

Comments Welcome

Clientele Change, Liquidity Shock, and the Return on Financially Distressed Stocks

Zhi Da and Pengjie Gao*
Kellogg School of Management
Northwestern University

This Draft: January 18, 2006

ABSTRACT

We provide empirical evidence supporting the view that a sharp rise in a firm's default likelihood causes a change in its shareholder clientele: mutual funds decrease their holdings of the firm's share, trading volume and cost increase, and the order imbalance measure indicates large selling pressure. The liquidity risk of the stock as measured by its exposure to the Pástor and Stambaugh (2003) liquidity factor rises. Liquidity risk of the stock returns to normal in the subsequent month and the stock price recovers. Such price recovery explains the first-month abnormal high return earned by stocks with high default likelihood documented in Vassalou and Xing (2004). The abnormal high return is mostly reward for providing liquidity when it is most needed.

*Correspondence: Finance Department, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Evanston IL 60208. E-mail: z-da@kellogg.northwestern.edu and p-gao@kellogg.northwestern.edu. We are grateful to Nicholas Barberis, Hank Bessembinder, Kent Daniel, Darrell Duffie, Steve Hillegeist, Ivalina Kalcheva, Leonid Kogan, Bob Korajczyk, Mitchell Peterson, Christopher Polk, Todd Pulvino, Ernst Schaumburg, Michael Schill (FMA discussant), S. "Vish" Viswanathan and seminar participants at Northwestern University, FMA 2005 annual meeting and Lehman Brothers for their helpful comments. We thank Ravi Jagannathan for his continuous guidance and support. We also thank Tarun Chordia, Ken French, Ľuboš Pástor, and Maria Vassalou for making their data available to us. We are responsible for all remaining errors.

In a recent paper, Vassalou and Xing (2004) show that stocks more likely to default earn a higher return than otherwise similar stocks during the first month after they enter the highest default-risk portfolio. Since defaults are more likely to occur during economic downturns, default risk is likely to contain a nondiversifiable component, therefore requiring a risk premium. However, the magnitude of the risk premium appears rather large – the stocks in the highest default risk decile constructed by Vassalou and Xing(2004) earn about 90 basis points more per month than otherwise similar stocks, with an associated monthly Sharpe ratio of around 0.25 during the period from 1970 to 1999.¹ As Hansen and Jagannathan (1991), and MacKinlay (1995) point out, such high Sharpe ratio can not be easily explained within the “perfect and complete markets” paradigm.

In this paper we argue that a sharp rise in a firm’s exposure to default risk, as measured by the Default Likelihood Indicator (DLI) as in Vassalou and Xing (2004), also triggers a clientele change in its underlying stockholders. It is well recognized in the literature that the downgrading of a bond can cause a change in the underlying clientele for that bond. For example, when the rating of a bond falls below investment grade, some institutions that hold the bonds are required to sell it. We believe that a similar clientele change occurs for the stock of a firm that experiences a sharp rise in probability of financial distress. Institutional investors are often restricted to invest in stocks that are liquid, with considerable market capitalizations and stable dividend payouts (c.f. Almazan, Brown, Carlson and Chapman, 2004). A stock is less likely to satisfy these requirements when its default likelihood goes up, a fact that will trigger selling amongst institutional investors who currently hold such a stock. We find that mutual funds significantly decrease their holdings of stocks of firms that experience a sharp rise in their default likelihood measures, which is consistent with this view.

A sudden change in the clientele for a stock is likely to trigger selling by one group of investors with no simultaneous increase in the demand from ready buyers to take the other side, resulting in a liquidity shock. In such situations, market makers will have to step in to take the other side and provide liquidity. A substantial price concession may have to be offered to the market makers for providing immediacy in those situations.² The price will bounce back once outside investors recognize the opportunity and move their capital to that stock. However, as Berndt, Douglas, Duffie, Ferguson and Schranzk (2005) point out, flow of capital to the new investment opportunity will take some time. As expected, the liquidity risk of the stock changes during such liquidity shock. We find that the initial price concession and subsequent price recovery for the stock also coincides well with changes in its liquidity risk as measured by its exposure to the Pástor and Stambaugh (2003) liquidity factor. The Pástor and Stambaugh (2003) liquidity factor is particularly relevant here as it captures both lower frequency (monthly) and higher frequency (daily) liquidity effects.

¹During the same period, the momentum portfolio earns about 90 basis points per month with a monthly Sharpe ratio of 0.26; the value/growth strategy earns about 35 basis points with a monthly Sharpe ratio of 0.13. These numbers are computed based on the UMD and HML factors from Ken French’s website.

²This price concession is in addition to the drop in the stock’s fundamental value caused by the increase in default risk.

We argue that such price recovery explains a large part of the high return on financially distressed stocks documented in Vassalou and Xing(2004).

The existence of “dividend clientele” is well documented in the literature.³ The case of Florida Power and Light Company (FPL) nicely illustrates of the existence of dividend clientele: a change in dividend policy of the firm causes the clientele holding the stock to sell, resulting in a large temporary price drop.^{4,5} Our empirical findings support the view that there are also clientele changes for stocks of financially distressed firms. A sharp rise in the probability of financial distress triggers selling by the clientele holding the stock, resulting in a large price drop followed by a corresponding large positive return when the stock price recovers.

While a stock may experience a sharp change in its exposure to economy-wide, pervasive risk, any such change is likely to persist for a while.⁶ In contrast, we find that most of the high returns on stocks that experience sharp increases in their default likelihood measures accrue during the first month following portfolio formation, but little during the months afterwards. Further, various characteristics of those stocks, such as size, book-to-market ratios and default likelihood, hardly change from the first- to the second-month since portfolio formation. Such return pattern supports our view that the first-month high return to stocks that experience a large increase in their default likelihood measure is reward to those who provide liquidity in the market for those stocks when it is most needed. In addition, we also find that:

- Those stocks experience significant increases in their trading volumes and trading costs around portfolio formation dates;
- Trading in those stocks are more likely to be seller-initiated during the portfolio formation month when prices are depressed, but are more likely to be buyer-initiated during the month after as prices recover;
- The stock’s exposure to the Pastor and Stambaugh (2003) liquidity factor increases significantly during the portfolio formation month, coinciding with the price concession. The

³See Jagannathan and Boyd (1994), Allen and Michaely (2002) and the references therein. More recently, Grinstein and Michaely (2005) show that Institutional investors avoid firms that do not pay dividends and Garham and Kumar (2005) show that dividend clientele also exists among individual investors.

⁴We are grateful to S. Viswanathan for bringing this example to our attention. Soter, Brigham and Evanson (1996) present an interesting case study of the sudden dividend cut of FPL, the first ever dividend cut by a healthy utility company with a 46-year history of increasing dividend payout. They suggest that the massive selling by one group of current shareholders induces significant price drop (18% - 20%). This group of shareholders are likely to be “older people who depend heavily on dividends for income and they are largely passive investors concerned mostly with cashing dividend checks.” (New York Times, May 12, 1994) Subsequently, “value-based” bargain hunters (large and sophisticated investors) are attracted (institutional ownership increases from 34% at the end of 1993 to 47% at the end of 1995), and price recovered (on May 31, the price of FPL closed 1% higher than the pre-announcement period price).

⁵Brav and Heaton (1998) also document that many institutional investors stop holding stocks that omit dividends in the post-ERISA period when private pension fund managers are subject to a more strict “prudent man” rule.

⁶For example, Jagannathan and Wang (1996) examine changes in systematic risk that takes place at business cycle frequencies.

exposure then returns to its normal level during the month after, coinciding with the price recovery.

- Past return and its interaction with a liquidity measure (Amihud 2002) drive out DLI in predicting the next-month stock (risk adjusted) returns.

All these observations support our view that a sharp rise in the default likelihood measure of a stock triggers a change in its clientele, which generates a liquidity shock and a temporary price concession, and the subsequent price recovery leads to a higher return on the stock.⁷

Our findings add to the growing literature documenting the significant reward for liquidity provision in equity and bond markets. For example, Keim and Madhavan (1996) find that the counter party of a block trade will be compensated for providing liquidity. Coval and Stafford (2005) show that investors who trade against mutual funds during equity fire sales earn significant returns for providing liquidity when few others are willing or able. Da and Schaumburg (2005) show that the profit to a trading strategy that exploits the temporary divergence between price and fundamental measured using equity analysts' target prices is likely to contain rewards for liquidity provision. The temporary liquidity shock has also been analyzed theoretically in the model of Campbell, Grossman, and Wang (1993), and investigated empirically by Conrad, Hameed and Niden (1994) and Avramov, Chordia and Goyal (2005) most recently. In this paper, we show that such liquidity shock can also help to explain the first month high return on financially distressed stocks. Of even more interest, we provide supporting evidence that such liquidity shock is likely to be a result of a clientele change when the stock becomes financially distressed. Here, we want to draw a conceptual distinction between the *liquidity shock* and the commonly studied *liquidity risk*: the impact of the liquidity shock is usually temporary but the impact of liquidity risk is permanent because it carries a risk premium.⁸ The high return on financially distressed stocks is primarily a result of the liquidity shock since it accrues only during the first month after portfolio formation. However, as one would expect, *liquidity shock* and *liquidity risk* are related empirically. We find that a stock does load more on Pastor and Stambaugh's (2003) aggregate liquidity factor during

⁷The trading of Midway Airlines (ticker = MDW) during July 9 to Aug 10, 1990 plotted in Figure 1 seems to be consistent with our view. Midway Airlines experienced a large increase in its default likelihood during July: the DLI increased from 0.21 at the end of June to 0.49 at the end of July. The increase in DLI was mainly driven by two events: a potential downgrade of the company's preferred stock by S&P announced on July 10 and a large quarterly loss of \$11 million dollars announced on July 26. The price of the stock was depressed from \$7.875 on July 9 to \$6.75 on July 30 accompanied with heavy selling (the order imbalance measures were mostly negative). The price then recovered during Aug as more buyers came into the market (the order imbalance measure became positive). In addition, mutual funds, as a group, decrease their holdings of MDW from 2.4% to 0.6% from June to Sep, indicating a clientele change on its shareholders.

⁸Acharya and Pedersen (2005) decompose the *liquidity risk* premium on individual stocks into four parts: (1) the part due to the level of stock liquidity (c.f. Amihud and Mendelson (1986), Amihud (2002), Chordia, Subrahmanyam, and Anshuman (2001), Breen, Hodrick, and Korajczyk (2002) and Bekaert, Harvey, and Lundblad (2003)), (2) the part due to the covariance between the stock return and the aggregate liquidity in the economy (c.f. Chordia, Roll, and Subrahmanyam (2001), Pástor and Stambaugh (2003), Acharya and Pedersen (2005)), (3) the part due to commonality in liquidity among stocks (c.f. Chordia, Roll, and Subrahmanyam (2000), Hasbrouck and Seppi (2001) and Huberman and Halka (2001)), and (4) the part due to the covariance between the level of stock liquidity and the market return.

the liquidity shock and the liquidity factor loading (or the liquidity beta) returns to its normal level soon afterwards.

Our findings also contribute to another growing literature that examines the relationship between default risk and stock returns by zooming in on the role of liquidity shock. Whether default risk is an economy wide risk factor is one of the fundamental questions in financial economics. Vassalou and Xing (2004) are among the first to analyze the relationship between stock returns and default risk. They ingeniously isolate stocks having greater default risk exposure and find that they earn a higher return during the first month after portfolio formation – too high to be explained by the Fama-French three factor model (1993), which seems to indicate the need for default risk as an additional risk factor. Recent studies by Campbell, Hilscher and Szilagyi (2005), and Garlappi, Shu and Yan (2005), however, find that higher default risk does not necessarily lead to a higher stock return. These two seemingly contradictory sets of results could be reconciled by the liquidity shock we have identified for the financially distressed stock. The short-term liquidity-induced price reversal plays a very little role in the latter papers, as Campbell, Hilscher and Szilagyi (2005) specifically examine annual return and Garlappi, Shu and Yan (2005) have explicitly excluded the very illiquid stocks. Consistent with the results in the latter papers, we show that the impact of default risk on stock returns is significantly reduced if second-month returns are used in various asset pricing tests. Therefore, insisting on the necessity of a separate aggregate default risk factor in reduced form asset pricing models may be premature.

Although our initial motivation was to explain the high return earned by financially distressed stocks, our findings will be of interest to a wider audience. The fact that there is a clientele change for a stock that experiences a sharp rise in DLI is interesting by itself. More generally, we highlight another channel where changes in stock characteristics can affect short-term stock returns: the change in stock characteristic could trigger a clientele change in the stock’s shareholders, resulting in a temporary liquidity shock which generates short-run return reversal. Finally, we provide an interesting example in which the liquidity beta of a stock changes in a systematic fashion around certain events. Although the change in liquidity beta is perfectly consistent with the price movement around the event, the aggregate liquidity factor may be insignificant in a standard cross sectional asset pricing test using event-window returns. In other words, it is very important to account for the time-varying nature of the liquidity risk.

The remainder of the paper is organized as follows: Section I briefly reviews various proxies for default and financial distress risk, the Default Likelihood measure (DLI) proposed by Vassalou and Xing (2004) in particular, and discuss how leverage, past return and asset volatility collectively contribute to the cross-sectional variation of DLI. Section II provides evidence that a sharp increase in DLI is likely to trigger a clientele change and leads to a temporary price concession and the later price recovery contributes to the high returns on financially distressed stocks during the first month after portfolio formation. Section III examines the returns on financially distressed stocks over longer horizon and shows that financially distressed stocks do not earn significantly higher

returns during the second month after portfolio formation and thereafter and the impact of default risk on stock returns is significantly reduced if second-month returns are used; Section IV concludes with a brief summary.

I. An Anatomy of the Default Likelihood Measure

Previous researchers have identified characteristics that are associated with default or financial distress risk. The most direct measure is financial leverage. A long thread of literature on bankruptcy predictions has consistently found that financial leverage is both economically and statistically significant in predicting the likelihood of bankruptcy, which can be viewed as indirect evidence that financial leverage is related to default risk.⁹ Andrade and Kaplan (1998) show that high leverage is the primary cause of distress. Both systematic and idiosyncratic risk increases with financial leverage, *ceteris paribus*, and increases in such risk would be associated with an increase in expected return. Black (1976) points out this “leverage effect” and Bhandari (1988) finds the expected stock returns are indeed positively related to debt-to-equity ratio, even after controlling for beta and size.

B/M is also believed to be associated with default or financial distress risk. According to Fama and French (1992): “A high B/M says that the market judges the prospects of a firm to be poor relative to firms with low B/M. Thus B/M may capture the relative-distress effect.” Indeed, Fama and French (1995) show that firms with high B/M have persistently low earnings, higher financial leverage, more earning uncertainty, and are more likely to cut dividends as compared to low B/M firms. Since $\log B/M$ can also be expressed as the difference between \log market leverage and \log book leverage, Fama and French interpret B/M as an “involuntary leverage effect”. Since small firms are more prone to default, size is also believed to be associated with distress as in Chan and Chen (1991). Other researchers use only accounting bankruptcy measures for distress risk, for instance, O-score and Z-score in Dichev (1998).¹⁰

A common criticism against using accounting measures argues that the accounting information can only be updated at a lower frequency. To accommodate this problem, Vassalou and Xing (2004) estimate a default likelihood indicator (DLI) within the Black and Scholes (1973) and Merton’s (1974) framework for each firm as:

$$DLI = N(-DD) = N\left(-\frac{\ln(V_A/X) + (\mu - \frac{1}{2}\sigma_A^2)T}{\sigma_A\sqrt{T}}\right), \quad (1)$$

where $N(\cdot)$ is the normal distribution’s cumulative density function; X and T are the face value and the maturity of the firm’s debt, respectively; V_A is the value of the firm’s assets; μ and σ_A are the instantaneous drift and volatility of the firm’s assets, respectively. V_A , μ and σ_A are estimated iteratively using daily stock returns of the past year. Vassalou and Xing (2004) are

⁹For an example of a more comprehensive survey on this topic, please refer to Shumway (2001).

¹⁰See Ohlson (1980) and Altman (1968) for O-score and Z-score, respectively.

also among the first to analyze the relationship between default risk and equity return. They find: (1) both size and B/M effect can be viewed as default effects, (2) stocks with high DLI (usually also with small size and high book-to-market ratio) have very high returns during the first month immediately after the portfolio formation. and (3) the change in aggregate DLI (denoted by dSV) is priced in cross-sectional stock returns even with the presence of Fama and French’s three factors. The main advantage to using DLI is that it works from market price information that is updated more frequently than credit rating and other accounting default measures, so it is potentially a better measure for predicting bankruptcy. Vassalou and Xing (2004) show that DLI predicts actual defaults well, and Vassalou and Xing (2003 and 2005) demonstrate that changes in DLI capture default risk over time better than credit rating upgrading or downgrading. Hillegeist, Keating, Cram and Lundstedt (2004) compare a slightly modified version of DLI against traditional accounting measures: the Z-score and O-score, and find DLI to provide more information on the probability of default than these two accounting measures. For this reason, we decide to use DLI as our default risk measure in this paper.

To compute DLI, Vassalou and Xing (2004) use three economically sensible inputs: V_A/X , μ and σ_A . Empirically, μ is computed as mean of changes in $\ln V_A$ and is closely related to stock returns (ret).¹¹ V_A/X is closely related to financial leverage ($lev = D/E$), as $V_A/X \simeq 1 + 1/lev$. Finally, σ_A measures the volatility of the assets over the return estimation horizon, which cannot be directly observed but must be estimated using the return and firm asset value; σ_A , then, is also closely related to the stock return volatility.¹² In summary, DLI can be thought of as an “all-in-one” measure, defined as a nonlinear transformation of leverage with two additional variables, i.e., $DLI = f(lev, ret, \sigma_A)$. To better understand DLI, we can look at the relative importance of these three variables. For this purpose, we carry out a variance decomposition exercise similar to those studied in Vuolteenaho (2002), and Cohen, Polk and Vuolteenaho (2003). The details are provided in the Appendix. In a nutshell, the variance decomposition delineates how much the cross-sectional variations of the DLI can be attributed to the cross-sectional variations of the three variables.

Insert Table I about here

Several observations emerge from the variance-decomposition results in Table I. First, financial leverage contributes to approximately 50 percent of the cross-sectional variation of DLI, regardless whether we focus on the whole sample or the subsample of firms with high DLIs. Consistent with prior empirical evidence in Altman (1968) and Shumway (2000), among others, financial leverage is the most salient proxy for default or financial distress risk. Second, Vassalou and Xing highlights the importance of firm level volatility as a determinant of default risk. We find even though asset volatility contributes modestly (around 20 percent) to the cross-sectional variations in DLI of the

¹¹To be more precise, $\mu_E - r = \frac{\partial E}{\partial V} \frac{V}{E} (\mu - r)$ where E denotes equity value and μ_E denotes equity return and $\frac{\partial E}{\partial V}$ measures the sensitivity of equity value with respect to the underlying asset value V .

¹²To be precise, $\sigma_E = \frac{\partial E}{\partial V} \sigma_A$ where σ_E measures the stock return volatility.

overall sample, its contribution in the high DLI subsample (the sample of interests for this paper) is much less. In the top one-third of the sample (as in Panel B) with the highest DLI, it only contributes about 7 percent, while in the top DLI quintile (as in Panel C), it contributes less than 4 percent. Third, past returns contribute the lion’s share to the cross-sectional variation of DLI. In the overall sample, it contribute about 17 percent; but in the top one-third and one-fifth of the sample (the high DLI samples), it contributes 32 percent and 34 percent, respectively. The fact that past return is such an important determinant of DLI, especially for high DLI stocks, help to relate the high first month return of default risk stock to previous literature on return reversal. In the literature of short-term return reversal, past losers tend to demonstrate strong return reversal during the first month after portfolio formation (c.f. Jegadeesh (1990), Lehman (1990), Jegadeesh and Titman (1995), and Bessembinder and Hertznel (1993) in which they show significant negative autocorrelations in returns at various frequencies). In the remainder of the paper, we verify that the return of the highest-DLI stock decile displays a short-term return reversal pattern, likely driven by a liquidity shock due to a clientele change. This observation accords well to the general findings in Avramov, Chordia and Goyal (2005), who show that temporary price pressure on illiquid stocks help to explain the short-run return reversal.

II. Clientele Change and First-month Returns on Financially Distressed Stocks

Our variance decomposition exercise shows that past return contributes substantially to high DLI. Since past return is negatively related to DLI, we expect high DLI stocks to be past losers. To confirm this, we sort all stocks¹³ into ten deciles according to the DLI measures at the end of every month and compute the equally-weighted¹⁴ average return during the portfolio formation month for each decile. As the default likelihood is directly related to actual default and delisting from major exchanges, delisting returns deserve careful handling in our empirical exercise. Shumway (1997), and Shumway and Warther (1999) meticulously examine the delisting returns in CRSP and explore their empirical implications with regards to some well-known “anomalies”. They suggest assigning -0.30 and -0.55 to performance related delistings of NYSE and NASDAQ stocks, respectively. These two delisting returns are widely used in subsequent literature. Nevertheless, such numbers are slightly outdated, considering the recent completion of a historical project in delisting returns, as shown in CRSP white paper (2001). We will take a different approach.¹⁵ If delisting returns are available from CRSP, we use CRSP delisting returns in our calculation. Otherwise, in line with Shumway (1997), and Shumway and Warther (1999), we recompute the average delisting

¹³The leverage ratios of financial firms are usually high due to the nature of their business, which leads to higher DLI measures but do not necessarily reflect high default risk. For this reason, financial firms are often excluded as in Garlappi, Shu and Yan (2005). The results in this paper are qualitatively similar if we exclude financial firms as reported in an earlier version of the paper.

¹⁴We use equally-weighted returns throughout the paper so our results are comparable to those in Vassalou and Xing (2004).

¹⁵We thank Jim Christopher at CRSP for helpful insights on delisting returns in CRSP stock files, and handling of delisting returns.

returns based on the nature of delisting, as identified by the CRSP delisting code.¹⁶ The results are provided in Table II, Panel A .

Insert Table II about here

The results confirm that in general there is indeed a negative relationship between DLI and past return. In particular, stocks in the highest DLI decile earn an average return of -3.58% during the portfolio formation month; They are clearly recent losers. They also earn the highest return (2.1%) during the first month after portfolio formation. This return pattern is consistent with the short-term return reversal previously documented in the literature.¹⁷

Panel B of Table II displays the probability transition matrix of a stock moving from DLI decile i during the month immediately prior to the portfolio formation month ($t-1$), to DLI decile j during the portfolio formation month (t). All probabilities in the same row should therefore add up to 1. As shown in the last column, about 17% of the stocks in the highest-DLI portfolio migrated from other deciles and are associated with larger increases in DLI. These stocks display more pronounced return reversal patterns. On average, they suffer a larger return loss during the portfolio formation month (as in the last column of Panel C) and have higher positive returns during the month after (as in the last column of Panel D).¹⁸

Insert Table III about here

Table III also documents various characteristics of the 10 DLI-sorted portfolios. Consistent with Vassalou and Xing (2004), the highest-DLI stocks are associated with the smallest size and highest book-to-market ratios. Not surprisingly, high DLI stocks also trade at low prices. In fact, both mean and median price decreases monotonically with DLI. The highest DLI stocks trade at a mean of \$3.58 and a median of only \$2.37.¹⁹ Seguin and Smoller (1997) also find that “penny stocks” (by definition those less than three dollars) listed on NASDAQ are more likely to be delisted for distress related reasons. This is consistent with our finding that a high-DLI stock is associated with low trading price. The low trading price makes the percentage transaction cost much higher

¹⁶The average of delisting returns based on the nature of delisting are available from the author upon request. As a further robustness check, we rerun our empirical exercises using the delisting return suggested by Shumway (1997), and Vincent and Shumway (1999), or simply assigning the delisting return as -1 , and the results are quantitatively similar.

¹⁷Stocks with the lowest DLI also demonstrate some degree of return reversal: they earn a high return of 2.48% during the portfolio formation month and a low return of 1.13% during the following month.

¹⁸A notable exception is a stock that migrates from decile 1 to decile 10 within a month. However, such stocks are too scarce (28 out of almost 900,000 stock/month observation) to let us draw any reliable inference.

¹⁹One common practice in empirical asset pricing studies is to exclude penny stocks in light of liquidity related concerns. However, this practice, in the context of the current paper, amounts to excluding a large number of financially distressed stocks – the subset of stocks we are most interested in. Therefore, as in Vassalou and Xing (2004), we decide not to apply any price filter. Instead we explicitly examine and control for the liquidity effects associated with these stocks. If we exclude stocks traded less than 5 dollars, the highest DLI stocks in the remaining sample do not earn significantly higher returns even during the first month after portfolio formation, consistent with the evidence reported in Garlappi, Shu and Yan (2005).

for financially distressed stocks, thus making them more illiquid at the same time.²⁰ We consider the “illiquidity” measure suggested by Amihud (2002):^{21,22}

$$Amihud_t = \frac{1}{T} \sum_{d=1}^T \frac{|R_{i,t-d}|}{Vol_{i,t-d}}. \quad (2)$$

We average the daily absolute value of the ratio between return and dollar trading volume of individual stocks during the portfolio formation month t to get the Amihud measure for month t – $Amihud_t$. As a robustness check, we also average this ratio across the past 250 trading days to get an alternative Amihud measure – $Amihud(250)_t$. In order to construct the Amihud measure, we use the filtering rules suggested by Amihud (2002), except that we do not exclude NASDAQ stocks and stocks traded at less than five dollars. In particular, we require that individual stocks must be traded on the stock exchanges for at least 200 days. Furthermore, to minimize the influence of special liquidity provisions from the market makers during the IPO process (see Ellis, Michaely and O’Hara, 2000), we exclude the first 250 observations when a firm first enters CRSP in our sample.²³ The illiquidity measures of individual stocks are then equally-weighted to obtain the illiquidity measure at the portfolio level. The results are striking: both versions of Amihud’s illiquidity measures increase almost monotonically with the DLI.²⁴

One particular problem associated with illiquid stocks traded at low prices is that the bid-ask bounce could lead to a non-negligible upward bias in average return computation, as discussed in Blume and Stambaugh (1983) and most recently in Canina, Michaely, Thaler and Womack (1998). A natural question is whether the first-month high return on the highest-DLI stock portfolio is entirely driven by the bias due to the bid-ask bounce. We believe that the answer is NO. Blume and Stambaugh (1983) show that the bias on return per period due to the bid-ask bounce can be

²⁰As in Panel B of Table VI, the percentage bid-ask spread monotonically increases in DLI, and the percentage bid-ask spread for stocks in DLI-decile 10 is at least 8 times higher than that for stocks in DLI-decile 1.

²¹To measure the liquidity effects precisely, we would hope to use some versions of liquidity measures constructed from a market intraday database like ISSM and TAQ. However, these data have relatively, short time horizons. Left with some liquidity measure constructed from daily return and trading volume data, we decide to use the Amihud measure. There are some indirect evidence showing that Amihud illiquidity measure performs remarkably well in capturing the liquidity effect. Lesmond, Ogden and Trzcinka (1999) derive a limited-dependent variable (LDV)-based transaction cost and liquidity measure, and find that such a measure compare favorably to measures constructed from tick-by-tick data. Using data from more than thirty equity markets around the globe, Lesmond (2005) show a high correlation between the Amihud measure and the LDV-based measure, both capturing the underlying liquidity effect well.

²²Pástor and Stambaugh (2003) adjust the liquidity measure by the total market capitalization to account for the increased trading activities over time. Acharya and Pedersen (2005) apply an affine transformation to the original Amihud measure in order to compute a sensible liquidity-adjusted return. Since we focus on the relative liquidity of a stock in a cross-section in which these adjustments have little impact, we decide to work with the original Amihud measure.

²³To assess the robustness of our empirical measures, we also consider a few variants of the above construction: (1) We experiment with excluding the top and bottom 1 percent of the annual observations to mitigate the influence of outliers. (2) We replace the missing value of the daily liquidity measure with concurrent year minimum, mean, median and maximum illiquidity measures. All of the results are quantitatively and qualitatively similar.

²⁴The Amihud measures for NASDAQ stocks are likely to be underestimated due to “double countings” in their reported trading volumes. We verify the positive relation between the Amihud measure and DLI in a subsample of only NYSE/AMEX stocks.

measured by $\left(\frac{P_A - P_B}{P_A + P_B}\right)^2$, where P_A and P_B are bid and ask price, respectively. First, assuming a bid-ask spread of \$0.25 and given an average price of \$3.58 for stocks in the highest-DLI stock portfolio, a rough estimate for the bias is 12 bps = $\left(\frac{0.25}{3.58 \times 2}\right)^2$, which is much smaller than the 90 bp return premium the highest-DLI stocks earn over the stocks in the next highest-DLI decile. Second, we also compute the bias measure for individual stock and average the bias measures first within each DLI decile and then across time. We report the average monthly return bias due to bid-ask bounce for each DLI decile in Panel A of Table III. For this calculation, we again assume a bid-ask spread of \$0.25, which is typically higher than the actual bid-ask spread especially for penny stocks.²⁵ Therefore, the return bias measures we compute are most likely overestimates and can thus serve as an upper bound for the true return bias. For example, Blume and Stambaugh (1993) choose a single day at random - Dec 13, 1973 - and select all NYSE common stocks with bid prices less than \$8. The average bias measure for these 332 stocks is only 5 bps. As expected, the bias increases with DLI. The bias is 54 bps for the highest-DLI decile, which is higher than the rough estimate of 12 bps we calculated earlier using the average price. This is because our assumption on the bid-ask spread generates extremely large bias measure on penny stocks which pulls up the average. However, the difference in the average bias measure between stocks in DLI-decile 10 and stocks in DLI-decile 9 is only 26 bps, again much smaller than their return difference of 90 bps. Finally, as a robustness check, we also compute an alternative return bias measure in a subsample from 1983 to 1999, using the actual quoted spread (quoted ask - quoted bid) from quote data in TAQ (after 1993) and ISSM (before 1993).²⁶ As trade could happen between the quoted bid and quoted ask, the alternative return bias measure is again likely to be overstated.²⁷ The alternative return bias measure is uniformly smaller than the first return bias measure. Again the difference in the average bias measure between stocks in DLI-decile 10 and stocks in DLI-decile 9 (25 bps) is much smaller than their return difference of 90 bps. Therefore, random bounce between bid and ask does not fully explain the first-month high return on the highest-DLI stock portfolio.²⁸

In summary, the highest-DLI stocks are characterized by small market capitalization, high book-to-market ratio, low trading price and low level of liquidity. Institutional investors such as pension funds and mutual funds are often restricted to invest in stocks that are liquid, with considerable market capitalizations and stable dividend payouts (c.f. Almazan, Brown, Carlson and Chapman,

²⁵For a stock with a price less than or equal to \$0.25, the assumption of a \$0.25 bid-ask spread does not make much sense. We therefore assume a bid-ask spread equal to 50% of the trading price for such a stock.

²⁶The sampling period for NYSE stocks is from 1983 to 1999 and the sampling period for NASDAQ stocks is from 1987 to 1999. Because the ISSM data were constructed in early years through data collection from various sources, not all transaction records are in the database. In particular, six months worth of data for NASD stocks from 1987 through 1989 in ISSM are missing.

²⁷For example, floor traders at NYSE can cross the trades by taking the opposite side of the incoming order and execute at the better of bid or ask quotes. It is also possible that large blocks can be executed on the up-stair market.

²⁸It is possible that for stocks in the highest-DLI decile, their prices bounce systematically from bid at the end of portfolio formation month to ask at the end of the first month after. This systematic bid-ask bounce will lead to a much larger first-month return on these stocks. However, such systematic bid-ask bounce is entirely consistent with our explanation. The fact that trade occurs at the bid during portfolio formation indicates large selling pressure after the stock becomes financially distressed. As more buyers come to the market in the next month, trade occurs at the ask.

2004). A financially distressed stock is unlikely to satisfy these restrictions and it is not surprising to observe a clientele change for the stock as the institutional investors sell it from their current holding. Institutional investors may include mutual funds, pension funds and hedge funds, among others. We decide to focus on mutual funds because they have relative regular disclosures as required by SEC.²⁹ It turns out our conjecture about the clientele change is true at least for mutual funds as a group.

A. *Selling pressure from mutual funds*

Mutual funds are likely to be a group of investors facing many potential investment constraints. For example, there is anecdotal evidence that a typical mutual fund in general avoids low priced stocks so as not to be looked as “speculative” or “imprudent”.^{30,31} For example, between 1980 to 2005, in the sample of stocks held by all mutual funds and which can be matched with CRSP monthly stock file, merely 3.73 percent of stocks are priced less than 5 dollar as of reporting date while 90.38 percent of stocks are priced more than 10 dollars.³² We choose to focus on mutual funds as a clientele and we infer their buy and sell decisions by looking at the aggregate mutual fund holdings and holding changes when stocks become financially distressed.

The mutual fund holding data come from the CDA/Spectrum mutual fund holding database, which collects the holding information from the N30-D filings to the Security and Exchange Commission (SEC). A detailed description of the database can be found in Wermers (1999). As our mutual fund holding database only starts at 1980, we only consider the sample from 1980 to 1999. Although typically stocks are likely to be held by a large number of mutual funds, there are number of stocks which are only held by one or two mutual funds recorded by the CDA/Spectrum database. A possible explanation for this observation is that small holdings are exempted from reporting by SEC regulations, giving us a lower-end truncated sample.³³ Therefore, it is likely the number

²⁹We also obtain qualitatively similar results using CDA/Spectrum Institutional 13F Stock Holdings and Transactions database, where the quarterly transactions and holdings by institutional investors including mutual funds, banks, insurance companies, pension funds and endowment funds are recorded.

³⁰Mutual funds may “window dress”, i.e., they sell recent losers before reporting their holdings (c.f. Haugen and Lakonishok (1988), Musto (1997), and Meier and Schaumburg, 2005). This could be another reason why increase in financial distress could trigger a clientele change and selling by mutual funds, as financially distressed stocks are likely to be recent losers.

³¹Because the eventual delisting may be very costly to the stockholders and SEC rules preclude most institutions from holding unlisted shares (cf. Macey, O’Hara and Pompilio, 2004), some institutions may want to sell the stocks even before the eventual delisting.

³²Even some very specialized micro-cap investors generally hold a small percentage of low priced stocks. For example, according to its prospectus, during the period from 09/1982 to 06/2005, for all shares held by Dimensional Fund Advisor Micro-cap fund (Ticker Symbol: DFSCX), about 6% of the stocks were less than 1 dollar, 13% of the stocks were greater than 1 dollar but less than 3 dollar, another 13% of the stocks were greater than 3 dollar but less than 5 dollar, and the rest were all greater than 5 dollars. In all cases, DFA holds less than 1% of outstanding shares as reported by CRSP. DFA invests only in the bottom 4% of market capitalization stocks in this series of micro-fund.

³³For example, N30-D form filing guideline states “A Manager may omit holdings otherwise reportable if the Manager holds, on the period end date, fewer than 10,000 shares (or less than \$200,000 principal amount in the case of convertible debt securities) and less than \$200,000 aggregate fair market value (and option holdings to purchase only such amounts).”

of mutual fund shareholders are under-stated according to CDA/Spectrum but the likely impact should be relatively small. Without further assumptions, it is not entirely clear how such reporting practice may influence the inference of current empirical study. To assess such bias, we further sort the stocks into three groups based on the breadth of ownership as a robustness check: Low refers to ones for which the underlying shareholders is less than or equal to 2; Medium refers to ones for which the underlying shareholders between 3 and 7 (inclusive); and High refers to ones for which the underlying shareholders greater than or equal to 8. These break points roughly match the 33 percentile and 67 percentile of underlying mutual fund shareholders across all stocks and all years in our sample. We report the statistics from the full sample (1980 - 1999), and also two subsamples (1980 - 1989 and 1990 - 1999) to ensure that the results are not driven by later period when the number of mutual funds dramatically increases. A final caveat is in order. Because we only look at the aggregate mutual fund holdings and holding changes in the event of stocks' financial distress, we cannot say much about intra-fund flows of share holdings.

At any quarter, we sum across the reported number of shares held by individual mutual funds and obtain the aggregate holdings of mutual funds. We examine two aspects of the aggregate mutual fund holdings and holding changes of the financially distressed stocks. We first investigate the aggregate mutual fund holdings and holding changes of *all* high DLI stocks. At a given quarter Q , we identify all stocks which fall into the highest DLI decile ranking during any month of the current quarter and record the aggregate mutual fund holdings ($Holding_{i,Q}$). Then we track all high DLI stocks' aggregate mutual fund holdings during the preceding quarter ($Holding_{i,Q-1}$). The aggregate holding change ($\Delta Holding_i$) is defined as

$$\Delta Holding_i = Holding_{i,Q} - Holding_{i,Q-1} \quad (3)$$

and we conjecture that mutual funds on average decrease their holdings of the stock ($\Delta Holding_i < 0$) for high DLI stocks if mutual funds on average avoid holding financially distressed stocks.

We also examine the aggregate mutual fund holdings and holding changes of *recent* high DLI stocks. That is, at a given quarter Q , we only identify stocks which were not in the highest DLI decile in *all* months during the preceding quarter, but recently migrated into high DLI decile during *any* month in current quarter. We compare the mutual fund holdings before ($Holding_{i,Q-1}$) and after ($Holding_{i,Q}$) the stocks become financially distressed in current quarter, and compute the aggregate mutual fund holding changes ($\Delta Holding_i$) as

$$\Delta Holding_i = Holding_{i,Q} - Holding_{i,Q-1} \quad (4)$$

We also conjecture that the mutual funds on average decrease their holdings of the stock ($\Delta Holding_i < 0$) if the stock becomes financially distressed. In addition, we expect the holding decreases to be sharper for *recent* high DLI stocks if the clientele change is triggered by a sudden increase in

financial distress.

Insert Table IV about here

The results presented in Table IV consistently supports our conjecture that when stocks becomes financially distressed, there is a change of clientele, as proxied by mutual fund aggregate ownership, across all sample periods and all levels of the breadth of ownership. On average, mutual funds avoid holding high DLI stocks. In the full sample period, mutual funds decrease their holdings of *all* high DLI stocks by 0.67% of all shares outstanding on average within a quarter; and for *recent* high DLI stocks, mutual funds decrease holdings by 0.95% within one quarter.³⁴ The decrease of holdings is particularly pronounced for high breadth of ownership stocks. In the full sample period, mutual fund decreases holdings of all high DLI stocks with high number of ownerships by 1.87% of all shares outstanding on average within a quarter; and for recent high DLI stocks with high breadth of ownership, mutual funds decrease holdings by 2.36% within one quarter. All these reported changes are statistically significant at 1 percent significance level. We also verify that the decrease in mutual fund holding mostly occurs during the quarter when the stock becomes financially distressed (see Panel C and D of Table IV). For *all* high DLI stocks, the absolute quarterly mutual fund holding change is below 0.11% during each of the four quarters immediately following the event quarter (Q). For *recent* high DLI stocks, although there are still significant decrease in mutual fund holding during the first two quarters immediately following the event quarter (Q), the magnitude of such decrease is much smaller (0.13%) as compared to the decrease during the event quarter (0.95%).

B. Lack of ready buyers

The selling of financially distressed stocks by institutional investors such as mutual funds is unlikely to be absorbed by ready buyers without moving the price. The market makers, afraid of the selling being information-driven, will only want to buy the stock at a lower price. Outside investors are unlikely to move in their capital immediately as argued by Berndt, Douglas, Duffie, Ferguson and Schranzk (2005). It takes time and human capital for an investor to identify a profitable opportunity and then mobilize capital (capital immobility).³⁵ We think this is especially true for financially distressed stocks. The success and failure of distressed securities investing depend on the investor's efficiency and effectiveness in uncovering and analyzing all of the variables specific to the distressed company. The investor "will not only know everything about the company and its

³⁴The mutual fund holding change does not differ significantly across different calendar quarters. For *all* high DLI stocks, the mutual fund change is -0.6% , -0.58% , -0.72% and -0.76% during calendar quarter 1 to 4. For *recent* high DLI stocks, the mutual fund change is -1% , -0.7% , -1.1% and -1.0% during calendar quarter 1 to 4. Therefore, the mutual fund holding change result is unlikely to be driven primarily by large year-end selling for tax reasons as documented by Branch (1977), and more recently Grinblatt and Moskowitz (2004). Starks, Yong and Zheng (2005) provide a nice synthesis on this topic.

³⁵Consistent with the capital immobility argument, Duarte, Lonstaff and Yu (2005) find that the fixed-income arbitrage strategies requiring more "intellectual capital" to implement tend to produce significant risk-adjusted returns and the risk-adjusted excess returns from these strategies are related to capital flows into fixed-income arbitrage hedge funds.

financials but will have studied the creditors involved in the reorganization as well: their numbers, their willingness to compromise, and the complexity of their claims help indicate how long the reorganization will last, what the asset distributions will be, and whether the expected returns are worth the wait”.³⁶ Gathering and analyzing such firm specific information is a daunting task and very time consuming, requiring a large amount of human capital. The absence of Wall Street research coverage on distressed firms makes this task even harder.³⁷ As a proxy for Wall Street research coverage, for each stock each month, we check whether analyst earnings forecast is made for the firm’s announced past quarter earning and, if so, compute the number of unique analysts. The earning forecast data is obtained from I/B/E/S from 1984 to 1999. For each of the 10 DLI sorted portfolio, we report the average percentage of stocks receiving analyst coverage and the average number of analysts for the stocks receiving coverage at all in Table VII. As expected, both coverage measures decrease with DLI. Amongst stocks in the lowest-DLI decile, 74% receive analyst coverage – 5.4 analysts on average following each stock, if the stock receives analyst coverage at all. In sharp contrast, amongst stocks in the highest-DLI decile, only 20% receive analyst coverage and there are only 2.5 analysts per stock, if the stock receives analyst coverage at all.

Insert Table V about here

When there is large selling pressure and lack of immediate ready buyers, the stock price will be temporarily depressed. The price concession may attract new buyers including arbitrageurs to enter the market and the price will soon recover. Pástor and Stambaugh (2003) focus on liquidity shocks that play out within the span of a day. Keim and Madhavan (1996) does this as well, showing that the price impact of a block sell order lasts on average for just one day. To examine the duration of liquidity shock for financially distressed stocks, we trace out the first 20 daily returns after portfolio formation for stocks in the highest DLI portfolio. Figure 2 plots these daily returns. Consistent with Pástor and Stambaugh (2003) and Keim and Madhavan (1996), we observe a strong first day return reversal of, on average, more than 60 bps for financially distressed stocks. However, the above average return lasts until the second week after portfolio formation, which indicates a persistence in the liquidity shock.

Insert Figure 2 about here

The persistence of the liquidity shock for financially distressed stocks is also related to limit-to-arbitrage (c.f. Shleifer and Vishny,1997).³⁸ The risk of investing in financially distressed stocks is high. In the event of bankruptcy, the entire investment might be wiped out since the stockholder

³⁶See “Distressed Securities Investing” by Dion Friedland, Chairman of Magnum Funds.

³⁷“The lack of Wall Street coverage is due to the fact investment banks tend not to view companies emerging from bankruptcy as potential clients. Further, these companies are tainted in general by the financial distress and thus do not make it onto the list of companies to which Wall Street investment banks allocate expensive research resources...” – “Distressed Securities Investing” by Dion Friedland, Chairman of Magnum Funds.

³⁸Gabaix, Krishnamurthy and Vigneron (2005) provide evidence supporting limit-to-arbitrage in the mortgage-backed security market.

only has a residual claim on the firm’s assets during the bankruptcy process. More importantly, such risk is highly idiosyncratic as argued by Gilson (1995). Table VII also reports the average idiosyncratic risk measures for stocks in 10 DLI-sorted deciles. For each month and each stock, we regress the daily stock excess returns on the Fama-French three factors over the past six months and take the $1 - R^2$ (where R^2 is the adjusted- R^2) as a measure of firm-level idiosyncratic risk.³⁹ Clearly, the idiosyncratic risk measure increases monotonically with DLI. In particular, for stocks with the highest DLI, nearly 97% of the total risk is idiosyncratic in nature. As argued by Wurgler and Zhuravskaya (2002) and Mendenhall (2004), idiosyncratic volatility means higher nondiversifiable risk borne by arbitrageurs. Another way to think about the R^2 measure is to regard it as a price non-synchronicity measure and interpret it as a proxy related to the proportion of private information (c.f. Durnev, Morck, Yeung, and Zarowin (2003)). It follows that the high $1 - R^2$ measure in the high DLI portfolio indicate that a large fraction of the information is the private information. Given this interpretation, it is easy to understand why the liquidity shock is particularly pronounced among the high DLI portfolios as private information is usually associated with larger price impact of trade as in Kyle (1985). Bessembinder, Chan, and Seguin (1996) also provide some supporting evidence. They find firm-specific information to have the largest proportional effect on the volume of small firms, which is consistent with the increased turnover we documented for financially distressed stocks. Finally, since financially distressed stocks trade at low prices, the percentage transaction costs are usually higher. Moreover, the difficulty of collecting and analyzing information specific to distressed stock results in a higher degree of information asymmetry. Market makers, in order to protect themselves from this information asymmetry, will impose higher trading costs for the distressed stocks over a longer period of time, as argued in Sadka and Scherbina (2004). Both high idiosyncratic risks and large transaction costs may keep risk-averse arbitrageurs from investing in distressed stock immediately after it becomes distressed, as argued in the “limits-to-arbitrage” literature and price recovery takes longer.⁴⁰

To summarize the findings so far, a sharp increase in a firms’ financial distress risk is likely to trigger a clientele change of its stockholders. Selling by existing institutional investors such as mutual funds, which is unlikely to be absorbed by ready buyers, generates a liquidity shock. The subsequently temporarily depressed stock price will induce the market maker to step in and take the other side. The liquidity will improve after a while and the prices will bounce back, as outside investors recognize the opportunity and gradually move their capital to the stock. In the next subsection, we examine the trading volume, trading cost, order imbalance and level of liquidity during such time, providing additional evidence to support the presence of liquidity shock.

³⁹The exact regression equation is (5).

⁴⁰Similar arguments have been advanced to explain divergence between price and fundamental in various markets. For example, Pontiff (1996) in the close-end fund market; Jarrow and O’hara (1989) in the market of primes and scores; Mitchell, Pulvino and Stafford (2002) in the equity market.

C. Changes in trading volume, trading cost, order imbalance and level of liquidity during the liquidity shock

Due to the liquidity shock associated with a financially distressed stock, an investor wishing to sell a significant quantity of it will suffer a price concession, and conversely, an investor ready to buy it (therefore provide liquidity) will be rewarded by the later price recovery. Such liquidity shock has been discussed in the model of Campbell, Grossman, and Wang (1993). One implication of the model is that large trade by liquidity investors leads to a temporary divergence between price and fundamental value. This implies that price concessions accompanied by high volume will tend to be reversed. Empirically, Conrad, Hameed, and Niden (1994) report that stocks with high trading activity are likely to experience short-term return reversal and stocks with low trading activity short-term return continuation. We examine the trading activity of financially distressed during the liquidity shock and document a similar pattern. Panel A of Table VI compares the trading volume for stocks in various DLI deciles during three two-month-periods: (1) the two months prior to the portfolio formation month ($[-2,-1]$); (2) the portfolio formation month and the first month after portfolio formation ($[0,1]$); (3) the second and third month after portfolio formation ($[2,3]$). The trading volumes are adjusted for changes in the total number of shares outstanding. Finally, all trading volumes are normalized by the trading volume during the two months prior to the portfolio formation month ($[-2,-1]$). “New” high DLI stocks are stocks which have just recently entered the highest-DLI decile during the portfolio formation month. Although the normalized trading volumes during month ($[0,1]$) are in general decreasing in DLI, this pattern reversed for the highest DLI-decile: we observe an increase in trading for stocks in the highest-DLI decile around the liquidity shock. This pattern is mainly driven by “new” high DLI stocks. For this subset of stocks that have recently become financially distressed, we observe a significant increase in trading activity only around the liquidity shock, and not afterwards, consistent with the implication of the model by Campbell, Grossman, and Wang (1993).

Insert Table VI about here

Financially distressed stocks also experience a large increase in trading cost during the liquidity shock. We measure the trading cost using the percentage bid-ask spread, defined as the ratio between the quoted bid-ask spread and the midpoint of the quoted bid and quoted ask. The percentage bid-ask spread is computed using intraday quote data from TAQ (after 1993) and ISSM (before 1993). The sampling period for NYSE stocks is from 1983 to 1999 and the sampling period for NASDAQ stocks is from 1987 to 1999. The average spreads are reported in Panel B of Table VII. As we expect, the spread measure increases monotonically with DLI, verifying that financially distressed stocks are more costly to trade. More interestingly, while the trading cost measure hardly changes during the portfolio formation month for stocks in DLI decile 1 to 9, it increases significantly for the financially distressed stocks in DLI-decile 10. Again, such increase in trading cost is mainly driven by “new” high DLI stocks whose percentage bid-ask spread increases by more

than 1% with an associated t-value above 10. This increase is not surprising given the fact that “new” high DLI stocks are recent losers.

If heavy selling by institutional investors leads to price concession and subsequent buying by outside investors leads to later price recovery, we would expect more sell-initiated trades during portfolio formation month and more buyer-initiated trades during the month after formation for financially distressed stocks. This is exactly what we find using order imbalance measures developed in Chordia, Roll and Subrahmanyam (2002) and Chordia and Subrahmanyam (2004). The time series of the order imbalance measures start from 1988 and end in 1998. $OIBSH1_t$ is the buyer-initiated shares purchased less than the seller-initiated shares sold on day t . $OIBSH2_t$ is $OIBSH1_t$ scaled by the total number of shares traded on day t . We average both variables first within each month and then within each DLI-sorted portfolio to get monthly order imbalance measures for each portfolio. The results are reported in Panel C of Table VI. For stocks in the highest-DLI decile, $OIBSH1$ is negative during portfolio formation month which means more trades are seller-initiated, and $OIBSH1$ is positive during the month after formation which means more trades are buyer-initiated. The change in $OIBSH1$ is positive and significant. In addition, across all DLI-sorted deciles during the formation month, $OIBSH1$ is only negative in the highest-DLI decile. We also observe significantly more buyer-initiated trades after portfolio formation for stocks in the highest-DLI decile with the relative order imbalance measure ($OIBSH2$). Finally, we show that this change in order imbalance is more pronounced for “new” high DLI stocks only recently entering the highest-DLI decile during the portfolio formation month. Changes in both order imbalance measures are more positive and significant.

In addition, we expect the liquidity risk of a stock to fluctuate around the liquidity shock. We measure the stock liquidity risk using the liquidity beta proposed by Pástor and Stambaugh (2003). The liquidity beta measures the exposure of the stock to an aggregate economywide liquidity factor. Specifically, the liquidity beta n months after portfolio formation for portfolio i is defined as the slope coefficient (β_i^n) in the following regression:

$$r_{i,t}^n = \alpha_i^n + \beta_i^n L_t + \beta_{i,M}^n MKT_t + \beta_{i,S}^n SMB_t + \beta_{i,H}^n HML_t + \varepsilon_{i,t},$$

where $r_{i,t}^n$ is the excess return n th month after portfolio formation; L_t is the innovation in the aggregate liquidity factor defined by Pástor and Stambaugh (2003); and MKT , SMB and HML are the Fama-French three factors. We examine four liquidity betas: (1) the pre-formation liquidity beta which is the average liquidity betas during the three months prior to the portfolio formation month (month [-3,-1]); (2) the liquidity beta during the portfolio formation month (month 0); the liquidity beta during the first month after the portfolio formation month (month 1); and (4) the post-formation liquidity beta which is average liquidity betas during the second to fourth month after portfolio formation (month [2,4]). Figure 3 plots the four liquidity betas for High DLI stocks (all stocks in the highest-DLI decile), New High DLI stocks (subset of High DLI stocks that only recently entered the highest-DLI decile during the portfolio formation month) and Old High

DLI stocks (the remaining High DLI stocks that also belong to the highest-DLI decile during the portfolio formation month). For High DLI and New High DLI stocks, their liquidity betas display an inverse-V shape around portfolio formation. The liquidity betas increase significantly during the portfolio formation month, which indicates a drop in stock liquidity risk, coinciding with the price concession. The liquidity betas then drop significantly during the first month after portfolio formation and return to their normal levels thereafter. The decreases in liquidity betas indicate an improvement in stock liquidity risk, coinciding with the price recovery. As expected, the inverse-V shape is more pronounced for New High DLI stocks. In contrast, the liquidity betas of Old High DLI stocks do not vary significantly around portfolio formation. Panel D of Table VI reports the four liquidity betas for all 10 DLI-sorted portfolios as well as the New DLI stocks. It also reports in the changes in liquidity betas from period to period. The t-values associated with these changes are computed using the Newey-West standard error estimators with three lags. Across all 11 portfolios, we observe statistically significant fluctuations in liquidity betas around portfolio formation only for the High DLI stocks and the New High DLI stocks.

That stock price reversal coincides with changes in liquidity beta is consistent with the theoretical model and empirical findings by Pástor and Stambaugh (2003). Since liquidity beta carries a positive risk premium, when the liquidity beta of a stock increases, the stock becomes more risky, *ceteris paribus*, and its discount rate goes up, resulting in a price drop. Conversely, as the liquidity beta later drops, the discount rate also decreases and the stock price will recover. The resulting high return on the stock during the first month after portfolio formation is therefore consistent with the dynamic decrease in the liquidity beta. However, an unconditional asset pricing test which ignores the dynamic nature of the liquidity risk, is likely to produce spurious results. As we can see from Panel C of Table VI, stocks in the highest-DLI decile having the smallest liquidity beta earn the highest return while stocks in the lowest-DLI decile having the largest liquidity beta earn a lower return. An unconditional cross-sectional regression where first-month returns are regressed on the liquidity betas will likely produce a negative risk premium on the aggregate liquidity factor, which is counter-factual. This is again because the large first-month return on high-DLI stocks is mainly driven by the price recovery following the temporary liquidity shock, rather than a permanent liquidity risk premium as can be captured by the loading on the aggregate liquidity factor.

D. *Characteristics regression*

In this subsection, we want to directly examine various stock characteristics all how they explain next month stock returns. Since various characteristics are highly correlated with each other at the portfolio level (as in Table III), sorting stocks into portfolio according to one characteristic will inevitably induce dispersion along the dimensions of other characteristics. Therefore, double-sorting is less effective in controlling for these characteristics. We therefore use a cross-sectional regression approach at individual stock level. If the first-month high return on financially distressed

stocks are in fact driven by high default risk and *DLI* captures default risk better than other stock characteristics, we would expect *DLI* to be significant in the cross-sectional regression even with the presence of other stock characteristics. On the other hand, if the first-month high return is a result of the liquidity-induced price reversal, we would expect *Pastret* to always be strongly significant. Since a larger price concession will be followed by a larger price recovery, *ceteris paribus*, the past one-month return is negatively related to the next-month return in a mechanical way. Finally, as financially distressed stocks are typically illiquid, we would also expect the liquidity measure *Amihud* to be significant in the regression as in Amihud (2002) and Acharya and Pedersen (2005), among others.

The cross-sectional regression approach is similar in spirit to that used by Brennan, Chordia and Subrahmanyam (1998). We control for systematic factor risk by first computing the Fama-French three factor alpha.⁴¹ The factor loadings at month m are computed using rolling window regression from $m-T-1$ to $m-1$. For each month from 1970/01 to 1999/12, we run a cross-sectional regression of the next month alpha on various stock characteristics from the current month. All variables are cross-sectionally demeaned so the intercept term of the regression is zero. In addition, the stock characteristics are standardized so the regression slope coefficient of a variable can be interpreted as the impact on the alpha of a one standard deviation change in the variable. The slope coefficients are then averaged across time and reported. The robust t value is computed using the Newey-West autocorrelation adjusted standard error with 12 lags. The five characteristics we considered are: *Pastret* (stock return during the month prior to portfolio formation), *Amihud*, *DLI*, *Size* (log of market capitalization) and *B/M* (book-to-market ratio). We exclude stocks with missing characteristics and negative B/Ms.

Insert Table VII about here

Panel A of Table VII reports the correlations among these five characteristics in both the full sample and the top *DLI*-quintile subsample. Then signs of these correlations are all consistent with the pattern reported in Table III. *DLI* is highly correlated with *Size* and *B/M*. In fact, Vassalou and Xing (2004) shows that both size and B/M effects can be viewed as default effects. *Amihud* and *Pastret*, on the other hand, are less correlated with other characteristics.

Panel B of Table VII reports the regression results where factor loadings are computed using monthly returns in a rolling window of 5 years. In the first three regressions (Model 1 to 3), the only regressor is either *DLI*, *Amihud* or *Pastret*. As expected, either *DLI*, *Amihud* or *Pastret* individually can all be significantly associated with the next month stock return alpha. *Pastret* is strongly significant (t -value of -9.7) and *Amihud* is slightly more significant than *DLI* (t -value of 3.56 for *Amihud* v.s. 3.16 for *DLI*). *DLI*, however, becomes insignificant with the presence of other characteristics (Model 4 and 5). Specifically, *DLI* becomes insignificant once *Pastret* and

⁴¹The results are qualitatively similar if the first month returns instead of alphas are used.

Amihud are included (Model 4). In addition, since all three characteristics are correlated with *Size* and *B/M*, both of which are shown to have explanatory power on alpha, Model 5 controls for the *Size* and *B/M* characteristics by including them in the regressions. In Model 5, *DLI* is not significant and assumes the wrong sign but *Pastret* and *Amihud* are still significant. Finally, since the liquidity-shock-induced price reversal is likely to be more pronounced for illiquid stocks, we would expect a interaction term between *Pastret* and *Amihud* to be negative and significant. This is indeed the case as in Model 6. The interactive term is highly significant and subsumes the explanatory power of *Amihud*. We also repeat the regressions in the sample we are more interested in – the group of stocks in the highest DLI quintile. The results are almost identical qualitatively, though *DLI* is slightly more significant.

Since risk characteristics may change when a stock becomes financially distressed, factor loadings estimated using a rolling window of 5 years may not reflect the risk characteristics of the stock at portfolio formation. As a robustness check, we estimated the factor loadings using daily return in a much shorter rolling window of 6 months. Specifically, at each month m , for every stock with more than thirty valid observations, we estimate the following regression using daily excess returns and the Fama-French three factors over past six months:

$$\begin{aligned}
R_{i,t} - R_{RF,t} = & \alpha + \beta_{i,0}MKT_t + \beta_{i,1}MKT_{t-1} \\
& + \beta_{i,2} \left[\frac{MKT_{t-2} + MKT_{t-3} + MKT_{t-4}}{3} \right] \\
& + h_{i,0}HML_t + h_{i,1}HML_{t-1} + h_{i,2} \left[\frac{HML_{t-2} + HML_{t-3} + HML_{t-4}}{3} \right] \\
& + s_{i,0}SMB_t + s_{i,1}SMB_{t-1} + s_{i,2} \left[\frac{SMB_{t-2} + SMB_{t-3} + SMB_{t-4}}{3} \right] + \varepsilon_{i,t}, \quad (5)
\end{aligned}$$

where *MKT*, *HML* and *SMB* are the market excess return factor, HML factor and SMB factor, respectively. To avoid overparameterizing the estimation equation, we also restrict the factors coefficients to stay the same for $t-2$, $t-3$ and $t-4$ as in Lewellen and Nagel (2005). To control for the nonsynchronous trading, we use the sum-beta method in Dimson (1979). After obtaining the estimates, we compute the “sum-beta” estimates for market excess return, HML and SMB factors as:

$$\begin{aligned}
\hat{\beta}_i &= \hat{\beta}_{i,0} + \hat{\beta}_{i,1} + \hat{\beta}_{i,2}, \\
\hat{h}_i &= \hat{h}_{i,0} + \hat{h}_{i,1} + \hat{h}_{i,2}, \\
\hat{s}_i &= \hat{s}_{i,0} + \hat{s}_{i,1} + \hat{s}_{i,2}.
\end{aligned} \quad (6)$$

The alpha for the subsequent month ($m+1$) is computed based on the following equation

$$\tilde{\alpha}_{i,m+t} = (R_{i,m+1} - R_{RF,m+1}) - \hat{\beta}_i MKT_{m+1} - \hat{h}_i HML_{m+1} - \hat{s}_i SMB_{m+1} \quad (7)$$

The regression results are presented in Panel C of Table VII and are qualitatively similar to those in Panel B. In summary, default risk as measured by *DLI* does not seem to provide additional explanatory power regarding next month alpha on top of *Pastret*, *Amihud*, *Size* and *B/M*. *Pastret*, however, strongly predicts the next month alpha on top of other characteristics. The liquidity measure, *Amihud*, also provides some additional predictive power. An interaction term between *Pastret* and *Amihud* is highly significant and subsumes the explanatory power of *Amihud*. These findings are consistent with the liquidity-shock based explanation for the high first-month return on the high-DLI stocks.

E. Economic significance of the first-month high returns

In this paper, we focus on stocks with high DLIs. These stocks earn about 90 basis points more than otherwise similar stocks during the first month after portfolio formation. These stocks with large exposure to default risk, are more likely to have smaller market capitalizations, lower trading prices and higher percentage trading costs, as shown in Table III.⁴² Naturally, a question arises, is the first-month high return on these stocks economically significant? In other words, can such high return be captured by portfolio trading strategies after accounting for transaction costs? This subsection answers this question in detail.

| |
|------------------------------|
| Insert Table VIII about here |
|------------------------------|

We further sort these stocks into quintiles according to their market capitalizations. We then compute the average monthly returns for each quartile. We also compute the average percentage bid-ask spread and the average return bias due to bid-ask bounce for each quartile. Again, both measures are computed using the actual quoted spread (quoted ask – quoted bid) from quote data in TAQ (after 1993) and ISSM (before 1993). The sampling periods for these two measures are from 1983 to 1999 for NYSE stocks and from 1987 to 1999 for NASDAQ stocks. This quoted spread is likely to over-estimate the true “effective” bid-ask spread. The results are presented in Panel A of Table VIII. First, for all four quintiles, the first-month returns after portfolio formation are much higher than the return bias measures. Therefore, random bid-ask bounce do not completely explain the high first-month returns. It is more likely that trading price, on average, systematically bounces from bid at portfolio formation to ask a month later, which is consistent with our liquidity-based explanation. Second, the first-month high returns are primarily driven by penny stocks in the lowest-size quartile. These stocks have an average market cap of 2 million dollars, an average trading price of only \$1.27 and an average first-month return of 5.76%. This relatively high return is not too surprising. Given its low price, the same bounce from bid to ask will result in a higher return. Finally, For all four quintiles, the average transaction costs as measured by the percentage bid-ask

⁴²During the sampling period from 1971 to 1999, there are on average 260 stocks in the highest DLI-decile per month, with a total market capitalization slightly above 10 billion dollars (from 3 billion dollars at in 1971 to 30 billion dollars in 1999).

spreads are much higher than the first-month returns, which means that the first-month high return on high-DLI stocks is, on average, economically insignificant. Our liquidity-based explanation would predict a more pronounced price reversal for the subsample of high-DLI stocks that have recently experienced increases in DLIs. This is indeed the case. When we examine the New DLI stocks, which enter the highest-DLI decile only during the portfolio formation month, we observe larger (in absolute term) negative returns during the portfolio formation month and higher positive returns in the month after. However, these high returns are still not economically significant since they are on average smaller than the transaction costs. Similar results are obtained when we sort high-DLI stocks into quintiles according to their trading prices at portfolio formation as in Panel B of Table VIII. In conclusion, outside investors (other than the market makers) cannot consistently capture the first-month high returns on high-DLI stocks by trading at monthly frequency. This is consistent with the findings in Avramov, Chordia and Goyal (2005) in which they show the profits to contrarian trading strategy are smaller than the likely transaction costs and therefore short-term return reversal does not constitute a violation of efficient market hypothesis. Finally, this is also consistent with the view that market makers, generically defined, are compensated by providing liquidity when it is most needed.

III. Returns on Financially Distressed Stocks After the First Month

Since the liquidity shock is short-lived, the stock return after the first month is less affected. On the other hand, the risk characteristics of the stock should not change by much in magnitude over a month. We show that financially distressed stocks do not earn significantly higher return during the second month after portfolio formation or thereafter and the impact of default risk on stock returns is significantly reduced if the second-month returns are used. These findings further support our view that a large part of the high return on financially distressed stocks is caused by the price recovery following the liquidity shock.

| |
|---|
| Insert Table IX and Figure 4 about here |
|---|

Panel A of Table IX reports the equally-weighted average stock returns in each of the first six months after portfolio formation. The return of the highest DLI portfolio immediately decreases by more than a quarter from 2.10% in the first month to 1.52% in the second month, and stabilizes afterwards. This drop of 58 bps is highly significant (with a t-value above 10), and is five times higher in magnitude than the average change in the rest of the portfolio returns. Panel B of Table IX reports the average Size, B/M and DLI of the 10 DLI-sorted portfolios one month after portfolio formation. The changes in these characteristics within one month are very small in magnitude. For stocks in the highest DLI decile, these changes are all smaller than 5%. Therefore, the 58 bp drop in return is unlikely explained by changes in risk associated with these stocks. The drop is more consistent with the liquidity-shock-based explanation and better interpreted as reward for liquidity provision to those who buy these stocks when they become financially distressed. Figure 4

contains graphic representations of this result. In the top graph, the return of the highest DLI stock displays a clear first month reversal pattern, which disappears after the first month. If the liquidity shock is driven by the clientele change that follows a sharp increase in default likelihood, we would expect a more pronounced return reversal pattern for stocks that have recently entered the highest DLI-decile. This is exactly what we find in the bottom graph in which we break down stocks in the highest-DLI decile into two groups: stocks belonging to the highest-DLI decile in the previous month (Old High DLI) the stocks do not belong to the highest-DLI decile in the previous month (New High DLI). The New High DLI stocks, which account for about 17% of all High DLI stocks (See Panel B of Table II), display more pronounced return reversals, as expected. On average, they lose about 14% during the portfolio formation month, then gain 3% one month after and afterwards earn returns comparable to other stocks. Table IX and Figure 4 also help to reconcile the seemingly different findings in Vassalou and Xing (2004) and Campbell, Hilscher and Szilagyi (2005). Although the return spread between high and low default risk stocks is large and positive during the first month after portfolio formation due to the liquidity shock, the return spread will be much smaller over a longer horizon (such as one year in Campbell, Hilscher and Szilagyi (2005)) as the liquidity shock dies out.

A. *Asset pricing tests with the second-month returns*

Since the risk characteristics of a stock do not change significantly over a month and the liquidity shock usually dies out within the first month after portfolio formation, the second-month returns are better choices for asset pricing tests.⁴³ We show that the impact of aggregate default risk on stock returns is significantly reduced if second-month returns are used, which further supports our view that a large part of the high return on financially distressed stocks is driven by a short-lived liquidity shock due to the clientele change.

If we run a simple time-series regression of the first month return of stocks in the highest DLI decile on the Fama-French three factors, we obtain a significant positive alpha of 64 bp. The results are reported below with t -value in bracket. They are consistent with the asset pricing test results in Vassalou and Xing (2004) and seem to indicate that the return of high default risk is too high to be explained by the standard Fama-French three factors. A separate default risk factor seems to be needed in the reduced form asset pricing model.

$$R_{HDLI,1} - r_f = 0.0064 + 1.13MKT + 1.85SMB + 0.75HML$$

(2.33) (16.64) (18.97) (6.91)

⁴³This is also consistent with standard practice in momentum literature. In addition, it helps to reduce the bias introduced by the bid-ask bounce. In fact, it is often the cited reason for skipping a week or a month between portfolio formation and portfolio holding period in momentum literature. For instance, Jegadeesh and Titman (1993) skip a week to avoid “bid-ask spread, price pressure and lagged reaction effects”. Similarly, Fama and French (1996) skip a month to “reduce bias from bid-ask bounce”.

If we use second month return instead, we have:

$$R_{HDLI,2} - r_f = 0.0003 + 1.09MKT + 1.79SMB + 0.75HML$$

(0.13) (16.48) (19.04) (7.13)

The intercept term drops to a number indistinguishable from zero while the slope coefficients hardly change, confirming that risk characteristics of the stock did not change by much during the first month after portfolio formation. The 61 bp decrease in the alpha (from 64 bp to 3 bp) is very close to the 58 bp drop in average return from the first to the second month. This decrease is not likely driven by change in risk as both characteristics and the Fama-French three factor loadings hardly change, and its existence again favors our liquidity explanation. Once we control for the liquidity shock by using the second month return, the return of high default risk stock can be fully explained by the three factors and we do not need an additional default risk factor.⁴⁴

To confirm this result, we also conduct GMM tests. Denote the factors as F and the stochastic discount factor as $m = a + bF$, we want to test:

$$E[mR] = 1,$$

where R denotes the equally-weighted return vector of the test portfolios. The GMM is estimated using the optimal weighting matrix. The results of the GMM tests are provided in Table X.

Insert Table X about here

We first conduct the GMM tests on the 10 DLI-sorted portfolios (see Panel A). Using the first-month returns, an aggregate default risk factor, dSV , computed as the changes in the average DLI across all stocks, is significant even with the presence of the Fama-French three factors. This finding is consistent with the results in Vassalou and Xing (2004). The significance of dSV disappears if the second-month returns are used: dSV ceases to provide any additional explanatory power on top of the three factors. Similar results are obtained when we repeat the GMM tests on the 27 portfolios formed by independent triple sorts on DLI, size and book-to-market ratios (see Panel B), as in Vassalou and Xing (2004). Again, dSV becomes insignificant once second-month returns are used. We also verify that the risk characteristics of the stock did not change significantly after one month for the 27 portfolios, as in Table XI.

Insert Table XI and XII about here

⁴⁴Similar results are obtained for the New High DLI stocks which have recently entered the Highest DLI portfolio. The Fama-French three factor alpha is as high as 138 bps (with a t-value of 5.1) if first-month returns are used. The alphas drops to -23 bps (with a t-value of -0.79) if the second-month returns are used.

Table XII reports factor loadings on the aggregate default risk factor (dSV) for both 10 DLI-sorted portfolios and 27 portfolios sorted on size, book to market and DLI, during the first and second month after portfolio formation. Overall, the changes in the default risk factor loadings are small. For the highest-DLI stock portfolio, the factor loading decreases from 1.9 to 1.8, but the size of such change is too small to explain the 58 bps drop in return. Again, this seems to indicate that the change in default risk as measured by default factor loading do not explain the decrease in average return from the first to the second month for the highest-DLI stocks.

In summary, although the first month returns on portfolios sorted by DLI cannot be explained by the standard Fama-French three factors, when we skip a month between portfolio formation and holding period, the second month returns can be well explained by the three factors. In addition, the impact of aggregate default risk on stock returns is significantly reduced if second-month returns are used.

IV. Conclusion

Vassalou and Xing (2004) show that stocks of firms under financial distress, on average earn a large positive abnormal return during the first month after portfolio formation, even after adjusting for risk using standard asset pricing models. In this paper, we show that a sharp rise in a firm's exposure to financial distress risk triggers a clientele change for its stock, resulting in temporary selling pressure. For example, mutual funds significantly decrease their holdings of stocks from firms that experience sharp rises in their default likelihood measures. When the liquidity of the stock later improves, the stock price recovers, which contributes to the high return on financially distressed stocks during the first month after portfolio formation. Changes in various market microstructure characteristics of a stock, such as trading volume, percentage bid-ask spread and order imbalance measures, are all consistent with there being such liquidity shock. Therefore, a major part of the high return on these stocks can be interpreted as reward for liquidity provision when it is most needed.

Consistent with this view, we find that the high returns on financially distressed stocks accrue during the first month following portfolio formation, but little during the months afterwards, although various risk characteristics hardly change. This result supports the claim in Campbell, Hilscher and Szilagyi (2005), and Garlappi, Shu and Yan (2005), that high default risk itself does not necessarily lead to high return in the future. In addition, we find that although the first month high return on the high-DLI stocks cannot be explained by the standard Fama-French three factors, when we skip a month, the second month return can be well explained by the three factors, and an aggregate default risk factor ceases to be significant in various asset pricing tests using the second month returns on portfolios sorted on DLI. Consequently, there is no need for a separate aggregate default risk factor is needed in reduced form asset pricing models. Our findings also highlight the time-varying nature of a stock's exposure to liquidity risk. A stock's exposure to Pastor and

Stambaugh's (2003) aggregate liquidity factor increases significantly during the liquidity shock and then returns to its normal level afterwards, coinciding with the initial stock price concession and subsequent price recovery.

Though we provide and favor a liquidity-based explanation for the short-run market dynamics of stock prices when the underlying firm becomes financially distressed and prone to default, we cannot completely rule out some behavioral interpretations of the phenomenon. The sudden surge in default likelihood can be loosely thought of as some form of news concerning defaults.⁴⁵ One may interpret the concurrent drastic return drop and subsequent return reversal as investors overreact to such default news during the portfolio formation month. Given the increasingly uncertainty associated with financially distressed firms and the absence of Wall Street coverage on their stocks, investors may become overconfident about their own interpretation of the default news, and drive the price below the fundamental values (c.f. Daniel, Hirshleifer, and Subrahmanyam, 1998 and Odean, 1998). When more information about the prospectus of the firm becomes available and the uncertainty resolves, price converges back to fundamental values. In this context, some element of slow information diffusion is particularly relevant for the valuation errors of the agents (Hong and Stein, 1998). Finally, the documented clientele change in the underlying stockholder also echoes well with the heterogeneous investor assumption in Hong and Stein (1998) and valuation regime switch in Barberis, Shleifer and Vishny (1998). We believe further research relating the behavioral bias to the default news is warranted.

In this paper, we measure the default or financial distress risk using Default Likelihood Indicator (DLI) proposed by Vassalou and Xing (2004), which has the advantage of incorporating market price information that is more frequently updated. However, since DLI is estimated at monthly frequency, we still cannot identify the exact time at which a firm experiences a sharp increase in default risk. Our approach, which is essentially a calendar-time approach, only identifies the average impact of default risk on stock liquidity at a portfolio level. A complimentary event-time approach which focuses on large credit rating downgrades for individual firm, could potentially provide a sharper identification of such impact.⁴⁶ In addition, if the bond of the firm is also traded, we can make use of the information embedded in the bond price change to better isolate that component of the stock price change which is due to the liquidity shock. These are also potential venues for future investigation.

⁴⁵Da and Schaumburg (2005) attempt to detect price change due to liquidity shock with the help of equity analyst's target price. They argue that after controlling factor risk at the sector level, a price decrease (increase) accompanied by a target price upgrade (downgrade) is more likely to be induced by a liquidity shock. However, such strategy is less applicable for the financially distressed stocks given their low analyst coverage.

⁴⁶In a related paper, Odders-White and Ready (2005) show that the adverse selection component of the stock liquidity measure is higher when the credit rating is poorer.

References

- [1] Acharya, V. V. and L. H. Pedersen (2005): “Asset pricing with liquidity risk,” *Journal of Financial Economics*, forthcoming.
- [2] Allen, F. and R. Michaely (2002): “Payout policy,” *North-Holland Handbooks of Economics*.
- [3] Almazan, A. K. C. Brown, M. Carlsonb and D. A. Chapman (2004): “Why constrain your mutual fund manager?” *Journal of Financial Economics*, Vol 73, 289–321.
- [4] Altman, E. (1968): “Financial ratios, discriminant analysis and the prediction of corporate bankruptcy,” *Journal of Finance*, Vol 23, 589-609.
- [5] Amihud, Y. (2002): “Illiquidity and stock returns: cross-section and time-series effects,” *Journal of Financial Markets*, Vol 5, 31-56.
- [6] Amihud, Y., and H. Mendelson (1986): “Asset pricing and the bid-ask spread,” *Journal of Financial Economics*, Vol 17, 223-250.
- [7] Andrade, G. and S. N. Kaplan (1998): “How costly is financial (not economic) distress? Evidence from highly leveraged transactions that became distressed,” *Journal of Finance*, Vol. 53, 1443-1498.
- [8] Avramov D., T. Chordia and A. Goyal (2005): “Liquidity and autocorrelations in individual stock returns,” *Journal of Finance*, forthcoming.
- [9] Barberis, N., A. Shleifer and R. Vishny (1998): “A model of investor sentiment,” *Journal of Financial Economics*, Vol 49, 307-343.
- [10] Bekaert, G., C. R. Harvey, and C. Lundblad (2003): “Liquidity and expected returns: Lessons from emerging markets,” Working Paper.
- [11] Berndt, A., R. Douglas, D. Duffie, M. Ferguson, and D. Schranck (2005): “Measuring default risk premia from default swap rates and EDFs,” *Working Paper*.
- [12] Bessembinder, H. and M. Hertzel (1993): “Return autocorrelations around non-trading days,” *Review of Financial Studies*, Vol 6, 155-189.
- [13] Bessembinder, H., K. Chan and P. J. Seguin (1996): “An empirical examination of information, differences of opinion, and trading activity,” *Journal of Financial Economics*, Vol 40, 105-134.
- [14] Bhandari, L.C. (1988): “Debt/equity ratio and expected common stock returns: Empirical evidence,” *Journal of Finance*, Vol 43, 507-528.
- [15] Black, F. (1976): “Studies of stock market volatility changes,” *1976 Proceedings of the American Statistical Association, Business and Economic Statistics Section*, 177–181.

- [16] Black, F. and M. Scholes (1973): “The pricing of options and corporate liabilities,” *Journal of Political Economy*, Vol 81, 637-659.
- [17] Blume, M.E. and R. F. Stambaugh (1983): “Biases in computed returns : an application to the size effect,” *Journal of Financial Economics*, Vol 12, 387-404.
- [18] Branch, B. (1977): “A tax loss trading rule,” *Journal of Business*, Vol 50, 198-207.
- [19] Brav A. and J.B. Heaton (1998): “Did ERISA’s prudent man rule change the pricing of dividend omitting firms?”, *Working Paper*.
- [20] Breen,W., L. Hodrick, and R. Korajczyk (2002): “Predicting equity liquidity,” *Management Science*, Vol 48, 470–483.
- [21] Brennan, M.J., T. Chordia and A. Subrahmanyam (1998): “Alternative factor specifications, security characteristics, and the cross-section of expected stock returns,” *Journal of Financial Economics*, Vol 49, 345-373.
- [22] Campbell, J. Y., S. J. Grossman, and J. Wang (1993): “Trading volume and serial correlation in stock returns,” *Quarterly Journal of Economics*, 108(4), 905–939.
- [23] Campbell J. Y., J. Hilscher and J. Szilagyi (2004): “In search of distress risk,” *Working Paper*, Harvard University.
- [24] Canina, L., R. Michaely, R. Thaler and K. Womack (1998): “Caveat compounder: A warning about using the daily CRSP equal-weighted index to compute long-run excess returns,” *Journal of Finance*, Vol 53, 403-416.
- [25] Chan, K.C. and N. Chen (1991): “Structural and return characteristics of small and large firms,” *Journal of Finance*, Vol 46, 1467-1484.
- [26] Chordia, T., R. Roll, and A. Subrahmanyam (2000): “Commonality in liquidity,” *Journal of Financial Economics*, Vol 56, 3-28.
- [27] Chordia, T., R. Roll, and A. Subrahmanyam (2001): “Market liquidity and trading activity,” *Journal of Finance*, Vol 56, 501–530.
- [28] Chordia, T., R. Roll, and A. Subrahmanyam (2002): “Order imbalance, liquidity, and market returns,” *Journal of Financial Economics*, Vol 65, 111–130.
- [29] Chordia, T. and A. Subrahmanyam (2004): “Order imbalance and individual stock returns: Theory and evidence,” *Journal of Financial Economics*, Vol 72, 485-518.
- [30] Chordia, T., A. Subrahmanyam, and V. R. Anshuman (2001): “Trading activity and expected stock returns,” *Journal of Financial Economics*, Vol 59, 3–32.

- [31] Cohen R.B., C. Polk and T. Vuolteenaho (2003a): “The value spread,” *Journal of Finance*, Vol 58, 609-641.
- [32] Conrad, J. S., A. Hameed and C. Niden (1994): “Volume and autocovariances in short-horizon individual security returns”, *Journal of Finance*, Vol 49, 1305-1329
- [33] Coval, J. and E. Stafford (2005): “Asset fire sales (and purchases) in equity markets,” *Working Paper*.
- [34] Da, Z. and E. Schaumburg (2005): “Detecting liquidity needs in the stock market using equity analysts’ target prices,” *Working Paper*.
- [35] Daniel, K., D. Hirshleifer and A. Subrahmanyam (1998): “Investor psychology and security market under- and overreactions,” *Journal of Finance*, Vol 53, 1839-1885.
- [36] Dichev, I. (1998): “Is the risk of bankruptcy a systematic risk?,” *Journal of Finance*, Vol 53, 1131-47.
- [37] Dimson, E. (1979): “Risk measurement when shares are subject to infrequent trading,” *Journal of Financial Economics*, Vol 7, 197-226.
- [38] Duarte, J., F. A. Longstaff and F. Yu (2005): “Risk and return in fixed income arbitrage: nickels in front of a steamroller,” *Working Paper*.
- [39] Durnev, A., R. Morck, B. Yeung, and P. Zarowin (2003): “Does greater firm-specific return variation mean more or less informed stock pricing?” *Journal of Accounting Research*, Vol 41, 797-836.
- [40] Ellis, K., R. Michaely and M. O’Hara (2000): “When the underwriter is the market maker: An examination of trading in the IPO aftermarket,” *Journal of Finance*, Vol 55, 1039-1074.
- [41] Fama, E. and K. French (1992): “The cross-section of expected stock returns,” *Journal of Finance*, Vol 47, 427-465.
- [42] Fama, E. and K. French (1993): “Common risk factors in the returns on stocks and bonds,” *Journal of Financial Economics*, Vol 33, 3-56.
- [43] Fama, E. and K. French (1995): “Size and book-to-market factors in earnings and returns,” *Journal of Finance*, Vol 50, 131-155.
- [44] Fama, E. and K. French (1996): “Multifactor explanation of asset pricing anomalies,” *Journal of Finance*, Vol 51, 55-84.
- [45] Gabaix, X., A. Krishnamurthy, and O. Vigneron (2005): “Limits of arbitrage: Theory and evidence from the mortgage-backed securities market,” *Working Paper*.

- [46] Garlappi, L., T. Shu and H. Yan (2005): “Default risk, shareholder advantage, and stock returns,” *Working Paper*.
- [47] Gilson, S.C. (1995): “Investing in distressed situations: a market survey,” *Financial Analyst Journal*, Nov/Dec, 8-27.
- [48] Graham J.R. and A. Kumar (2005): “Do dividend clienteles exist? Evidence on dividend preferences of retail investors,” *Journal of Finance*, forthcoming.
- [49] Grinblatt M. and T. J. Moskowitz (2004): “Predicting stock price movements from past returns: the role of consistency and tax-loss selling,” *Journal of Financial Economics*, Vol 71, 541-579.
- [50] Grinstein, Y. and R. Michaely (2005): “Institutional holdings and payout policy,” *Journal of Finance*, Vol 60, 1389-1426.
- [51] Hansen L.P. and R. Jagannathan (1991): “Implications of security market data for models of dynamic economies,” *Journal of Political Economy*, Vol. 99, 225-262.
- [52] Hasbrouck, J. and D. J. Seppi (2001): “Common factors in prices, order flows, and liquidity,” *Journal of Financial Economics*, Vol 59, 383–411.
- [53] Haugen, R. and J. Lakonishok (1988): “The incredible January effect: The stock market’s unsolved mystery,” Dow Jones-Irwin, Homewood, Illinois.
- [54] Hillegeist, S.A., Keating, E.K., Cram D.P. and K.G. Lundstedt (2003): “Assessing the probability of bankruptcy,” *Review of Accounting Studies*, Vol 9, 5-34.
- [55] Hong, H., and J. C. Stein (1999): “A unified theory of underreaction, momentum trading, and overreaction in asset markets,” *Journal of Finance*, Vol 54, 2143-2184.
- [56] Huberman, G. and D. Halka (2001): “Systematic liquidity,” *Journal of Financial Research*, Vol 24, 161–178.
- [57] Jagannathan, R. and Z. Wang (1996): “The conditional CAPM and the cross-section of expected returns,” *Journal of Finance*, Vol 51, 3-53.
- [58] Jagannathan, R. and J. B. Boyd (1996): “Ex-dividend price behavior of common stocks,” *Review of Financial Studies*, Vol 7, 711-741.
- [59] Jarrow, R.A. and M. O’Hara (1989): “Primes and scores: An essay on market imperfections,” *Journal of Finance*, Vol 44,1263-1287.
- [60] Jegadeesh, N. (1990): “Evidence of predictable behavior of security returns,” *Journal of Finance*, Vol 45, 881-898.

- [61] Jegadeesh, N. and S. Titman (1993): “Returns to buying winners and selling losers: Implications for stock market efficiency,” *Journal of Finance*, Vol 48, 65-91.
- [62] Jegadeesh, N. and S. Titman (1995): “Short-horizon return reversals and the bid-ask spread,” *Journal of Financial Intermediation*, Vol 4, 116-132.
- [63] Keim, D.B. and A. Madhavan (1996): “The upstairs market for large-block transactions: Analysis and measurement of price effects,” *Review of Financial Studies*, Vol 9, 1-36.
- [64] Kyle, A. S. (1985): “Continuous auctions and insider trading,” *Econometrica*, Vol 53, 1315-1336.
- [65] Lehman, B. (1990): “Fads, martingales and market efficiency,” *Quarterly Journal of Economics*, Vol 105, 1-28.
- [66] Lesmond D. (2005): “Liquidity of emerging markets”, *Journal of Financial Economics*, Vol 77, 411-452.
- [67] Lesmond D., J. Ogden and C. Trzcinka (1999): “A new estimate of transaction costs,” *Review of Financial Studies*, Vol 12, 1113-1141.
- [68] Lewellen, J. and S. Nagel (2005): “The conditional CAPM does not explain asset-pricing anomalies,” *Journal of Financial Economics*, Forthcoming.
- [69] Macey, J., M. O’Hara and D. Pompilio (2004): “Down and out in the stock market: The law and finance of the delisting process,” *Working Paper*.
- [70] Mackinlay, A.C. (1995): “Multifactor models do not explain deviations from the CAPM,” *Journal of Financial Economics*, Vol. 38, 3-28.
- [71] Meier, I. and E. Schaumburg (2005): “Do funds window dress? Evidence for US domestic equity mutual funds,” *Working Paper*.
- [72] Mendenhall, R. R. (2004): “Arbitrage risk and post-earnings-announcement drift,” *Journal of Business*, Vol 77, 875-894.
- [73] Merton, R.C. (1974): “On the pricing of corporate debt: The risk structure of interest rates,” *Journal of Finance*, Vol 29, 449-470.
- [74] Mitchell, M.L., T.C. Pulvino and E. Stafford (2002): “Limited arbitrage in equity markets,” *Journal of Finance*, Vol. 57, 551-584.
- [75] Musto, D. K. (1997): “Portfolio disclosures and year-end price shifts,” *Journal of Finance*, Vol 52, 1563-1588.
- [76] Odders-White E.R. and M.J. Ready (2005): “Credit ratings and stock liquidity,” *Review of Financial Studies*, Vol 19, 119-157

- [77] Odean, T. (1998): “Volume, volatility, price and profit when all trades are above average,” *Journal of Finance*, Vol 53, 1887-1934.
- [78] Ohlson, J. A. (1980): “Financial Ratios and the Probabilistic Prediction of Bankruptcy,” *Journal of Accounting Research*, Vol 18, 109-131.
- [79] Pástor, L. and R.F. Stambaugh (2003): “Liquidity risk and expected stock returns,” *Journal of Political Economy*, Vol 111, 642-685.
- [80] Pontiff, J. (1996): “Costly arbitrage: Evidence from closed-end funds,” *Quarterly Journal of Economics*, Vol. 111, 1135-1151.
- [81] Sadka, R. and A. Scherbina (2004): “Analyst disagreement, mispricing and liquidity,” *Working Paper*.
- [82] Seguin P. J. and M. M. Smoller (1997): “Share price and mortality: An empirical evaluation of newly listed Nasdaq stocks,” *Journal of Financial Economics*, volume 45, 333-363.
- [83] Shleifer, A. and R. W. Vishny (1997): “The limits of arbitrage,” *Journal of Finance*, Vol 52, 35–55.
- [84] Shumway, T. (1997): “The Delisting bias in CRSP data,” *Journal of Finance*, Vol 52, 327-340.
- [85] Shumway, T. (2001): “Forecasting bankruptcy more accurately: A simple hazard model,” *Journal of Business*, Vol 74, 101-124.
- [86] Shumway, T. and V. A. Warther (1999): “The delisting bias in CRSP’s Nasdaq data and its implications for the size effect,” *Journal of Finance*, Vol 54, 2361-2379.
- [87] Soter, D., E. Brigham and P. Evanson (1996): “The dividend cut ‘heard round the world’: The case of FPL,” *Journal of Applied Corporate Finance*, Vol 9, 4-15.
- [88] Starks L.T., L. Yong, L. Zheng (2005): “Tax-loss selling and the January effect: evidence from municipal bond closed-end funds,” *Working Paper*.
- [89] Vassalou, M. and Y. Xing (2003): “Equity returns following changes in default risk: New insights into the informational content of credit rating changes,” *Working Paper*, Columbia University.
- [90] Vassalou, M. and Y. Xing (2004): “Default risk in equity returns,” *Journal of Finance*, Vol 59, 831-868.
- [91] Vassalou, M. and Y. Xing (2005): “Abnormal equity returns following downgrades,” *Working Paper*, Columbia University.
- [92] Vuolteenaho, T. (2002): “What drives firm-level stock returns,” *Journal of Finance*, Vol 57, 233-264.

- [93] Wermers, R. (1999): “Mutual fund herding and the impact on stock prices,” *Journal of Finance*, Vol 54, 581-622.
- [94] Wurgler, J. and K. Zhuravskaya (2002): “Does arbitrage flatten demand curves for stocks?” *Journal of Business*, Vol 75, 583-608.

Appendix: Variance Decomposition of the Default Likelihood Indicator (DLI)

Empirically, the Default Likelihood Indicator is computed as a function of three variables: leverage (lev), past stock return (ret) and asset volatility (σ_A), i.e., $DLI = N(-DD) = f(lev, ret, \sigma_A)$. We want to examine the relative importance of these three variables in a variance decomposition framework. Theoretically, as normal CDF is a monotone transformation of its argument ($-DD$), we can either work with the transformed variable (DLI) or the original variable ($-DD$). Unfortunately, directly working with DLI is challenging because DLI is highly skewed due to the nonlinear transformation of normal CDF. Therefore, we decide to study the variance decomposition of the equivalent variable: $-DD$, which is better-behaved statistically.

Applying the first-order Taylor series expansion of $-DD$ around the cross-sectional mean of lev , ret and σ_A , we have⁴⁷:

$$-\overline{DD} = \frac{\partial f}{\partial lev} \overline{lev} + \frac{\partial f}{\partial ret} \overline{ret} + \frac{\partial f}{\partial \sigma} \overline{\sigma_A} + \kappa, \quad (8)$$

where κ captures the approximation error, and variables with upper bar are cross-sectionally demeaned. Therefore, we have

$$var(DD) = \frac{\partial f}{\partial lev} cov(DD, lev) + \frac{\partial f}{\partial ret} cov(DD, ret) + \frac{\partial f}{\partial \sigma} cov(DD, \sigma_A) + cov(DD, \kappa), \quad (9)$$

where $var(\cdot)$ and $cov(\cdot)$ are the cross-sectional variance and covariance, respectively. Dividing both sides of the above equation by $var(DD)$, we then have

$$1 = \frac{\partial f}{\partial lev} \beta_{lev} + \frac{\partial f}{\partial ret} \beta_{ret} + \frac{\partial f}{\partial \sigma} \beta_{\sigma_A} + \beta_{\kappa}. \quad (10)$$

The term $\frac{\partial f}{\partial(\cdot)} \beta_{(\cdot)}$ then measures the contribution of each input to the cross-sectional variations of DLI. The sum of the contribution from the three factors is less than one, and the difference, as captured by β_{κ} , is due to the approximation error in the Taylor series expansion. The partial derivatives, or sensitivity, $\frac{\partial f}{\partial(\cdot)}$ are computed numerically by the finite difference method. β can be measured by regression. For instance, β_{lev} is estimated by regressing \overline{lev} on $-\overline{DD}$ cross-sectionally (so the intercept of the regression is zero by construction). Empirically, we have a panel data of $-DD$, lev , ret and σ_A . To estimate β , we follow Vuolteenaho (2002) and run a Weighted Least Squares (WLS) regression. In practice, this means deflating the data for each firm-date by the number of firms in the corresponding cross-section. The results are reported in Table 1. We report only simple WLS standard error. The simple WLS standard errors translate to t -values above fifty for all estimates; therefore, we are confident that all the estimates will still be significant, even if we adjust for auto-correlation and cross-sectional correlation of the error terms. Of course, this is hardly surprising, as (10) is merely a statement of an identity.

⁴⁷For simplicity of notation, we omit the time subscript t and firm superscript i .

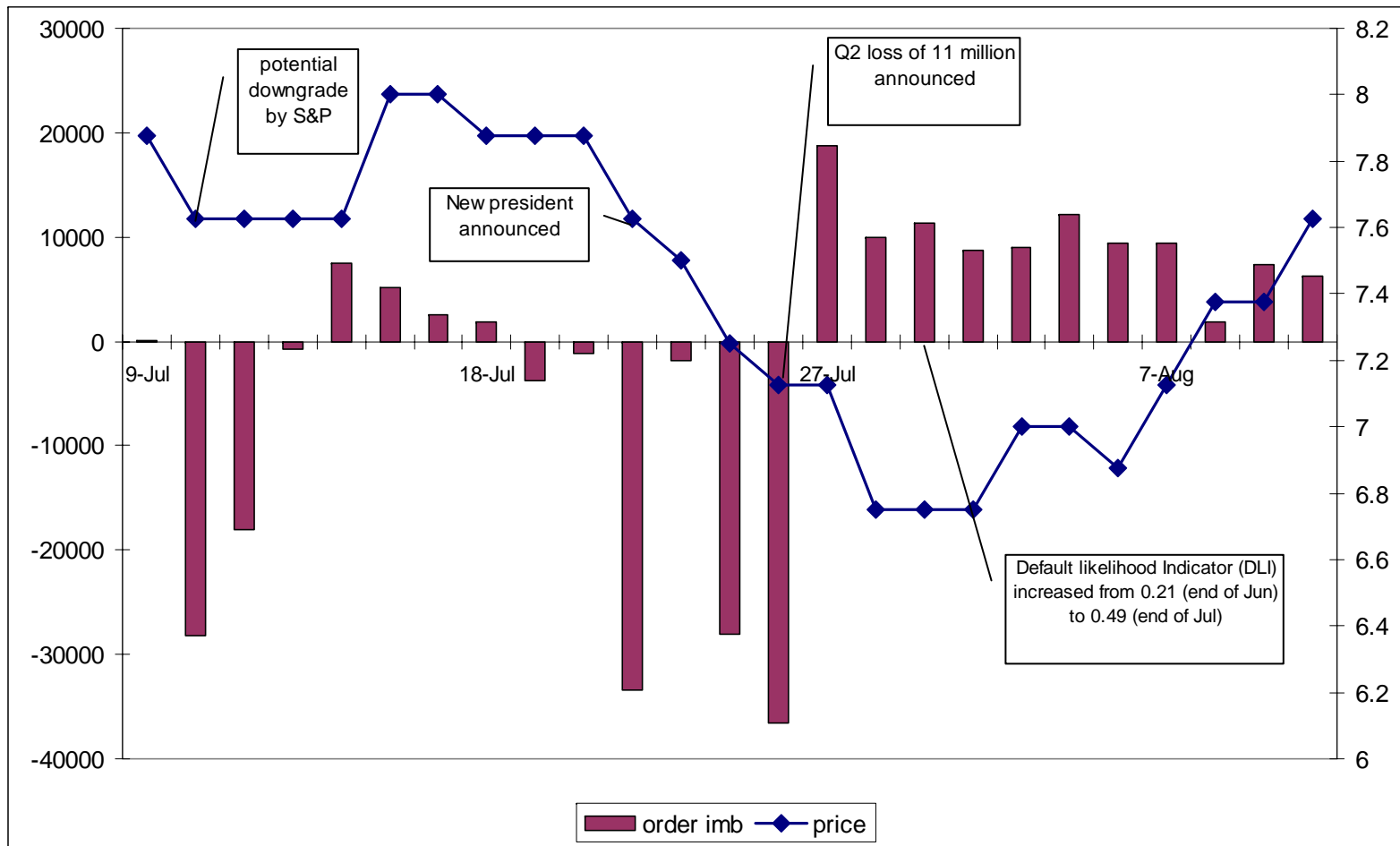


Figure 1: This figure plots the daily closing price (in blue line) and daily order imbalance (number of buyer-initiated shares purchased less than the seller-initiated shares sold, in red bar) for Midway Airlines (ticker = MDW) during the period from Jul 9 to Aug 10, 1990.

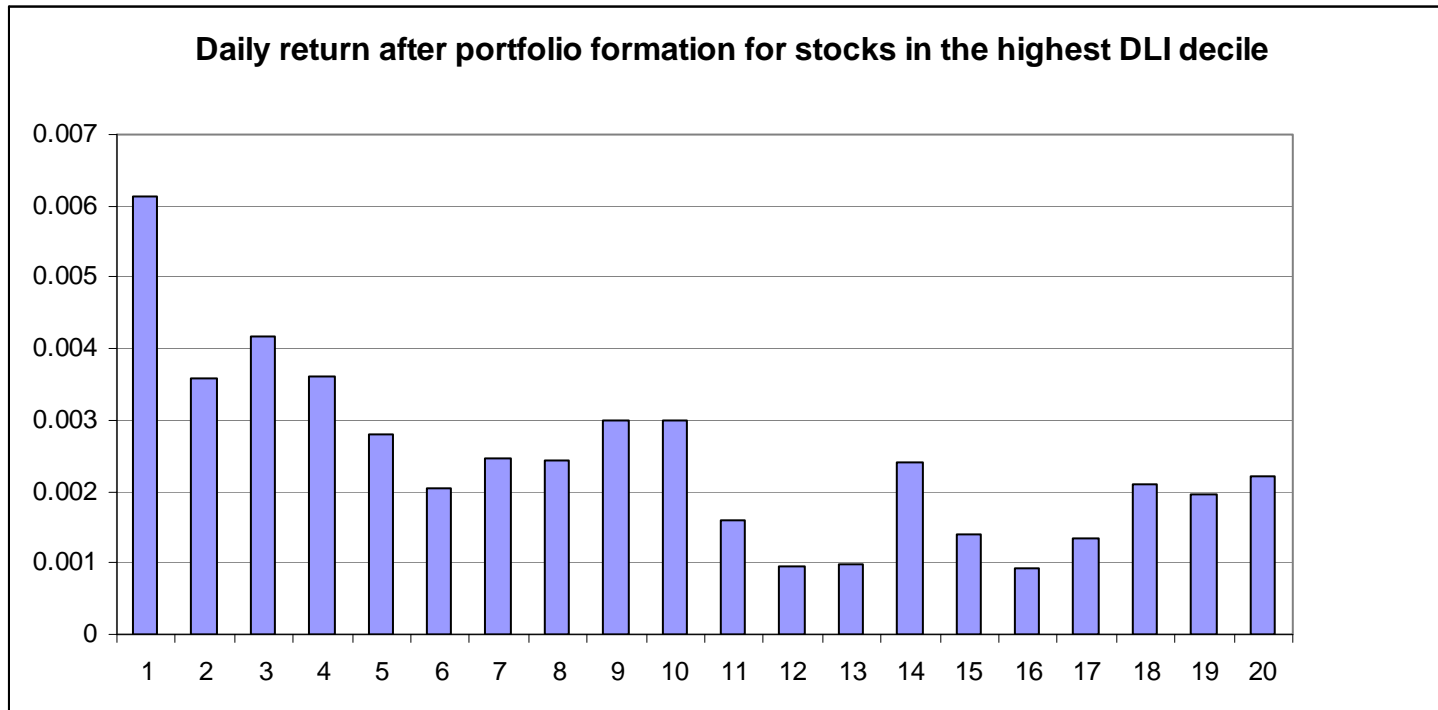


Figure 2: This figure plots the average equally-weighted daily returns during each of the first 20 days after portfolio formation for stocks in the highest DLI decile. The sampling period is from 1971/01 to 1999/12.

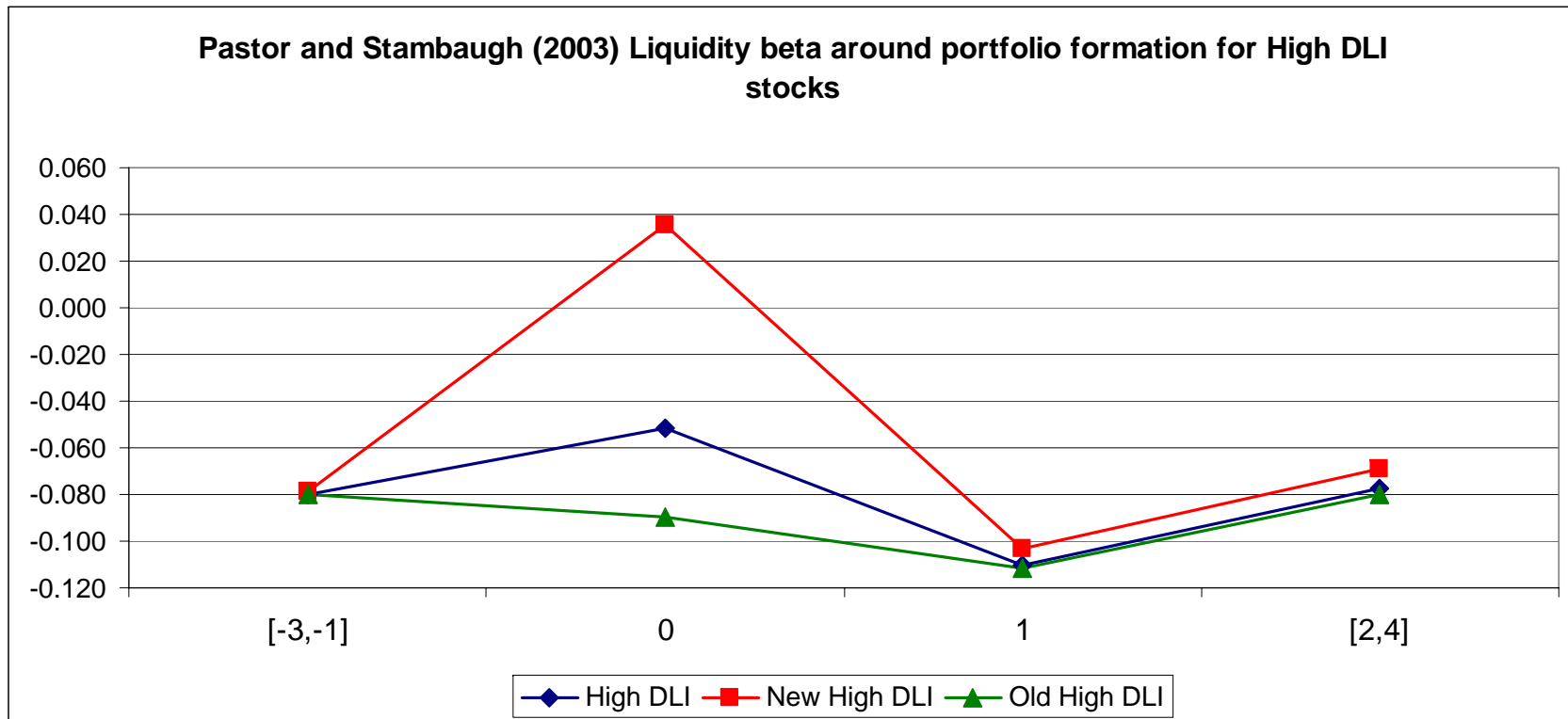


Figure 3: This figure plots the liquidity betas around the portfolio formation for High DLI stocks (stocks in the highest-DLI decile), New High DLI stocks (subset of High DLI stocks that do not belong to the highest-DLI decile in the previous month) and Old High DLI stocks (the remaining High DLI stocks that also belong to the highest-DLI decile in the previous month). “[-3,-1]” refers to the three months prior to the portfolio formation month; “0” refers to the the portfolio formation month; “1” refers to the first month after the portfolio formation month and “[2,4]” refers to the second to fourth month after portfolio formation.

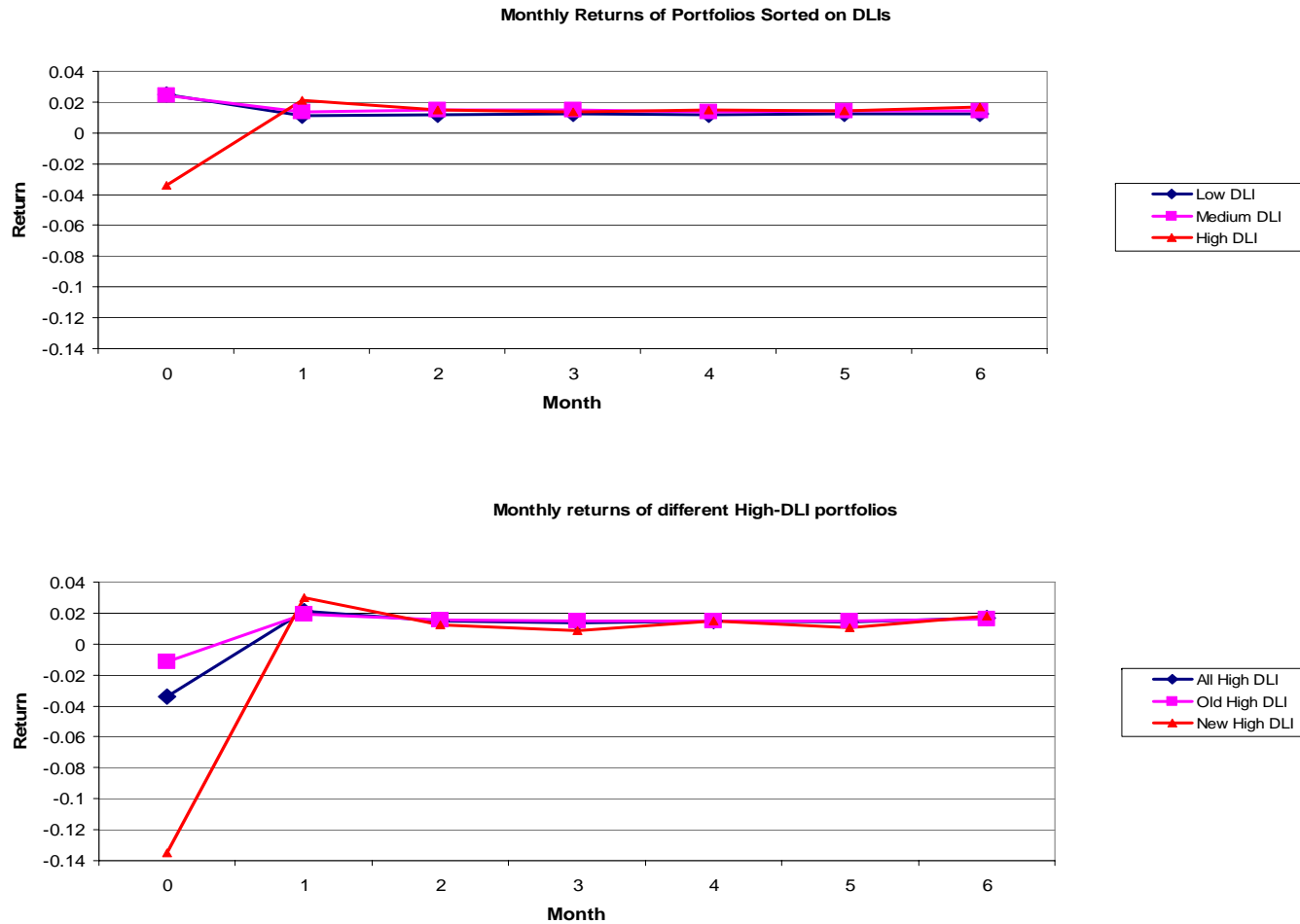


Figure 4: The top graph plots the average equally-weighted returns during portfolio formation month and each of the first six months after portfolio formation for stocks in the highest, the lowest and medium DLI deciles. We then break down stocks in the highest-DLI decile into two groups: stocks belonging to the highest-DLI decile in the previous month (Old High DLI), and the stocks which do not belong to the highest-DLI decile in the previous month (New High DLI). The bottom graph plots the average equally-weighted returns during portfolio formation month and each of the first six months after portfolio formation for stocks in the highest DLI decile, Old High DLI sub-group and New High DLI sub-group. The sampling period is from 1971/01 to 1999/12.

Table I: Variance decomposition of Default Likelihood Indicator (DLI) based on leverage, past-return and asset volatility

This table reports the percentage of total cross-sectional variation in DLI explained by financial leverage, past one-year return and asset volatility in a variance decomposition framework. We have performed the decomposition on the full sample (Panel A), the top 1/3 of the sample with the highest DLI (Panel B) and the top 1/5 of the samples with the highest DLI (Panel C). The sampling period is from 1971/01 and 1999/12. Details are provided in the Appendix.

| | Leverage | Past One-year Return | Asset Volatility | Approximation Errors |
|------------------------------------|----------|----------------------|------------------|----------------------|
| Panel A: Full Sample | | | | |
| Average | 0.69 | 0.02 | 0.56 | |
| Sensitivity of -DD | 1.54 | -1.79 | 3.44 | |
| Beta with respect to -DD | 0.34 | -0.10 | 0.06 | |
| WLS Standard Errors | 0.00 | 0.00 | 0.00 | |
| Percentage of Variance Explained | 51.82% | 17.03% | 20.23% | 10.92% |
| Panel B: top 1/3 DLI sample | | | | |
| Average | 1.47 | -0.20 | 0.74 | |
| Sensitivity of -DD | 0.37 | -1.35 | 1.09 | |
| Beta with respect to -DD | 1.39 | -0.24 | 0.07 | |
| WLS Standard Errors | 0.01 | 0.00 | 0.00 | |
| Percentage of Variance Explained | 51.70% | 31.76% | 7.13% | 9.41% |
| Panel C: top 1/5 DLI sample | | | | |
| Average | 2.01 | -0.34 | 0.80 | |
| Sensitivity of -DD | 0.21 | -1.26 | 0.60 | |
| Beta with respect to -DD | 2.34 | -0.27 | 0.06 | |
| WLS Standard Errors | 0.02 | 0.00 | 0.00 | |
| Percentage of Variance Explained | 48.70% | 34.26% | 3.69% | 13.35% |

Table II: 10 DLI-sorted portfolios, their migration matrix and the associated returns during portfolio formation month and the first-month after portfolio formation

At the end of each month from 1970/12 to 1999/12, we sort all stocks into 10 deciles according to their DLIs (decile 1: Low DLI and decile 10: High DLI). Panel A reports the equally-weighted return during and one month after portfolio formation. We also report the measure for return bias

(in bp) due to bid-ask bounce computed as $\left(\frac{P_A - P_B}{P_A + P_B}\right)^2$ where P_A and P_B are the bid and ask price

of the stock. We first compute the return bias for the full sample (1970-1999) by assuming a constant bid-ask spread of \$0.25. We also compute the return bias using the actual quoted spread (quoted ask – quoted bid) from quote data in TAQ (after 1993) and ISSM (before 1993). The sampling period for NYSE stocks is from 1983 to 1999 and the sampling period for NASDAQ stocks is from 1987 to 1999.

Panel B reports the transition probability of a stock moving from DLI decile i during the month immediately prior to the portfolio formation month ($t-1$) to DLI decile j during the portfolio formation month (t). Panel C and D report the associated equally-weighted returns during the portfolio formation month (t) and one month after portfolio formation month ($t+1$), respectively. The sampling period is from 1970 to 1999.

Panel A:

| Decile # | Return during formation month | Return one month after formation | Return bias due to bid-ask bounce Assuming a spread of \$0.25, 1970-1999 (in bp) | Return bias due to bid-ask bounce Using actual quoted spread, 1983-1999 (in bp) |
|----------|-------------------------------|----------------------------------|--|---|
| 1 | 0.0248 | 0.0113 | 1.75 | 0.56 |
| 2 | 0.0231 | 0.0107 | 2.35 | 0.91 |
| 3 | 0.0270 | 0.0138 | 3.14 | 1.29 |
| 4 | 0.0268 | 0.0133 | 4.33 | 1.84 |
| 5 | 0.0240 | 0.0138 | 5.83 | 2.58 |
| 6 | 0.0208 | 0.0140 | 7.92 | 3.71 |
| 7 | 0.0167 | 0.0123 | 11.38 | 5.58 |
| 8 | 0.0086 | 0.0126 | 17.61 | 9.74 |
| 9 | -0.0022 | 0.0118 | 28.28 | 17.01 |
| 10 | -0.0339 | 0.0210 | 53.81 | 42.09 |

Panel B: Transition probability from month t-1 to t (in %)

| Decile # at t-1 | Decile # at t | | | | | | | | | |
|--------------------|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 81.68 | 7.20 | 6.63 | 2.14 | 0.95 | 0.63 | 0.42 | 0.23 | 0.10 | 0.02 |
| 2 | 20.36 | 50.55 | 19.93 | 5.18 | 1.86 | 1.05 | 0.55 | 0.33 | 0.16 | 0.02 |
| 3 | 13.71 | 11.06 | 42.29 | 21.93 | 6.78 | 2.36 | 1.08 | 0.52 | 0.22 | 0.05 |
| 4 | 3.68 | 2.60 | 21.85 | 39.69 | 21.74 | 6.77 | 2.31 | 0.96 | 0.34 | 0.07 |
| 5 | 1.41 | 0.83 | 6.36 | 23.29 | 37.96 | 21.11 | 6.41 | 1.95 | 0.56 | 0.12 |
| 6 | 0.68 | 0.33 | 1.96 | 7.17 | 22.88 | 38.70 | 21.08 | 5.67 | 1.33 | 0.20 |
| 7 | 0.34 | 0.17 | 0.63 | 1.91 | 6.63 | 22.85 | 41.26 | 21.43 | 4.31 | 0.46 |
| 8 | 0.12 | 0.09 | 0.26 | 0.54 | 1.58 | 5.68 | 22.61 | 46.95 | 20.52 | 1.65 |
| 9 | 0.07 | 0.04 | 0.07 | 0.15 | 0.36 | 1.02 | 4.06 | 20.60 | 57.81 | 15.83 |
| 10 | 0.02 | 0.01 | 0.02 | 0.03 | 0.05 | 0.14 | 0.37 | 1.57 | 15.09 | 82.70 |

Panel C: Average monthly return during month t (in %)

| | | | | | | | | | | |
|----|------|-------|-------|-------|-------|-------|-------|-------|--------|--------|
| 1 | 1.75 | -1.83 | -2.38 | -2.69 | -2.74 | -2.27 | -2.91 | -4.93 | -4.23 | -6.57 |
| 2 | 5.06 | 1.63 | -1.85 | -4.32 | -5.26 | -3.63 | -5.15 | -5.94 | -8.90 | -6.24 |
| 3 | 6.37 | 5.21 | 1.83 | -1.89 | -4.22 | -4.58 | -4.35 | -6.33 | -9.21 | -11.88 |
| 4 | 6.55 | 7.99 | 5.98 | 1.69 | -2.69 | -5.29 | -5.86 | -6.38 | -12.09 | -18.51 |
| 5 | 5.30 | 8.24 | 8.88 | 6.51 | 1.37 | -3.57 | -6.39 | -8.85 | -12.11 | -21.01 |
| 6 | 5.87 | 6.72 | 9.15 | 10.48 | 7.18 | 1.03 | -4.57 | -8.53 | -12.53 | -15.67 |
| 7 | 7.04 | 5.51 | 9.21 | 12.02 | 12.60 | 7.81 | 0.58 | -6.26 | -12.87 | -21.01 |
| 8 | 6.84 | 7.08 | 6.03 | 12.29 | 15.44 | 16.01 | 9.06 | 0.16 | -8.67 | -19.50 |
| 9 | 3.84 | 5.00 | 6.19 | 10.87 | 18.02 | 20.23 | 20.42 | 11.40 | -0.38 | -12.70 |
| 10 | 2.10 | 7.73 | 4.31 | 7.00 | 8.72 | 14.46 | 33.00 | 35.95 | 16.86 | -1.18 |

Panel D: Average monthly return during month t+1 (in %)

| | | | | | | | | | | |
|----|-------|-------|-------|------|-------|------|-------|------|-------|------|
| 1 | 1.09 | 1.21 | 1.51 | 1.71 | 1.39 | 1.82 | 1.47 | 3.37 | 1.33 | 0.69 |
| 2 | 1.16 | 1.07 | 1.58 | 1.13 | 1.48 | 3.79 | 0.36 | 2.98 | 4.21 | 3.99 |
| 3 | 1.34 | 1.00 | 1.47 | 1.45 | 1.34 | 2.02 | 1.51 | 3.09 | 0.22 | 5.68 |
| 4 | 0.96 | 1.12 | 1.23 | 1.26 | 1.52 | 1.67 | 1.81 | 3.76 | 2.05 | 4.37 |
| 5 | 1.77 | -0.75 | 1.24 | 1.22 | 1.35 | 1.66 | 2.15 | 1.94 | 3.74 | 1.64 |
| 6 | 1.34 | 1.00 | 0.96 | 1.02 | 1.33 | 1.37 | 1.69 | 2.14 | 2.62 | 2.19 |
| 7 | 1.26 | 0.85 | -0.07 | 1.17 | 1.34 | 1.22 | 1.20 | 1.53 | 2.23 | 2.14 |
| 8 | 0.95 | 0.53 | 3.08 | 2.04 | 1.02 | 0.48 | 0.77 | 1.32 | 1.98 | 2.00 |
| 9 | -0.36 | 2.85 | 0.50 | 2.92 | -0.15 | 0.88 | -0.15 | 0.40 | 1.13 | 3.03 |
| 10 | -5.81 | -4.60 | -1.29 | 4.21 | 1.25 | 2.78 | 0.01 | 0.37 | -0.31 | 1.93 |

Table III: Characteristics of portfolios sorted on DLI

At the end of each month from 1970/12 to 1999/12, we sort all stocks into 10 deciles according to their DLIs. We report various characteristics (the mean and median) of these portfolios. The two illiquidity measures are multiplied by 1000.

| Port ID | Characteristics (mean) | | | | | |
|--------------------------|------------------------|------------------------|--------------------|-------|-----------------|--------|
| | DLI (%) | MktCap (in million) | Book-to- market | Price | Amihud (250) | Amihud |
| Low DLI | 0.00 | 2164.92 | 0.62 | 52.12 | 0.30 | 0.47 |
| 2 | 0.00 | 1303.78 | 0.73 | 29.37 | 0.49 | 0.92 |
| 3 | 0.00 | 926.84 | 0.75 | 24.48 | 0.59 | 0.87 |
| 4 | 0.01 | 644.64 | 0.78 | 20.06 | 0.83 | 1.29 |
| 5 | 0.04 | 452.80 | 0.83 | 17.02 | 1.14 | 1.56 |
| 6 | 0.17 | 339.21 | 0.89 | 14.52 | 1.70 | 2.51 |
| 7 | 0.61 | 225.86 | 0.99 | 11.51 | 2.46 | 3.52 |
| 8 | 2.15 | 141.27 | 1.12 | 8.77 | 3.68 | 6.24 |
| 9 | 7.85 | 80.72 | 1.32 | 6.12 | 6.60 | 11.54 |
| High DLI | 36.45 | 39.60 | 1.92 | 3.58 | 14.47 | 31.75 |
| Characteristics (median) | | | | | | |
| Low DLI | 0.00 | 345.70 | 0.55 | 26.08 | 0.07 | 0.07 |
| 2 | 0.00 | 228.58 | 0.68 | 21.16 | 0.12 | 0.13 |
| 3 | 0.00 | 159.36 | 0.70 | 19.21 | 0.15 | 0.15 |
| 4 | 0.01 | 107.13 | 0.73 | 16.46 | 0.21 | 0.22 |
| 5 | 0.04 | 75.43 | 0.76 | 13.76 | 0.31 | 0.31 |
| 6 | 0.16 | 54.27 | 0.81 | 11.19 | 0.46 | 0.49 |
| 7 | 0.57 | 36.86 | 0.89 | 8.79 | 0.76 | 0.83 |
| 8 | 2.01 | 23.75 | 1.00 | 6.45 | 1.24 | 1.49 |
| 9 | 7.25 | 15.48 | 1.17 | 4.37 | 2.18 | 3.19 |
| High DLI | 30.57 | 8.13 | 1.56 | 2.37 | 4.10 | 7.69 |

Table IV: Aggregate mutual fund holdings and mutual fund holding changes of all and recent High-DLI stocks

This table illustrates the quarterly aggregate mutual fund holding and holding changes of all high DLI stocks and recent high DLI stocks. Panel A examines the aggregate mutual fund holdings and holding changes of all high DLI stocks when they become financially distressed during any month of the quarter. Panel B examines the aggregate mutual fund holdings and holding changes of recent high DLI stocks when they become financially distressed during any month of the quarter. Panel C reports the quarterly mutual fund holding changes during the four quarters after the event quarter (Q) for all high DLI stocks. Panel C reports the quarterly mutual fund holding changes during the four quarters after the event quarter (Q) for all recent high DLI stocks. All high DLI or recent high DLI stocks are further sorted into three groups based on the number of underlying mutual fund shareholders. “Low” refers to ones for which the underlying shareholders is less than or equal to 2, “Medium” refers to ones for which the underlying shareholders between 3 and 7 (inclusive), and “High” refers to ones for which the underlying shareholders greater than or equal to 8. The ranking approximately matches the 33rd percentile and 67th percentile of underlying mutual fund shareholders across all stocks and all years. “All” refers to the full sample irrespective of the number of the underlying mutual fund shareholders. N is the number of stocks across all quarters. The sampling period is from 1980-1999. All holdings and holding changes are reported in percentage.

Panel A: Aggregate mutual fund holdings and mutual fund holding changes of *all* High-DLI stocks

| Statistics | | Aggregate Mutual Fund Holdings at (Q-1) (%) | Aggregate Mutual Fund Holdings at (Q) (%) | Quarterly Holding Changes (%) | Aggregate Mutual Fund Holdings at (Q-1) (%) | Aggregate Mutual Fund Holdings at (Q) (%) | Quarterly Holding Changes (%) | Aggregate Mutual Fund Holdings at (Q-1) (%) | Aggregate Mutual Fund Holdings at (Q) (%) | Quarterly Holding Changes (%) |
|------------|----------------------|---|---|-------------------------------|---|---|-------------------------------|---|---|-------------------------------|
| | | 1980 - 1999 | | | 1980-1989 | | | 1990 - 1999 | | |
| Low | Mean | 1.599 | 1.458 | -0.141 | 1.883 | 1.74 | -0.143 | 1.326 | 1.188 | -0.139 |
| | <i>t</i> -statistics | 61.40 | 60.25 | -5.53 | 50.86 | 49.77 | -4.07 | 36.92 | 36.26 | -3.77 |
| | N | 5711 | 5711 | 5711 | 2798 | 2798 | 2798 | 2913 | 2913 | 2913 |
| Medium | Mean | 3.707 | 2.641 | -1.066 | 4.182 | 3.136 | -1.047 | 3.452 | 2.376 | -1.076 |
| | <i>t</i> -statistics | 75.34 | 69.44 | -22.95 | 55.48 | 49.91 | -15.00 | 54.47 | 50.53 | -17.71 |
| | N | 4496 | 4496 | 4496 | 1570 | 1570 | 1570 | 2926 | 2926 | 2926 |
| High | Mean | 5.921 | 4.055 | -1.866 | 5.052 | 4.236 | -0.816 | 6.192 | 3.998 | -2.194 |
| | <i>t</i> -statistics | 44.71 | 52.19 | -14.92 | 25.58 | 29.95 | -4.83 | 38.38 | 43.53 | -14.28 |
| | N | 1033 | 1033 | 1033 | 246 | 246 | 246 | 787 | 787 | 787 |
| All | Mean | 2.839 | 2.17 | -0.669 | 2.834 | 2.348 | -0.486 | 2.843 | 2.046 | -0.797 |
| | <i>t</i> -statistics | 95.48 | 97.69 | -25.78 | 71.26 | 70.84 | -14.42 | 67.43 | 68.91 | -21.43 |
| | N | 11240 | 11240 | 11240 | 4614 | 4614 | 4614 | 6626 | 6626 | 6626 |

Panel B: Aggregate mutual fund holdings and mutual fund holding changes of *recent* High-DLI Stocks

| Statistics | | Aggregate Mutual Fund Holdings at (Q-1) (%) | Aggregate Mutual Fund Holdings at (Q) (%) | Quarterly Holding Changes (%) | Aggregate Mutual Fund Holdings at (Q-1) (%) | Aggregate Mutual Fund Holdings at (Q) (%) | Quarterly Holding Changes (%) | Aggregate Mutual Fund Holdings at (Q-1) (%) | Aggregate Mutual Fund Holdings at (Q) (%) | Quarterly Holding Changes (%) |
|------------|----------------------|---|---|-------------------------------|---|---|-------------------------------|---|---|-------------------------------|
| | | 1980 - 1999 | | | 1980 - 1989 | | | 1990 - 1999 | | |
| Low | Mean | 1.676 | 1.595 | -0.081 | 1.963 | 1.857 | -0.107 | 1.351 | 1.299 | -0.053 |
| | <i>t</i> -statistics | 31.37 | 29.64 | -1.46 | 28.14 | 24.76 | -1.46 | 16.86 | 17.21 | -0.62 |
| | N | 1308 | 1308 | 1308 | 694 | 694 | 694 | 614 | 614 | 614 |
| Medium | Mean | 4.391 | 3.228 | -1.163 | 4.659 | 3.719 | -0.941 | 4.228 | 2.93 | -1.298 |
| | <i>t</i> -statistics | 45.33 | 43.62 | -12.96 | 33.74 | 31.20 | -7.13 | 32.30 | 31.51 | -10.84 |
| | N | 1416 | 1416 | 1416 | 534 | 534 | 534 | 882 | 882 | 882 |
| High | Mean | 7.463 | 5.099 | -2.364 | 5.789 | 4.858 | -0.931 | 7.994 | 5.175 | -2.818 |
| | <i>t</i> -statistics | 35.75 | 46.79 | -12.42 | 20.54 | 23.28 | -4.24 | 31.35 | 40.67 | -11.90 |
| | N | 586 | 586 | 586 | 141 | 141 | 141 | 445 | 445 | 445 |
| All | Mean | 3.862 | 2.914 | -0.948 | 3.409 | 2.892 | -0.517 | 4.181 | 2.929 | -1.252 |
| | <i>t</i> -statistics | 55.59 | 60.74 | -16.52 | 41.86 | 41.13 | -7.58 | 40.59 | 45.01 | -14.81 |
| | N | 3310 | 3310 | 3310 | 1369 | 1369 | 1369 | 1941 | 1941 | 1941 |

Panel C: Aggregate mutual fund quarterly holding change after event quarter for *all* High-DLI stocks

| | | Quarterly Holding Changes (Q+1 - Q) (%) | Quarterly Holding Changes (Q+2 - Q+1) (%) | Quarterly Holding Changes (Q+3 - Q+2) (%) | Quarterly Holding Changes (Q+4 - Q+3) (%) |
|--------|----------------------|--|--|--|--|
| Low | Mean | 0.048 | 0.053 | -0.031 | 0.082 |
| | <i>t</i> -statistics | 2.00 | 2.24 | -1.27 | 3.08 |
| | N | 4326 | 3530 | 3324 | 3118 |
| Medium | Mean | -0.03 | -0.233 | 0.034 | -0.054 |
| | <i>t</i> -statistics | -0.81 | -6.27 | 0.88 | -1.38 |
| | N | 3893 | 3450 | 3209 | 3030 |
| High | Mean | -0.398 | -0.205 | 0.009 | 0.05 |
| | <i>t</i> -statistics | -5.18 | -2.77 | 0.12 | 0.65 |
| | N | 974 | 921 | 877 | 834 |
| All | Mean | -0.032 | -0.102 | 0.002 | 0.019 |
| | <i>t</i> -statistics | -1.54 | -4.78 | 0.08 | 0.83 |
| | N | 9193 | 7901 | 7410 | 6982 |

Panel D: Aggregate mutual fund quarterly holding change after event quarter for *recent* High-DLI stocks

| | | Quarterly Holding Changes (Q+1 - Q) (%) | Quarterly Holding Changes (Q+2 - Q+1) (%) | Quarterly Holding Changes (Q+3 - Q+2) (%) | Quarterly Holding Changes (Q+4 - Q+3) (%) |
|--------|----------------------|--|--|--|--|
| Low | Mean | 0.059 | 0.106 | -0.116 | 0.169 |
| | <i>t</i> -statistics | 1.19 | 1.96 | -2.22 | 3.00 |
| | N | 968 | 813 | 771 | 732 |
| Medium | Mean | -0.127 | -0.284 | 0.035 | -0.068 |
| | <i>t</i> -statistics | -1.79 | -4.24 | 0.51 | -0.97 |
| | N | 1091 | 999 | 931 | 885 |
| High | Mean | -0.584 | -0.143 | -0.097 | 0.134 |
| | <i>t</i> -statistics | -5.05 | -1.37 | -0.89 | 1.15 |
| | N | 404 | 391 | 376 | 353 |
| All | Mean | -0.129 | -0.115 | -0.045 | 0.056 |
| | <i>t</i> -statistics | -3.08 | -2.81 | -1.08 | 1.29 |
| | N | 2463 | 2203 | 2078 | 1970 |

Table V: Average idiosyncratic risk measure and analyst coverage for 10 DLI-sorted portfolios

For each of the 10 DLI-sorted portfolios, we report the average idiosyncratic risk measure and the average analyst coverage. The idiosyncratic risk measure is estimated from 1971/01 to 1999/12. The average analyst coverage is estimated from 1984/01 to 1999/12.

| Port | Idio risk measure | # of stocks receiving coverage as % of total # of stocks in the portfolio | average # of analyst for stocks receiving coverage |
|----------|-------------------|---|--|
| Low DLI | 86.3% | 73.5% | 5.39 |
| 2 | 86.5% | 76.7% | 4.98 |
| 3 | 88.2% | 67.4% | 4.55 |
| 4 | 89.0% | 62.6% | 4.20 |
| 5 | 89.9% | 57.0% | 3.80 |
| 6 | 90.8% | 51.7% | 3.42 |
| 7 | 91.9% | 44.9% | 3.11 |
| 8 | 93.3% | 36.6% | 2.87 |
| 9 | 94.8% | 29.1% | 2.60 |
| High DLI | 96.6% | 20.3% | 2.50 |

Table VI: Changes in trading volume, trading cost, order imbalance and liquidity betas during the liquidity shock

This table reports various stock characteristics during liquidity shock for 10 DLI-sorted deciles and also New High DLI stocks. New High DLI stocks are stocks which just enter into the highest-DLI decile during the current portfolio formation month.

Panel A reports the trading volume during three two-month periods: (1) the two months prior to the portfolio formation month ([-2,-1]); (2) the portfolio formation month and the first month after portfolio formation([0,1]); (3) the second and third month after portfolio formation ([2,3]). The trading volumes are adjusted for changes in the total number of shares outstanding. Finally, the trading volumes are normalized by the trading volume during the two months prior to the portfolio formation month ([-2,-1]). The sampling period is from 1970 to 1999.

Panel B reports the percentage bid-ask spread one month before portfolio formation, at portfolio formation and one month after portfolio formation. The percentage bid-ask spread is defined as (ask – bid) / mid. It is computed using intraday quote data from TAQ (after 1993) and ISSM (before 1993). The sampling period for NYSE stocks is from 1983 to 1999 and the sampling period for NASDAQ stocks is from 1987 to 1999.

Panel C reports two order imbalance measures during and one month after the portfolio formation month. Both measures are developed in Chordia, Roll and Subrahmanyam (2002) and Chordia and Subrahmanyam (2004). OIBSH1 measures the buyer-initiated shares purchased less than the seller-initiated shares sold and OIBSH2 is OIBSH1 scaled by the total number of shares traded. The sampling period is from 1988 to 1998.

Panel D reports the liquidity betas during the portfolio formation month (0) and the first month after the portfolio formation month (1). It also reports the average liquidity betas during two three-month periods: the pre-formation - the three months prior to the portfolio formation month ([-3,-1]) and the post-formation – the second to fourth month after portfolio formation ([2,4]). As in Pastor and Stambaugh (2003), the liquidity beta during month n is defined as the slope coefficient (β^n) in the following regression:

$$r_{i,t}^n = \alpha_i^n + \beta_i^n L_t + \beta_{i,M}^n MKT_t + \beta_{i,S}^n SMB_t + \beta_{i,H}^n HML_t + \varepsilon_{i,t},$$

where r^0 denotes the excess return during portfolio formation month and MKT, SMB and HML are the Fama-French three factors. L is the innovation in the aggregate liquidity measure defined in Pastor and Stambaugh (2003). The changes in the liquidity betas over these periods are also reported, and the associated t-values are computed using Newey-West standard error estimators with three lags. The sampling period is from 1970 to 1999.

Panel A: Normalized trading volume

| Portfolio | (1) Normalized Volume during Month [0,1] | t-value associated with (1)-1 | (2) Normalized Volume during Month [2,3] | t-value associated with (2)-1 |
|--------------|---|-------------------------------------|---|-------------------------------------|
| Low DLI | 1.035 | 4.33 | 1.061 | 6.04 |
| 2 | 1.036 | 3.13 | 1.064 | 4.25 |
| 3 | 1.036 | 3.89 | 1.055 | 4.67 |
| 4 | 1.026 | 2.91 | 1.042 | 3.75 |
| 5 | 1.024 | 2.48 | 1.040 | 3.24 |
| 6 | 1.017 | 1.57 | 1.037 | 2.42 |
| 7 | 1.013 | 1.08 | 1.016 | 1.14 |
| 8 | 1.000 | 0.04 | 1.025 | 1.56 |
| 9 | 0.993 | -0.57 | 1.025 | 1.31 |
| High DLI | 1.037 | 1.60 | 1.052 | 2.71 |
| New High DLI | 1.045 | 2.18 | 1.040 | 1.75 |

Panel B: Percentage trading cost

| Portfolio | (1) Percentage spread 1month prior to the formation (%) | (2) Percentage spread at formation (%) | (3) Percentage spread 1 month after formation (%) | t-value associated with (2)-(1) |
|--------------|---|---|---|---------------------------------------|
| Low DLI | 1.36 | 1.35 | 1.36 | -0.94 |
| 2 | 1.71 | 1.71 | 1.71 | 0.05 |
| 3 | 1.92 | 1.90 | 1.92 | -1.51 |
| 4 | 2.30 | 2.27 | 2.30 | -1.24 |
| 5 | 2.71 | 2.70 | 2.71 | -0.55 |
| 6 | 3.18 | 3.17 | 3.18 | -0.60 |
| 7 | 3.84 | 3.82 | 3.86 | -0.53 |
| 8 | 4.95 | 4.94 | 4.98 | -0.21 |
| 9 | 6.71 | 6.76 | 6.82 | 0.94 |
| High DLI | 10.68 | 11.01 | 11.04 | 3.63 |
| New High DLI | 7.22 | 8.31 | 8.23 | 10.53 |

Panel C: Order imbalance measures

| Portfolio | (1) OIBSH1 during formation month | (2) OIBSH1 one month after formation | (2) - (1) Change in OIBSH1 | t-value associated with (2) - (1) | (3) OIBSH2 during formation month (in %) | (4) OIBSH2 one month after formation (in %) | (4) - (3) Change in OIBSH2 | t-value associated with (4) - (3) |
|--------------|---|---|----------------------------------|---|--|---|----------------------------------|---|
| Low DLI | 10756.2 | 9885.6 | -870.6 | -3.87 | 0.91 | 0.51 | -0.40 | -5.42 |
| 2 | 11319.7 | 11466.3 | 146.6 | 0.17 | -0.28 | 0.07 | 0.35 | 1.66 |
| 3 | 10128.5 | 10293.3 | 164.8 | 0.39 | 0.05 | 0.00 | -0.05 | -0.41 |
| 4 | 10314.2 | 10161.5 | -152.7 | -0.30 | 0.00 | -0.12 | -0.12 | -0.92 |
| 5 | 9586.6 | 9539.7 | -46.9 | -0.09 | -0.73 | -0.77 | -0.04 | -0.25 |
| 6 | 8058.1 | 8747.4 | 689.3 | 1.20 | -1.63 | -1.32 | 0.31 | 1.87 |
| 7 | 6313.8 | 7416.9 | 1103.1 | 1.75 | -2.56 | -2.42 | 0.14 | 0.76 |
| 8 | 4312.7 | 5949.2 | 1636.5 | 2.52 | -3.60 | -3.40 | 0.20 | 0.88 |
| 9 | 1562.3 | 3698.0 | 2135.7 | 3.23 | -5.76 | -4.98 | 0.78 | 2.90 |
| High DLI | -710.3 | 818.1 | 1528.4 | 2.03 | -6.79 | -6.05 | 0.74 | 2.35 |
| New High DLI | -2456.6 | 2958.4 | 5415.0 | 2.87 | -7.81 | -4.26 | 3.55 | 5.67 |

Panel D: Pastor and Stambaugh's liquidity betas

| Portfolio | (1) average liquidity beta during month=[-3,-1] | (2) liquidity beta during formation month = 0 | (3) liquidity beta one month after month = 1 | (4) average liquidity beta during month = [2,4] | (2)-(1) | t-value for (2)-(1) | (3)-(2) | t-value for (3)-(2) | (4)-(3) | t-value for (4)-(3) |
|--------------|---|---|--|---|---------|---------------------------|---------|---------------------------|---------|---------------------------|
| Low DLI | 0.002 | 0.006 | 0.026 | 0.016 | 0.004 | 0.39 | 0.021 | 3.07 | -0.010 | -2.19 |
| 2 | -0.025 | -0.022 | -0.002 | -0.006 | 0.002 | 0.17 | 0.020 | 1.39 | -0.004 | -0.34 |
| 3 | -0.012 | -0.014 | -0.010 | -0.008 | -0.002 | -0.14 | 0.004 | 0.42 | 0.001 | 0.14 |
| 4 | -0.001 | 0.003 | 0.008 | 0.004 | 0.004 | 0.37 | 0.006 | 0.51 | -0.004 | -0.48 |
| 5 | 0.000 | 0.005 | 0.012 | -0.008 | 0.005 | 0.47 | 0.007 | 0.53 | -0.020 | -2.18 |
| 6 | 0.000 | -0.024 | -0.009 | -0.008 | -0.024 | -2.30 | 0.015 | 1.20 | 0.002 | 0.16 |
| 7 | 0.025 | 0.009 | -0.002 | -0.004 | -0.016 | -1.30 | -0.011 | -0.74 | -0.003 | -0.27 |
| 8 | 0.011 | -0.001 | -0.022 | -0.016 | -0.012 | -0.84 | -0.021 | -1.45 | 0.006 | 0.58 |
| 9 | 0.002 | 0.004 | -0.015 | -0.006 | 0.002 | 0.11 | -0.019 | -1.15 | 0.009 | 0.72 |
| High DLI | -0.080 | -0.052 | -0.110 | -0.077 | 0.028 | 2.07 | -0.058 | -2.01 | 0.033 | 2.69 |
| New High DLI | -0.078 | 0.036 | -0.103 | -0.069 | 0.114 | 2.39 | -0.139 | -2.11 | 0.034 | 0.61 |

Table VII: Cross-sectional regressions with stock characteristics

Each month from 1970/01 to 1999/12, we run a cross-sectional regression of the next month three-factor alphas on various current month stock characteristics. The alphas are estimated using rolling-window regressions. All variables are cross-sectionally demeaned so the intercept term is zero. In addition, the stock characteristics are also standardized so the regression slope coefficient can be interpreted as the impact on the return of a one standard deviation change in the variable. The slope coefficients are then averaged cross time and reported. The robust t value is computed using Newey-West autocorrelation adjusted standard error with 12 lags. *Amihud* is a liquidity measure; *DLI* is the Default Likelihood Indicator of Vassalou and Xing (2004); *Size* is the log of market capitalization; *B/M* is the book-to-market ratio and *Pastret* is the return one month prior to the portfolio formation. We exclude stocks with missing characteristics and negative B/M. The regressions are estimated for both the full sample (1589 stocks per month on average) and the top DLI Quintile (272 stocks per month on average). Panel A reports the correlations among the characteristics (Full sample in lower-triangular and the Top DLI-quintile in the upper triangular). Panel B and C reports the regression results. The robust t value is reported below the coefficient estimate in italic. The regression slopes are presented in the unit of percentage return. For Panel B, the factor loadings are computed using monthly data in a five-year rolling window. For Panel C, the factor loadings are computed using daily data in a 6-month rolling window.

Panel A: Correlations

| | | Top DLI Quintile | | | | |
|----------------|---------|------------------|--------|--------|--------|--------|
| | | Amihud | DLI | Size | B/M | Pret |
| Full Sample | Amihud | | 0.140 | -0.190 | 0.103 | 0.016 |
| | DLI | 0.183 | | -0.232 | 0.353 | -0.123 |
| | Size | -0.143 | -0.318 | | -0.208 | 0.034 |
| | B/M | 0.128 | 0.426 | -0.362 | | -0.089 |
| | Pastret | -0.003 | -0.117 | 0.043 | -0.106 | |

Panel B: Regression results (pre-formation factor loadings estimated using 5-year monthly data)

| | Full sample | | | | | | | Top DLI-quntile | | | | | | |
|---------|-------------|--------|--------|--------|-------|--------------------|--------------|-----------------|--------|--------|--------|-------|--------------------|--------------|
| | Pastret | Amihud | DLI | Size | B/M | Pastret* Amihud | R- square | Pastret | Amihud | DLI | Size | B/M | Pastret* Amihud | R- square |
| Model 1 | | | 0.217 | | | | 0.80% | | | 0.660 | | | | 1.00% |
| | | | 3.16 | | | | | | | 5.73 | | | | |
| Model 2 | | 0.233 | | | | | 0.74% | | 0.592 | | | | | 1.21% |
| | | 3.56 | | | | | | | 4.67 | | | | | |
| Model 3 | -0.995 | | | | | | 1.17% | -2.263 | | | | | | 2.38% |
| | -9.70 | | | | | | | -13.35 | | | | | | |
| Model 4 | -1.004 | 0.200 | 0.037 | | | | 2.47% | -2.244 | 0.541 | 0.265 | | | | 4.44% |
| | -9.97 | 3.22 | 0.61 | | | | | -13.66 | 4.25 | 2.42 | | | | |
| Model 5 | -1.023 | 0.178 | -0.084 | -0.019 | 0.284 | | 3.24% | -2.215 | 0.345 | -0.066 | -0.649 | 0.611 | | 6.10% |
| | -10.19 | 3.26 | -1.60 | -0.31 | 4.97 | | | -13.44 | 2.97 | -0.70 | -4.36 | 5.02 | | |
| Model 6 | -0.877 | 0.043 | -0.101 | -0.033 | 0.288 | -0.597 | 3.68% | -1.954 | 0.276 | -0.086 | -0.625 | 0.629 | -0.639 | 7.02% |
| | -9.36 | 0.54 | -1.90 | -0.56 | 5.21 | -7.80 | | -11.93 | 1.40 | -0.89 | -4.34 | 5.31 | -4.16 | |

Panel C: Regression results (pre-formation factor loadings estimated using 6-month daily data)

| | Full sample | | | | | | | Top DLI-quntile | | | | | | |
|---------|-------------|--------|--------|--------|-------|--------------------|--------------|-----------------|--------|--------|--------|-------|--------------------|--------------|
| | Pastret | Amihud | DLI | Size | B/M | Pastret* Amihud | R- square | Pastret | Amihud | DLI | Size | B/M | Pastret* Amihud | R- square |
| Model 1 | | | 0.243 | | | | 1.07% | | | 0.622 | | | | 0.99% |
| | | | 3.22 | | | | | | | 5.46 | | | | |
| Model 2 | | 0.274 | | | | | 0.92% | | 0.646 | | | | | 1.23% |
| | | 4.74 | | | | | | | 6.04 | | | | | |
| Model 3 | -0.801 | | | | | | 0.98% | -2.080 | | | | | | 2.10% |
| | -8.83 | | | | | | | -14.64 | | | | | | |
| Model 4 | -0.806 | 0.228 | 0.043 | | | | 2.54% | -2.069 | 0.597 | 0.206 | | | | 4.17% |
| | -9.24 | 4.41 | 0.63 | | | | | -14.63 | 5.57 | 1.90 | | | | |
| Model 5 | -0.829 | 0.188 | -0.082 | -0.052 | 0.314 | | 4.24% | -2.040 | 0.382 | -0.117 | -0.664 | 0.618 | | 6.07% |
| | -9.76 | 4.09 | -1.41 | -0.47 | 3.96 | | | -14.22 | 3.79 | -1.26 | -4.64 | 4.80 | | |
| Model 6 | -0.670 | 0.046 | -0.100 | -0.069 | 0.318 | -0.656 | 4.71% | -1.754 | 0.336 | -0.140 | -0.643 | 0.635 | -0.700 | 7.03% |
| | -8.65 | 0.61 | -1.71 | -0.62 | 4.14 | -8.51 | | -12.45 | 1.74 | -1.48 | -4.53 | 5.14 | -4.68 | |

Table VIII: Economic significance of the first-month high return on the High-DLI and New High-DLI stocks

We focus on the High-DLI stocks (stocks in the highest-DLI decile during the formation month) and New High-DLI stocks (stocks that enter the highest-DLI decile only during the formation month) and further sort them into quartiles according to their market capitalizations (in Panel A) or their trading prices (in Panel B). We then report various characteristics for each quartile. The percentage bid-ask spread and the return bias due to bid-ask bounce are both computed using the actual quoted spread (quoted ask – quoted bid) from quote data in TAQ (after 1993) and ISSM (before 1993). The sampling periods for these two characteristics are from 1983 to 1999 for NYSE stocks and from 1987 to 1999 for NASDAQ stocks. For other characteristics, the sampling periods are from 1971 to 1999.

Panel A: Size-sorted quartile

| Quartile | # of stocks | Mktcap (million \$) | Trading price | Return during formation month | Return one month after formation | Bid-ask spread (%) | Return bias due to bid-ask bounce (bp) |
|---------------------|-------------|---------------------|---------------|-------------------------------|----------------------------------|--------------------|--|
| High-DLI Stocks | | | | | | | |
| 1 | 65 | 137.9 | 7.37 | -0.0236 | 0.0037 | 5.18 | 11.08 |
| 2 | 65 | 13.6 | 3.51 | -0.0257 | 0.0079 | 9.86 | 31.98 |
| 3 | 65 | 5.5 | 2.18 | -0.0279 | 0.0152 | 14.27 | 63.65 |
| 4 | 65 | 2.0 | 1.27 | -0.0585 | 0.0576 | 23.10 | 154.48 |
| New High DLI Stocks | | | | | | | |
| 1 | 11 | 235.8 | 9.69 | -0.0998 | 0.0199 | 3.69 | 5.50 |
| 2 | 12 | 21.8 | 4.93 | -0.1170 | 0.0152 | 7.02 | 18.07 |
| 3 | 12 | 8.4 | 3.19 | -0.1424 | 0.0234 | 10.70 | 39.93 |
| 4 | 11 | 3.0 | 1.79 | -0.1801 | 0.0619 | 18.89 | 128.84 |

Panel B: Price-sorted quartile

| Quartile | # of stocks | Mktcap (million \$) | Trading price | Return during formation month | Return one month after formation | Bid-ask spread (%) | Return bias due to bid-ask bounce (bp) |
|---------------------|-------------|---------------------|---------------|-------------------------------|----------------------------------|--------------------|--|
| High-DLI Stocks | | | | | | | |
| 1 | 65 | 123.3 | 8.56 | -0.0177 | 0.0058 | 4.82 | 10.18 |
| 2 | 65 | 21.4 | 3.26 | -0.0240 | 0.0074 | 9.21 | 29.78 |
| 3 | 66 | 9.6 | 1.77 | -0.0324 | 0.0161 | 14.58 | 70.41 |
| 4 | 65 | 4.9 | 0.77 | -0.0618 | 0.0553 | 23.80 | 147.50 |
| New High DLI Stocks | | | | | | | |
| 1 | 11 | 209.3 | 11.14 | -0.0852 | 0.0154 | 3.61 | 6.32 |
| 2 | 12 | 39.5 | 4.73 | -0.1169 | 0.0176 | 6.74 | 17.49 |
| 3 | 12 | 14.3 | 2.63 | -0.1449 | 0.0289 | 10.79 | 43.43 |
| 4 | 11 | 6.2 | 1.19 | -0.1921 | 0.0582 | 19.71 | 127.92 |

Table IX: Returns of portfolios sorted on DLI

For each month from 1971/01 to 1999/12, we sort all stocks into 10 deciles according to their DLIs. Panel A reports the equally-weighted returns of these portfolios during each of the first six months after portfolio formation. Panel B reports the average size, book-to-market ratio and DLI at the end of the first month after portfolio formation and the changes in these characteristics from the previous month.

Panel A: first six month return of the DLI-sorted portfolios

| Port ID | Return (1 mth) | Return (2 mth) | Return (3 mth) | Return (4 mth) | Return (5 mth) | Return (6 mth) |
|----------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Low DLI | 0.0113 | 0.0120 | 0.0122 | 0.0120 | 0.0121 | 0.0125 |
| 2 | 0.0107 | 0.0154 | 0.0158 | 0.0164 | 0.0156 | 0.0152 |
| 3 | 0.0138 | 0.0148 | 0.0148 | 0.0139 | 0.0125 | 0.0139 |
| 4 | 0.0133 | 0.0143 | 0.0143 | 0.0145 | 0.0139 | 0.0138 |
| 5 | 0.0138 | 0.0148 | 0.0148 | 0.0139 | 0.0146 | 0.0144 |
| 6 | 0.0140 | 0.0155 | 0.0145 | 0.0142 | 0.0138 | 0.0128 |
| 7 | 0.0123 | 0.0132 | 0.0142 | 0.0137 | 0.0130 | 0.0137 |
| 8 | 0.0126 | 0.0137 | 0.0133 | 0.0131 | 0.0142 | 0.0141 |
| 9 | 0.0118 | 0.0123 | 0.0131 | 0.0131 | 0.0146 | 0.0146 |
| High DLI | 0.0210 | 0.0152 | 0.0137 | 0.0149 | 0.0143 | 0.0165 |

Panel B: Other Characteristics of the DLI-sorted portfolios

| Port ID | MktCap (\$million) 1 mth | Δ MktCap (\$million) | B/M 1 mth | Δ B/M | DLI (%) 1 mth | Δ DLI (%) |
|----------|-----------------------------|--------------------------------|--------------|--------------|---------------------|---------------------|
| Low DLI | 2189.97 | 25.05 | 0.62 | 0.00 | 0.01 | 0.01 |
| 2 | 1328.26 | 24.47 | 0.73 | 0.01 | 0.02 | 0.02 |
| 3 | 941.52 | 14.68 | 0.75 | 0.00 | 0.03 | 0.03 |
| 4 | 653.11 | 8.47 | 0.79 | 0.01 | 0.07 | 0.06 |
| 5 | 459.87 | 7.08 | 0.83 | 0.00 | 0.16 | 0.12 |
| 6 | 343.50 | 4.28 | 0.90 | 0.01 | 0.41 | 0.24 |
| 7 | 229.26 | 3.40 | 0.99 | 0.01 | 1.05 | 0.43 |
| 8 | 143.43 | 2.17 | 1.13 | 0.01 | 2.85 | 0.70 |
| 9 | 81.87 | 1.14 | 1.33 | 0.01 | 8.60 | 0.75 |
| High DLI | 40.67 | 1.07 | 1.89 | -0.03 | 34.89 | -1.55 |

Table X: Two-stage optimal GMM estimation of asset pricing models using both first- and second- month returns

The tests are performed on two sets of portfolio returns during the first- and second-month after portfolio formation. Panel A presents the results using the equally-weighted monthly returns on 10-DLI sorted portfolios. Panel B represents the results using the equally weighted monthly returns on 27 portfolios sorted on size, book to market equity and DLI. MKT refers to the gross returns on the stock market portfolio. dSV is the change in the survival rate, or 1 minus the aggregate DLI, as in Vassalou and Xing (2004). HML is a zero-investment portfolio, which is long on high BM stocks and short on low BM stocks. SMB is a zero-investment portfolio, which is long on small market capitalization (size) stocks and short on big size stocks. The GMM estimations use Hansen's (1982) optimal weighting matrix. J-stat denotes Hansen's test on the over-identification restrictions of the model. The estimation period is from 1971/01 to 1999/12. The t-values are reported below the coefficients in *italics*.

Panel A: 10-DLI sorted portfolios

| First-month returns | | | | | | Second-month returns | | | | | |
|---------------------|-------------|--------------|-------------|--------------|-------------|----------------------|-------------|--------------|-------------|--------------|-------------|
| constant | MKT | SMB | HML | dSV | J-stat | constant | MKT | SMB | HML | dSV | J-stat |
| 0.85 | 13.43 | -17.02 | 24.75 | | 49.77 | 0.88 | 8.77 | -11.47 | 19.15 | | 14.76 |
| <i>10.31</i> | <i>1.72</i> | <i>-2.38</i> | <i>2.38</i> | | <i>0.00</i> | <i>14.69</i> | <i>1.65</i> | <i>-2.18</i> | <i>2.34</i> | | <i>0.02</i> |
| 0.81 | 12.00 | 21.17 | 38.43 | -132.17 | 8.38 | 0.84 | 12.44 | -6.50 | 25.18 | -33.12 | 7.63 |
| <i>6.79</i> | <i>1.28</i> | <i>1.56</i> | <i>2.90</i> | <i>-3.08</i> | <i>0.14</i> | <i>10.26</i> | <i>1.77</i> | <i>-0.86</i> | <i>2.36</i> | <i>-1.11</i> | <i>0.18</i> |

Panel B: 27 size / BM /DLI sorted portfolios

| First-month returns | | | | | | Second-month returns | | | | | |
|---------------------|-------------|-------------|--------------|--------------|-------------|----------------------|-------------|--------------|--------------|--------------|-------------|
| constant | MKT | SMB | HML | dSV | J-stat | constant | MKT | SMB | HML | dSV | J-stat |
| 1.00 | 0.82 | 0.53 | -5.13 | | 163.05 | 0.98 | 1.77 | -1.32 | -3.42 | | 113.12 |
| <i>44.31</i> | <i>0.41</i> | <i>0.23</i> | <i>-1.86</i> | | <i>0.00</i> | <i>46.22</i> | <i>0.85</i> | <i>-0.58</i> | <i>-1.23</i> | | <i>0.00</i> |
| 0.93 | 4.88 | 7.85 | -5.21 | -39.44 | 133.69 | 0.95 | 4.55 | 3.29 | -2.02 | -25.98 | 111.37 |
| <i>28.95</i> | <i>1.76</i> | <i>1.89</i> | <i>-1.68</i> | <i>-2.15</i> | <i>0.00</i> | <i>27.99</i> | <i>1.35</i> | <i>0.74</i> | <i>-0.62</i> | <i>-1.17</i> | <i>0.00</i> |

Table XI: Characteristics during and after portfolio formation

For each of the 27 equally weighted portfolios sorted on size, book-to-market ratio (B/M) and DLI, we report the average size, B/M and DLI at the end of the portfolio formation month and one month after. The estimation period is from 1971/01 to 1999/12.

| Portfolio | | | Size (\$million) | | B/M | | DLI (%) | |
|-----------|--------|--------|---------------------------|-----------------|---------------------------|-----------------|---------------------------|-----------------|
| Size | B/M | DLI | Portfolio formation month | One month after | Portfolio formation month | One month after | Portfolio formation month | One month after |
| Small | High | High | 12.53 | 12.74 | 2.03 | 2.00 | 16.64 | 16.46 |
| Small | High | Medium | 17.05 | 17.31 | 1.54 | 1.54 | 0.17 | 0.38 |
| Small | High | Low | 18.59 | 18.78 | 1.50 | 1.49 | 0.00 | 0.01 |
| Small | Medium | High | 14.44 | 14.62 | 0.82 | 0.83 | 9.65 | 9.98 |
| Small | Medium | Medium | 19.73 | 19.99 | 0.81 | 0.82 | 0.13 | 0.27 |
| Small | Medium | Low | 21.04 | 21.26 | 0.81 | 0.81 | 0.00 | 0.03 |
| Small | Low | High | 13.98 | 14.21 | 0.36 | 0.38 | 10.32 | 10.80 |
| Small | Low | Medium | 20.04 | 20.48 | 0.39 | 0.40 | 0.11 | 0.26 |
| Small | Low | Low | 22.37 | 22.74 | 0.39 | 0.40 | 0.00 | 0.03 |
| Medium | High | High | 88.70 | 89.67 | 1.72 | 1.72 | 9.64 | 9.73 |
| Medium | High | Medium | 97.11 | 98.39 | 1.38 | 1.38 | 0.14 | 0.31 |
| Medium | High | Low | 99.87 | 100.90 | 1.29 | 1.29 | 0.00 | 0.02 |
| Medium | Medium | High | 95.32 | 96.28 | 0.81 | 0.82 | 5.16 | 5.38 |
| Medium | Medium | Medium | 106.84 | 108.20 | 0.80 | 0.80 | 0.11 | 0.24 |
| Medium | Medium | Low | 120.28 | 121.38 | 0.79 | 0.79 | 0.00 | 0.01 |
| Medium | Low | High | 97.81 | 99.27 | 0.39 | 0.40 | 4.96 | 5.24 |
| Medium | Low | Medium | 107.58 | 109.56 | 0.39 | 0.40 | 0.10 | 0.24 |
| Medium | Low | Low | 124.06 | 126.01 | 0.39 | 0.40 | 0.00 | 0.02 |
| Big | High | High | 1111.65 | 1126.22 | 1.56 | 1.55 | 7.87 | 7.77 |
| Big | High | Medium | 1570.78 | 1589.43 | 1.32 | 1.32 | 0.11 | 0.26 |
| Big | High | Low | 1755.62 | 1766.38 | 1.25 | 1.24 | 0.00 | 0.03 |
| Big | Medium | High | 1159.58 | 1178.61 | 0.80 | 0.81 | 5.08 | 5.18 |
| Big | Medium | Medium | 1692.97 | 1711.36 | 0.79 | 0.79 | 0.10 | 0.22 |
| Big | Medium | Low | 2371.23 | 2387.20 | 0.77 | 0.77 | 0.00 | 0.01 |
| Big | Low | High | 1544.19 | 1557.13 | 0.39 | 0.41 | 3.94 | 4.01 |
| Big | Low | Medium | 2010.20 | 2037.37 | 0.40 | 0.40 | 0.09 | 0.21 |
| Big | Low | Low | 4456.93 | 4515.04 | 0.36 | 0.37 | 0.00 | 0.01 |

Table XII: Default factor loadings during the first and the second month after portfolio formation

We report the factor loadings on the aggregate default risk factor (dSV) for both 10 DLI-sorted portfolios and 27 portfolios sorted on size, book to market and DLI, during the first and the second month after portfolio formation. The estimation period is from 1971/01 to 1999/12.

Panel A: Default factor betas for the 10-DLI sorted portfolios

| Portfolio | Low DLI | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | High DLI |
|-----------------------|---------|--------|--------|-------|-------|-------|-------|-------|-------|----------|
| 1 st month | -0.056 | -0.029 | -0.056 | 0.104 | 0.201 | 0.330 | 0.278 | 0.357 | 0.976 | 1.904 |
| 2 nd month | -0.015 | -0.149 | 0.004 | 0.123 | 0.180 | 0.284 | 0.378 | 0.335 | 0.996 | 1.804 |

Panel B: Default factor betas for the 27 size / book-to-market / DLI sorted portfolios

| Size | B/M | DLI | 1 st month | 2 nd month |
|--------|--------|--------|-----------------------|-----------------------|
| Small | High | High | 1.578 | 1.510 |
| Small | High | Medium | 0.806 | 0.847 |
| Small | High | Low | 0.127 | 0.286 |
| Small | Medium | High | 0.888 | 0.762 |
| Small | Medium | Medium | 0.515 | 0.635 |
| Small | Medium | Low | 0.598 | 0.458 |
| Small | Low | High | 0.787 | 1.002 |
| Small | Low | Medium | 0.566 | 0.429 |
| Small | Low | Low | 0.509 | 0.768 |
| Medium | High | High | 0.639 | 0.636 |
| Medium | High | Medium | 0.303 | 0.353 |
| Medium | High | Low | 0.473 | 0.275 |
| Medium | Medium | High | 0.526 | 0.428 |
| Medium | Medium | Medium | 0.155 | 0.063 |
| Medium | Medium | Low | 0.154 | 0.159 |
| Medium | Low | High | 0.136 | 0.543 |
| Medium | Low | Medium | -0.142 | -0.029 |
| Medium | Low | Low | -0.091 | -0.120 |
| Big | High | High | 0.623 | 0.416 |
| Big | High | Medium | -0.017 | 0.165 |
| Big | High | Low | -0.021 | 0.160 |
| Big | Medium | High | -0.193 | -0.076 |
| Big | Medium | Medium | 0.073 | 0.103 |
| Big | Medium | Low | 0.000 | -0.012 |
| Big | Low | High | 0.352 | 0.188 |
| Big | Low | Medium | -0.228 | -0.219 |
| Big | Low | Low | -0.202 | -0.190 |