)	(2.123)
$RET_{t-6,t-4}$	0.314	0.452***	0.313	0.442***	0.290	0.428**	0.294	0.434***
	(1.498)	(2.750)	(1.621)	(2.865)	(1.379)	(2.581)	(1.407)	(2.649)
$RET_{t-9,t-7}$	0.398*	0.401**	0.367	0.374*	0.384*	0.385*	0.390*	0.390**
	(1.705)	(2.050)	(1.581)	(1.936)	(1.650)	(1.958)	(1.685)	(1.993)
$RET_{t-12,t-10}$	0.040	0.035	0.035	0.030	0.037	0.026	0.040	0.026
	(0.219)	(0.214)	(0.195)	(0.186)	(0.199)	(0.158)	(0.220)	(0.161)
Beta		0.082		0.091		0.073		0.084
		(0.615)		(0.678)		(0.549)		(0.621)
Vol		-0.413*		-0.388		-0.432*		-0.434*
		(-1.650)		(-1.536)		(-1.725)		(-1.737)
Skew		0.011		0.003		0.017		0.013
		(0.207)		(0.054)		(0.316)		(0.248)
Rev		-3.968***		-4.015***		-3.973***		-3.973***
		(-8.844)		(-8.865)		(-8.855)		(-8.818)
Analyst		0.153***		0.152***		0.141***		0.141***
		(5.338)		(5.417)		(4.938)		(4.766)
Constant	1.010	2.793***	0.871	2.533***	1.219*	3.131***	1.122	2.997***
	(1.282)	(4.765)	(1.134)	(4.316)	(1.654)	(5.545)	(1.561)	(5.233)
R-squared	0.039	0.065	0.038	0.065	0.038	0.065	0.037	0.065

Table 3.

Decomposed half-price impacts associated with positive and negative return days and Fama-MacBeth cross-section regression

Panel A reports the results of Fama-MacBeth cross-sectional regression of excess stock return on the decomposed half-price impacts associated with positive and negative return days. $Tran\_A^+$, and $Tran\_A^-$ represent transitory price impact for positive and negative return days. $Perm\_A^+$, and $Perm\_A^-$ represent permanent price impact for positive and negative return days. All of the price impact measures are transformed in the natural logarithm form. *Size* and *BTM* denote the natural logarithm of the market capitalization and the book-to-market equity ratio, respectively. The compounding holding period return over the most recent three months ($RET_{t-3,t-1}$), from month *t-6* to month *t-4* ($RET_{t-6,t-4}$), from month *t-9* to month *t-7* ($RET_{t-9,t-7}$), and from month *t-12* to month *t-10* ($RET_{t-12,t-10}$) are included. *Vol and Skew* are the standard deviation and the skewness of the monthly return for the past 60 months, respectively. *REV* denotes the short-term reversal and *Analyst* represents the natural logarithm of one plus the number of analyst. Panel B reports the results of Fama-MacBeth cross-sectional regression of excess stock return on the residual variables of $Tran\_A^-$, $Tran\_A^+$, $Perm\_A^+$, and $Perm\_A^-$. The samples cover the period from January 1981 to December 2015. The Newey-West (1987) t-statistics with six-lags are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

A. Fama-MacBeth cross-sectional regression with the decomposed half-price impacts associated with positive and negative return days

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$Perm\_A^+$	0.049	0.055*						
	(1.467)	(1.764)						
$Perm\_A^-$			0.067**	0.082***				
			(2.100)	(2.749)				
$Tran\_A^+$					0.040*	0.048***		
					(1.914)	(2.659)		
$Tran\_A^-$							0.049**	0.054***
							(2.163)	(2.857)
Size	-0.033	-0.122***	-0.026	-0.112***	-0.025	-0.116***	-0.021	-0.112***
	(-0.733)	(-3.735)	(-0.601)	(-3.587)	(-0.564)	(-3.593)	(-0.484)	(-3.600)
BTM	0.191***	0.129**	0.181***	0.117*	0.193***	0.131**	0.182***	0.118*
	(2.785)	(2.018)	(2.649)	(1.828)	(2.832)	(2.051)	(2.683)	(1.856)
$RET_{t-3,t-1}$	0.297	0.385**	0.309	0.403**	0.303	0.396**	0.302	0.393**
	(1.506)	(1.994)	(1.603)	(2.148)	(1.570)	(2.103)	(1.567)	(2.080)
$RET_{t-6,t-4}$	0.308	0.445***	0.309	0.438***	0.306	0.449***	0.306	0.434***
	(1.468)	(2.708)	(1.598)	(2.828)	(1.474)	(2.707)	(1.591)	(2.779)
$RET_{t-9,t-7}$	0.385	0.385*	0.367	0.369*	0.389*	0.391**	0.361	0.364*
	(1.642)	(1.961)	(1.580)	(1.924)	(1.665)	(2.000)	(1.550)	(1.882)
$RET_{t-12,t-10}$	0.037	0.034	0.032	0.031	0.033	0.034	0.029	0.031
	(0.204)	(0.207)	(0.181)	(0.192)	(0.183)	(0.213)	(0.163)	(0.190)
Beta		0.071		0.081		0.100		0.091
		(0.535)		(0.600)		(0.753)		(0.687)
Vol		-0.411		-0.391		-0.424*		-0.397
		(-1.648)		(-1.552)		(-1.704)		(-1.578)
Skew		0.015		0.008		0.008		0.003
		(0.285)		(0.151)		(0.155)		(0.053)
Rev		-3.969***		-3.999***		-3.979***		-3.994***
		(-8.827)		(-8.839)		(-8.865)		(-8.867)
Analyst		0.151***		0.151***		0.149***		0.149***
		(5.254)		(5.286)		(5.129)		(5.331)
Constant	1.079	2.865***	0.933	2.604***	1.060	2.890***	1.008	2.786***
	(1.390)	(4.942)	(1.248)	(4.448)	(1.437)	(5.029)	(1.367)	(4.869)
R-squared	0.039	0.065	0.038	0.065	0.038	0.065	0.038	0.065

B. Fama-MacBeth cross-sectional regression using a residual approach

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$Res\_Tran^{-}\_Tran^{+}$	0.081*					
	(1.676)					
$Res\_Tran^{-}\_Perm^{+}$		0.053***				
		(2.828)				
$Res\_Tran^{-}\_Perm^{-}$			0.033			
			(1.639)			
$Res\_Tran^{+}\_Tran^{-}$				0.0140		
				(0.319)		
$Res\_Perm^{+}\_Tran^{-}$					-0.003	
					(-0.0827)	
$Res\_Perm^{-}\_Tran^{-}$						0.030
						(0.982)
Size	-0.126***	-0.121***	-0.126***	-0.130***	-0.132***	-0.129***
	(-3.788)	(-3.702)	(-3.989)	(-3.962)	(-4.006)	(-4.071)
BTM	0.127**	0.128**	0.119*	0.129**	0.128**	0.119*
	(1.989)	(2.011)	(1.885)	(2.015)	(2.002)	(1.871)
$RET_{t-3,t-1}$	0.396**	0.387**	0.373**	0.392**	0.382**	0.376**
	(2.116)	(2.017)	(1.980)	(2.098)	(1.985)	(2.007)
$RET_{t-6,t-4}$	0.441***	0.432***	0.417***	0.435***	0.431***	0.420***
	(2.651)	(2.596)	(2.654)	(2.605)	(2.611)	(2.703)
$RET_{t-9,t-7}$	0.366*	0.364*	0.342*	0.368*	0.363*	0.346*
	(1.849)	(1.840)	(1.762)	(1.877)	(1.840)	(1.798)
$RET_{t-12,t-10}$	0.019	0.024	0.020	0.023	0.022	0.017
	(0.115)	(0.146)	(0.121)	(0.142)	(0.132)	(0.107)
Beta	0.079	0.080	0.063	0.076	0.056	0.050
	(0.594)	(0.597)	(0.477)	(0.557)	(0.420)	(0.373)
Vol	-0.427*	-0.433*	-0.396	-0.431*	-0.427*	-0.391
	(-1.715)	(-1.736)	(-1.569)	(-1.727)	(-1.709)	(-1.547)
Skew	0.016	0.013	0.010	0.019	0.022	0.0150
	(0.307)	(0.255)	(0.180)	(0.357)	(0.410)	(0.277)
Rev	-3.967***	-3.966***	-4.011***	-3.971***	-3.964***	-4.013***
	(-8.812)	(-8.814)	(-8.892)	(-8.828)	(-8.793)	(-8.860)
Analyst	0.140***	0.140***	0.139***	0.138***	0.139***	0.139***
	(4.841)	(4.865)	(4.949)	(4.669)	(4.803)	(4.818)
Constant	3.053***	2.989***	2.985***	3.116***	3.141***	3.027***
	(5.360)	(5.224)	(5.289)	(5.469)	(5.497)	(5.316)
R-squared	0.064	0.064	0.064	0.064	0.064	0.064

Table 4.

Decomposed half-price impacts for good and bad news days and Fama-MacBeth cross-section regression

Panel A reports the results of Fama-MacBeth cross-sectional regression of excess stock return on the decomposed half-price impacts for good and bad news days. $Tran\_A^{GN}$, and $Tran\_A^{BN}$ represent transitory price impact for good and bad news days, respectively. $Perm\_A^{GN}$, and $Perm\_A^{BN}$ represent permanent price impact for good and bad news days, respectively. All of the price impact measures are transformed in the natural logarithm form. *Size* and *BTM* denote the natural logarithm of the market capitalization and the book-to-market equity ratio, respectively. The compounding holding period return over the most recent three months ($RET_{t-3,t-1}$), from month *t-6* to month *t-4* ($RET_{t-6,t-4}$), from month *t-9* to month *t-7* ($RET_{t-9,t-7}$), and from month *t-12* to month *t-10* ($RET_{t-12,t-10}$) are included. *Vol and Skew* are the standard deviation and the skewness of the monthly return for the past 60 months, respectively. *REV* denotes the short-term reversal and *Analyst* represents the natural logarithm of one plus the number of analyst. Panel B reports the results of Fama-MacBeth cross-sectional regression of excess stock return on the residual variables of $Tran\_A^{BN}$, $Tran\_A^{GN}$, $Perm\_A^{GN}$, and $Perm\_A^{BN}$. The samples cover the period from January 1981 to December 2015. The Newey-West (1987) t-statistics with six-lags are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

A. Fama-MacBeth cross-sectional regression with the decomposed half-price impacts for good and bad news days

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$Perm\_A^{GN}$	0.036	0.043						
	(1.054)	(1.332)						
$Perm\_A^{BN}$			0.074**	0.089***				
			(2.228)	(2.795)				
$Tran\_A^{GN}$					0.034*	0.041**		
					(1.667)	(2.307)		
$Tran\_A^{BN}$							0.054**	0.059***
							(2.333)	(3.031)
Size	-0.032	-0.121***	-0.021	-0.108***	-0.022	-0.113***	-0.017	-0.109***
	(-0.697)	(-3.742)	(-0.486)	(-3.432)	(-0.504)	(-3.570)	(-0.390)	(-3.463)
BTM	0.183***	0.121*	0.183***	0.118*	0.186***	0.124*	0.185***	0.120*
	(2.667)	(1.862)	(2.686)	(1.847)	(2.727)	(1.905)	(2.725)	(1.882)
$RET_{t-3,t-1}$	0.308	0.415**	0.319*	0.416**	0.297	0.407**	0.308	0.403**
	(1.585)	(2.164)	(1.655)	(2.218)	(1.530)	(2.132)	(1.593)	(2.128)
$RET_{t-6,t-4}$	0.353*	0.483***	0.308	0.437***	0.348*	0.484***	0.298	0.426***
	(1.855)	(3.169)	(1.589)	(2.784)	(1.844)	(3.154)	(1.545)	(2.681)
$RET_{t-9,t-7}$	0.379	0.396**	0.372	0.378**	0.377	0.397**	0.358	0.365*
	(1.608)	(2.040)	(1.604)	(1.976)	(1.601)	(2.047)	(1.538)	(1.887)
$RET_{t-12,t-10}$	0.028	0.007	0.037	0.040	0.021	0.005	0.0280	0.037
	(0.147)	(0.0409)	(0.207)	(0.249)	(0.110)	(0.0292)	(0.156)	(0.226)
Beta		0.095		0.091		0.117		0.100
		(0.702)		(0.671)		(0.863)		(0.756)
Vol		-0.428*		-0.392		-0.444*		-0.400
		(-1.682)		(-1.554)		(-1.749)		(-1.587)
Skew		0.008		0.007		0.003		0.001
		(0.143)		(0.122)		(0.0529)		(0.0253)
Rev		-3.831***		-3.952***		-3.827***		-3.950***
		(-8.639)		(-8.747)		(-8.651)		(-8.783)
Analyst		0.144***		0.150***		0.141***		0.147***
		(5.153)		(5.283)		(5.050)		(5.327)
Constant	1.085	2.891***	0.847	2.521***	1.026	2.892***	0.958	2.743***
	(1.378)	(4.913)	(1.123)	(4.205)	(1.384)	(4.947)	(1.296)	(4.731)
R-squared	0.039	0.066	0.038	0.065	0.038	0.066	0.038	0.065

B. Fama-MacBeth cross-sectional regression using a residual approach

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$Res\_Tran^{BN}\_Tran^{GN}$	0.105**					
	(2.359)					
$Res\_Tran^{BN}\_Perm^{GN}$		0.058***				
		(3.059)				
$Res\_Tran^{BN}\_Perm^{BN}$			0.036*			
			(1.781)			
$Res\_Tran^{GN}\_Tran^{BN}$				-0.008		
				(-0.219)		
$Res\_Perm^{GN}\_Tran^{BN}$					-0.019	
					(-0.586)	
$Res\_Perm^{BN}\_Tran^{BN}$						0.028
						(0.898)
Size	-0.119***	-0.116***	-0.125***	-0.126***	-0.130***	-0.127***
	(-3.646)	(-3.630)	(-3.933)	(-3.935)	(-4.004)	(-4.008)
BTM	0.118*	0.119*	0.121*	0.121*	0.119*	0.120*
	(1.806)	(1.832)	(1.907)	(1.846)	(1.832)	(1.887)
$RET_{t-3,t-1}$	0.417**	0.421**	0.379**	0.407**	0.410**	0.382**
	(2.188)	(2.201)	(1.999)	(2.139)	(2.136)	(2.025)
$RET_{t-6,t-4}$	0.466***	0.456***	0.408**	0.453***	0.452***	0.414***
	(2.996)	(2.910)	(2.560)	(2.891)	(2.901)	(2.625)
$RET_{t-9,t-7}$	0.374*	0.370*	0.347*	0.371*	0.370*	0.352*
	(1.912)	(1.890)	(1.792)	(1.912)	(1.900)	(1.836)
$RET_{t-12,t-10}$	-0.003	0.001	0.023	-0.003	-0.004	0.023
	(-0.0162)	(0.00653)	(0.141)	(-0.0165)	(-0.0220)	(0.144)
Beta	0.112	0.114	0.073	0.100	0.090	0.060
	(0.826)	(0.842)	(0.554)	(0.720)	(0.654)	(0.447)
Vol	-0.457*	-0.455*	-0.400	-0.458*	-0.450*	-0.394
	(-1.799)	(-1.790)	(-1.580)	(-1.803)	(-1.770)	(-1.557)
Skew	0.012	0.007	0.008	0.015	0.016	0.014
	(0.223)	(0.138)	(0.157)	(0.281)	(0.299)	(0.261)
Rev	-3.779***	-3.789***	-3.960***	-3.781***	-3.784***	-3.960***
	(-8.494)	(-8.528)	(-8.789)	(-8.498)	(-8.513)	(-8.762)
Analyst	0.135***	0.133***	0.137***	0.130***	0.130***	0.136***
	(4.882)	(4.800)	(4.912)	(4.606)	(4.705)	(4.776)
Constant	2.985***	2.955***	2.979***	3.117***	3.150***	3.014***
	(5.119)	(5.055)	(5.225)	(5.346)	(5.395)	(5.237)
R-squared	0.065	0.065	0.064	0.065	0.065	0.064

Table 5.

Decomposed half-price impacts for bad news days and Fama-MacBeth cross-section regression using a residual approach

This table reports the results of Fama-MacBeth cross-sectional regression of excess stock return on the residual measures. $Res\_Tran^{BN}\_Tran^{-}$ is regression residual obtained by regressing $Tran^{BN}$ on $Tran^{-}$, and vice versa. $Res\_Tran^{BN}\_A^{-}$ is regression residual obtained by regressing $Tran^{BN}$ on A^{-}, and vice versa. $Res\_Tran^{BN}\_A$ is regression residual obtained by regressing $Tran^{BN}$ on *A*, and vice versa. *Size* and *BTM* denote the natural logarithm of the market capitalization and the book-to-market equity ratio, respectively. The compounding holding period return over the most recent three months ($RET_{t-3,t-1}$), from month *t-6* to month *t-4* ($RET_{t-6,t-4}$), from month *t-9* to month *t-7* ($RET_{t-9,t-7}$), and from month *t-12* to month *t-10* ($RET_{t-12,t-10}$) are included. *Vol and Skew* are the standard deviation and the skewness of the monthly return for the past 60 months, respectively. *REV* denotes the short-term reversal and *Analyst* represents the natural logarithm of one plus the number of analyst. The samples cover the period from January 1981 to December 2015. The Newey-West (1987) t-statistics with six-lags are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$Res\_Tran^{BN}\_Tran^{-}$	0.316**					
	(2.088)					
$Res\_Tran^{BN}\_A^{-}$		0.038*				
		(1.822)				
$Res\_Tran^{BN}\_A$			0.037*			
			(1.905)			
$Res\_Tran^{-}\_Tran^{BN}$				-0.116		
				(-0.833)		
$Res\_A^{-}\_Tran^{BN}$					0.028	
					(0.943)	
$Res\_A\_Tran^{BN}$						0.031
						(0.936)
Size	-0.129***	-0.125***	-0.125***	-0.132***	-0.128***	-0.126***
	(-4.051)	(-3.970)	(-3.930)	(-4.109)	(-3.995)	(-3.934)
BTM	0.117*	0.120*	0.119*	0.117*	0.120*	0.118*
	(1.832)	(1.892)	(1.862)	(1.839)	(1.879)	(1.839)
$RET_{t-3,t-1}$	0.380**	0.379**	0.374**	0.378**	0.379**	0.379**
	(2.010)	(1.998)	(1.986)	(1.997)	(2.006)	(2.024)
$RET_{t-6,t-4}$	0.410**	0.409**	0.429***	0.407**	0.411***	0.435***
	(2.574)	(2.567)	(2.687)	(2.556)	(2.599)	(2.752)
$RET_{t-9,t-7}$	0.342*	0.349*	0.369*	0.339*	0.351*	0.374*
	(1.773)	(1.802)	(1.904)	(1.763)	(1.828)	(1.944)
$RET_{t-12,t-10}$	0.023	0.027	0.015	0.023	0.024	0.016
	(0.139)	(0.164)	(0.088)	(0.138)	(0.147)	(0.095)
Beta	0.062	0.071	0.084	0.059	0.058	0.075
	(0.456)	(0.535)	(0.631)	(0.439)	(0.429)	(0.560)
Vol	-0.401	-0.399	-0.421*	-0.400	-0.391	-0.412
	(-1.584)	(-1.576)	(-1.663)	(-1.580)	(-1.543)	(-1.626)
Skew	0.013	0.009	0.015	0.014	0.014	0.018
	(0.249)	(0.166)	(0.273)	(0.261)	(0.251)	(0.343)
Rev	-3.950***	-3.958***	-3.921***	-3.946***	-3.956***	-3.915***
	(-8.743)	(-8.786)	(-8.715)	(-8.740)	(-8.754)	(-8.687)
Analyst	0.137***	0.137***	0.135***	0.136***	0.136***	0.137***
	(4.924)	(4.918)	(4.818)	(4.904)	(4.832)	(4.850)
Constant	3.048***	2.982***	3.028***	3.085***	3.016***	3.023***
	(5.336)	(5.234)	(5.288)	(5.431)	(5.240)	(5.221)
R-squared	0.064	0.064	0.064	0.064	0.064	0.065

Table 6.

Net price impact for good and bad news days and Fama-MacBeth cross-section regression

Panel A reports the results of Fama-MacBeth cross-sectional regression of excess stock return on the *Net price impact*. *NPI* represents net transitory price impact measure. NPI^{GN} and NPI^{BN} denote half-*Net price impact* associated with good and bad news days, respectively. The observations are eliminated at the highest or lowest 0.5% tails of each type of NPI measure. *Size* and *BTM* denote the natural logarithm of the market capitalization and the book-to-market equity ratio, respectively. The compounding holding period return over the most recent three months ($RET_{t-3,t-1}$), from month *t-6* to month *t-4* ($RET_{t-6,t-4}$), from month *t-9* to month *t-7* ($RET_{t-9,t-7}$), and from month *t-12* to month *t-10* ($RET_{t-12,t-10}$) are included. *Vol and Skew* are the standard deviation and the skewness of the monthly return for the past 60 months, respectively. *REV* denotes the short-term reversal and *Analyst* represents the natural logarithm of one plus the number of analyst. Panel B reports the results of Fama-MacBeth cross-sectional regression of excess stock return on the *Net price impact* for bad news days with (decomposed) half-price impact measure for negative return days and turnover version of Amihud illiquidity. The samples cover the period from January 1981 to December 2015. The Newey-West (1987) t-statistics with six-lags are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

A. Fama-MacBeth cross-sectional regression with the *Net price impact* and *Net Price impact* for good and bad news days

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
NPI	0.075**	0.088***						
	(2.403)	(3.053)						
NPI^{GN}			0.076***	0.094***			0.017	0.018
			(2.632)	(3.378)			(0.526)	(0.587)
NPI^{BN}					0.098***	0.112***	0.107***	0.125***
					(2.739)	(3.243)	(2.616)	(3.006)
Size	-0.016	-0.113***	-0.021	-0.116***	-0.017	-0.113***	-0.016	-0.111***
	(-0.403)	(-3.584)	(-0.528)	(-3.645)	(-0.404)	(-3.561)	(-0.388)	(-3.477)
BTM	0.189***	0.117*	0.190***	0.120*	0.190***	0.117*	0.184***	0.114*
	(2.806)	(1.846)	(2.772)	(1.860)	(2.789)	(1.839)	(2.673)	(1.751)
$RET_{t-3,t-1}$	0.286	0.413**	0.272	0.403**	0.292	0.419**	0.312	0.448**
	(1.376)	(2.126)	(1.344)	(2.104)	(1.437)	(2.203)	(1.555)	(2.367)
$RET_{t-6,t-4}$	0.349*	0.490***	0.334*	0.470***	0.334*	0.475***	0.345*	0.494***
	(1.867)	(3.231)	(1.770)	(3.082)	(1.757)	(3.042)	(1.813)	(3.229)
$RET_{t-9,t-7}$	0.348	0.375*	0.343	0.381*	0.345	0.372*	0.338	0.377*
	(1.457)	(1.919)	(1.444)	(1.961)	(1.459)	(1.908)	(1.410)	(1.908)
$RET_{t-12,t-10}$	0.038	0.041	0.017	0.002	0.034	0.045	0.030	0.030
	(0.207)	(0.253)	(0.0900)	(0.0114)	(0.185)	(0.270)	(0.159)	(0.178)
Beta		0.128		0.124		0.128		0.143
		(0.958)		(0.910)		(0.953)		(1.042)
Vol		-0.461*		-0.456*		-0.459*		-0.471*
		(-1.848)		(-1.813)		(-1.842)		(-1.880)
Skew		0.009		0.004		0.009		0.002
		(0.180)		(0.0782)		(0.176)		(0.0462)
Rev		-3.804***		-3.753***		-3.830***		-3.654***
		(-8.738)		(-8.458)		(-8.825)		(-8.469)
Analyst		0.137***		0.135***		0.135***		0.130***
		(4.843)		(4.807)		(4.839)		(4.751)
Constant	0.912	2.882***	0.990	2.917***	0.920	2.885***	0.910	2.871***
	(1.316)	(4.965)	(1.420)	(4.985)	(1.304)	(5.030)	(1.281)	(4.892)
R-squared	0.039	0.066	0.039	0.067	0.039	0.067	0.043	0.070

B. Fama-MacBeth regression with the *Net price impact* for bad news days, (decomposed) half-price impact measure, and turnover version of Amihud illiquidity

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
NPI^{BN}	0.085**	0.101***	0.085**	0.099***	0.083**	0.098***	0.082**	0.096***
	(2.503)	(2.966)	(2.478)	(2.852)	(2.441)	(2.849)	(2.414)	(2.794)
$Tran\_A^{BN}$	0.026	0.028					0.012	0.009
	(1.305)	(1.569)					(0.530)	(0.480)
A^{-}			0.045	0.053*			-0.014	0.027
			(1.450)	(1.801)			(-0.161)	(0.330)
A					0.050	0.056*	0.051	0.022
					(1.413)	(1.665)	(0.534)	(0.237)
Size	-0.008	-0.105***	-0.010	-0.101***	-0.008	-0.100***	-0.008	-0.099***
	(-0.194)	(-3.357)	(-0.226)	(-3.249)	(-0.174)	(-3.237)	(-0.175)	(-3.226)
BTM	0.188***	0.118*	0.188***	0.117*	0.187***	0.117*	0.190***	0.120*
	(2.769)	(1.847)	(2.753)	(1.829)	(2.747)	(1.827)	(2.808)	(1.882)
$RET_{t-3,t-1}$	0.308	0.433**	0.316	0.443**	0.321	0.446**	0.318	0.440**
	(1.511)	(2.274)	(1.551)	(2.334)	(1.573)	(2.339)	(1.556)	(2.297)
$RET_{t-6,t-4}$	0.344*	0.488***	0.350*	0.493***	0.358*	0.500***	0.354*	0.498***
	(1.809)	(3.107)	(1.834)	(3.169)	(1.875)	(3.210)	(1.868)	(3.202)
$RET_{t-9,t-7}$	0.351	0.380*	0.363	0.392**	0.362	0.392**	0.363	0.395**
	(1.484)	(1.945)	(1.541)	(2.018)	(1.542)	(2.025)	(1.547)	(2.030)
$RET_{t-12,t-10}$	0.030	0.052	0.035	0.050	0.037	0.054	0.032	0.051
	(0.163)	(0.315)	(0.187)	(0.300)	(0.198)	(0.325)	(0.175)	(0.308)
Beta		0.143		0.140		0.144		0.146
		(1.080)		(1.037)		(1.076)		(1.102)
Vol		-0.449*		-0.441*		-0.441*		-0.435*
		(-1.802)		(-1.771)		(-1.773)		(-1.742)
Skew		0.005		0.006		0.006		0.006
		(0.0912)		(0.121)		(0.107)		(0.112)
Rev		-3.831***		-3.834***		-3.827***		-3.841***
		(-8.843)		(-8.818)		(-8.809)		(-8.864)
Analyst		0.141***		0.143***		0.144***		0.144***
		(5.012)		(4.956)		(5.004)		(4.986)
Constant	0.825	2.737***	0.745	2.560***	0.708	2.538***	0.738	2.528***
	(1.108)	(4.812)	(0.957)	(4.460)	(0.891)	(4.350)	(0.937)	(4.289)
R-squared	0.042	0.068	0.042	0.069	0.043	0.069	0.045	0.071

Table 7.

Net price impact for bad news days and Fama-MacBeth cross-section regression using WLS

This table reports the results of Fama-MacBeth cross-sectional regression of excess stock return on the *Net price impact* for bad news days with control varibales. NPI^{BN} denotes half-*Net price impact* associated with bad news days. The observations are eliminated at the highest or lowest 0.5% tails of each type of *Net price impact* measure. $Tran\_A^{BN}$ represents the transitory half-price impact for bad news days and A and A^- is turnover-version Amihud (2002) illiquidity and its half-price impact for negative return days, respectively. *Size* and *BTM* denote the natural logarithm of the market capitalization and the book-to-market equity ratio, respectively. The compounding holding period return over the most recent three months ($RET_{t-3,t-1}$), from month *t-6* to month *t-4* ($RET_{t-6,t-4}$), from month *t-9* to month *t-7* ($RET_{t-9,t-7}$), and from month *t-12* to month *t-10* ($RET_{t-12,t-10}$) are included. *Vol and Skew* are the standard deviation and the skewness of the monthly return for the past 60 months, respectively. *REV* denotes the short-term reversal and *Analyst* represents the natural logarithm of one plus the number of analyst. The samples cover the period from January 1981 to December 2015. The Newey-West (1987) t-statistics with six-lags are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
NPI^{BN}	0.068**	0.080**	0.056**	0.065*	0.051*	0.070**	0.049*	0.073**	0.0498*	0.059*
	(2.289)	(2.345)	(2.032)	(1.863)	(1.735)	(2.021)	(1.670)	(2.099)	(1.762)	(1.679)
$Tran\_A^{BN}$			0.020	0.043					-0.001	0.065**
			(0.793)	(1.585)					(-0.035)	(2.194)
A^-					0.045	0.014			-0.007	0.089
					(1.209)	(0.254)			(-0.077)	(0.752)
A							0.050	0.007	0.057	-0.138
							(1.187)	(0.113)	(0.525)	(-1.126)
Size	0.038	-0.130***	0.042	-0.115***	0.044	-0.138***	0.044	-0.138***	0.043	-0.132***
	(0.884)	(-3.587)	(0.959)	(-3.010)	(0.953)	(-3.035)	(0.945)	(-3.078)	(0.933)	(-3.008)
BTM	0.208***	0.125	0.208***	0.131	0.208***	0.116	0.208***	0.118	0.210***	0.124
	(2.693)	(1.236)	(2.714)	(1.339)	(2.692)	(1.280)	(2.690)	(1.281)	(2.759)	(1.370)
$RET_{t-3,t-1}$	0.563***	0.590***	0.572***	0.611***	0.576***	0.603***	0.576***	0.602***	0.566***	0.583***
	(2.628)	(2.991)	(2.644)	(3.140)	(2.679)	(3.106)	(2.679)	(3.071)	(2.638)	(2.981)
$RET_{t-6,t-4}$	0.554***	0.440**	0.557***	0.489**	0.557***	0.458**	0.557***	0.470**	0.551***	0.465**
	(3.232)	(2.193)	(3.232)	(2.503)	(3.220)	(2.272)	(3.215)	(2.331)	(3.204)	(2.349)
$RET_{t-9,t-7}$	0.562**	0.257	0.567**	0.295	0.574**	0.349	0.569**	0.335	0.571**	0.367
	(2.082)	(0.579)	(2.104)	(0.680)	(2.139)	(0.865)	(2.128)	(0.812)	(2.147)	(0.960)
$RET_{t-12,t-10}$	0.303*	0.009	0.277	0.011	0.266	-0.000	0.263	0.005	0.253	-0.021
	(1.669)	(0.046)	(1.563)	(0.0563)	(1.537)	(-0.002)	(1.529)	(0.0231)	(1.478)	(-0.106)
Beta		0.326*		0.334*		0.290*		0.298*		0.292*
		(1.811)		(1.924)		(1.697)		(1.734)		(1.756)
Vol		-0.534**		-0.499*		-0.513**		-0.505*		-0.494*
		(-2.043)		(-1.890)		(-1.968)		(-1.914)		(-1.930)
Skew		-0.036		-0.050		-0.035		-0.037		-0.044
		(-0.483)		(-0.644)		(-0.471)		(-0.487)		(-0.570)
Rev		-3.470***		-3.490***		-3.473***		-3.470***		-3.475***
		(-6.157)		(-6.281)		(-6.218)		(-6.211)		(-6.316)
Analyst		0.142***		0.150***		0.137***		0.135***		0.141***
		(3.503)		(3.990)		(4.078)		(3.955)		(3.943)
Constant	0.139	3.120***	0.113	2.844***	0.003	3.196***	-0.008	3.189***	0.015	3.228***
	(0.196)	(4.862)	(0.154)	(4.286)	(0.003)	(4.179)	(-0.010)	(4.028)	(0.019)	(4.235)
R-squared	0.052	0.099	0.054	0.104	0.053	0.105	0.054	0.105	0.056	0.108

Table 8.

Portfolio analysis: Sorting by half-*NPI* measure for bad news days.

At the end of each month, all common stocks (share code 10 and 11) in NYSE and AMEX are sorted into decile portfolios based on the NPI^{BN} which denotes half-*NPI* measure for bad news days. Panel A reports the average value of the natural logarithm of the firm's market value and book-to-market ratio, market beta, and NPI^{BN} for each decile portfolio. Panel B and C report equal- and value-weighted monthly returns and alphas of the decile portfolios, respectively. "Low-High" column denotes the average raw returns and alphas of the zero-investment portfolio. The alphas are estimated as intercepts from the regressions of excess portfolio returns on the Fama-French three factors (FF alpha), on the Fama-French three factors with the momentum factor (Carhart alpha), and on the Carhart four factors with the Pastor and Stambaugh (2003) liquidity factor (PS alaph). The samples cover the period from 1981 to 2015. The Newey-West (1987) t-statistics with six-lags are in parentheses.

	Decile Portfolio										
	1(Low)	2	3	4	5	6	7	8	9	10(High)	High -Low
	A. Portfolio Characteristics										
NPI^{BN}	-0.558	-0.107	-0.061	-0.037	-0.026	-0.003	0.041	0.159	0.534	4.910	
Size	15.061	16.155	16.519	16.519	16.266	15.889	15.529	15.322	15.080	13.476	
BTM	-0.212	-0.272	-0.351	-0.377	-0.378	-0.298	-0.147	-0.110	-0.039	-0.208	
Beta	1.093	1.137	1.133	1.119	1.114	1.105	1.054	1.083	1.074	1.037	
	B. Equal-weighted Portfolio return and alpha										
Return	0.803	1.081	1.091	1.022	1.104	1.057	1.197	1.307	1.217	1.420	0.617
	(2.849)	(3.877)	(4.033)	(3.984)	(4.381)	(4.195)	(4.904)	(4.961)	(4.317)	(4.426)	(3.247)
FF alpha	-0.454	-0.198	-0.156	-0.186	-0.075	-0.123	0.013	0.072	0.017	0.303	0.757
	(-3.558)	(-1.887)	(-1.499)	(-1.870)	(-0.816)	(-1.347)	(0.160)	(0.751)	(0.145)	(1.474)	(4.470)
Carhart alpha	-0.230	0.013	0.005	-0.079	0.016	-0.039	0.081	0.234	0.228	0.586	0.816
	(-1.668)	(0.148)	(0.0554)	(-0.883)	(0.188)	(-0.391)	(0.950)	(2.381)	(1.963)	(2.841)	(4.354)
PS alpha	-0.230	0.012	0.004	-0.080	0.016	-0.040	0.080	0.235	0.228	0.586	0.816
	(-1.660)	(0.134)	(0.040)	(-0.888)	(0.177)	(-0.395)	(0.933)	(2.377)	(1.951)	(2.826)	(4.339)
	C. Value-weighted Portfolio return and alpha										
Return	0.289	0.395	0.422	0.417	0.489	0.396	0.401	0.422	0.581	0.493	0.204
	(2.612)	(3.614)	(3.998)	(3.877)	(4.839)	(3.809)	(4.140)	(4.164)	(5.485)	(4.691)	(2.321)
FF alpha	-0.378	-0.284	-0.250	-0.267	-0.167	-0.268	-0.273	-0.237	-0.071	-0.172	0.206
	(-5.965)	(-6.456)	(-6.706)	(-7.075)	(-4.055)	(-5.845)	(-5.831)	(-4.538)	(-0.992)	(-2.005)	(2.294)
Carhart alpha	-0.391	-0.277	-0.244	-0.257	-0.177	-0.276	-0.250	-0.249	-0.052	-0.153	0.238
	(-5.638)	(-5.879)	(-6.428)	(-6.604)	(-3.759)	(-5.740)	(-4.978)	(-4.607)	(-0.777)	(-1.945)	(2.690)
PS alpha	-0.391	-0.278	-0.244	-0.257	-0.178	-0.277	-0.250	-0.248	-0.052	-0.153	0.238
	(-5.622)	(-5.920)	(-6.433)	(-6.554)	(-3.738)	(-5.840)	(-5.016)	(-4.590)	(-0.779)	(-1.940)	(2.687)

Table 9.

Portfolio analysis: Dependently double sorted by half-*NPI* measure for bad news days and control variables.

At the end of each month, all common stocks (share code 10 and 11) in NYSE and AMEX are sorted into tercile portfolios based on the control variables, and then within each control variable, stocks are sorted again into decile portfolio based on the NPI^{BN} which denotes half-*NPI* measure for bad news days. The alphas of the five-factor model suggested by Pastor and Stambaugh (2003) are reported in the table. The NPI^{BN} decile portfolios that are averaged across the tercile portfolios sorted by control variables are regressed on the five-factor model. “Low-High” column denotes the average raw returns and alphas of the zero-investment portfolio. Panel A and B report the estimated alphas for equal- and value-weighted portfolio case, respectively. *ME* denotes firm’s market value and *BTM* represents the book-to-market ratio. *A* denotes the turnover-version Amihud illiquidity measure, and *Turnover* represents share turnover. *Amihud* is the original Amihud (2002) illiquidity measure. The samples cover the period from 1981 to 2015. The Newey-West (1987) t-statistics with six-lags are in parentheses.

	Decile Portfolio										
	1(Low)	2	3	4	5	6	7	8	9	10(High)	High -Low
	A. Equal-weighted Portfolio: five-factor model alpha										
ME	-0.165	-0.018	0.063	0.037	0.157	0.044	0.186	0.202	0.198	0.352	0.517
	(-1.677)	(-0.153)	(0.580)	(0.329)	(1.480)	(0.427)	(1.615)	(1.911)	(1.934)	(2.719)	(4.041)
BTM	-0.122	0.054	0.065	-0.015	0.100	0.107	0.086	0.226	0.173	0.591	0.713
	(-0.907)	(0.504)	(0.642)	(-0.177)	(1.064)	(0.999)	(1.013)	(2.122)	(1.422)	(2.725)	(3.985)
A	-0.049	-0.042	-0.064	-0.012	0.040	0.088	0.101	0.167	0.204	0.502	0.550
	(-0.449)	(-0.386)	(-0.643)	(-0.113)	(0.470)	(0.823)	(0.975)	(1.599)	(1.763)	(3.568)	(4.014)
Turnover	-0.136	-0.111	-0.018	-0.006	0.028	-0.006	0.032	0.176	0.212	0.726	0.862
	(-1.043)	(-1.080)	(-0.185)	(-0.0679)	(0.318)	(-0.0707)	(0.328)	(1.504)	(1.649)	(3.479)	(4.094)
Amihud	-0.088	-0.075	0.059	0.011	0.122	0.116	0.219	0.167	0.147	0.321	0.409
	(-0.990)	(-0.681)	(0.498)	(0.0917)	(1.241)	(1.034)	(2.039)	(1.668)	(1.450)	(2.693)	(3.358)
	B. Value-weighted Portfolio: five-factor model alpha										
ME	-0.430	-0.330	-0.300	-0.332	-0.226	-0.310	-0.287	-0.274	-0.289	-0.266	0.163
	(-7.659)	(-5.887)	(-6.079)	(-6.022)	(-4.091)	(-6.013)	(-5.198)	(-5.291)	(-5.371)	(-4.366)	(2.558)
BTM	-0.393	-0.276	-0.227	-0.276	-0.209	-0.175	-0.247	-0.294	-0.217	-0.191	0.203
	(-6.138)	(-5.608)	(-5.103)	(-6.998)	(-4.587)	(-3.514)	(-5.359)	(-5.482)	(-3.626)	(-2.641)	(2.441)
A	-0.385	-0.246	-0.289	-0.294	-0.307	-0.183	-0.325	-0.265	-0.257	-0.196	0.189
	(-8.009)	(-4.569)	(-5.998)	(-6.324)	(-7.091)	(-2.941)	(-7.152)	(-5.524)	(-5.588)	(-3.583)	(3.015)
Turnover	-0.449	-0.341	-0.269	-0.250	-0.241	-0.196	-0.310	-0.215	-0.287	-0.237	0.212
	(-8.479)	(-6.694)	(-5.359)	(-6.351)	(-6.002)	(-3.570)	(-6.174)	(-4.439)	(-4.515)	(-3.671)	(2.768)
Amihud	-0.373	-0.340	-0.294	-0.334	-0.246	-0.264	-0.252	-0.263	-0.282	-0.251	0.122
	(-8.245)	(-6.382)	(-5.331)	(-6.011)	(-4.999)	(-4.471)	(-4.469)	(-5.010)	(-5.666)	(-4.577)	(2.208)

Table 10.
Sub-period analysis

At the end of each month, all common stocks (share code 10 and 11) in NYSE and AMEX are sorted into decile portfolios based on the NPI^{BN} which denotes half-*NPI* measure for bad news days. Sub-period 1 covers the period from January 1981 to December 1999, and sub-period 2 covers the period from Jan 2000 to December 2015. "Low-High" column denotes the average raw returns and alphas of the zero-investment portfolio. Panel A and B report equal- and value-weighted monthly returns and alphas of the decile portfolios, respectively. The alphas are estimated as intercepts from the regressions of excess portfolio returns on the Fama-French three factors (FF alpha), on the Fama-French three factors with the momentum factor (Carhart alpha), and on the Carhart four factors with the Pastor and Stambaugh (2003) liquidity factor (PS alaph). The samples cover the period from 1981 to 2015. The Newey-West (1987) t-statistics with six-lags are in parentheses.

	Decile Portfolio										
	1(Low)	2	3	4	5	6	7	8	9	10(High)	High -Low
	A. Equal-weighted Portfolio return and alpha										
	A-1. Jan. 1981–Dec. 1999										
Return	0.916	1.073	1.203	1.205	1.234	1.204	1.310	1.361	1.291	1.447	0.530
	(2.820)	(3.188)	(3.495)	(3.646)	(3.746)	(3.783)	(4.459)	(4.222)	(3.549)	(3.151)	(1.940)
FF model	-0.531	-0.434	-0.334	-0.339	-0.275	-0.256	-0.107	-0.094	-0.183	-0.098	0.433
	(-3.902)	(-2.899)	(-2.371)	(-2.534)	(-2.299)	(-2.777)	(-0.926)	(-0.699)	(-1.209)	(-0.366)	(1.846)
Carhart model	-0.358	-0.179	-0.099	-0.165	-0.103	-0.168	-0.073	0.047	0.046	0.180	0.538
	(-3.430)	(-1.967)	(-0.947)	(-1.742)	(-1.480)	(-1.949)	(-0.795)	(0.445)	(0.312)	(0.662)	(2.113)
PS Model	-0.36	-0.182	-0.102	-0.168	-0.105	-0.17	-0.074	0.046	0.045	0.185	0.545
	(-3.560)	(-2.068)	(-1.006)	(-1.864)	(-1.517)	(-2.046)	(-0.814)	(0.443)	(0.307)	(0.660)	(2.099)
	A-2. Jan. 2000–Dec. 2015										
Return	0.668	1.090	0.957	0.804	0.950	0.882	1.064	1.243	1.128	1.388	0.720
	(1.387)	(2.361)	(2.234)	(2.004)	(2.441)	(2.196)	(2.627)	(2.879)	(2.559)	(3.133)	(2.765)
FF model	-0.197	0.255	0.179	0.076	0.225	0.128	0.248	0.380	0.335	0.709	0.906
	(-0.803)	(1.590)	(1.233)	(0.526)	(1.570)	(0.746)	(2.028)	(2.575)	(1.763)	(2.175)	(4.046)
Carhart model	-0.083	0.347	0.248	0.122	0.263	0.171	0.284	0.464	0.432	0.850	0.933
	(-0.370)	(2.635)	(1.990)	(0.904)	(1.872)	(1.066)	(2.311)	(3.573)	(2.766)	(2.950)	(3.942)
PS Model	-0.083	0.347	0.248	0.122	0.263	0.171	0.284	0.464	0.432	0.851	0.934
	(-0.369)	(2.595)	(1.940)	(0.899)	(1.848)	(1.049)	(2.292)	(3.610)	(2.774)	(2.944)	(3.958)
	B. Value-weighted Portfolio return and alpha										
	B-1. Jan. 1981–Dec. 1999										
Return	0.463	0.652	0.617	0.622	0.666	0.609	0.536	0.590	0.657	0.534	0.071
	(2.913)	(3.987)	(4.073)	(4.143)	(4.473)	(4.179)	(4.395)	(4.232)	(4.556)	(3.588)	(0.639)
FF model	-0.548	-0.362	-0.386	-0.383	-0.338	-0.383	-0.391	-0.372	-0.283	-0.407	0.141
	(-7.677)	(-5.079)	(-7.240)	(-8.245)	(-8.376)	(-7.191)	(-6.265)	(-5.034)	(-3.096)	(-3.952)	(1.096)
Carhart model	-0.576	-0.301	-0.344	-0.379	-0.326	-0.381	-0.381	-0.392	-0.261	-0.354	0.222
	(-7.715)	(-4.845)	(-6.795)	(-7.945)	(-7.212)	(-6.375)	(-6.281)	(-5.258)	(-3.095)	(-3.366)	(1.616)
PS Model	-0.578	-0.302	-0.345	-0.380	-0.328	-0.383	-0.382	-0.393	-0.263	-0.354	0.224
	(-7.896)	(-4.970)	(-6.989)	(-8.329)	(-7.720)	(-6.743)	(-6.620)	(-5.274)	(-3.122)	(-3.335)	(1.649)
	B-2. Jan. 2000–Dec. 2015										
Return	0.133	0.097	0.193	0.203	0.317	0.174	0.244	0.236	0.508	0.448	0.315
	(0.794)	(0.613)	(1.192)	(1.184)	(2.109)	(1.065)	(1.458)	(1.454)	(2.901)	(2.689)	(2.027)
FF model	-0.192	-0.206	-0.091	-0.126	0.001	-0.138	-0.088	-0.068	0.235	0.101	0.293
	(-2.331)	(-3.940)	(-2.444)	(-2.357)	-0.011	(-2.081)	(-1.530)	(-1.117)	(2.727)	(1.014)	(2.377)
Carhart model	-0.192	-0.205	-0.094	-0.119	-0.002	-0.142	-0.081	-0.078	0.235	0.107	0.299
	(-2.254)	(-3.792)	(-2.406)	(-2.128)	(-0.034)	(-2.076)	(-1.309)	(-1.209)	(2.731)	(1.098)	(2.459)
PS Model	-0.192	-0.205	-0.094	-0.119	-0.002	-0.142	-0.081	-0.078	0.234	0.107	0.299
	(-2.246)	(-3.730)	(-2.402)	(-2.112)	(-0.032)	(-2.086)	(-1.307)	(-1.233)	(2.732)	(1.096)	(2.450)