Did Stop Signs Stop Investor Trading? Investor Attention and Liquidity in the Pink Sheets Tiers of the OTC Market

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Abstract

In 2007, OTC Markets Group assigned each Pink Sheets company to a public disclosure tier and affixed a colorful graphic to its stock symbol signifying the company's tier. This natural experiment offers a unique setting to investigate if creation of these disclosure tiers and the associated colorful graphics grab investors' attention, change investors' trading behavior, and translate into changes in liquidity. Using a difference-in-difference design, we find evidence that firms labeled as 

(i.e., current information) experienced an increase in liquidity while firms labeled as 

(i.e., no information) experienced a decrease in liquidity. We also find stock returns around the key event dates leading up to the release of the graphic disclosure tiers are positively associated with the subsequently observed liquidity changes.

JEL classification: G12, G14, N20
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OTC Markets Group Inc., f/k/a Pink Sheets, operates the inter-dealer quotation system for over-the-counter (OTC) securities. OTC securities are generally traded in two markets, OTC Bulletin Board (OTCBB) and Pink Sheets (or both). In 2007, OTC Markets Group implemented a system that classifies companies solely traded in the Pink Sheets market, which we refer to as *PS* firms, into three tiers (i.e., categories) based on the levels of the company's existing public disclosures and affixes colorful graphics to the company's trading symbol to make the classification salient. The three categories are represented by the following graphics: 

, 

, and 

. In this paper we use this natural experiment to test whether the simple act of assigning a firm to a disclosure tier and attaching a colorful graphic, which we refer to as graphic disclosure tiers, influences investor behavior.

This setting is particularly fruitful because the clientele of the Pink Sheets market is mostly individual investors rather than institutional investors (Ang, Shtauber, and Tetlock 2011). Individual investors, who have limited attention and processing power (Hirshleifer and Teoh 2003), might not have been fully processing the degree to which each *PS* firm makes public disclosures prior to the firm being assigned a tier with attention getting graphics. This potential for naïveté is supported by numerous archival and laboratory studies that have shown that individual investors' response to publicly available information is limited (Malmendier and Shanthikumar 2007; Hirshleifer et al. 2009; Libby et al. 2002).[1]

The introduction of the graphic disclosure tiers are expected to increase individual investors' attention to disclosure practices for several reasons. First, individuals are sensitive to

[1] A growing body of research suggests that the potential for naiveté may also apply to institutional investors because investor inattention has been reflected in stock returns of publicly traded firms on U.S. major stock exchanges. For example, earnings surprises receive weaker market responses and are associated with stronger drift when investors are distracted by same day earnings announcements from other firms (Hirshleifer et al. 2009) or when earnings are announced on Fridays when investors are less attentive (DellaVigna and Pollet 2009). The market responds to *recycled news* when it appears saliently on the front page of *New York Times* five months after the same news was first reported (Huberman and Regev 2001).

the salience in which information is disclosed (Maines and McDaniel 2000; Barber and Odean 2008) and individuals pay more attention to simple versus complex messages (Lerman 2011), so using simple salient graphic to reveal disclosure levels should attract investor attention. Second, given that individuals tend to weigh stimuli that are more easily available (Tversky and Kahneman 1973; Kruschke and Johansen 1999), the introduction of such an easily available graphic should cause individuals to more heavily consider disclosure practices. And lastly, because limited attention investors tend to focus more on categories than on firm-specific information (Peng and Xiong 2006; Cooper, Dimitrov, and Rau 2001), we expect individual investors to pay more attention to the disclosure levels once they are categorized.

If the graphic disclosure tiers increased individual investors' attention to the levels of public disclosure and assuming certain investors prefer to invest in stocks with higher levels of disclosure (Lawrence 2011), we would expect to see a shift in the trading behavior of investors from the no information firms to the current information firms. This shift in trading should result in a shift in liquidity such that stocks of current information firms become relatively more liquid than stocks of no information firms. On the other hand, we may not observe a difference in trading behavior upon the release of the graphic disclosure tiers if investors already fully considered *PS* firms' disclosure levels in making their trading decisions. It could also be the case that these investors are not influenced by the new disclosure system either because the graphics aren't salient enough, the investors do not trust the OTC Markets Group's categorization, or the investors are not concerned about differences in disclosure practices.

Our tests of differences (a difference-in-difference design) in liquidity over a three-month pre- and three-month post-implementation period of the graphic classification system for over 2,000 *PS* firms demonstrate a shift in liquidity. We find that relative to firms in the limited

information category, current information firms, which are classified as having the highest level of disclosure, experience an increase in liquidity while no information firms experience a decrease in liquidity. We found no notable change in the liquidity of the limited information firms relative to unclassified firms (i.e., firms dually quoted on the Pink Sheets and OTCBB markets). These results are robust to controlling for industry, firm size, ADR status, and time trends in liquidity.

We also investigate the stock market response to three key events related to the implementation of the new classification system. The first event is April 24, 2007, when the OTC Markets Group first announced its intent to develop a disclosure classification system to increase investors' awareness of firms' disclosure levels. The second event is the July 13, 2007 announcement that the task of assigning *PS* companies into different disclosure categories will be completed by August 1, 2007. The third event is August 1, 2007 when the OTC Markets Group completed assigning disclosure tiers and affixing graphics to the companies' symbols everywhere the symbols appear on pinksheets.com. We find that firms in the no information category generally experience a negative return over a five-day window around each event while the current information firms experience positive returns. Returns of firms in the limited information category are not significantly different from zero around any of these events. Our findings suggest that at least some of the *PS* investors expected a shift of attention away from the no information firms and towards the current information firms under the new system.

Finally, we investigate whether individual *PS* firms' stock returns around the three event dates are associated with the subsequently observed liquidity changes that arose after the introduction of the graphic disclosure tiers. Our regression analysis reveals that abnormal returns around the three event dates are positively associated with the observed liquidity changes,

indicating that investors in *PS* firms anticipated at least some of the subsequent liquidity changes.

Our study makes several contributions. First, our unique setting allows us to demonstrate a direct link between changes in investor attention and liquidity. Our results provide direct evidence on the effectiveness of the OTC Markets Group's innovation for improving market liquidity for its high disclosure *PS* firms in a market primarily populated with individual investors through the use of a graphic classification system that draws attention to a firm's public disclosure practices. OTC Markets Group's actions appear to have some success in increasing individual investor attention to (away from) those firms that provide more (less) public disclosures. This adds to our understanding of how an information intermediary can improve the liquidity of markets with both minimal disclosure requirements and individual investors. The setting provides an example of how the psychological principle of attention effects can be used to improve information processing by investors and contributes more generally to our understanding of behavioral finance (see Daniel, Hirshleifer, and Teoh 2002 for a review of the extensive evidence on psychological biases and capital markets).

Our study also informs the literature more broadly on *PS* firms, which are unique in that they are publicly traded but not subject to mandated SEC disclosure requirements under the 1934 Securities Exchange Act (e.g., audited 10-K, 10-Q, and 8-K filings). For the last decade, the *PS* firms are the only publicly traded firms in the US that can avoid filing audited financial statements. Prior to 1999, domestic OTCBB firms were also exempt from the reporting requirement under the 1934 Securities Exchange Act. But in 1999, when the SEC removed the exemption for OTCBB firms, more than 2,600 firms or 76% of the OTCBB firms not previously filing with the SEC chose to be removed from the OTCBB and to become *PS* firms (Bushee and

Leuz 2005). This led the number of *PS* firms to double yet these firms, which are known for their illiquidity, have been largely overlooked by prior research.[2]

Finally, our study extends the line of research that addresses the role of mandated disclosures in improving market efficiency. Bushee and Leuz (2005) document that OTCBB firms that decided in 1999 to provide mandatory filings to the SEC, rather than become a *PS* firm, experienced increased liquidity. In addition, Greenstone, Oyer, and Vissing-Jorgensen (2006) find that larger OTC firms that were required to increase their disclosure as a result of the 1964 Securities Acts Amendments experienced an increase in firm value. Our results suggest that a regulatory mandate for additional disclosures may not be required and that firm liquidity can still shift when information intermediaries saliently separate firms with higher levels of disclosures from those with lower levels. This is consistent with Daniel, Hirshleifer, and Teoh's (2002) call for "minimally coercive and relatively low-cost measures to help investors make better choices and make the market more efficient" (p. 193).

The next section provides details on the institutional setting. Section II describes how we measure our primary variable of interest, liquidity. Section III discusses our tests and results on changes in liquidity, Section IV discusses our stock return event study tests, and Section V concludes.

I. Institutional Background

A. The history of the Pink Sheets market and the introduction of graphic disclosure tiers

The Pink Sheets market started in 1913 when the National Quotation Bureau was established and began distributing daily inter-dealer quotes of OTC stocks on pink paper (thus the name Pink Sheets). In 1999, the daily paper-based quotations were replaced with real-time

[2] We include a discussion of the few studies on OTC firms in the next section.

quotations. Since the switch the Pink Sheets market has grown significantly. As of December 31, 2010, Pink Sheets market reported a total annual trading volume of over $95 billion for 5,954 securities (OTC Markets Group 2010 Annual Report), an increase of over 200% since year 2000.

A unique feature of the Pink Sheets market is that many firms traded in this market bear no formal responsibility to provide financial disclosures to the SEC (Bushee and Leuz 2005). The SEC warns investors that it is difficult to find reliable and unbiased information about firms traded in the Pink Sheets market, which "can be among the most risky investments" (*http://www.sec.gov/answers/pink.htm*). In general, the SEC only mandates a company to provide periodic reports to disclose important information to investors if the company 1) is a U.S. company that has at least 500 investors *and* at least $10 million in assets; 2) lists its securities on the AMEX, Boston Stock Exchange, Chicago Stock Exchange, Cincinnati Stock Exchange, International Securities Exchange, Nasdaq, NYSE, Pacific Exchanges, or Philadelphia Stock Exchange; or 3) has securities quoted on the OTCBB. As a result, small U.S. *PS* firms (i.e., those not dually quoted on the OTCBB) do not have to file reports with the SEC, although they may voluntarily register with the SEC and therefore commit themselves to similar reporting requirements (SEC 2004).

Besides smaller U.S. based firms, *PS* firms include foreign firms trading in the form of American Depository Receipts (ADRs). They do not have to file U.S. GAAP reports with the SEC. Instead they are only required to supply to the SEC copies of information that the company makes public in its home country (see Miller 1999 for more discussion).

The lack of transparency makes *PS* firms more prone to pump-and-dump schemes and stock spams (Böhme and Holz 2006; Frieder and Zittain 2007; Krantz 2005; Nelson, Price and Rountree 2009). As early as 1963, SEC's general counsel, Phillip Loomis Jr., testified that "the

overwhelming preponderance of fraud cases before the Commission in past years have involved the securities of companies which have not been subject to the reporting requirements of the Exchange Act" (SEC 1963). More recently, Aggarwal and Wu (2006) find that stocks of OTCBB and *PS* firms account for nearly half (68 out of 142) of the stock market manipulation cases pursued by the SEC from 1989 to 2001. Perhaps not surprisingly, the Pink Sheets website also directly warns investors to "be aware that good information is simply not available for many Pink Sheets traded companies and that there are unscrupulous individuals that will attempt to defraud investors through manipulative schemes in Pink Sheets stocks" (as quoted by Bollen and Christie 2009, p.1326).

In March 2007, to help improve the efficiency of the Pink Sheets market, OTC Markets Group launched a separate market platform, referred to as OTCQX or the "quality controlled marketplace." To be included on this platform firms must file audited US GAAP financial statements and undergo a qualitative review. Only 13 companies appear on OTCQX as of 2007.[3] Because the sample of OTCQX firms is so small and these firms trade on a different platform (their trades are all electronic and settled and cleared in the U.S. similar to any Nasdaq or NYSE stock) our main analyses exclude the OTCQX *PS* firms.

In April 2007, the OTC Markets Group announced that they will assign the remaining Pink Sheets firms that were not also cross listed as OTCBB into one of three disclosure tiers and affix colorful graphics on each firm's quote page and next to the firm's trading symbol everywhere it appears on the OTC Markets' website. The three disclosure tiers and their colorful graphics are: 1) current information, which is represented by 

, 2) limited information, which is represented by a yield traffic sign 

, and 3) no information,

[3] This number was obtained from OTCQX's list of companies in 2007.

which is represented by a stop sign 

(see http://www.otcmarkets.com/otc-pink/learn/otc-market-tiers). The current information tier, which we denote as *CURRENT*, includes firms who make adequate "filings publicly available through the OTC disclosure & News Service" but it "is not a designation of quality or investment risk." The limtied information tier, denoted *LIMITED,* consists of firms that provide at least some information that is not older than six months but not enough information to be considered current as well as firms "with financial reporting problems, economic distress, or in bankruptcy." The no information tier, denoted *NO*, is for firms "that are not able or willing to provide disclosure to the public markets - either to a regulator, an exchange or OTC Markets Group" that is less than six months old.

There is an additional status that can be assigned to any firm, denoted 

, that includes firms with concerns of "a spam campaign, questionable stock promotion, known investigation of fraudulent activity committed by the company or insiders, regulatory suspensions, or disruptive corporate actions." When a firm falls in this category, OTC Markets Group suspends quotation for the firm. Given the extreme nature of these firms, we omit them from our analysis. Figures 1 and 2 provide further details and examples of the disclosure tiers.

The OTC Markets Groups introduced these colorful graphic disclosure tiers to help investors quickly assess a firm's disclosure level and alert investors about pending investigations. It is a fruitful setting to examine the impact of investor attention in the market place. First, this event avoids the influence from a firm's self-selection. In contrast to the OTCQX designation, for which a firm needs to apply, the three tiers are assigned by the OTC Markets Groups based on a firm's *existing* public disclosure. Thus any impacts we observe are not attributed to a firm's *new* disclosure. Second, this event happened quickly, thus minimizing

the influence of other confounding events. The OTC Markets Groups tentatively added the graphics to a firm's quotation page in May 2007 and expanded the graphics to a firm's trading symbol everywhere that it appears on OTC's website by August 1, 2007. With such a short window, the setting also reduces the chances that a firm changes its disclosure levels. We exclude the three-month transition period from May to July of 2007 in our tests to get a clean setting and to best isolate the impact of introducing the graphic disclosure tiers.

B. Prior research

Compared to stocks listed on major exchanges such as the NYSE, AMEX, and Nasdaq, stocks traded in the OTC markets (often smaller and less liquid) have received little attention. Inspired by the significant growth in OTC markets including the Pink Sheets market, a few studies attempt to broaden our understanding of the market quality and asset pricing in the OTC markets. Macey et al. (2008) examine changes in liquidity and transaction costs for firms involuntarily delisted from the NYSE and subsequently quoted in the Pink Sheets in 2002. They find that spreads increase substantially and liquidity deteriorates for these delisting firms. Similarly, Harris et al. (2008) find that firms delisted from Nasdaq during 1999-2002 experience increased spread and volatility when they were subsequently traded in the OTCBB and/or the Pink Sheets. Focusing on asset pricing, Eraker and Ready (2010) document significantly *negative* rates of return (less than -20%) in the OTC market during the period 2000-2009.

In a recent study of the OTC market from 1975 through 2008, Ang et al. (2011) find that the OTC market relative to other listed markets (i.e., NYSE and Nasdaq) has similar size, value, and volatility return premiums while the premium for return momentum is smaller. But most importantly for our study, they find that the OTC market has a much larger return premium for illiquidity relative to other listed markets and this return premium for illiquidity is much larger

for OTC stocks that have low disclosure standards (i.e., firms that do not publicly disclose book value of equity). Their results suggest that small changes in liquidity in the OTC market are expected to have a large impact on asset prices and the impact will be amplified for those OTC firms with low disclosures. Interestingly, they also observe that OTC firms with low disclosures earn lower stock returns than other OTC firms. The authors argue that although this is inconsistent with traditional theories of disclosure, the observed overpricing of low disclosure firms may result from investors failing to appreciate adverse selection in firms' disclosure policies.

There is scant empirical evidence on the impact of changes in disclosure in the OTC market (Bushee and Leuz 2005). As mentioned in the introduction, there are two studies that offer some insights on the consequence of disclosure rules in the OTC market. One study is Greenstone et al. (2006) who investigate the impact of the 1964 Securities Acts Amendments. The 1964 Amendments extended the mandatory disclosure requirement for firms publicly traded on major exchanges to OTC firms that have more than one million dollars in total assets and at least 750 shareholders.[4] They find that investors seem to value the additional disclosure requirements made on the OTC firms because the OTC firms most affected by the 1964 Amendments experience positive abnormal returns during the period between the initial proposal and the enactment and in the period around the announcement to comply with the new disclosure requirement.

The other study is Bushee and Leuz (2005) who investigate how SEC disclosure regulations affect stock returns and liquidity in the OTCBB market. In 1999 the SEC approved the "eligibility rule" that allows only companies that provide current financial information to the

[4] Starting in 1966 these thresholds have evolved to the current requirement of 500 shareholders and $10 million in total assets (see for example Owens 1964 and SEC 1996).

SEC or banking or insurance regulators to be quoted on OTCBB, effectively mandating periodic filings of financial reports for all domestic OTCBB firms who previously did not have to provide SEC filings. Bushee and Leuz (2005) find that the "Noncompliant" firms subsequently experienced significant decrease in liquidity. In contrast, firms who are "Already Compliant" and "Newly Compliant" experience larger positive stock returns around key event dates related to the approval of the eligibility rule and also significant increases in liquidity.

The implementation of the graphic disclosure classification system for *PS* firms introduces a unique opportunity to test whether the simple act of signaling companies' public disclosure levels through colorful graphics can influence investor attention. This setting differs from that in Bushee and Leuz (2005) in which OTCBB firms are required to provide investors with up-to-date disclosures under the eligibility rule.

II. Measuring Liquidity

To measure liquidity before and after the official implementation of the graphic disclosure classification system, we obtain proprietary daily data from OTC Markets Group on each *PS* firm's disclosure tier from August 1, 2007 to October 31, 2007. We also obtain volume, closing price, and best bid and ask price as of 4pm of each trading day from November 1, 2006 to October 31, 2007 for all *PS* firms and dually quoted OTCBB firms. Because the OTCBB firms are not part of the new graphic disclosure classification system, we use the *dually* quoted OTCBB firms as a control group, hereafter referred to in italics as *OTCBB*, to filter out any concurrent economic events that might affect the liquidity of all firms traded in the OTC market.

Since our primary focus is on how the introduction of the graphic disclosure tiers affects liquidity, we measure liquidity for each of our sample firms during a pre-implementation and a

post-implementation period around August 1, 2007. Because it took the OTC Markets Group three months from May to July of 2007 to fully implement the new classification system, we exclude these months in our tests. We consider the pre-implementation period as February through April of 2007 and the post-implementation period as August through October of 2007. None of our sample firms changed disclosure tiers during the post-implementation period.

As discussed by Amihud, Ho, and Schwartz (1985), liquidity in a market "encompasses many characteristics: low trading costs, the accuracy of price adjustments to new information, price continuity, continuity of trading, depth, and the ease and speed of execution" (p. 4). There is no commonly accepted measure of liquidity at the firm level but common proxies for liquidity include the percentage bid-ask spread, monthly dollar trading volume, percentage of days traded in a month (Bushee and Leuz 2005; Leuz et al. 2008; Macey et al. 2008; Ang et al. 2011), and price impact (Amihud 2002). Accordingly, we consider each of these four measures and also create one parsimonious measure of liquidity using factor analysis. The benefit of using a common factor, rather than just each of the four correlated variables which capture different aspects of firm liquidity, is that the common factor will be less subject to random measurement errors.[5] Factor analysis isolates these measurement errors from our extracted common factor (Kim and Mueller 1978, p. 68), which we denote as *LIQUIDITY*.

We calculate the three-month average of daily percentage bid-ask spread during the pre- and the post-implementation periods, denoted *SPREAD*, as the absolute difference between closing bid and closing ask prices, divided by the mid-point of the bid and ask prices, multiplied by 100. To measure price impact, we calculate the log of the three-month average (during the pre- and the post-implementation periods, respectively) of the absolute value of daily returns divided by daily dollar volume in millions, denoted as *IMPACT*. Amihud (2002) interprets

[5] Bartov and Bodnar (1996, p. 406) include a discussion of the prevalence of measurement errors in bid-ask spreads.

IMPACT as the daily price response associated with one dollar of trading volume. Percentage of days traded in a month, denoted *TRADEDAYS*, is calculated as the number of days in a month that a firm has actual trading, divided by the number of all potential trading days in the month.[6] We measure monthly dollar trading volume, denoted *VOLUME*, as the log of daily trading volume (shares traded times the closing price) summed over the month (in thousands of dollars).[7] We further average *TRADEDAYS* and *VOLUME* over the three-month pre- and the three-month post- implementation windows. This is consistent with Bushee and Leuz (2005) because many *PS* securities are thinly traded (SEC 2004) and we want to eliminate any temporary liquidity effects. Finally, we winsorize *SPREAD*, *VOLUME*, and *IMPACT* at the 1% and 99% of their distributions to reduce the influence of extreme values. For *TRADEDAYS*, we eliminate days with less than five dollar trading volume from the numerator. Depending on the measure of interest, our final sample includes 1,500 to 2,000 *OTCBB* firms and 2,000 to 3,500 *PS* firms.

Table 1 reports the results of our factor analysis using *SPREAD*, *VOLUME*, *TRADEDAYS* and *IMPACT* to calculate the common factor, denoted *LIQUIDITY*, for 8,368 sample observations in the three-month pre- and the three-month post-implementation periods. In panel A we report a correlation matrix for the four variables used in the factor analysis. As expected, all four variables are significantly correlated with each other in the predicted directions. *SPREAD* and *IMPACT* are positively and significantly correlated, so are *TRADEDAYS* and *VOLUME*.

Panel B shows the eigenvalues of the correlation matrix. We have four liquidity measures and all measures have one unit of variance, so the sum of the eigenvalues is four. The rule of

[6] When we measure the numerator of *TRADEDAYS* as the number of days in a month that a firm has more than 100 shares traded as in Ang et al. (2011, p. 13) our results are unchanged.
[7] Share turnover is another liquidity measure that prior research often uses (Bushee and Leuz 2005; Pownall et al. 2010). We do not include this measure because data on *PS* firms' shares outstanding are not readily available.

thumb for the principal component analysis is to keep any factors that have eigenvalues greater than one (Kaiser 1960). In our sample, only the first factor has an eigenvalue greater than one (i.e., 2.79). This factor explains 70% of the total variances of the four liquidity variables (i.e., 2.79/4=70%). We multiply this factor by negative one so that a higher factor indicates more liquidity and use this *LIQUIDITY* variable in our subsequent analyses. Panel C shows that *LIQUIDITY* is highly correlated with the individual liquidity measures, with a correlation of -86% with SPREAD, -83% with *IMPACT*, 68% with *TRADEDAYS*, and 96% with *VOLUME*.

III. Tests of Changes in Liquidity

A. Main test

To assess whether the implementation of the graphic disclosure tiers is associated with observable changes in liquidity, we use a difference-in-difference research design. Specifically, we estimate a model in the following form:

$$\Delta Liquidity_i = \alpha_0 + \alpha_1 CURRENT_i + \alpha_2 LIMITED_i + \alpha_3 NO_i + \mu_i \qquad (1)$$

where:

$\Delta Liquidity_i$	= change in one of our five liquidity measures (*LIQUIDITY*, *SPREAD*, *IMPACT*, *TRADEDAYS*, and *VOLUME*) between the three-month pre-implementation period and the three-month post- implementation period for firm i;
CURRENT	= 1 for firms that fall in the "current information" category, and 0 otherwise;
LIMITED	= 1 for firms that fall in the "limited information" category, and 0 otherwise;
NO	= 1 for firms that fall in the "no information" category, and 0 otherwise.

This regression allows us to use each firm as its own control to assess how the change in liquidity for a given category of *PS* firms compares to the change in liquidity for other categories of *PS* firms. We also use the *OTCBB* firms as another control group (the intercept, α_0, captures

the change in liquidity for these OTCBB firms). This across category comparison is important because it controls for the impact of market-wide concurrent events on liquidity in the OTC markets. We believe this is not critical in our analysis, however, because we use difference-in-difference research design over a relatively short period of time (i.e., a total of nine months).

In Equation (1), α_1 measures the difference in the changes in liquidity between *PS CURRENT* firms and *OTCBB* firms while α_2 measures the difference in the changes in liquidity between *PS LIMITED* firms and *OTCBB* firms. Finally, α_3 measures the difference in the changes in liquidity between *PS NO* firms and *OTCBB* firms. We can assess differences across the other categories by testing for differences across the α_1, α_2, and α_3 coefficient estimates.

Table 2 reports the results of estimating Equation (1). We exclude observations with absolute studentized residuals greater than two and we rely on robust standard errors. Column (1) reports estimates of the model on 3,366 firms with the independent variable as the change in our parsimonious measure, denoted Δ*LIQUIDITY*. The coefficient on *CURRENT* is significantly positive at the 0.01 level, while the coefficient on *LIMITED* is insignificantly different from zero, and the coefficient on *NO* is significantly negative. This demonstrates that the liquidity of the *PS* current information group increased significantly more so than the *OTCBB* firms in the three months after implementation of the graphic disclosure tiers. It also demonstrates that the no information group experienced a significant decline in liquidity relative to the *OTCBB* firms. The change in liquidity of the limited information group is similar to that of the *OTCBB* firms.

The last three rows in column (1) of table 2 report tests on the differences across the coefficients. We find that the coefficients for the three independent variables are all significantly different from one another ($p< 0.01$), suggesting that the *CURRENT* group's increase in liquidity is reliably greater than that of the *LIMITED* group and that the decrease in the *NO* group's

liquidity is significantly different from the change in liquidity experienced by the *LIMITED* group.

Columns (2) through (5) in table 2 report results using the change in each individual liquidity measure as the independent variable. For example, in column (5) we construct Δ*VOLUME* based on 5,320 observations. We find that relative to *OTCBB* firms, firms in the *CURRENT* category experience an increase in trading volume ($p<0.01$) while those in the *NO* category experience a decrease in trading volume ($p<0.01$). The *LIMITED* firms experience no change in trading volume compared to the *OTCBB* firms. As reported in the last three rows of table 2, the relative improvement in trading volume for the *CURRENT* group is statistically ($p<0.01$) greater than that experienced by the *LIMITED* and *NO* groups and the decline in trading volume experienced by the *NO* group is statistically different ($p<0.01$) from the change in trading volume of the *LIMITED* group.

Results on changes in the other liquidity measures (i.e., *SPREAD*, *IMPACT*, and *TRADEDAYS*) are consistent with those for Δ*LIQUIDITY* and Δ*VOLUME* except in two instances. Specifically, for Δ*SPREAD*, we observe that the bid-ask spread for the *LIMITED* group significantly increases relative to the *OTCBB* firms. Although this relative increase is less than that observed by the *NO* group, the magnitude of the difference between the *LIMITED* and the *NO* groups is not statistically different from zero. Also, with Δ*IMPACT* we find that while both the *CURRENT* and the *LIMITED* firms showed a relative decline in price impact relative to the *OTCBB* firms, the decline across the *CURRENT* and *LIMITED* firms is not statistically distinguishable.

The overall conclusion from table 2 is that liquidity for the *CURRENT* firms increased relative to the *OTCBB* firms while liquidity for the NO firms decreased relative to the *OTCBB*

firms upon the implementation of the graphic disclosure tiers. The changes in the liquidity of the *LIMITED* firms are similar to those experienced by the *OTCBB* firms. This is consistent with the graphic disclosure tiers increasing investors' attention and trades toward firms with current information and away from firms reporting no information.

To assess the magnitude of the changes in our various measures of liquidity, we present univariate descriptive statistics in table 3 that underlie the regression results reported in table 2. Column (1) in table 3 reports the number of observations in each disclosure tier. In columns (2) and (3), we report the mean, median, and standard deviation of the levels of each of our liquidity measures in the pre- and post-implementation periods. Column (4) reports statistics on the change in the liquidity measures for each category of firms. In column (5) we report the mean and median change in liquidity for each category relative to the *OTCBB* firms as the difference in the changes in liquidity. Column (6) converts column (5) into percentage terms by scaling the relative change reported in column (5) by the firms' liquidity during the pre-implementation period. Because other market-wide economic events also affect liquidity, it is important to focus on the *relative* percentage change in liquidity measures between the categorized *PS* firms and the *OTCBB* firms, rather than the changes for *PS* firms alone.

Column (2) in panel A of table 3 reveals that the mean *LIQUIDITY* for the *CURRENT* companies in the pre-implementation period is 0.935. As expected, the liquidity for the *CURRENT* firms exceeds the average of the *LIMITED* firms of 0.192, which exceeds that of the *NO* firms of -0.165. Interestingly, the *CURRENT* firms have higher mean and median liquidity than the average *OTCBB* firms (this difference is statistically significant). This is because some well-known foreign corporations such as Adidas AG, Burberry Ltd., Bank of China, Continental

AG, Fiat S.p.A., Daimler AG, Nestle S.A., and Toshiba Corporation that have high levels of liquidity choose to list on Pink Sheets rather than major U.S. stock exchanges.

Column (4) in panel A of table 3 reveals that the mean and median Δ*LIQUIDITY* for the *CURRENT* firms is 0.015 and 0.036. The mean difference is not statistically different from zero based on a t-test but the median is significant at $p<0.10$ based on the Wilcoxon signed rank test. Importantly, however, the *OTCBB* firms experienced a mean and median **decline** in *LIQUIDITY* of 0.111 and 0.113 over the same period. This results in a mean and median increase for the *CURRENT* firms that are 0.126 and 0.150 greater than that of the *OTCBB* firms. Both of these relative increases are statistically greater than zero at the 0.01 level. This difference, as reported in column (6), translates to an incremental 13% increase in the liquidity of the *CURRENT* firms. Both the *LIMITED* and *NO* firms experienced declines in *LIQUIDITY*. Although the decline for the *LIMITED* firms is not statistically different from that of the *OTCBB* firms, the mean and median decline of the *NO* firms are both significantly ($p<0.01$) greater than the mean and median decline of the *OTCBB* firms. The difference is also likely economically meaningful given that the decline in *LIQUIDITY* for the *NO* firms results in an incremental 65% decrease in their liquidity.

Panels B through E provide similar descriptive statistics to those in panel A for *SPREAD*, *IMPACT*, *TRADEDAYS*, and *VOLUME*. The results are similar to those found on *LIQUIDITY*. The bid-ask spread of the *CURRENT* group decreased an incremental 15%, while the *LIMITED* and *NO* groups bid-ask spreads increased an incremental seven and six percent. The *IMPACT* of the *CURRENT* group decreased an incremental 47%, while the *LIMITED* group's *IMPACT* only decreased three percent and the *IMPACT* for the *NO* group increased an incremental four percent. *TRADEDAYS* for the *CURRENT* group increased an incremental seven percent while

the *LIMITED* group's *TRADEDAYS* only increased two percent and the *TRADEDAYS* for the *NO* group decreased an incremental three percent. *VOLUME* for the *CURRENT* group increased an incremental two percent while the *LIMITED* group's *VOLUME* did not incrementally change and the *VOLUME* for the *NO* group decreased an incremental two percent.

Taken together, our evidence so far indicates that the OTC Markets Group's release of the graphic disclosure tiers led to changes in the liquidity of firms in different disclosure categories, with firms in the better disclosure categories benefiting from relatively increased liquidity and those in worse disclosure categories suffering from relatively decreased liquidity. This is consistent with the simple act of categorizing and graphically labeling firms based on their existing disclosure levels causing investors to re-allocate their attention and trading towards firms with higher disclosure levels.

B. Robustness tests

The advantages of a difference-in-difference research design lie in its simplicity and its potential to mitigate concerns of endogeneity and establish causality (Bertrand and Mullainathan, 2003, Bertrand et al.2004). However, some internal validity concerns may still exist (Meyer 1995). For example, if during the sample period some confounding factors (e.g., industry or macroeconomic conditions) do not affect all the firms in the same way, our inference that the release of the graphic disclosure categories drives the observed changes in liquidity may not be valid.[8] Accordingly, in this section, we conduct additional robustness tests to rule out alternative

[8]Specific to our setting, when the economy slows down, investors' tendency to flight-to-liquidity could make the No information group less liquid and the current information group more liquid. Yet, for our sample period ending October 2007 a deteriorating economy is not likely driving our inferences because as reported by The National Bureau of Economics the recent recession did not start until December 2007. Furthermore, the beginning of the financial market turmoil did not start until the summer of 2008 (Shleifer and Vishny 2011).

explanations for our findings. For parsimony, we focus on our common factor measure, *LIQUIDITY*.

First, we seek to rule out if the increased liquidity for the *PS Current* group simply reflects a liquidity improvement over time while the decreased liquidity for the *PS No* group reflects a downward trend in liquidity rather than as a response to the graphic disclosure tiers. To account for possible time trends, we explicitly control for changes in *LIQUIDITY* prior to our sample period. Specifically, we construct *LIQUIDITY* using data from the three-month period, November 2006 to January 2007 and we use this to calculate a lagged change in *LIQUIDITY*. We find the lagged change in *LIQUIDITY* is *negatively* associated with the change in liquidity over the pre- and post-implementation periods (untabulated). Thus, our sample firms show a mean-reversion in liquidity instead of a continuous trend.

To further investigate the impact of trends, we estimate model (1) while including the lagged change in liquidity as an additional control variable. Consistent with the univariate correlation, as shown in table 4 column (1) the coefficient on the lagged change in *LIQUIDITY* is significantly negative. More importantly, our findings on the coefficients for the current information group and no information group remain the same.

Our second robustness check involves controlling for the potential impact of industry clustering (if any) within certain category of *PS* firms. When different industries experience systematic changes in liquidity and these industries happen to cluster within the various disclosure categories, it is possible that our findings represent an industry level shift in liquidity that is unrelated to the implementation of the graphic disclosure tiers. The lack of industry membership information makes it impossible to directly control for industry. So we construct an inferred industry membership based on the degree of return covariance of an individual firm's

daily returns with the 10 industry average daily returns obtained from Ken French's website. In particular, we download daily average returns for the 10 industry sectors traded on NYSE, AMSE and Nasdaq from November 1, 2006 to April 30, 2007 (i.e., six months prior to the introduction of the graphic disclosure classification system). For each firm in our sample, we regress its daily returns on 10 daily industry average returns. The coefficients on the industry daily average returns signal how closely a *PS* firm's return co-move with the respective industries. The larger the coefficient, the stronger the return covariance. We assign each firm to the industry with the largest coefficient. To the extent that stock returns capture economic shocks that have a strong industry component (Bhojraj et al. 2003), this approach implicitly captures a *PS* firm's industry membership.

Untabulated analysis suggests that the industries are relatively evenly distributed across OTCBB firms and the three categories of *PS* firms. So it is unlikely that industry clustering within the disclosure categories drive the differences in liquidity change across groups of *PS* firms. Nonetheless, we rerun model (1) after controlling for industry dummies based on the implied industry membership.[9] As reported in table 4 column (2), the coefficients *Current*, *Limited* and *No*, which now reflect the average liquidity change of one disclosure category relative to the *OTCBB* firms *within the same industry*, are similar to those reported in table 2. Overall, this analysis indicates that the *PS Current* and *No* groups' liquidity changes are not driven by any concurrent industry level changes that might cluster within any of the disclosure categories.

Our third robustness test focuses on the potential impact of ADR firms. Because the OTC Markets Group has no listing standards that regulate who can trade through its platform, firms

[9] We estimate model (1) repeatedly because our sample size would become too small if we perform all of our robustness tests in one regression.

that are either unable or unwilling to qualify for other stock exchanges (e.g., NYSE and Nasdaq) often choose to list on the OTC market. The lack of listing requirement leads to heterogeneity among *PS* firms. For example, large foreign firms such as Nissan and Adidas are ADR *PS* firms. These ADR firms likely have a richer information environment and more institutional investors than a typical *PS* firm. As a result, investors in these firms may be less likely to be influenced by the introduction of the new disclosure classifications than investors in other *PS* firms and therefore including ADRs in our sample may reduce the power of our tests. Although given that even sophisticated institutional investors are subject to "home bias" (Lewis 1999) and not all of ADR investors are sophisticated, it is not clear that the new graphic disclosure tiers will not have any effect on the liquidity of the ADRs.

We obtain a list of ADR firms that are traded on the OTC market from J.P. Morgan's ADR analytics (https://www.adr.com//) and merge it with our sample using trading symbols and firm names. We find that 466 out of 5,629 firms (8%) in our sample are ADRs. Almost all of them (i.e., 462 out of 466) belong to the current information group. The clustering of ADR firms in the current information group makes it unlikely that ADR firms affect the inferences on the no information, limited information and the *OTCBB* firms. We split the current information group into two subgroups based on whether a firm is an ADR or not. We then rerun model (1) including two indicator variables: *Current_NotADR* =1 if the firm is not an ADR and *Current_ADR*=1 if the firm is an ADR.[10]

Results reported in table 4, column (3) confirm that the inferences related to the limited information, the no information and the OTCBB groups remain the same. Within the current information group, implementing the graphic disclosure tiers increases liquidity for both the ADR and non-ADR firms, although in smaller magnitude for the latter. This demonstrates that

[10] Our inferences are similar when we exclude all ADR firms from our analysis.

the ADRs in our sample experienced increased liquidity as a result of the new classification system.

Firm size tends to affect firms' disclosure strategy and information environment (Atiase 1986; Diamond and Verrecchia 1991). Our final robustness check investigates whether there was some common shock during our sample period that differentially affected the liquidity of large and small firms and confounds our analysis of changes in liquidity across the disclosure categories. In this analysis we explicitly control for firm size so that we can interpret the coefficients on the different *PS* categories as relative liquidity changes for firms with similar size.

Most databases do not collect total assets for *PS* firms despite that they are public firms and may provide some public filings. Instead, we use data from S&P's Compustat Monthly Security files at the end of April 2007 to calculate market capitalization for 49% of our sample firms just before the OTC Markets Group introduced the new disclosure classification.[11] We do not control for the change in market capitalization during our event window because as we demonstrate in the next section, firms' liquidity changes are reflected in market prices, making the change of market capitalization another outcome variable and inappropriate to control it away (Angrist and Pischke, 2009, p. 68).

In our regression analysis, we estimate model (1) but include as a control variable the natural log of a firm's market value. We use the natural log to reduce the influence of extreme values. Table 4 column (4) reports that controlling for firm size does not change our inferences. On average, the current information group still experiences relative increases in liquidity and the

[11] We cannot use the OTC Markets Group data to calculate market capitalization because it does not include shares outstanding.

no information group experiences relative decreases in liquidity. The coefficient for market value is insignificant indicating that firm size is not an omitted correlated variable in our analysis.

IV. Stock Market Reactions

In this section we examine whether investors in *PS* firms anticipated the impact of the new disclosure classifications. Specifically, we use an event study methodology to investigate market reactions surrounding three major events: 1) the announcement on April 24, 2007 of OTC Markets Group's intention to develop a disclosure classification system; 2) the announcement on July 13, 2007 of the upcoming final implementation date; and 3) the final release of the graphic disclosure tiers on August 1, 2007. Following Bushee and Leuz (2005), we measure buy-and-hold raw returns during a five-day window that starts three days before and ends one day after the event dates, denoted $RETURN_{i,-3,+1}$. We then estimate the following model on the three categories of *PS* firms and *OTCBB* firms.

$$RETURN_{i,-3,+1} = \beta_0 + \beta_1 CURRENT_i + \beta_2 LIMITED_i + \beta_3 NO_i + \varepsilon_i \qquad (2)$$

where:

$RETURN_{i,-3,+1}$ = the five-day buy-and-hold raw returns during the event window (-3, +1) for firm *i*.

We winsorize the stock returns at 1% and 99% of the distribution and exclude outliers with absolute studentized residuals greater than two. We also report robust standard errors. We include the *OTCBB* firms to help control for events during each of these windows that have implications for all Pink Sheets firms. The intercept captures the returns of the *OTCBB* firms.

Table 5 shows that the *NO* group experiences consistently more negative stock returns (-1.08%, -1.52%, and -1.51%; $p<0.05$) than the *OTCBB* firms surrounding each of the three

events.[12] Compared to *OTCBB* firms, the *CURRENT* group shows more positive returns around April 24, 2007 (0.67; $p<0.10$) and July 13, 2007 (0.84%; $p<0.01$), while the *LIMITED* group has no differential market returns than the *OTCBB* firms in any of the event windows. This suggests that at least some investors realized that the introduction of the graphic disclosure classification system would have negative valuation implications for the *NO* firms and some positive valuation implications for the *CURRENT* firms.

To further assess the market's ability to predict the impact of the new disclosure classification system, we regress changes in each of our five liquidity measures on the event period abnormal returns of our *PS* firms (we do not include *OTCBB* firms), with abnormal returns calculated as the difference between the firm's five-day buy-and-hold raw returns and the same window average buy-and-hold raw returns of the *OTCBB* firms (i.e., those OTCBB firms dually quoted in the Pink Sheets market). We then estimate the following model:

$$\Delta Liquidity_i = \beta_0 + \beta_1 AR_{event,i} + \varepsilon_i \qquad (3)$$

where:

AR_{event} = difference between the five-day buy-and-hold raw returns around event windows for the *PS* firm *i* and the average same window buy-and-hold raw returns for *OTCBB* firms;

Table 6, panel A reports the results when abnormal returns are pooled across the three event dates, while in panels B, C, and D, we report the regression for each of the event dates, April 24, 2007, July 13, 2007, and August 1, 2007, respectively. As can be seen in panel A, the abnormal returns to the *PS* firms are increasing in the subsequent increase in *LIQUIDITY*, *VOLUME*, and *TRADEDAYS* and in the subsequent decrease in *SPREAD* and *IMPACT*, all with p-values less than 0.01. The results across each of the three event dates are consistent with the

[12] Based on the intercept in column (3), the average *OTCBB* firm experienced large negative returns of -1.17 percent around August 1, 2007. Further untabulated analysis reveals that the average Nasdaq small cap stock similarly experienced -1.12 percent returns around August 1, 2007.

pooled results, with the exceptions of insignificant coefficients on $AR_{July\ 13}$ in the Δ*SPREAD* analysis in panel C and on $AR_{August\ 1}$ in the Δ*TRADEDAYS* analysis in panel D.

Overall the results in tables 5 and 6 suggest that at the event dates the investors had a sense for which firms were likely to benefit the most (or be hurt the most) in terms of liquidity by the subsequent introduction of the graphic disclosure tiers. This finding is consistent with the conclusion of Ang et al. (2010) that OTC market returns are particularly sensitive to a firm's liquidity.

V. Conclusion

Utilizing a natural experiment from the Pink Sheets market, we investigate whether the introduction of graphic disclosure tiers that highlight firms' existing disclosure practices can attract investor attention and impact liquidity. We demonstrate that once OTC Markets Group fully implemented such a system on August 1, 2007, changes in liquidity occurred. Specifically, we find that Pink Sheets firms in the current information category show an increase in liquidity and those in the no information category experience a decrease in liquidity relative to dually quoted OTCBB firms between three-month pre- and three-month post-implementation periods. We observe no changes in liquidity for limited information category relative to the dually quoted OTCBB firms. These results suggest that the graphic labels are sufficient to draw investor attention and cause a significant shift in liquidity among Pink Sheets firms. Our robustness checks confirm that firms' industry membership, past liquidity changes, ADR status, and firm size do not drive our results.

We also examine stock returns around three events leading up to and including the August 1, 2007 release of the graphic disclosure tiers. We find that investors anticipated that the

introduction of the graphic disclosure tiers would have negative valuation implications for the no information firms and some positive valuation implications for the current information firms relative to the dually quoted OTCBB firms. Further regression analyses show that the event period abnormal returns are positively associated with the subsequently observed changes in liquidity among the Pink Sheets firms. This suggests that the market had some sense of the liquidity changes that would result from the release of the new disclosure classification via colorful graphics.

Our study indicates that market intermediaries such as OTC Markets Group can alter market liquidity through jointly categorizing and colorfully labeling its securities based on their disclosure levels. Apparently the attention-getting tactics direct investor attention to disclosure levels and hence lead to greater (less) liquidity in Pink Sheet firms with higher (lower) levels of public disclosures.

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Figure 1
Description of the Disclosure Categories among Pink Sheets Firms

On August 1, 2007, OTC Markets Group Inc. implemented a graphic disclosure classification system that labels listed Pink Sheets securities based on their disclosure levels. The labels and their descriptions are summarized here. These labels were affixed to each Pink Sheets company's trading symbol on OTC Markets Group's website. OTC Markets Group suspends the quoting of firms that are in the "Caveat Emptor" category that includes firms under investigation for spam or fraud.

Categories	Original labels as of 08/01/2007	Current labels as of 12/20/2010	Descriptions (based on news release from OTC Markets Group on July 13, 2007, http://www.otcmarkets.com/news/otc-press-release?id=55, last accessed on 01/17/2011
Current information			Firms that have information public available through regulatory filings or through the Pink Sheets New Service.
Limited information			Firms that have no current information available but have limited financial information not older than six months. These firms generally have "financial reporting problems, economically distressed or in bankruptcy."
No information			"Indicates companies that are not able or willing to provide disclosure to the public market-either to a regulator, an exchange or Pink Sheet."
Caveat Emptor			"Buyer Beware. There is a public interest concern associated with the company, which may include a spam campaign, stock promotion or known investigation of fraudulent activity committed by the company or insiders."

Figure 2
Examples of Pink Sheets Firms in Each Disclosure Category
(www.otcmarkets.com/stock, accessed on 12/20/2010)

Figure 2a: Current Information

Figure 2b: Limited Information

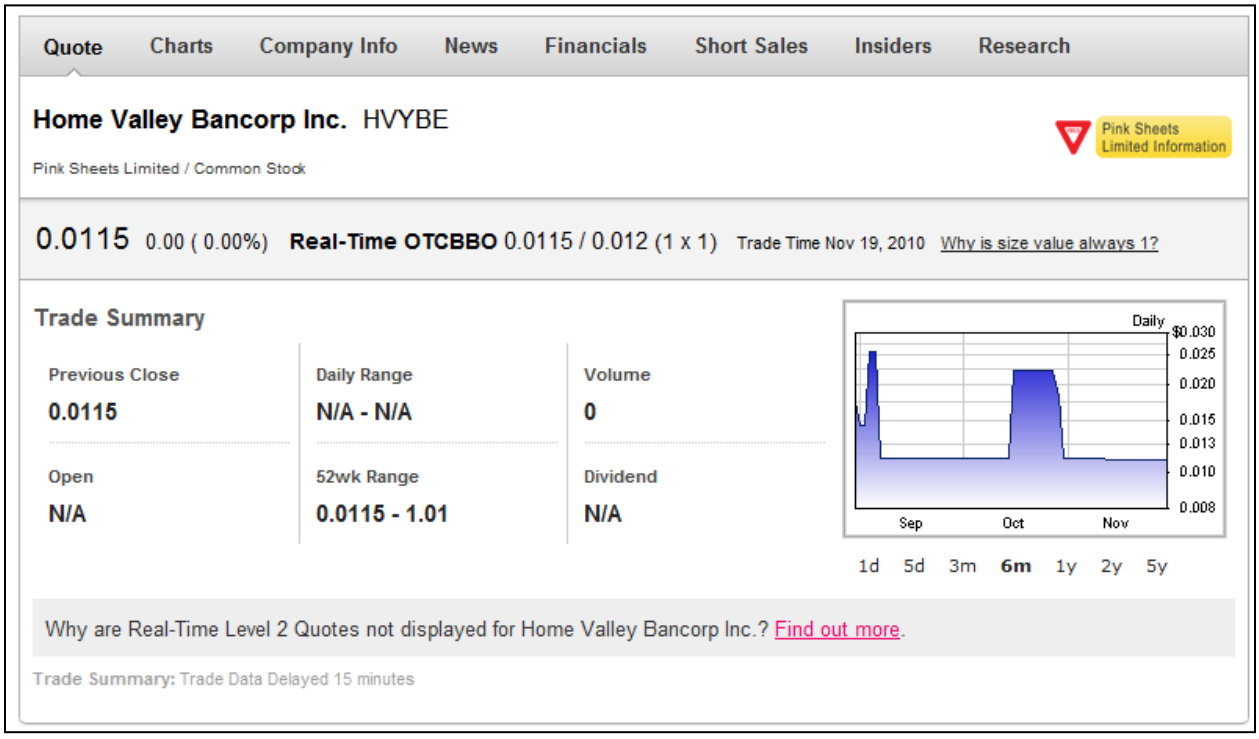


Figure 2c: No Information

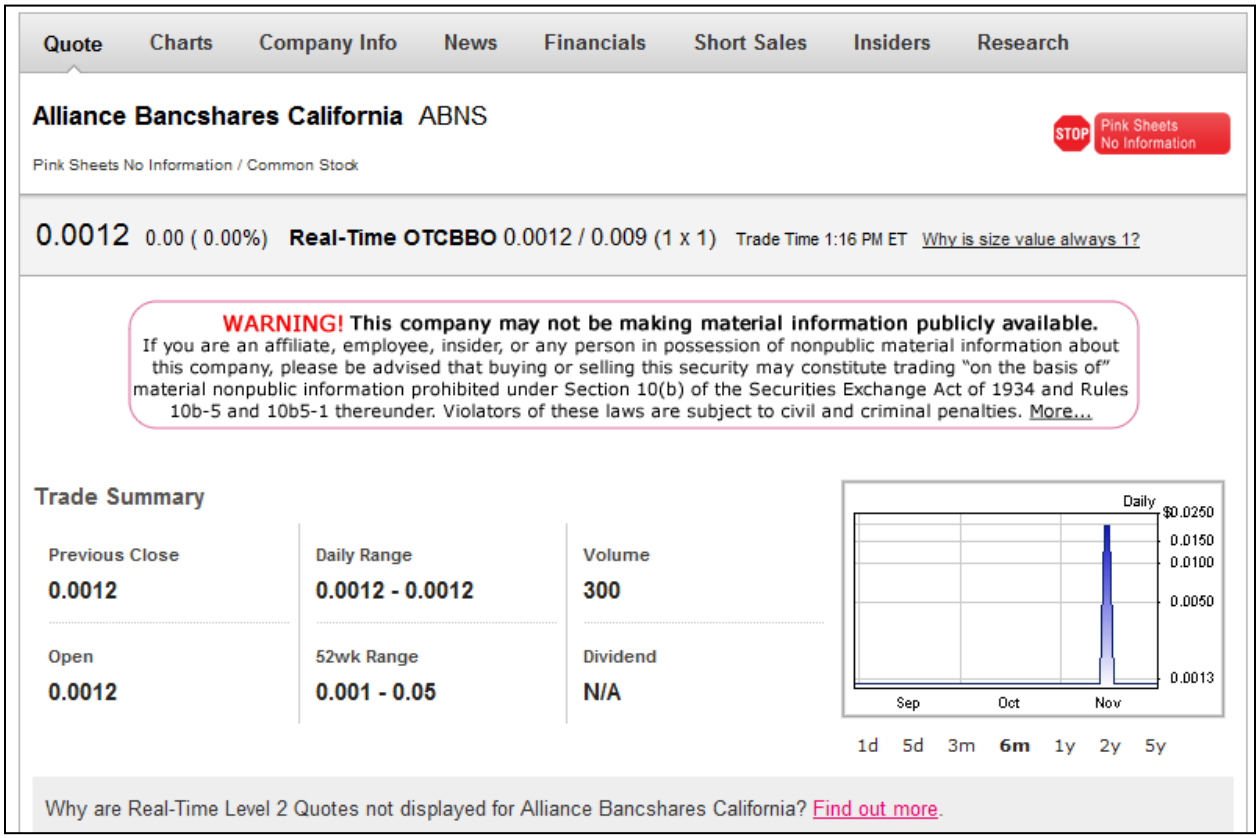
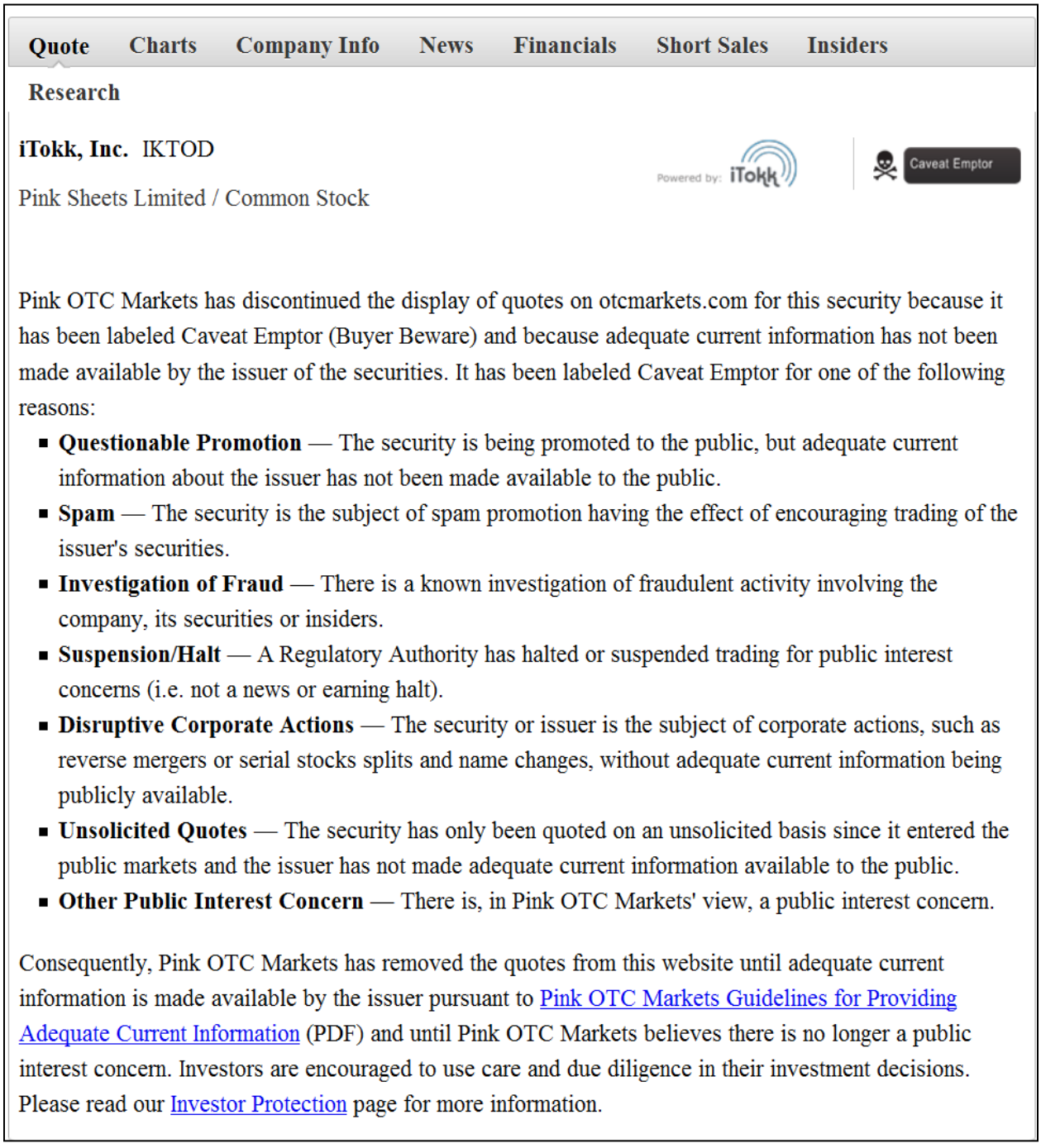


Figure 2d: Caveat Empotor



Appendix: Variable Definitions

SPREAD = the percentage daily bid-ask spread, calculated as the absolute value of the difference between closing bid and closing ask prices, divided by the mid-point of the bid and ask prices, and multiplied by 100. We winsorize this variable at the top and bottom 1% of the distribution;

IMPACT = the Amihud (2002) illiquidity measure, calculated as the log of the three-month average (during the pre- and the post-implementation periods, respectively) of the absolute value of daily returns divided by daily dollar volume (in millions);

TRADEDAYS = the percentage of days traded in a month, calculated as the number of days in a month that a firm has actual trading, divided by the number of total potential trading days in the month;

VOLUME = monthly dollar trading volumes, measured as the log of daily trading volume (shares traded times the closing price) summed over the month (in thousands of dollars);

LIQUIDITY= factor scores extracted from a principle component analysis on the above four measures;

CURRENT= 1 if a firm is assigned to the Pink Sheets current information category with the 

graphic, and zero otherwise;

LIMITED = 1 if a firm is assigned to the Pink Sheets limited information category with the 

graphic, and zero otherwise;

NO = 1 if a firm is assigned to the Pink Sheets no information category with the 

graphic, and zero otherwise;

OTCBB=1 if a firm is dually quoted on the OTCBB and Pink Sheets, and zero otherwise;

$RETURN_{-3,+1}$ = five-day buy-and-hold raw returns around three event dates: 1) April 24, 2007, 2) July 13, 2007, and 3) August 1, 2007;

AR_{event} = abnormal returns, calculated as the difference between a Pink Sheets firm's buy-and-hold returns around an event date and the average buy-and-hold returns during the same window for all dually quoted OTCBB firms.

Table 1
Descriptive Statistics Related to the Liquidity Factor

This table provides data related to our principal component analysis on four measures of liquidity, *SPREAD*, *IMPACT*, *TRADEDAYS*, and *VOLUME* (defined in Appendix), used to develop a single parsimonious liquidity factor. We include all Pink Sheet firms that were assigned to *CURRENT*, *LIMITED*, or *NO* disclosure categories (defined in the Appendix) and dually quoted OTCBB firms that have the four liquidity measures available from two three-month periods from February to April 2007 and from August to October 2007 for a total of 8,368 observations with non-missing values. Panel A shows the correlations among the individual liquidity measures. Panel B shows the eigenvalues of the correlation matrix and demonstrates that one factor explains 70% of the total variances of the four liquidity variables. This factor is multiplied by negative one and used as our overall liquidity measure, denoted as *LIQUIDITY*, so that a larger *LIQUIDITY* measure indicates greater liquidity. Panel C shows that *LIQUIDITY* is highly correlated with each of the individual liquidity measures.

Panel A: Correlations among the individual liquidity measures with Pearson (Spearman) correlation is above (below) the diagonal

	SPREAD	*IMPACT*	*TRADEDAYS*	*VOLUME*
SPREAD		0.66 <.0001	-0.44 <.0001	-0.72 <.0001
IMPACT	0.84 <.0001		-0.25 <.0001	-0.78 <.0001
TRADEDAYS	-0.44 <.0001	-0.27 <.0001		0.66 <.0001
VOLUME	-0.81 <.0001	-0.78 <.0001	0.69 <.0001	

Panel B: Eigenvalues of the Correlation Matrix

Factor #	*Eigenvalue*	*Proportion (=Eigenvalue/4)*	*Cumulative Proportion*
1	2.79	0.70	0.70
2	0.78	0.19	0.89
3	0.34	0.09	0.98
4	0.09	0.02	1.00

Panel C: Correlations between *Liquidity* and the Individual Liquidity Measures

	LIQUIDITY (Factor #1 × (-1))
SPREAD	-0.86
IMPACT	-0.83
TRADEDAYS	0.68
VOLUME	0.96

Table 2
Regression Analysis of Changes in Liquidity around the Release of the Graphic Disclosure Clategories

$$\Delta Liquidity = \alpha_0 + \alpha_1 CURRENT + \alpha_2 LIMITED + \alpha_3 NO + \mu_i \quad (1)$$

This table reports coefficient estimates for equation (1) where $\Delta Liquidity$ denotes the change in liquidity over the three months from February to April 2007 and from August to October 2007 for each of our five measures of liquidity. The intercept in equation (1) captures the average liquidity change for the dually quoted OTCBB companies. The coefficient on each of the independent variables measures the liquidity changes for that disclosure category (defined in Appendix) relative to that of the OTCBB firms (i.e., difference-in-difference). In the last three rows we report p-values from χ^2 test of a difference in the coefficients across the Pink Sheets disclosure categories. We exclude observations with absolute studentized residuals greater than two. Robust standard errors are reported in parentheses. Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	*ΔLIQUIDITY*	*ΔSPREAD*	*ΔIMPACT*	*ΔTRADEDAYS*	*ΔVOLUME*
CURRENT	0.126***	-1.238***	-0.215***	3.889***	0.225***
	(0.018)	(0.326)	(0.052)	(0.455)	(0.045)
LIMITED	0.025	1.091**	-0.084	1.345*	0.040
	(0.026)	(0.546)	(0.086)	(0.737)	(0.071)
NO	-0.108***	1.565***	0.163***	-1.379***	-0.162***
	(0.015)	(0.316)	(0.049)	(0.356)	(0.039)
OTCBB (Intercept)	-0.111***	1.441***	0.395***	-1.632***	-0.233***
	(0.009)	(0.184)	(0.033)	(0.256)	(0.026)
Observations	3,366	4,349	3,907	5,290	5,320
Adjusted R^2	0.038	0.009	0.011	0.026	0.012
p-value from χ^2 Test					
CURRENT=LIMITED	0.00	0.00	0.14	0.00	0.01
NO = LIMITED	0.00	0.41	0.00	0.00	0.01
CURRENT = NO	0.00	0.00	0.00	0.00	0.00

Table 3
Univariate Analysis of Changes in Liquidity around the Release of the Graphic Disclosure Categories

This table presents univariate statistics on the liquidity measures that underlie the regressions reported in table 2. Columns (2) and (3) report the mean, median in parentheses, and standard deviation in brackets of the liquidity measures during the pre-implementation period (three months before May 1, 2007), denoted *_PRE*, and during the post-implementation period (three months after August 1, 2007), denoted *_POST*. Column (4) presents tests of whether the changes in sample mean and median are significantly different from 0, based on two-tailed t-test and Wilcoxon signed rank test. Column (5) presents tests of whether the changes in sample mean and median are significantly different from changes for the *OTCBB* group based on two-tailed t-test and Wilcoxon signed rank test. ***, **, and * respectively indicate significance levels at p<0.01, p<0.05 and p<0.10. Column (6) reports the incremental changes in mean liquidity in percentage terms by dividing the mean in column 5 by the mean in column (2).

Panel A: Changes in *LIQUIDITY* across Different Groups of Firms

	(1)	(2)	(3)	(4)	(5)	(6)
Category	*Firms*	*LIQUIDITY _PRE*	*LIQUIDITY _POST*	*⊿LIQUIDITY*	*⊿LIQUIDITY relative to OTCBB*	*%⊿ LIQUIDITY relative to LIQUIDITY_PRE*
CURRENT	356	0.935 (1.099) [0.86]	0.950 (1.130) [0.89]	0.015 (0.036)* [0.29]	0.126*** (0.150)***	13%
LIMITED	264	0.192 (0.236) [0.83]	0.106 (0.177) [0.87]	-0.086*** (-0.089)*** [0.39]	0.025 (0.025)	13%
NO	1,281	-0.165 (-0.091) [0.91]	-0.383 (-0.379) [0.90]	-0.219*** (-0.222)*** [0.41]	-0.108*** (-0.109)***	-65%
OTCBB	1,465	0.377 (0.448) [0.70]	0.266 (0.328) [0.70]	-0.111*** (-0.113)*** [0.35]	N/A	N/A

Panel B: Changes in *SPREAD* across Different Groups of Firms

	(1)	(2)	(3)	(4)	(5)	(6)
Category	*Firms*	*SPREAD _PRE*	*SPREAD _ POST*	*Δ SPREAD*	*Δ SPREAD relative to OTCBB*	*%Δ SPREAD relative to SPREAD _PRE*
CURRENT	407	8.093 (1.913) [15.70]	8.296 (2.131) [15.61]	0.202 (0.034)* [5.43]	-1.238*** (-0.995)***	-15%
LIMITED	303	16.408 (11.261) [17.33]	18.940 (12.761) [18.19]	2.532*** (1.183)*** [8.97]	1.091** (0.153)	7%
NO	1,931	28.203 (20.415) [24.87]	31.208 (24.602) [24.58]	3.005*** (2.149)*** [11.28]	1.565*** (1.119)***	6%
OTCBB	1,708	11.852 (6.933) [14.30]	13.293 (8.271) [14.39]	1.441*** (1.030)*** [7.59]	N/A	N/A

Table 3 (continued)

Panel C: Changes in *IMPACT* across Different Groups of Firms

	(1)	(2)	(3)	(4)	(5)	(6)
Category	*Firms*	*IMPACT_PRE*	*IMPACT_POSP*	*⊿IMPACT*	*⊿IMPACT relative to OTCBB*	*%⊿IMPACT relative to IMPACT_PRE*
CURRENT	803	0.456 (0.367) [2.49]	0.637 (0.576) [2.51]	0.180*** (0.201)*** [1.14]	-0.215*** (-0.222)***	-47%
LIMITED	255	3.168 (3.431) [2.75]	3.479 (3.781) [2.67]	0.311*** (0.375)*** [1.27]	-0.084 (-0.047)	-3%
NO	1,320	4.156 (4.386) [2.45]	4.715 (5.143) [2.36]	0.559*** (0.512)*** [1.31]	0.163*** (0.090)***	4%
OTCBB	1,529	1.906 (1.732) [2.45]	2.301 (2.117) [2.38]	0.395*** (0.423)*** [1.27]	N/A	N/A

Panel D: Changes in *TRADEDAYS* across Different Groups of Firms

	(1)	(2)	(3)	(4)	(5)	(6)
Category	*Firms*	*TRADEDAYS_PRE*	*TRADEDAYS_POST*	*⊿TRADEDAYS*	*⊿TRADEDAYS relative to OTCBB*	*%⊿TRADEDAYS relative to TRADEDAYS_PRE*
CURRENT	949	56.144 (58.349) [33.89]	58.402 (62.243) [35.27]	2.258*** (2.663)*** [11.60]	3.889*** (3.242)***	7%
LIMITED	308	63.587 (68.864) [31.48]	63.300 (69.642) [33.02]	-0.287 (0.000) [12.14]	1.345* (0.579)*	2%
NO	2,106	46.290 (37.376) [34.08]	43.279 (32.227) [33.62]	-3.011*** (-1.859)*** [11.36]	-1.379*** (-1.279)***	-3%
OTCBB	1,927	53.887 (51.180) [33.30]	52.256 (47.979) [33.66]	-1.632*** (-0.579)*** [11.24]	N/A	N/A

Panel E: Changes in *VOLUME* across Different Groups of Firms

	(1)	(2)	(3)	(4)	(5)	(6)
Category	*Firms*	*VOLUME_PRE*	*VOLUME_POST*	*⊿VOLUME*	*⊿VOLUME relative to OTCBB*	*%⊿VOLUME relative to VOLUME_PRE*
CURRENT	970	12.624 (12.620) [2.53]	12.617 (12.573) [2.63]	-0.008 (-0.012) [1.13]	0.225*** (0.241)***	2%
LIMITED	314	11.116 (11.343) [2.77]	10.923 (11.089) [2.82]	-0.193*** (-0.218)*** [1.17]	0.040 (0.036)	0%
NO	2,091	9.001 (9.417) [3.48]	8.606 (8.901) [3.34]	-0.395*** (-0.431)*** [1.33]	-0.162*** (-0.177)***	-2%
OTCBB	1,945	11.667 (11.822) [2.16]	11.434 (11.569) [2.14]	-0.233*** (-0.254)*** [1.14]	N/A	N/A

Table 4
Robustness Tests

This table reports coefficient estimates for the equation estimated in table 2 column (1) with additional control variables. In column (1) we include lagged *ΔLIQUIDITY*. In column (2) we include nine industry indicator variables. In column (3) we include separate indicator variables for firms in the current information category that are ADRs and those that are not ADRs. In column (4) we include the natural log of market capitalization at the end of April 2007. We exclude observations with absolute studentized residuals greater than two. Robust standard errors are reported in parentheses. Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)
VARIABLES	*ΔLIQUIDITY*	*ΔLIQUIDITY*	*ΔLIQUIDITY*	*ΔLIQUIDITY*
CURRENT	0.133***	0.127***		0.061*
	(0.018)	(0.018)		(0.033)
LIMITED	-0.016	0.019	0.025	0.049
	(0.025)	(0.025)	(0.026)	(0.032)
NO	-0.146***	-0.110***	-0.108***	-0.101***
	(0.014)	(0.014)	(0.015)	(0.018)
OTCBB (Intercept)	-0.107***	-0.124***	-0.111***	-0.113***
	(0.009)	(0.017)	(0.009)	(0.017)
Lag_ΔLIQUIDITY	-0.251***			0.003
	(0.020)			(0.004)
Industry dummies		yes		
CURRENT_NotADR			0.051*	
			(0.030)	
CURRENT_ADR			0.179***	
			(0.019)	
LOGMV				0.003
				(0.004)
Observations	3,059	3,355	3,365	1,951
Adjusted R^2	0.112	0.045	0.041	0.030

Table 5
Stock Returns around the Announcement and the Implementation Dates

$$RETURN_{i,-3,+1} = \beta_0 + \beta_1 CURRENT_i + \beta_2 LIMITED_i + \beta_3 NO_i + \varepsilon_i \qquad (2)$$

This table reports regression results for equation (2) where $RETURN_{i,-3,+1}$ is five-day buy-and-hold returns around three event dates for firm *i*: 1) April 24, 2007, when Pink Sheets first announced their plan to develop a disclosure classification system; 2) July 13, 2007, when Pink Sheets announced the implementation date for the disclosure classification system; and 3) August 1, 2007, when the Pink Sheets formally released the graphics for the disclosure tiers. In model (2) the coefficients of the independent variables capture whether returns of firms in respective Pink Sheets categories differ from those of the dually quoted OTCBB firms. We winsorize stock returns at 1% and 99% of the distribution. We also exclude outliers with absolute studentized residuals greater than 2. Robust standard errors are reported in parentheses. Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

	(1)	(2)	(3)
VARIABLES	*$RETURN_{-3,+1}$ (April 24, 2007)*	*$RETURN_{-3,+1}$ (July 13, 2007)*	*$RETURN_{-3,+1}$ (August 1, 2007)*
CURRENT	0.67*	1.34***	-0.14
	(0.36)	(0.36)	(0.36)
LIMITED	0.02	-1.02	-0.19
	(0.84)	(0.80)	(0.78)
NO	-1.08**	-1.52***	-1.51***
	(0.45)	(0.44)	(0.44)
OTCBB (Intercept)	-0.44*	-0.49*	-1.17***
	(0.26)	(0.27)	(0.26)
Observations	3,507	3,673	3,674
CURRENT/LIMITED/NO/OTCBB	704/243/1,231/1,329	749/256/1,252/1,416	774/258/1,228/1,414
Adjusted R^2	0.003	0.01	0.004

Table 6
Event Window Abnormal Returns and Future Liquidity Changes

$$\Delta Liquidity_i = \beta_0 + \beta_1 AR_{event,i} + \mu_i \quad (3)$$

This table reports regression results for equation (3) where $\Delta Liquidity$ denotes the change in liquidity over the pre-implementation period (February to April 2007) and the post-implementation period (August to October 2007) for each of our five measures of liquidity. We use the average stock returns of all dually quoted OTCBB firms as the expected returns to construct abnormal returns, *AR*, for Pink Sheet firms. We also exclude outliers with absolute studentized residuals greater than 2. Panel A reports analysis using abnormal returns summed across the three event dates. Panels B, C, and D report analyses using abnormal returns around individual event dates. Robust standard errors are reported in parentheses. Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Panel A: Association between Changes in Liquidity and Abnormal Returns Pooled across All Event Dates

	(1)	(2)	(3)	(4)	(5)
VARIABLES	*ΔLIQUIDITY*	*ΔSPREAD*	*ΔIMPACT*	*ΔTRADEDAYS*	*ΔVOLUME*
AR_{Total}	0.002***	-0.026***	-0.005***	0.022***	0.004***
	(0.000)	(0.006)	(0.001)	(0.007)	(0.001)
Constant	-0.156***	2.436***	0.412***	-1.710***	-0.302***
	(0.008)	(0.158)	(0.024)	(0.209)	(0.021)
Observations	1,710	2,007	2,132	2,429	2,522
Adjusted R^2	0.029	0.012	0.017	0.004	0.010

Panel B: Association between changes In Liquidity and Abnormal Returns around April 24, 2007

	(1)	(2)	(3)	(4)	(5)
VARIABLES	*ΔLIQUIDITY*	*ΔSPREAD*	*ΔIMPACT*	*ΔTRADEDAYS*	*ΔVOLUME*
$AR_{April\ 24}$	0.002***	-0.035***	-0.008***	0.024*	0.003***
	(0.000)	(0.010)	(0.001)	(0.012)	(0.001)
Constant	-0.164***	2.428***	0.441***	-2.298***	-0.379***
	(0.009)	(0.159)	(0.025)	(0.233)	(0.022)
Observations	1,559	1,694	1,917	2,025	2,109
Adjusted R^2	0.018	0.010	0.017	0.002	0.003

Table 6 (continued)

Panel C: Association between Changes in Liquidity and Abnormal Returns around July 13, 2007

	(1)	(2)	(3)	(4)	(5)
VARIABLES	*ΔLIQUIDITY*	*ΔSPREAD*	*ΔIMPACT*	*ΔTRADEDAYS*	*ΔVOLUME*
$AR_{July\ 13}$	0.002***	-0.005	-0.005***	0.024*	0.003**
	(0.000)	(0.010)	(0.001)	(0.013)	(0.001)
Constant	-0.149***	2.287***	0.393***	-1.111***	-0.290***
	(0.009)	(0.159)	(0.025)	(0.230)	(0.022)
Observations	1,526	1,694	1,879	1,990	2,093
Adjusted R^2	0.009	-0.000	0.005	0.002	0.003

Panel D: Association between Changes in Liquidity and Abnormal Returns around August 1, 2007

	(1)	(2)	(3)	(4)	(5)
VARIABLES	*ΔLIQUIDITY*	*ΔSPREAD*	*ΔIMPACT*	*ΔTRADEDAYS*	*ΔVOLUME*
$AR_{August\ 1}$	0.002***	-0.034***	-0.004***	0.022	0.005***
	(0.001)	(0.012)	(0.002)	(0.015)	(0.002)
Constant	-0.148***	2.353***	0.402***	-0.874***	-0.243***
	(0.009)	(0.159)	(0.025)	(0.230)	(0.022)
Observations	1,508	1,665	1,870	1,969	2,070
Adjusted R^2	0.012	0.008	0.004	0.001	0.007