Convertible Bond Arbitrage, Liquidity Externalities, and Stock Prices *

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Abstract

In the context of convertible bond issuance, we examine the impact of arbitrage activity on underlying equity markets. In particular, we use changes in equity short interest following convertible bond issuance to identify convertible bond arbitrage activity and analyze its impact on stock market liquidity and prices for the period 1993 to 2006. There is considerable evidence of arbitrage-induced short selling resulting from issuance. Moreover, we find strong evidence that this activity is systematically related to liquidity improvements in the stock. These results are robust to controlling for the potential endogeneity of arbitrage activity.

Keywords: Convertible Bond Arbitrage, Liquidity, Market Efficiency, Hedge Funds.

JEL Classification: G12, G14

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1 Introduction

Does arbitrage activity impact market quality? Although this question is not new, the proliferation of hedge funds in recent years has brought increasing attention to important questions regarding their impact on both liquidity and market efficiency (see, e.g., Securities and Exchange Commission (SEC) (2003)). In this paper, we focus on one particular strategy: convertible bond arbitrage. The growth in the issuance of the equity-linked debt securities can be attributed, at least in part, to the growing supply of capital provided by hedging strategies. Convertible bond issuance has increased more than sixfold in the past fifteen years, from \$7.8 billion in 1992 to \$50.2 billion in 2006 (SDC Global New Issues database). In fact, the widespread belief among Wall Street practitioners is that convertible bond arbitrage hedge funds purchase 70% to 80% of the convertible debt offered in primary markets.¹

In order to clarify the intuition as to why convertible bond arbitrage might impact liquidity in underlying equity markets, it is useful to outline the basics of the strategy. The aim of convertible bond arbitrage is to exploit mispricing in convertible bonds, usually by buying an undervalued convertible bond (Henderson, 2005) and taking a short position in the equity.² A typical convertible bond arbitrage strategy employs delta-neutral hedging, in which a manager buys the convertible bond and sells short the underlying equity at the current delta. The position is set up so that no profit or loss is generated from very small movements in the underlying stock price, and where cash flows are captured from both the convertible bond's yield and the short position's interest rebate. If the price of the stock increases, the

¹While they do not constitute the entire universe of convertible bond arbitrageurs, hedge funds are an important subset. Mitchell, Pedersen, and Pulvino (Forthcoming), report that convertible arbitrage funds account for 75% of the market. Similar estimates can be found in the popular press. See, e.g., a Wall Street Journal article (Pulliam, 2004) reporting on convertible bond issuance in 2004 that "As much as 80% of those issues were bought by hedge funds, according to brokers who work on convertible-bond trading desks." The Financial Times (Skorecki, 2004) reports that hedge funds bought 70% of new issues in 2003 and that 95% of trades in converts are made by hedge funds. The evidence presented in this study of large increases in short selling near issuance is consistent with that view.

²A convertible bond is a hybrid debt instrument: it is a bond that may, at the option of the holder, be converted into stock at a specified price for a given time period. Due to the conversion option, convertible bonds purchasers may profit from equity price gains but they also have downside protection since they are guaranteed bond payments (and, in the event of bankruptcy, are senior to equity holders).

arbitrageur adds to the short position (because the delta has increased). Similarly, when a stock price declines, the arbitrageur buys stock to cover part of the short position (due to the decrease in delta). Aggregate equity market trading demand, in contrast, is expected to move in the opposite direction. For example, Chordia, Roll, and Subrahmanyam (2002) document a positive correlation between stock returns and order imbalances. This means that the activities of convertible bond arbitrageurs, a class of investors trading against net market demand, should improve liquidity. This potentially positive role for hedge funds and other convertible bond arbitrageurs is contrary to the view of a destabilizing role for arbitrageurs in markets (see Mayhew (2000) for a survey of this literature).

Although we do not have direct data on convertible bond arbitrage activity in individual stocks, we are able to identify firms and dates on which we know that this strategy is likely to be used (convertible bond issuance dates). For the period 1993 to 2006, we estimate convertible bond arbitrage activity by calculating changes in short selling at and around issuance. The methodology allows us to use aggregate data to identify the presence and estimate the impact of a particular type of trader in stock markets. Our approach is simple, yet it captures the strategy of interest, as we observe large increases in short interest near convertible debt offerings.

Our proxy for arbitrage activity (change in short interest of issuing firms) has several advantages over using hedge fund databases to estimate convertible bond arbitrage activity. First, this provides a measure of *positions* taken by arbitrageurs (in individual securities). Fund flows data in hedge fund databases are self-reported and therefore provide an incomplete measure of convertible bond arbitrage activity. Second, there may be style misclassification and funds reporting multiple strategies to hedge fund databases. Third, even if we measured the assets of the funds perfectly, the positions would still be unobservable due to the use of leverage.

We find considerable evidence of arbitrage activity (i.e., short selling in the stock) at the date of bond issuance. We also find increased equity market liquidity following bond issuance. Moreover, these liquidity improvements are positively and significantly related to convertible bond arbitrage activity. We also observe changes in stock price volatility. Following convertible debt issuance there is an average decrease in total volatility and a decrease in the idiosyncratic component of volatility. We do not find evidence of a systematic relationship between convertible bond arbitrage activity and these volatility changes. We measure price efficiency using return autocorrelation and variance ratios (measure presented in Lo and MacKinlay (1988), which captures the extent to which stock prices follow a random walk). We do not observe significant changes in either of these measures following issuance. Taken together, we interpret the findings as evidence that convertible bond arbitrage activity tends to affect equity markets positively; however, this is primarily through liquidity improvements, not through stock prices.

A critical aspect of the analysis is that we do not observe arbitrage activity directly; instead, we infer it based on changes in short interest at bond issuance. We conduct several tests to examine the validity of this important assumption.³ First, we rule out the possibility that changes that we observe are due to changes in market-wide variables or to factors impacting firms with similar characteristics. We do this by conducting all analyses based on changes relative to a set of control firms (matched on size, book-to-market, turnover, Second, it could be that short selling that we observe is due industry, and exchange). to valuation shorting resulting from news of the convertible bond issue, not due to classic convertible bond arbitrage. In order to address this issue, we hand-collect announcement dates for our sample of convertible bond issues. This allows us to separate the impact of announcement period shorting versus issue period shorting (which we interpret as valuation shorting versus convertible bond arbitrage, respectively). Finally, we construct a theoretical measure of convertible bond arbitrage that does not depend on short-selling data (under the assumption that arbitrageurs are primary buyers of the bonds). If the short selling that we observe is due to arbitrage, then we would expect measured changes in short interest to be

³We thank an anonymous referee for encouraging this line of inquiry.

correlated with this theoretical measure. We also examine whether the theoretical measure is systematically related to liquidity and price efficiency changes in the stock. In all of these tests, we find evidence consistent with the view that the short selling that we observe near convertible bond issues is due to convertible bond arbitrage.

The main contribution of this paper is that we identify arbitrage *activity* and are able to estimate its impact on market quality (we use changes in equity market liquidity and price efficiency as measures of quality). By identifying a particular trader type, our methodology allows us to shed additional light on the mechanisms through which quality changes following issuance occur. We find that changes in liquidity vary systematically with the positions taken by arbitrageurs. The findings in this paper may be of interest to managers of issuing firms concerned about liquidity and efficiency spillovers in their stock as a result of their capital structure decisions.

This paper is organized as follows. Section 2 contains a brief review of related literature. Section 3 constructs the main hypotheses. Section 4 describes the data and sample. Section 5 presents the analysis of arbitrage activity, liquidity, and prices. Finally, Section 6 concludes.

2 Related Literature

The notions of liquidity and efficiency "externalities" underlie much of the analysis in this paper. The idea in Ross (1976) and subsequent theoretical works (e.g., Grossman (1988); Biais and Hillion (1994); Easley, O'Hara, and Srinivas (1998)) that the introduction of options markets can enhance efficiency by making markets less incomplete and/or positively impacting informativeness of stock prices has been followed by empirical investigations of the impact of derivatives markets on the market for the underlying asset (e.g., Kumar, Sarin, and Shatsri (1998); DeTemple and Jorion (1990)).⁴ Mayhew (2000) provides an excellent

⁴More recently, Basak and Croitoru (2006) show how the presence of arbitrageurs improves market quality and risk sharing in the context of rational markets with heterogeneous risk-averse investors and short-sales

survey of this literature. The main findings indicate a positive impact on liquidity and no negative impact on price efficiency. Most authors report a decrease in total volatility and an increase in trading volume following the introduction of options. We consider our study of the liquidity and efficiency externalities of convertible bond markets to be an extension of this line of research. Because of the embedded option in the convertible bond, the issuance of convertible bonds is analogous to the introduction of options.⁵ Our identification (based on short selling) allows us to provide a more direct test of the impact of arbitrageurs. While prior work has provided evidence that the introduction of new securities markets can impact equity market quality on average, we identify the mechanisms through which quality changes occur.

Our basic empirical strategy uses increases in short interest near debt issuance to identify arbitrage activity. In that way, it is closely related to the growing empirical literature on short-selling activity. There has been considerable focus on the relationship between future stock returns and both observed short sales and short-sales constraints (see, e.g., Asquith, Pathak, and Ritter (2005); Boehme, Danielsen, and Sorescu (2006); Diether, Lee, and Werner (2005); Jones and Lamont (2002); Dechow, Hutton, Meulbroek, and Sloan (2001); Asquith and Meulbroek (1996)). The information content of short sales in event settings has also received attention in the recent empirical literature (e.g., Christophe, Ferri, and Angel (2004)). All of these papers provide evidence that short selling and short-sales constraints impact stock prices, suggesting that short sellers help to incorporate negative information into prices.

Although short sellers can help facilitate the incorporation of negative information into prices, many are uninformed. They use short sales to hedge other positions. Little has been done to distinguish this type of short seller.⁶ This is an important distinction because the

constraints.

 $^{{}^{5}}$ In fact (unreported analysis), we find that the absence of put or call options on a particular stock is associated with greater convertible bond arbitrage activity. This result confirms the idea that the existence of substitute markets is critical in any trading decision.

⁶Boehmer, Jones, and Zhang (2006) use proprietary order-level data from the NYSE to quantify the

impact of short selling on market quality will obviously depend largely on who is engaging in the short sale. Uninformed short sellers are likely to add liquidity to markets (rather than reduce it as a result of potential adverse selection). Asquith et al. (2005, p. 270) note that, "Of course, a firm might have a high short-interest ratio because there is both valuation shorting and arbitrage shorting taking place simultaneously. Unfortunately, we cannot identify these situations precisely." Our event-based approach takes us further toward identification of this specialized investment strategy from the aggregate data in that the change in short interest near the issue date can be attributed, in large part, to convertible bond arbitrage activity.⁷

There are three recent papers that use changes in short interest near events to infer the impact of a particular type of trader. Arnold et al. (2005) use the Tax Payer Relief Act of 1997 (which made selling short against the box more costly) as a laboratory for testing hypotheses regarding changes in the information content of short interest when tax-motivated short sellers (i.e., uninformed sellers) no longer have incentives to short.⁸ This event-driven approach to trader identification is similar in spirit to ours; however, we examine not only average changes, but also cross-sectional implications of the introduction of a particular trader type.⁹ Mitchell, Pulvino, and Stafford (2004) use short interest in acquirers near merger announcements to identify activities by risk arbitrageurs and estimate the impact of this trading activity on prices. Bechmann (2004) also examines changes in short selling near a corporate event. He provides evidence that short selling induced by hedging activities explains part of the stock price decline following convertible bond calls. In both Bechmann (2004) and Mitchell et al. (2004), the focus is mainly on price pressure induced by short-

information content of the flow of shorting activity by the type of account initiating the sale. In this way, they are able to make distinctions between the information content of sales and trader type. Their focus is on characterizing the information content of short sales, by size and trader (account type).

⁷We provide results of several tests of whether the changes in short selling are due to arbitrage or other factors.

⁸Selling short against the box allows investors with a long position in the stock to eliminate the exposure to the stock while deferring capital gains until a later tax period.

⁹That is, we examine the sensitivity of changes in liquidity and volatility to the magnitude of the increase in short selling due to arbitrage.

selling activity while our focus is on impact of arbitrage on stock market liquidity and prices.

Although they do not constitute the entire universe of convertible bond arbitrageurs, convertible bond arbitrage hedge funds do play a role in primary issues of convertible debt and have an impact on stock market quality. Risks and rewards of providing liquidity by hedge funds in the convertible bond market are thoroughly studied by Agarwal, Fung, Loon, and Naik (2006). Underpricing of convertible bonds at issue, risk, and returns of the convertible bond arbitrage strategy are studied by Henderson (2005). He finds evidence that new issues of convertible bonds are underpriced at issue but that excess returns occur soon after issuance (mainly in the first six months), which may decrease the presence of convertible bond arbitrage use over longer horizons. Mitchell, Pedersen, and Pulvino (Forthcoming) analyze the impact of capital outflows in hedge funds on convertible bond prices. Choi, Getmansky, and Tookes (2007) examine supply and demand in the convertible bond market, mapping the measure of arbitrage activity used in this paper to fund flows and returns in convertible bond arbitrage hedge funds.

3 Arbitrage, Liquidity, and Stock Prices: Predictions

This section outlines our main predictions. We measure changes in short selling near convertible bond issuance and relate this proxy for convertible bond arbitrage activity to changes in liquidity and stock price efficiency. As mentioned in the introduction, the typical convertible bond arbitrage strategy (delta hedging) implies that arbitrageurs engaged in dynamic hedging are likely to trade in the opposite direction of the rest of the market: they increase their short positions as stock prices increase, and decrease them when stock prices decrease. This should result in improved market liquidity (our alternative hypothesis). In this section, we test the following two null hypotheses:

 H_0 (*Liquidity*): Convertible bond arbitrage activity (i.e., increased short selling near issuance) is uncorrelated with changes in liquidity.

 H_0 (*Efficiency*): The increase in short selling near issuance is uncorrelated with changes in efficiency.

If convertible bond arbitrageurs have no special knowledge about the value of the underlying shares, we can interpret their participation in the equity market as an influx of traders whose presence improves liquidity since their presence would initially increase the supply of shares to buyers. If they are privately informed, however, adverse selection costs can increase, and liquidity can decrease. We do not expect to observe evidence of the latter possibility because convertible bond arbitrageurs typically act to exploit perceived underpricing in the bond, not equity.

Convertible bond arbitrageurs can also impact the efficiency of equity prices. In theory, if these traders are privately informed and the short selling that we identify in the data is due to an informational advantage about equity market valuation, price efficiency would increase following issuance.¹⁰ Even if these short sellers are not privately informed but are trading to exploit a known inefficiency such as autocorrelation, efficiency will also increase following issuance.¹¹ If instead short sellers are taking equity market positions primarily to hedge their positions in the bonds, then their presence would not directly impact efficiency of stock prices. We conjecture that although convertible bond arbitrageurs are sophisticated traders, they are relatively uninformed (i.e., they have no private information about the value of the equity that they short) and that they are trading to manage equity risk exposure, not to exploit mispricing. If this is the case:

P1: Convertible bond arbitrage activity (i.e., the increase in short selling near issuance) will be associated with improved market liquidity (via dynamic hedging strategies, in which arbitrageurs' trading activity tends to be in the opposite direction of the market).

P2: Convertible bond arbitrage activity will not impact the efficiency of prices.

 $^{^{10}}$ For example, see Diamond and Verrecchia (1987).

 $^{^{11}\}mathrm{We}$ thank an anonymous referee for suggesting this possibility.

For more precise interpretation of P2, it is useful to make a distinction between convertible bond arbitrage and other arbitrage activity (e.g., valuation shorts or exploitation of known autocorrelation). It may be reasonable to expect short selling due to general arbitrage activity to improve price efficiency; however, convertible bond arbitrageurs typically take their positions to hedge risk associated with the bond issue.

In our empirical analysis, we use a variety of proxies for both liquidity and price efficiency. For liquidity, we examine several measures: turnover; number of trades; the Amihud (2002) illiquidity measure; order imbalance, quoted spread, and quoted depth. High values for turnover, number of trades, and depth are interpreted as high liquidity. Low values of the Amihud (2002) measure, order imbalance, and spreads are interpreted as high liquidity. For stock price efficiency, we use: (1) the variance ratio, which compares stock price variances over different frequencies, where smaller deviations from 1 imply greater efficiency;¹² and (2) autocorrelation, where smaller return autocorrelation is interpreted as greater efficiency.¹³ We also examine long-run stock returns following bond issue. The latter is a test of efficiency in that it asks whether the short-sales positions that we observe in the data would make money over various horizons.

 $^{^{12}}$ See Lo and MacKinlay (1988).

¹³In unreported tests, we examined two additional efficiency measures: idiosyncratic volatility and R-squared. Results using these two measures are similar to the other efficiency measures. The distinction between idiosyncratic and systematic volatility is motivated by Bris et al.(2004). They interpret an observed low R-squared as evidence of efficiency. Similarly, we interpret an increase in idiosyncratic volatility as evidence of improved price efficiency because it suggests that more firm-specific information is incorporated into prices.

4 Data and Sample Selection

4.1 Short Interest and Convertible Debt Issues

The initial sample for this study consists of all convertible debt issues (public, private, and Rule 144a) by U.S. publicly traded firms for the period July 1993 through May 2006.¹⁴ Issue dates and other characteristics of the issues are from the SDC Global New Issues database and the Mergent Fixed Income Securities Database (FISD). We obtain monthly shortinterest data directly from the NYSE and the Nasdaq and match the short-interest data with the SDC data using ticker and date identifiers. Because the monthly short-interest files reflect short interest as of three trading days (five for the first years of our sample) prior to the fifteenth of each month, we calculate a trade date for each file and use that date to match to the SDC data.¹⁵ We then match these data to the CRSP/COMPUSTAT tapes and NYSE TAQ Database. We also obtain data on institutional holdings from the Thompson Financial Institutional (13f) Holdings and analyst opinion from I/B/E/S. For inclusion in the final sample, we require non-missing data on short interest, all liquidity and efficiency measures, and all control variables such as institutional holdings, analyst opinion, and historical volatility (see variables included in the regressions in Table 4, below).

Table 1 contains summary statistics on our sample of 846 convertible bond issues. The issuing firms have a mean (median) market capitalization of \$4.7 (\$1.2) billion. The convertible bond issue sizes constitute significant proportion of equity value, with the mean (median) dollar value of proceeds equal to 18.0% (14.9%) of equity market capitalization.

 $^{^{14}\}mathrm{We}$ begin the analysis in 1993 because NYSE TAQ data are used to construct some of the liquidity and price-efficiency measures.

¹⁵It is critical to correctly match the short-interest dates to the issue dates. The monthly short-interest files are based on short interest as of trade dates that occur during the middle of the month at non-constant days across months (due to settlement). Following the documentation from the short-interest files that we received from Nasdaq and the NYSE, we define the trade date as: 5 trading days before the 15th (or the preceding trading day if the 15th is not a trading day) through June 1995, and 3 trading days after June 1995. If a convertible bond is issued before the cutoff trade date of that month, that month is matched to the issue month. Otherwise, the next month is matched to the issue month. This algorithm is consistent with Bechmann (2004).

The firms for which we observe credit rating are rated "junk," with median S&P rating of BB-. In addition, our sample consists of about the same number of NYSE and Nasdaq issuers. We will investigate whether exchange listing is related to the prevalence of this strategy. Note that we do observe short selling in these stocks prior to issuance (or announcement, whichever is earlier), with mean (median) short interest during the prior six months equal to 4.5% (3.1%) of shares outstanding.

4.2 Proxy for the Presence of the Convertible Bond Arbitrage Strategy

Our proxy for the presence of the convertible bond arbitrage strategy is change in short interest intensity ("SI") during the month of the convertible bond issue. We initially define two measures of change in short interest as follows:

- *SI_%Shrout* is change in short interest (number of shares) divided by total shares outstanding. The change in short interest is the difference between short interest in the current month and short interest in the previous month.
- *SI_%Issue* is the dollar value change in short interest divided by issue proceeds. It is defined as difference between short interest in the current month and short interest in the previous month, times closing stock price on the issue date, divided by issue size (face value of the convertible bond times its offer price).

The first measure, $SI_{-}\%Shrout$, is the focus of our study because it provides a measure of the relative importance of the new arbitrageurs in the market for the stock. The second measure, $SI_{-}\%Issue$, is related to issue characteristics — namely, the amount of short-selling activity as a fraction of the issue size (which may be directly linked to hedging activity). Figure 1 reports means and medians of our SI measures during months -6 to +6 relative to the issue date (month 0). Consistent with our ex ante expectation, the figures show that we are capturing an increase in short selling related to the issue. The median increase in short interest relative to shares outstanding, $SI_{\sim}Shrout$, at issue, is 1.7%. The median dollar value increase in short interest relative to issue size, $SI_{\sim}SI_{ssue}$, at issue, is 13.1%.¹⁶ As shown in Figure 1, both measures capture similar variation in short-selling activity. We focus on $SI_{\sim}Shrout$ in the main analysis due to our interest in the implications of convertible bond arbitrage for the market for the underlying stock.¹⁷ We use this increase as a proxy for convertible bond arbitrage activity.¹⁸

Given the large increases during month 0, our analysis focuses on changes in short interest during this month. In the main analysis of changes in liquidity and stock price volatility we examine a relatively short time horizon (six months prior to and following issue and announcement) in order to isolate the impact of this strategy.¹⁹ Not surprisingly, there is significant time-series variation in the short-interest measures. Given these observations and findings in the literature of distinct time-series patterns in short interest in the aggregate data (see, e.g., Lamont and Stein (2004)), we include year and month fixed effects in all cross-sectional regression specifications to control for month-to-month variation.

Figure 2a provides a description of the time series of convertible bond issuance in the sample. Issuance has steadily increased over time. We have also seen a growth in the total assets managed by convertible bond arbitrage hedge funds.

 $^{^{16}}$ We examined the time-series of changes in short-interest and, not surprisingly, observe significant timeseries variation in the data. Therefore, we include time (year and month) fixed effects in all regressions.

¹⁷However (in unreported tests) we have replicated the analysis using SI_{SIssue} . All liquidity results are qualitatively similar (but weaker). The efficiency results are almost identical.

¹⁸Though it is true that short sellers can also short due to private information (see, e.g., Christophe et al.(2004) for the case of earnings announcements) and/or other types of arbitrage activity, the fact that we capture the increase in shorting over a relatively short horizon relative to the bond issue date makes us confident that our SI measures are, in large part, capturing convertible bond arbitrage. We explicitly test this in an analysis of short selling near announcement of the issue versus the actual issue date (see the discussion of Table 6).

¹⁹Convertible bonds often have call provisions; however, beginning with Ingersoll (1977) the empirical evidence has suggested that firms call too late. Further, callability should minimally impact our study over the six-month horizon because callable bonds often have call protection periods, generally greater than six months. See, e.g., Asquith (1995).

5 Convertible Bond Arbitrage, Liquidity, and Stock Prices

In this section, we examine links between changes in short interest near issuance and equity market characteristics.

5.1 Summary of Firm Characteristics, By SI Portfolio

Table 2 provides summary statistics of all of the firms prior to issuance in the sample (column "All").²⁰ We also divide the sample into four portfolios based on the change in short interest at issue, using the $SI_{-}\%Shrout$ measure, in order to provide some insight into the types of issuers for which the convertible bond arbitrage strategy is most evident. Portfolio 1 (4) corresponds to the smallest (largest) short-interest change. Panel A of the table reveals the following: First, Nasdaq stocks see the largest SI change following issuance, as there is a smaller fraction of Nasdaq stocks in the smallest SI portfolio compared to the largest SI portfolio. Second, small issuers and private issues experience higher SI change in their underlying stocks. Third, convertible bond arbitrage activity is higher in stocks that have a high pre-issue short interest, indicating that arbitrageurs choose issues where they believe they will have the ability to short the stock. Finally, as would be expected if convertible bond arbitrage using shares to manage equity risk, the amount of short selling following issuance is positively and significantly related to the conversion ratio (number of shares into which the bond can be converted).²¹

Panel B of Table 2 reports stock liquidity measures. Number of trades, dollar volume, Amihud's (2002) illiquidity measure, order imbalance, and spread indicate that stocks in the smallest SI portfolio are more liquid. Share turnover and depth indicate otherwise.

 $^{^{20}}$ All measures are calculated using daily or monthly data from the 6 months (2 months for *Intraday* AR(1)) ending 1 month prior to issuance or announcement, whichever is earlier.

²¹In robustness analysis, we use conversion ratio directly in order to construct a theoretical measure of arbitrage based only on bond characteristics, not observed changes in short interest.

However, as noted above, firms in the high SI portfolio tend to be smaller, making the direct comparison of the level of liquidity measures inappropriate. We therefore focus on *changes* in liquidity in our main analysis, and control for pre-issue liquidity level and change in firm size in our regressions.

In Panel C of Table 2 we present descriptive statistics on a variety of return and price efficiency measures. We observe higher convertible bond arbitrage activity in stocks with higher average returns and standard deviation of returns, as well as higher betas, higher idiosyncratic volatility, and lower R-squared parameters (estimated from a market model regression). We also calculate autocorrelation of returns and variance ratios (see Lo and MacKinlay (1988)), which we use as measures of the degree of efficiency. Daily and intraday AR(1) parameters are calculated using daily returns and 30-minute interval returns, respectively. From the table we do not observe a significant relationship between changes in short interest in these efficiency measures. This suggests that stock price efficiency is not an important factor in convertible bond arbitrage (as would be expected, if equity positions are taken primarily to hedge equity risk).

5.2 Impact of Convertible Bond Arbitrage on Liquidity and Prices

5.2.1 Average Changes, by SI Portfolio

In Table 3a, we present results from the examination of the impact of convertible bond arbitrage on stock market liquidity and prices. All changes are defined as the "post-issue" period mean (6 months (120 trading days) beginning 1 month (20 trading days) following the bond issue or announcement, whichever is earlier) minus the "pre-issue" period mean (6 months (120 trading days) ending 1 month (20 trading days) prior to the bond issue or announcement, whichever is later).²² Along with changes in short interest, we measure

 $^{^{22}}$ We exclude the +/-1 month (20 trading days) around the bond issue and announcement to avoid mechanical changes in liquidity and efficiency measures that directly result from the bond issue (e.g., the "uptick" rule can generate temporary pressures due to traders taking initial positions related to the issue).

changes in the following liquidity proxies: share turnover, number of trades, dollar volume, the illiquidity measure developed by Amihud (2002), order imbalance (absolute difference between buyer- and seller-initiated trades), and time-weighted average quotes.²³ The Amihud (2002) measure is a proxy for Kyle's (1985) λ and is defined as absolute return divided by dollar volume.

We find strong evidence of an increase in liquidity based on all measures following issuance (with the exception of quoted depth, which indicates a decrease in liquidity).²⁴ Consistent with the prediction (P1), these improvements increase systematically with arbitrage activity, $SI_{\sim}Shrout$. For example, change in (log) turnover for the largest SI portfolio is .31 higher than that for the smallest SI portfolio. These findings suggest that convertible bond arbitrageurs supply (uninformed) liquidity to equity markets. Most important, because we link liquidity changes to SI, we provide direct evidence of the impact of arbitrageurs on liquidity. Prior literature on the impact of derivatives markets on stock markets document only average changes in these variables (see, e.g., Mayhew (2000) for a survey).

For stock prices and efficiency, the following measures are presented: average daily returns, standard deviation of daily returns, idiosyncratic volatility, R-squared, beta, AR(1) parameters, and variance ratios. In regression analysis, we rely on the latter two variables to capture changes in efficiency. The standard deviation of returns is included in Table 3a so that we can compare the results with the empirical regularity of decreases in volatility following the introduction of options markets. If arbitrageurs impact stock price efficiency, then we would expect decreases in return predictability, as captured by the AR(1) parameters. Further, the variance ratio (Lo and MacKinlay (1988)) captures the extent to which stock prices follow a random walk.

Panel B of Table 3a provides evidence that the impact of convertible bond arbitrage on stock price efficiency is very weak. Consistent with prior work, we do find an average decrease

 $^{^{23}}$ We also examine opening quotes. Results are qualitatively similar.

 $^{^{24}}$ However, regression analysis (Table 4) shows that quoted depth increases with arbitrage activity, after we control for other variables.

in both total return variance as well as the idiosyncratic component of returns following convertible bond issuance. However, we do not find evidence that these average declines vary systematically with short-selling activity (i.e., there is no evidence that arbitrage is what is driving the declines). Average returns decrease near issuance and these decreases are higher for the highest SI portfolios (consistent with the observation that returns decrease following announcement of convertible bond issues). Beta and R-squared both increase but only the former is systematically increasing across convertible bond arbitrage portfolios. We do not observe significant changes in the AR(1) parameters or variance ratios. Across SI portfolios, the only systematic variation that we observe is in returns and beta. Taken together, the results in Panel B of Table 3a do not indicate an impact of convertible bond arbitrage on stock price efficiency. Regression analysis (below) will further investigate these findings.

It is possible that the results in Table 3a are being driven by market-wide changes in liquidity and volatility, rather than convertible bond arbitrage activity. To examine this potentially important issue, we analyze the measures in Table 3a for a set of control firms. In Table 3b, we examine the possibility that our results are driven by the impact of shortselling activity in general, rather than convertible bond arbitrage. To do this, we match firms in the sample based on size, market-to-book, turnover before issuance; exchange, and industry (using Fama and French (1997) industry definitions). The following procedure is used for identifying matching firms from the CRSP/COMPUSTAT database: Firms that have issued any convertible debt during years -1 to +1 relative to issue are eliminated from the universe of potential control firms; same exchange is required (e.g., NYSE issuers match only on NYSE firms); firms are further matched on Fama French (1997) industry code, if no such firm exists (very rarely), switch to two-digit SIC; finally, for the remaining sample of firms, a score is assigned for each potential control firm where $score = [abs(\frac{turnover}{issuer\ turnover} - core]$ $1) + abs(\frac{market \ cap}{issuer \ market \ cap} - 1)) + (abs(\frac{book-to-market}{issuer \ book-to-market} - 1)].$ The firm with the lowest score is chosen.

Results from the control sample are reported in Table 3b.²⁵ All results in Table 3b are presented as *differences* between the issuer and control firms. From the table, it is clear that the liquidity results are robust to matched firm controls. For stock price efficiency measures we do not observe significant differences between the issuing firms and control firms, suggesting a little or no role in stock price efficiency for convertible bond arbitrageurs. If convertible bond arbitrageurs take positions mainly to exploit mispricing in the bond (and not the stock), then this would be expected. Because it is important to control for market-wide effects, the change variables in the analysis henceforth are presented as deviations from control firms.

5.2.2 Regression Analysis

We use an event study methodology to further characterize the relationships among convertible bond arbitrage, liquidity, and stock prices. These tests are more restrictive than the tests based on portfolio sorts in Table 3a; however, we would like to explicitly control for factors other than SI, short-interest intensity. We use regression analysis to estimate the impact of short selling as well as other stock characteristics on changes in liquidity and price-efficiency measures during the six months prior to and following the convertible bond issue and announcement.

²⁵In addition, we conduct two "issue matches": We match convertible bond issuers to a sample of straightdebt issuers (by size, book to market, industry, exchange, and issue size). This distinguishes the effect of convertible bond issuance from a general increase in leverage. Results are similar to those in Table 4, with the exception of spread and depth variables: we find that SI is positively and significantly related to increases in turnover and number of trades. SI is negatively and significantly related to spreads and Amihud's (2002) illiquidity measure. In our second "issue match," we match convertible bond issuers to firms issuing seasoned equity because purchasers of the equity issue would not need to manage a short inventory, as is the case for convertible bond arbitrage. Results are similar to those in the straight-debt analysis. In general, we find that the impact of SI is somewhat stronger in these robustness checks than in the main analysis. Detailed results are available upon request. We thank William Fung for encouraging the equity issuer robustness check.

$$\begin{split} \Delta Liquidity_{i} \ or \ \Delta Efficiency_{i} = \\ \alpha + \beta_{1}SI_{-}\%Shrout_{i} + \beta_{2}\Delta Market \ Cap_{i} + \beta_{3}\Delta Volatility_{i} + \\ \beta_{4}\Delta Institutional \ Holdings_{i} + \beta_{5}Pre\text{-}Issue \ Price_{i} + \beta_{6}NYSE_{i} + \\ \beta_{7}Public_{i} + \beta_{8}\Delta PrePost_{i} + \sum_{t=1993Jul}^{2006Apr} \beta_{9t}YearMonthDum_{i,t} + \epsilon_{i} \end{split}$$

(1)

Explanatory Variables

- *SI_%Shrout* is the short-interest intensity measure, which is change in short interest (number of shares) divided by total shares outstanding. The change in short interest is the difference between short interest in the current month and short interest in the previous month. This measure is interpreted as the amount of convertible bond arbitrage activity.
- Δ Market Cap is the change in (log) market capitalization, measured by average daily shares outstanding times closing stock price.
- Δ Volatility is the change in the standard deviation of daily returns.
- Δ *Institutional Holdings* is the change in institutional holdings (shares held by 13f institutions) divided by total shares outstanding.
- *Pre-Issue Price* is the average (log) price during the pre-issue period.
- *NYSE* is a dummy variable, equal to 1 if the firm is listed on NYSE and 0 otherwise.

- *Public* is a dummy variable, equal to 1 if the convertible bond is a public offering, and 0 otherwise.
- $\Delta PrePost$ is the number of days between the pre- and the post-issue period.²⁶
- *YearMonthDum*_t are year and month fixed effects, indicating timing of the convertible bond issue.

The estimated coefficient on $SI_\%Shrout$ is of primary interest. We expect to observe a positive role for $SI_\%Shrout$ in liquidity changes (P1) and no impact of $SI_\%Shrout$ on changes in price efficiency (P2). Control variables include changes in size, volatility, and institutional holdings. We control for volatility in liquidity regressions due to their documented relationship. For example, Pastor and Stambaugh (2003) find correlation of .57 between market illiquidity and volatility. Spiegel and Wang (2005) report high correlation between idiosyncratic volatility and liquidity (i.e., liquidity produces perfect volatility sorts for a cross-section of stocks). We also include pre-issue price as proxy for liquidity level (price and liquidity are negatively correlated; higher-priced stocks have lower spreads due to the fixed component in spreads) because we anticipate more room for marginal liquidity improvements for less-liquid stocks. We also allow for variation based on exchange and whether an issue is public or private (e.g., liquidity of the bond issue might be higher for public issues) and time effects.

The results of analysis are presented in Table 4. All standard errors are heteroskedasticityconsistent and include industry clustering using Fama and French (1997) industry definitions. The proxy for convertible bond arbitrage activity (SI) is significantly and positively related to liquidity improvements based on four of the six liquidity measures (number of trades, turnover, Amihud, and depth). We do not observe systematic variation of SI with either

 $^{^{26}}$ In order to separate out the potential impact of the announcement on liquidity and efficiency variables, the pre- and post-issue periods are defined as follows: The pre-issue period is defined as the 6 months ending 20 trading days prior to the issue or the announcement of the issue, whichever is first. The post-issue period is the 6 months beginning 20 trading days following issue or announcement, whichever is later. When the announcement month is the same as the issue month, this measure equals 40 trading days.

order imbalance or spread. (The spread result is somewhat puzzling because this measure showed significant changes based on portfolio sorts; however, change in market capitalization already captures a price change, and therefore the coefficient on percentage spread (change in spread/price) in the regression equation may pick up changes in dollar spread, rather than percentage spread.) Neither of the price efficiency measures are related to SI. We interpret this as evidence that these traders do not enhance efficiency and simply provide supply to equity markets, as in the prediction (P2).

Although it is not the main focus of the analysis, it is also interesting to note that liquidity increases with increases in institutional holdings, market capitalization, and volatility.

An assumption underlying much of the analysis in this paper is that the change in short interest near issuance is due to convertible bond arbitrage, which we do not directly observe. We attempt to separate other possible explanations of the observed short selling by providing several tests of whether the data are consistent with convertible bond arbitrage, including analysis of long-run stock returns following issuance (i.e., if the increase in short interest is due to valuation shorting, we would expect short sellers to make money from their positions). We then conduct a second test using hand-collected announcement dates for the sample of issuers to isolate the impact of convertible bond announcement- versus issueperiod shorting (which we interpret as valuation shorting and convertible bond arbitrage, respectively). Finally, we introduce a theoretical measure of convertible bond arbitrage that does not depend on short-selling data. The basic idea is that if we are, in fact, capturing convertible bond arbitrage activity in the data then the theoretical measure should be related to the actual measure. The results of these tests are consistent with short selling due to arbitrage and are presented below.

5.3 Long-Run Returns

As a final efficiency check, we test whether short sellers make money from their equity market positions. Results are presented in Table 5 and are consistent with the findings for the other

efficiency measures: there is no evidence that short sellers at issuance make money from their positions; however, we do observe a significantly negative return of -1.30% between announcement and issue date (when they are at least two trading days apart). Therefore, it may be that valuation shorts make money based on positions taken at the announcement of the issue, while short sellers engaged in convertible bond arbitrage strategies take positions near issuance and do not earn abnormal returns from equity positions.

Table 5 also suggests that there may be important differences between short selling that is observed on announcement versus issue dates and that these differences in short selling might provide powerful identification for the type of short selling (i.e., convertible bond arbitrage versus other types of arbitrage) that we are observing in the data. We delve deeper into this question by using the hand-collected data on announcement dates for all issues to separate the impact of short selling due to the market's knowledge that the bond is being issued from actual convertible bond arbitrage (which would be more likely to coincide with the issue itself). The results of this analysis are presented in the next section.

5.4 Convertible Bond Arbitrage Versus Valuation Shorts

5.4.1 Robustness Analysis Using Announcement Versus Issue Dates

Because we do not observe convertible bond arbitrage activity directly, we face the challenge that we may be picking up the impact of short selling due to some other factor. A particular concern is valuation short selling due to information that the firm is raising convertible debt. In order to address this issue, we hand-collect data on announcement dates of all convertible bond issues in our sample and identify 132 issues for which the announcement date and the issue date are such that the observed change in short interest for announcement and issuance occur during different short-interest reporting months.²⁷ The results of analysis are presented in Table 6 and are consistent with the main regressions in Table 4. With the exception

 $^{^{27}}$ We use *Lexis-Nexis* and *Factiva* news searches to identify the earliest date on which the bond issue is mentioned in the news.

of depth, all liquidity changes that are significantly related to our proxy for convertible bond arbitrage in the main analysis are also significant in this analysis. More important, changes in short interest during the announcement month (*SI_%Shrout_Announcement*) are not significantly related to any observed liquidity and efficiency changes.

In the next section, we further aim to isolate the impact of convertible bond arbitrage by repeating the analysis using a measure of arbitrage that relies solely on bond characteristics, and does not use short-selling data.

5.4.2 Robustness Analysis Using Theoretical Arbitrage

In this section we present another way to address the concern that the measured change in short interest at the time of the convertible bond issue is due to impact of valuation short sellers rather than convertible bond arbitrage. In order to address this issue, we take a second approach that requires no reliance on short-selling data near issuance. We construct a theoretical measure of convertible bond arbitrage based on a delta-neutral hedge (at the time of issue), using bond characteristics and an option-pricing model. We use a delta-neutral hedge because this is one of the most popular convertible bond arbitrage strategies. This allows us to isolate arbitrage in a way that does not depend on the data and therefore eliminates any potential for observed short selling due to factors unrelated to convertible bond arbitrage. Although we do not expect the entire issue to be bought by hedge funds engaged in this strategy, this identification technique assumes that a fraction of convertible bonds are bought by funds engaged in this activity. The calculation of *Theoretical_SI_%Shrout* follows.

Convertible bonds can be valued as the sum of an equity warrant and a straight bond, by using the binomial option pricing model for constant interest rates or a trinomial model with stochastic interest rates. We use the first approach,²⁸ where a convertible bond value equals

 $^{^{28}}$ This technique is often used to value convertible bonds (Connolly (2005)). The author emphasizes that in order for this approach to provide correct results, conversion price should be used as the exercise price for the equity warrant.

a straight bond value plus an equity warrant value calculated by the Black-Scholes option pricing model.²⁹ The price of the straight bond is calculated by using time to maturity, coupon and par value of the convertible bond, risk-free rate, and yield to maturity of a straight bond.^{30,31} Convertible bond prices at issue are obtained from FISD. This allows us to calculate the equity warrant value, implied volatility of the warrant, and delta of the convertible bond. The theoretical number of shares to be shorted is obtained from the following equation:^{32,33}

 $Theoretical_SI_\%Shrout = Delta * Conversion Ratio * Number of Bonds * 0.75$ (2)

It is important to note that *Theoretical_SI_%Shrout* is a noisy proxy for the actual convertible arbitrage activity. In reality, arbitrageurs can deviate from this theoretical value and do not fully hedge equity market risk due to a managerial decision to take a directional bet on the equity movement, short-sales constraints, or availability of alternatives to shorting

²⁹This theoretical framework is appropriate here for several reasons. First, even though the Black-Scholes model provides prices for European options, convertible bonds are issued out-of-the money reducing the importance of American option features. Moreover, 74.6% of convertible bond issuers do not pay dividends. Therefore, the European approximation is appropriate. The Black-Scholes model does not allow for the callability option of convertible bonds. However, we calculated delta for each convertible bond and tested delta's sensitivity to maturity. We found that sensitivity is minimal; therefore, the assumptions of the theoretical model are justified in the data.

³⁰Risk-free rate is obtained from Ken French's website (http://mba.tuck.dartmouth.edu/pages/faculty/ ken.french) for each year.

³¹Yield to maturity is obtained from the actual yield to maturity of a straight bond issued within 90 days of the issue of the convertible bond. The straight bond is matched on credit rating, maturity, and coupon. Credit ratings are obtained from the S&P. If they are not available from the S&P, we obtain credit ratings from Moody's and Fitch. For non-rated bonds (bonds not rated by S&P, Moody's and Fitch), all non-rated straight bonds that are issued within 90 days of the convertible bond issue are considered and further matched on coupon and maturity.

³²Delta measures the change in the convertible bond's price with respect to the change in the underlying stock price.

 $^{^{33}}$ Conversion ratio and number of bonds are obtained from FISD. We multiply the resulting theoretical SI by 75% because 75% of convertible bonds are bought by hedge funds (Mitchell, Pedersen, and Pulvino (2007)).

such as put options.^{34,35} "The most theoretically accurate convertible model will not ensure your success as a convertible arbitrageur any more than having the most expensive golf clubs will ensure your golf handicap. Because theoretical valuation is as much art as science, a good convertible valuation model is a necessary tool for the arbitrageur's trade — but it is only a tool" (Calamos (2003)).

The results of this analysis are presented in Table 7. Instead of observed short selling, as captured in Table 4, we analyze the impact of *Theoretical_SI_%Shrout* arbitrage on liquidity and prices. Though much weaker than the main results (because we are using a theoretical, rather than observed measure), the results of the analysis using theoretical SI are somewhat consistent with those presented in Table 4. *Theoretical_SI_%Shrout* is statistically significant for turnover and though insignificant, signs are consistent with measured SI for changes in: Amihud, number of trades, and depth. Similar to the measured SI, the evidence suggests no role for improvements in efficiency measures.

5.5 Robustness Analysis: Potential Endogeneity of Arbitrage

It is possible that convertible bond arbitrageurs are attracted to stocks for which they expect increases in liquidity. While our prior is that the direction of the causality runs from the arbitrageurs, we explicitly account for potential simultaneity by estimating a simultaneous equations model of both changes in market quality and short-interest changes. We therefore estimate the system using simultaneous equations.

³⁴Correlation between *Theoretical_SI_%Shrout* and *SI_%Shrout* is 24.8%.

 $^{^{35}}$ In several cases, we calculated that *Theoretical_SI_%Shrout* comprises about 20% of shares outstanding.

$$\Delta Liquidity_{i} =$$

$$\alpha + \beta_{1}SI_{-}\%Shrout_{i}^{IV} + \beta_{2}\Delta Market \ Cap_{i} + \beta_{3}\Delta Volatility_{i} +$$

$$\beta_{4}\Delta Institutional \ Holdings_{i} + \beta_{5}Pre\text{-}Issue \ Price_{i} + \beta_{6}NYSE_{i} +$$

$$\beta_{7}Public_{i} + \beta_{8}\Delta PrePost_{i} + \sum_{t=1993Jul}^{2006Apr} \beta_{9t}YearMonthDum_{i,t} + \epsilon_{i}$$

$$(3)$$

and

$$SI_{-}\%Shrout_{i} =$$

$$\alpha + \beta_{1}\Delta Liquidity_{i}^{IV} + \beta_{2}\Delta Dollar \ Volume_{i} + \beta_{3}\Delta Volatility_{i} +$$

$$\beta_{4}\Delta Institutional \ Holdings_{i} + \beta_{5}Dividends_{i} + \beta_{6}Conversion \ Premium_{i} +$$

$$\beta_{7}NYSE_{i} + \beta_{8}Public_{i} + \beta_{9}\Delta PrePost_{i} + \sum_{t=1993Jul}^{2006Apr} \beta_{10t}Year MonthDum_{i,t} + \epsilon_{i}$$

$$(4)$$

The explanatory variables in the liquidity change regressions are identical to those in Table 4, except $SI_{-}\%Shrout_{i}^{IV}$ instrumented. Similarly, liquidity change variables are instrumented in the $SI_{-}\%Shrout_{i}$ regressions. The other explanatory variables in the $SI_{-}\%Shrout_{i}$ regression are chosen to proxy for characteristics of firms that tend to be attractive to convertible bond arbitrageurs:³⁶

• *Dollar Volume* is the mean daily dollar volume during the pre-issue period. This variable is included to capture the impact of stock liquidity *levels* on convertible bond arbitrage activity. It is easier to dynamically hedge more liquid stocks.

 $^{^{36}}$ See Calamos (2003,p 25).

- *Volatility* is the mean standard deviation of daily returns during the pre-issue period. Convertible bond arbitrageurs are expected to prefer higher volatility issuers (higher potential trading profits due to the embedded option in the bond).
- Institutional Holdings is the level of institutional holdings (shares held by 13f institutions) divided by shares outstanding at calendar year end prior to issuance. This variable is a proxy for the availability of shares to borrow.
- *Dividends* are stock dividends and are included because convertible bond arbitrageurs are expected to prefer low/no dividend-paying stocks since short sellers have to pay dividends.
- Conversion Premium is the conversion premium. Calamos (2003, p. 25) states that arbitrageurs tend to prefer stocks with conversion premia that are less than 25% because low conversion ratios imply lower interest rate and credit risk.
- *NYSE* is a dummy variable, equal to 1 if the firm is listed on NYSE and 0 otherwise.
- *Public* is a dummy variable, equal to 1 if the convertible bond is a public offering, and 0 otherwise.
- $\Delta PrePost$ is the number of months between the pre- and the post-issue period.
- *YearMonthDum_t* are year and month fixed effects, indicating timing of the convertible bond issue.

In the first-stage regressions for arbitrage activity, we use percentage of shares affected by the issue (conversion ratio * number of bonds / shares outstanding) and analyst opinion prior to issuance (percentage of buy recommendations) as instruments, in addition to the explanatory variables specified in the simultaneous equations. These are chosen because convertible bond arbitrageurs short stocks with high percentage of shares affected by the issue (see the calculation of theoretical convertible bond arbitrage in the previous section) and because there may be more shorting in stocks with negative analyst recommendations. In the first-stage regressions for $\Delta Liquidity_i$, we include change in analyst coverage and change in absolute price deviation from \$30 as instruments (in addition to the other exogenous variables). We expect that there is a high correlation between analyst coverage and liquidity levels, and that stock price close to \$30 indicates higher liquidity.³⁷

The results from simultaneous equations for each liquidity measure are presented in Table 8. The main findings are qualitatively similar to the main regression (with the exception of depth, for which we do not observe a statistically significant increase after controlling for potential endogeneity). Moreover, the liquidity changes do not impact arbitrage activity (short-interest changes, in Panel B of the table).

5.6 Further Evidence of Convertible Bond Arbitrage: 2005—2006 Reg-SHO Data

Ideally, the preceding analysis would measure the change in short interest during the few days surrounding issuance; however, the short-interest data are available only on a monthly basis and do not perfectly capture short sales transactions. We take advantage of newly available data on short-selling activity (beginning in 2005, as a result of Regulation SHO) in order to investigate whether our monthly data capture short-sales transactions close to the issue date.³⁸ If arbitrageurs dynamically hedge, then transactions will provide additional information. The SHO transactions data allow us to supplement the main analysis in two ways: (1) we are able to observe trading at the issue date and (2) we can examine changes in

³⁷Percentage of shares affected is highly significant (t-statistic of 6.21) in the first-stage regression of arbitrage activity. We thank an anonymous referee for suggesting the importance of conversion ratio. Analyst opinion is also significant (t-statistic of 1.92) in the first-stage. For first-stage liquidity regressions, the analyst coverage variable is significant for four of six measures: turnover, number of trades, order imbalance, and depth. Price deviation from \$30 is significant in spread and depth. We use all exogenous variables and instruments in the first-stage regressions. We also confirm that the right-hand side variables in the liquidity regressions are not significant in the SI regressions and vice versa. First-stage results are not reported (for brevity) and are available upon request.

³⁸The U.S. Securities and Exchange Commission adopted Regulation SHO in June 2004.

short-selling activity following issuance. If arbitrageurs hedge dynamically, then we expect to observe an increase in short selling following issuance.

Figure 3 illustrates short-selling activity near the convertible bond issue date for the sample of 64 issues for which Reg-SHO data are available (those in 2005 and 2006). The increase in short selling on Day 0 provides further evidence that we are identifying convertible bond arbitrage activity and not short selling due to other factors. The figure also suggests that the level of short-selling activity following issuance is higher during the post-period, which is consistent with dynamic hedging by arbitrageurs. We explicitly test whether short selling increased in the results presented in Table 9.

Table 9 summarizes changes in short-selling activity in stocks of convertible bond issuers between March 2005 and May 2006. The "Pre-period" is defined as the 20 trading days ending 1 month prior to issuance or announcement, whichever is first. "Post-period" is defined as the 20 trading days beginning 1 month following issuance or announcement, whichever is later. The change is defined as the mean (or median) measure in post-period minus the mean (median) measure in pre-period.³⁹ For comparison, we also present results for control firms.⁴⁰ Control firms are identified based on size, market-to-book, turnover, industry, and exchange (as described in Section 4). The key finding in the table is that short-selling activity increases following issuance. Moreover, we do not find similar results for the control firms. The cross-sectional results presented in the previous sections indicate that the convertible bond arbitrage strategy has a significant impact on liquidity of the

³⁹Note that this "pre-" and "post-" period definition differs from that used in the main analysis (six-month period ending and beginning 20 trading days prior to and following issuance and announcement). We tighten the window over which we measure transactions in order to maximize the number of issues for analysis, given that the SHO data do not begin until 2005.

⁴⁰Diether, Lee, and Werner (2005) find that volatility increases, spreads widen, and more symmetric trading patterns result from the suspension of the "uptick" rule for SHO pilot stocks. This implies that analysis of control firms is critical in this study because SHO relaxes the short-sales constraints for a sub-sample of stocks. The results in Table 9 indicate that the documented changes in short-selling activity for issuing firms are not driven by Regulation SHO. In our sample of 64 issuers, 14 are pilot stocks (in which the "uptick" rule was suspended). As a further check, we deleted these 14 stocks from the analysis, and results are similar. In addition, of the matched firms, 12 are pilot stocks. Therefore, regulation SHO affects both groups, but the strong results of increased short-selling activity in Table 9 are evident only for issuing firms.

market for the underlying stock.

6 Conclusion

In this paper, we investigate the link between convertible bond arbitrage, liquidity, and stock prices with the goal of improving our understanding of the impact of arbitrageurs on market quality, measured by stock liquidity and efficiency. A typical convertible bond arbitrage strategy employs delta-neutral hedging in which a manager buys the convertible bond and sells the underlying equity at a specific delta. If the price of the stock increases, to keep the same delta hedge, the manager sells the stock. When the price of the stock decreases, the manager buys back the stock. Aggregate trading demand is expected to move in the opposite direction of this convertible bond arbitrage activity. Therefore, convertible bond arbitrageurs are expected to improve liquidity in the stock.

We examine changes in short interest near an event in which the convertible bond arbitrage strategy is widely used (bond issuance date), and are able to use aggregate data to estimate the equity positions taken by convertible bond arbitrageurs. This simple methodology allows us to identify the presence and impact of a particular trader type. We add to findings in previous studies documenting average changes in equity market quality when new securities are introduced in that we are able to examine cross-sectional implications of the introduction of a particular trader type. Specifically, we examine the sensitivity of changes in liquidity and volatility to the magnitude of the increase in short selling due to the arbitrage activity. This helps to shed additional empirical light on the issue of how the introduction of new securities that are used by arbitrageurs can impact overall market quality.

We document improvements in liquidity following issuance of convertible debt. More important, we find that the increase in liquidity is systematically related to the intensity of convertible bond arbitrage activity. This suggests positive liquidity spillovers due to the arbitrage activity in equity markets. We do not find evidence of a systematic relationship between arbitrage activity and stock price volatility and efficiency; however, we do find evidence of average changes in volatility measures near bond issuance. We perform a variety of robustness checks, including controlling for the potential endogeneity of convertible bond arbitrage activity and find similar results.

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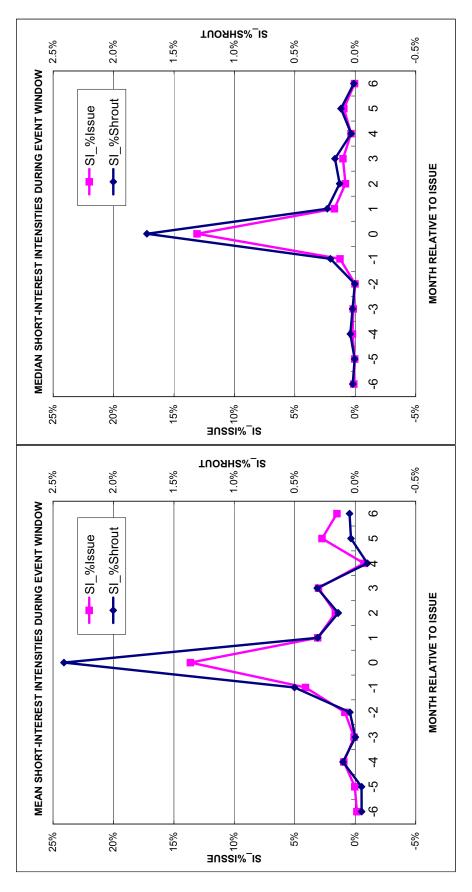
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Issuing F	Issuing Firms and Characteristics	ristics	
This table presents summary statistics for the sample of convertible bond issues between July 1993 and May 2006. <i>Market Cap</i> is the issuing firm's equity market capitalization. <i>NYSE</i> and <i>Nasdaq</i> are dummy variables, indicating where the issuing firm is listed. <i>Debt/Equity</i> is the ratio of long-term debt to equity market capitalization in the fiscal year prior to issuance. <i>Daily Dollar Volume</i> is the average daily dollar volume of the stock. <i>Beta</i> is the coefficient estimate of the regression of daily stock excess returns on CRSP value-weighted market excess return. <i>Issue Size</i> is the face value of the convertible bond times its offer price. <i>Short Interest</i> is the average monthly short interest. <i>Institutional Holdings/Shares Outstanding</i> is the institutional holdings (by 13f institutions) divided by shares outstanding in the calendar year end prior to issuance. <i>Credit Rating</i> is the bond rating issued by S&P. If the bond is not rated by S&P, Moody's or Fitch rating is used, in that order, as available. 444 of 846 bonds are rated by at least one of the three agencies.	^c convertible bond issu ^f and Nasdaq are dum ity market capitalizati e stock. Beta is the cc return. Issue Size is th est. Institutional Hold ding in the calendar ye Moody's or Fitch ratin	es between July 1993 an my variables, indicatin on in the fiscal year pri- efficient estimate of the fings/ <i>Shares Outstandin</i> ar end prior to issuance g is used, in that order,	s for the sample of convertible bond issues between July 1993 and May 2006. <i>Market Cap</i> pitalization. <i>NYSE</i> and <i>Nasdaq</i> are dummy variables, indicating where the issuing firm is g-term debt to equity market capitalization in the fiscal year prior to issuance. <i>Daily</i> ollar volume of the stock. <i>Beta</i> is the coefficient estimate of the regression of daily stock ed market excess return. <i>Issue Size</i> is the face value of the convertible bond times its offer nonthly short interest. <i>Institutional Holdings/Shares Outstanding</i> is the institutional by shares outstanding in the calendar year end prior to issuance. <i>Credit Rating</i> is the bond not rated by S&P, Moody's or Fitch rating is used, in that order, as available. 444 of 846 three agencies.
All daily and monthly measures are calculated using data from the 6 months ending 1 month prior to issuance or announcement, whichever is earlier.	ta from the 6 months e	nding 1 month prior to	issuance or announcement,
N = 846			
	Mean	Median	Standard Deviation
Market Cap (\$ million)	4,687	1,179	13,457
NYSE	0.49	0	0.50
Nasdaq	0.51	1	0.50
Debt/Equity	0.60	0.18	1.58
Daily Dollar Volume (\$ million)	42.58	12.67	103.10
Beta	1.34	1.27	0.75
Issue Size (\$ million)	291.20	175.50	368.92
Issue Size/Market Cap (%)	17.97	14.90	13.38
Short Interest (000 Shares)	5,497	2,152	14,753
Short Interest/Shares Outstanding (%)	4.47	3.05	4.75
Institutional Holdings/Shares Outstanding (%)	65.00	68.37	22.45
Credit Rating ¹	BB	BB-	
¹ For calculating the mean and median credit rating, a number is assigned to each rating: best (AAA or Aaa) = 1, second best = 2, etc. Using this system, mean rating = 12.29, which lies between BB and BB- for S&P and Fitch (or Ba2 and Ba3 for Moody's), median = 13 (BB- or Ba3), standard deviation = 3.85. Only rated issues are included in the calculation.	ssigned to each rating: best I Fitch (or Ba2 and Ba3 for	(AAA or Aaa) = 1, second l Moody's), median = 13 (BF	rating, a number is assigned to each rating: best (AAA or Aaa) = 1, second best = 2, etc. Using this system, and BB- for S&P and Fitch (or Ba2 and Ba3 for Moody's), median = 13 (BB- or Ba3), standard deviation = ilculation.

Figure 1 Mean and Median Short-Interest Intensities

issue date, divided by issue size (face value of the convertible bond times offer price). Sl_%Shrout is the monthly change in short interest divided by the number of The charts show the mean and median short-interest intensities during the event window (months -6 to +6). SI_961ssue is the dollar value of the monthly change in short interest/issue size. That is: difference between short interest in the current month and short interest in the previous month, times the closing stock price on the shares outstanding in the prior month.



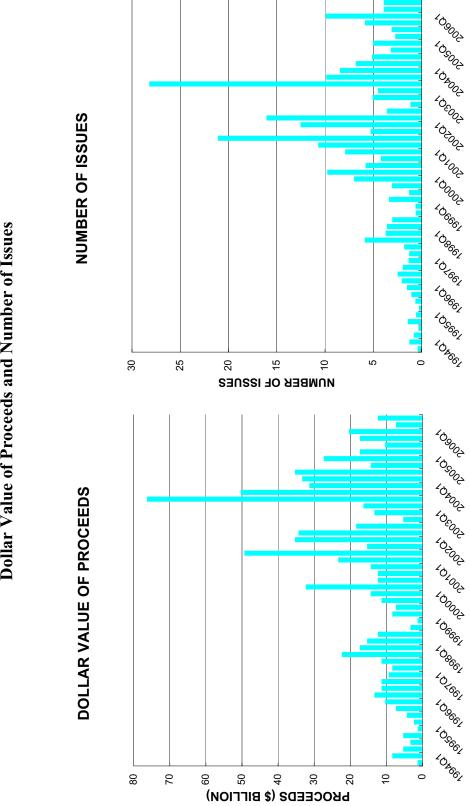
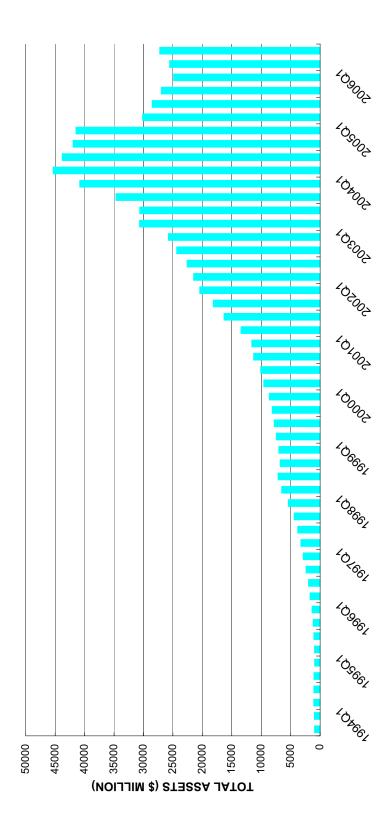


Figure 2a Dollar Value of Proceeds and Number of Issues Figure 2b Total Assets of Convertible Bond Arbitrage Hedge Funds



	Issuing Firm Characteristics, SI Portiono Sorts						
This table presents firm characteristics prior to issuance. Portfolios are based on arbitrage activity (SI_{-} %Shrout) at issuance. SI_{-} %Shrout is the monthly change in short interest divided by the number of shares outstanding in the prior month.	. Portfolios are base the prior month.	d on arbitrage acti	vity (SI_%Shrou	<i>ut</i>) at issuance. 2	SI_%Shrout is th	ie monthly change	in short
In Panel A, <i>NYSE</i> and <i>Nasdaq</i> are dummy variables, indicating where the issuing firm is listed. <i>Public</i> is 1 if the convertible bond is a public offering, 0 if private. <i>Market Cap</i> is the equity market capitalization. <i>Short Interest/Shares Outstanding</i> is the average monthly short interest divided by shares outstanding prior to issuance. <i>Institutional Holdings/Shares Outstanding</i> is the average monthly short interest divided by shares outstanding prior to issuance. <i>Institutional Holdings/Shares Outstanding</i> is the average monthly short interest divided by shares outstanding prior to issuance. <i>Institutional Holdings/Shares Outstanding</i> is the average monthly short interest divided by shares outstanding is the institutional holdings (by 13f institutions) divided by shares outstanding at calendar year end prior to issuance. <i>Conversion Ratio</i> is the number of shares of common stock that could be obtained by converting one bond. <i>Conversion Premium</i> is the percentage amount by which the conversion price exceeds the market value of the common stock at issuance.	dicating where the is <i>Shares Outstanding</i> gs (by 13f institution ed by converting one	ng where the issuing firm is listed. <i>Public</i> is 1 if the convertible bond is a public offering, 0 if private. <i>Market s Outstanding</i> is the average monthly short interest divided by shares outstanding prior to issuance. <i>Institutional</i> 13f institutions) divided by shares outstanding at calendar year end prior to issuance. <i>Conversion Ratio</i> is the converting one bond. <i>Conversion Premium</i> is the percentage amount by which the conversion price exceeds the	1. <i>Public</i> is 1 if thly short intere es outstanding a <i>n Premium</i> is th	the convertible st divided by shi t calendar year e te percentage am	bond is a public ares outstanding nd prior to issua ount by which ti	offering, 0 if prive prior to issuance. 	tte. <i>Market</i> <i>Institutional</i> <i>Ratio</i> is the e exceeds the
In Panel B, <i>Turnover</i> is the average daily volume divided by shares outstanding. <i>Number of Trades</i> is the average daily number of stock transactions on the firm's primary exchange. <i>Dollar Volume</i> is the average daily dollar stock volume. <i>Amihud</i> is the average ratio of daily absolute return to dollar volume. <i>OIBNUM</i> is the average daily absolute difference between the numbers of buyer- and seller-initiated trades divided by their sum. <i>Dollar Spread</i> and <i>Percentage Spread</i> are the difference between bid and ask quotes (time-weighted), expressed as dollars and percentage of bid-ask midpoint, respectively. <i>Total Depth/Shares Outstanding</i> is the sum of bid and ask quoted depths divided by shares outstanding.	ed by shares outstan ock volume. <i>Amihu</i> u seller-initiated trade: rcentage of bid-ask 1	shares outstanding. <i>Number of Trades</i> is the average daily number of stock transactions on the firm's primary olume. <i>Amihud</i> is the average ratio of daily absolute return to dollar volume. <i>OIBNUM</i> is the average daily -initiated trades divided by their sum. <i>Dollar Spread</i> and <i>Percentage Spread</i> are the difference between bid an ige of bid-ask midpoint, respectively. <i>Total Depth/Shares Outstanding</i> is the sum of bid and ask quoted depths	rades is the ave io of daily abso um. <i>Dollar Spr</i> ely. <i>Total Dept</i>	rrage daily numb lute return to dol <i>ead</i> and <i>Perceni</i> <i>h/Shares Outsta</i>	er of stock trans lar volume. <i>Oll</i> <i>tage Spread</i> are <i>iding</i> is the sum	actions on the firm 3NUM is the aver the difference bet t of bid and ask qu	n's primary age daily ween bid and oted depths
In Panel C, <i>Return</i> and <i>Standard Deviation of Return</i> are the mean and standard deviation of daily stock return, respectively. <i>Idiosyncratic Volatility</i> and <i>R-Squared</i> are, respectively, the standard deviation of residuals and R-Squared from the regression of daily stock excess return on CRSP value-weighted market excess return. <i>Beta</i> is the coefficient estimate of the same regression. <i>Daily AR(1)</i> and <i>Intraday AR(1)</i> are the first-order autocorrelation of returns, calculated using daily returns and 30-minute interval returns, respectively. <i>Variance Ratio (5)</i> is the 5-day variance ratio in Lo and MacKinlay (1988).	re the mean and stan squared from the reg) and <i>Intraday AR(I</i> 5-day variance ratio	mean and standard deviation of daily stock return, respectively. <i>Idiosyncratic Volatility</i> and <i>R-Squared</i> are, ed from the regression of daily stock excess return on CRSP value-weighted market excess return. <i>Beta</i> is the <i>Intraday AR(I)</i> are the first-order autocorrelation of returns, calculated using daily returns and 30-minute variance ratio in Lo and MacKinlay (1988).	laily stock retur ock excess return r autocorrelation ulay (1988).	n, respectively.	<i>ldiosyncratic Vc</i> -weighted mark ulated using dai	<i>latility</i> and <i>R-Squ</i> et excess return. <i>I</i> ly returns and 30-1	<i>ared</i> are, <i>leta</i> is the ninute
All measures in Panels B and C are calculated using daily or monthly data from the 6 months (2 months for <i>Intraday AR(1)</i>) ending 1 month prior to issuance or announcement, whichever is earlier. The last two columns show the mean measures of Portfolio 4 minus Portfolio 1 and the industry- and time-clustered t-statistics of the difference between the means. *, **, and *** denote 10%, 5%, and 1% significance, respectively.	ly or monthly data fi ans show the mean n %, 5%, and 1% sigr	om the 6 months (neasures of Portfol ifficance, respectiv	2 months for <i>Ini</i> io 4 minus Port ely.	<i>traday AR(1)</i>) er folio 1 and the ir	iding 1 month pi idustry- and time	rior to issuance or e-clustered t-statis	ics of the
N = 846							
P:	Panel A Firm an	Firm and Convertible Bond Characteristics	Bond Chara	cteristics			
		Portfolios	Portfolios based on SI_%Shrout	_%Shrout			
	All	P1 (Smallest)	P2	P3	P4 (Largest)	P4-P1	t-stat
NYSE	0.505	0.626	0.552	0.474	0.349	-0.277***	(-5.59)
Nasdaq	0.495	0.360	0.448	0.526	0.646	0.286^{***}	(5.79)
Public	0.252	0.280	0.278	0.265	0.184	-0.096**	(-2.29)
log Market Cap	21.076	21.720	21.402	20.779	20.404	-1.316***	(-9.54)
Short Interest/Shares Outstanding (%)	4.466	4.476	3.851	4.311	5.185	0.709***	(13.95)
Institutional Holdings/Shares Outstanding (%)	%) 65.002	65.171	65.768	63.860	65.205	0.034	(1.52)
Conversion Ratio	43.918	37.216	33.681	50.348	54.426	17.211^{***}	(2.80)
Conversion Premium (%)	35.062	34.624	36.190	37.043	32.400	-2.223	(-0.61)

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			Portfolios	Portfolios based on SI %Shrout	%Shrout			
		All	PI	P2	- P3	P4	P4-P1	t-stat
			(Smallest)			(Largest)		
log Turnover		-4.949	-5.103	-4.955	-4.941	-4.799	0.304^{***}	(3.47)
log Number of Trades		5.987	6.220	6.135	5.849	5.744	-0.476***	(-3.28)
log Dollar Volume		16.125	16.615	16.446	15.836	15.603	-1.013^{***}	(-5.95)
log Amihud		-20.585	-21.240	-20.903	-20.267	-19.929	1.311^{***}	(9.27)
OIBNUM (%)		16.789	15.909	16.302	17.201	17.741	1.832^{**}	(2.37)
Dollar Spread		0.125	0.114	0.122	0.124	0.139	0.026*	(1.88)
Percentage Spread (%)		0.538	0.440	0.433	0.618	0.662	0.222***	(3.44)
Total Depth/Shares Outstanding (%) x 1000	x 1000	8.366	7.185	6.859	8.904	10.512	3.327**	(2.19)

	Panel C: Return	el C: Return and Price-Efficiency Measures	fficiency Me	asures			
		Portfolios	Portfolios based on SI_%Shrout	%Shrout			
	All	P1	P2	P3	P4	P4-P1	t-stat
		(Smallest)			(Largest)		
Return (%)	0.238	0.166	0.269	0.256	0.261	0.094^{***}	(2.61)
Standard Deviation of Return (%)	3.572	3.053	3.333	3.726	4.175	1.122 * * *	(6.27)
Idiosyncratic Volatility (%)	3.210	2.699	2.997	3.344	3.799	1.100^{**}	(6.81)
R-Squared (%)	18.482	21.655	17.603	18.535	16.149	-5.505***	(-3.84)
Beta	1.334	1.257	1.317	1.366	1.396	0.139*	(1.88)
Daily AR(1) (%)	-0.965	-2.324	-1.145	0.174	-0.567	1.757	(1.56)
Intraday AR(1) (%)	0.048	-0.528	-0.153	0.336	0.536	1.063	(1.26)
Variance Ratio (5)	1.035	1.022	1.014	1.060	1.045	0.023	(0.00)

This table presents the changes in firm characteristics, by portfolios based on change in short interest (<i>SI_%Shrout</i>) at issuance. <i>SI_%Shrout</i> is the monthly change in short interest divided by the number of shares outstanding in the prior month. Changes in firm characteristics are defined as the average measure in post-issue period minus the pre- issue period measure. "Pre-issue period" is defined as the 6 months (2 months for <i>Intraday AR(1)</i>) ending 1 month prior to issuance or announcement, whichever is earlier. "Post-issue period" is the 6 months for <i>Intraday AR(1)</i>) starting 1 month after issuance or announcement, whichever is later.	rtfolios based on chau rior month. Changes months (2 months for <i>R(1)</i>) starting 1 mon	in firm characteris in firm characteris <i>Intraday AR(I)</i>) et a fiter issuance or	t (<i>SI_%Shrout</i>) at i tics are defined as adding 1 month priv announcement, wh	ssuance. <i>SI_%Shr</i> , the average measur or to issuance or ani tichever is later.	<i>ut</i> is the monthly e in post-issue peri nouncement, which	change in short od minus the pre- never is earlier.
In Panel A, <i>Short Interest/Shares Outstanding</i> is the average monthly short interest divided by shares outstanding. <i>Turnover</i> is the average daily volume divided by shares outstanding. <i>Number of Trades</i> is the average daily number of stock transactions on the firm's primary exchange. <i>Dollar Volume</i> is the average daily dollar stock volume. <i>Amihud</i> is the average ratio of daily absolute return to dollar volume. <i>OIBNUM</i> is the average daily absolute difference between the numbers of buyer- and seller-initiated trades divided by their sum. <i>Dollar Spread</i> and <i>Percentage Spread</i> are the difference between bid and ask quotes (time-weighted), expressed as dollars and percentage of bid-ask midpoint, respectively. <i>Total Depth/Shares Outstanding</i> is the sum of bid and ask quoted depths divided by shares outstanding.	the monthly short interest divided by shares outstanding. <i>Turnover</i> is the average daily volume divided by shares of stock transactions on the firm's primary exchange. <i>Dollar Volume</i> is the average daily dollar stock volume. volume. <i>OIBNUM</i> is the average daily absolute difference between the numbers of buyer- and seller-initiated <i>Spread</i> are the difference between bid and ask quotes (time-weighted), expressed as dollars and percentage of b is the sum of bid and ask quoted by shares outstanding.	st divided by share on the firm's prima is the average daily ence between bid a d ask quoted depth.	s outstanding. <i>Tu</i> , ary exchange. <i>Dol</i> , absolute differenc and ask quotes (tim and ishares	<i>rnover</i> is the avera, <i>lar Volume</i> is the a e between the num e-weighted), expres outstanding.	ge daily volume di verage daily dollar bers of buyer- and ssed as dollars and	vided by shares stock volume. seller-initiated percentage of bid-
In Panel B, <i>Return</i> and <i>Standard Deviation of Return</i> are the mean and standard deviation of daily stock return, respectively. <i>Idiosyncratic Volatility</i> and <i>R-Squared</i> are, respectively, the standard deviation of residuals and R-Squared from the regression of daily stock excess return on CRSP value-weighted market excess return. <i>Beta</i> is the coefficient estimate of the same regression. <i>[Daily AR(1)]</i> and <i>[Intraday AR(1)]</i> are the absolute value of first-order autocorrelation of returns, calculated using daily returns and 30-minute interval returns, respectively. <i>[Variance Ratio (5) - 1]</i> is the absolute deviation of the 5-day variance ratio in Lo and MacKinlay (1988) from 1.	e mean and standard e ed from the regressio nd $ mtraday AR(I) $ a (5) - I is the absolu	deviation of daily s n of daily stock ex re the absolute valu ite deviation of the	tock return, respec cess return on CRS ie of first-order aut 5-day variance rat	tively. <i>Idiosyncrat.</i> P value-weighted r ocorrelation of retu io in Lo and MacKi	<i>ic Volatility</i> and <i>R</i> - narket excess retur rrns, calculated usii inlay (1988) from 1	<i>Squared</i> are, n. <i>Beta</i> is the ng daily returns l.
The last column shows the mean measures of Portfolio 4 minus Portfolio 1. Industry- and time-clustered t-statistics of the changes and differences are in parentheses. *, **, and *** denote 10%, 5%, and 1% significance, respectively.	uus Portfolio 1. Indus	stry- and time-clust	ered t-statistics of	the changes and dif	ferences are in par	entheses. *, **,
N = 846						
	Panel A: Changes in Liquidity Measures	<u>çes in Liquidity</u>	Measures			
		Portfolio	Portfolios based on SI_%Shrout	%Shrout		
	All	P1	P2	P3	P4	P4-P1
		(Smallest)			(Largest)	
Short Interest/Shares Outstanding (%)	2.371***	0.181	1.233^{***}	2.598***	5.465***	5.284***
E	(17.90)	(1.02)	(8.44) 0.217***	(11.55)	(19.27)	(15.81)
log lurnover	(15,06)	(3.25)	0.21/222	0.2/2***	0.38/	0.508***
log Number of Trades	0.325***	0.195***	0.343***	0.336***	0.426***	0.231***
1	(15.74)	(6.52)	(6.07)	(9.67)	(10.57)	(4.60)
log Dollar Volume	0.441^{***}	0.241^{***}	0.436^{**}	0.510^{***}	0.574^{***}	0.333^{***}
	(15.88)	(6.75)	(9.37)	(10.77)	(9.13)	(4.60)
log Amihud	-0.458***	-0.330***	-0.475***	-0.510***	-0.519***	-0.188**
	(-17.02)	(-8.55)	(-11.52)	(-11.20)	(-8.05)	(-2.51)

Table 3aChanges in Firm Characteristics

		Tab Par	Table 3a (cont'd) Panel A (cont'd)				
			Portfolio	Portfolios based on SI_%Shrout	%Shrout		
		All	P1	P2	P3	P4	P4-P1
			(Smallest)			(Largest)	
OIBNUM (%)		-1.041***	-0.893***	-0.924***	-0.961***	-1.385***	-0.492
		(-7.07)	(-3.72)	(-3.26)	(-3.57)	(-4.58)	(-1.27)
Dollar Spread		-0.021***	-0.022***	-0.017***	-0.019***	-0.027***	-0.006
		(-7.40)	(-4.30)	(-3.21)	(-4.42)	(-4.70)	(-0.77)
Percentage Spread (%)		-0.134***	-0.081***	-0.105***	-0.188***	-0.160***	-0.079***
		(-11.48)	(-5.36)	(-9.36)	(-5.52)	(-6.57)	(-2.77)
Total Depth/Shares Outstanding (%)	x 1000	-0.712**	-0.287	-0.192	-1.903	-0.467	-0.180
		(-1.97)	(-0.95)	(-0.35)	(-1.58)	(96.0-)	(-0.31)
	Panel B: (Changes in Return and Price-Efficiency Measures	urn and Price-	Efficiency Mea	sures		
			Portfolio	Portfolios based on SI_%Shrout	%Shrout		
		All	P1	P2	P3	P4	P4-P1
			(Smallest)			(Largest)	
Return (%)		-0.201***	-0.128**	-0.230***	-0.214***	-0.232***	-0.105^{**}
		(-11.70)	(-4.26)	(-7.76)	(-6.83)	(-5.91)	(-2.12)
Standard Deviation of Return (%)		-0.250***	-0.341***	-0.183*	-0.356***	-0.123	0.219
		(-4.20)	(-3.98)	(-1.94)	(-3.49)	(96.0-)	(1.42)
Idiosyncratic Volatility (%)		-0.275***	-0.339***	-0.209**	-0.358***	-0.193*	0.146
		(-5.37)	(-4.26)	(-2.55)	(-3.88)	(-1.66)	(1.04)
R-Squared (%)		2.309^{***}	1.678*	1.790^{**}	2.152^{**}	3.612^{***}	1.934
		(4.48)	(1.88)	(2.10)	(2.24)	(3.66)	(1.45)
Beta		0.083^{***}	0.046	0.025	0.080*	0.180^{***}	0.135^{**}
		(3.06)	(1.21)	(0.47)	(1.67)	(3.41)	(2.07)
Daily AR(1) (%)		-0.295	0.077	-0.419	-0.431	-0.406	-0.483
		(-0.87)	(0.11)	(-0.58)	(99.0-)	(-0.61)	(-0.50)
Intraday AR(1) (%)		2.521	9.973	0.856	-0.276	-0.447	-10.420
		(1.34)	(1.34)	(1.23)	(-0.67)	(-0.77)	(-1.40)
[Variance Ratio (5) - 1] (%)		-1.102	-0.584	-0.911	-2.490	-0.428	0.156
		(-1.43)	(-0.41)	(09.0-)	(-1.47)	(-0.28)	(0.07)

Control	Control Firm Results: Changes in Firm Characteristics	Changes in F	irm Charact	eristics		
The changes (from pre- to post-issue) in issuing firm characteristics <i>minus</i> the changes in control firm characteristics are shown. Portfolios are based on change in short interest ($SI_{-}\%Shrout$) at issuance. $SI_{-}\%Shrout$ is the monthly change in short interest divided by the number of shares outstanding in the prior month. Control firms are matched based on size, book-to-market, and turnover before issuance; exchange, and industry. Changes in firm characteristics are defined as the average measure in post-issue period minus the pre-issue period measure. "Pre-issue period" is defined as the 6 months (2 months for Intraday AR(1)) ending 1 month prior to issuance or announcement, whichever is earlier. "Post-issue period" is the 6 months for Intraday AR(1)) starting 1 month after issuance or announcement, whichever is later.	acteristics <i>minus</i> the chinthly change in short in ore issuance; exchange, i riod" is defined as the 6 2 months for Intraday A	anges in control fin terest divided by the and industry. Chan months (2 months uR(1)) starting 1 m	m characteristics a le number of shares ages in firm charact for Intraday AR(1) onth after issuance	stics <i>minus</i> the changes in control firm characteristics are shown. Portfolios are based on change in short change in short interest divided by the number of shares outstanding in the prior month. Control firms are suance; exchange, and industry. Changes in firm characteristics are defined as the average measure in post is defined as the 6 months (2 months for Intraday AR(1)) ending 1 month prior to issuance or announcemenths for Intraday AR(1)) starting 1 month after issuance or announcement, whichever is later.	is are based on cha prior month. Cont as the average me rior to issuance or whichever is later.	nge in short trol firms are asure in post-issue announcement,
In Panel A, <i>Short Interest/Shares Outstanding</i> is the average monthly short interest of the stock divided by shares outstanding. <i>Turnover</i> is the average daily volume divided by shares outstanding. <i>Number of Trades</i> is the average daily number of stock transactions on the firm's primary exchange. <i>Dollar Volume</i> is the average daily dollar stock volume. <i>Amihud</i> is the average ratio of daily absolute return to dollar volume. <i>OIBNUM</i> is the average daily absolute difference between the numbers of buyer- and seller-initiated trades divided by their sum. <i>Dollar Spread</i> and <i>Percentage Spread</i> are the difference between bid and ask quotes (time-weighted), expressed as dollars and percentage of bid-ask midpoint, respectively. <i>Total Depth/Shares Outstanding</i> is the sum of bid and ask quoted depths divided by shares outstanding.	age monthly short intere laily number of stock tra urn to dollar volume. <i>O</i> <i>Percentage Spread</i> are <i>i/Shares Outstanding</i> is	st of the stock divinations of the stock divination of the full ansactions on the full average of the difference between the sum of bid and	ded by shares outst irm's primary exchi rrage daily absolute veen bid and ask qu depths	anding. <i>Turnover</i> mge. <i>Dollar Volum</i> difference betweer otes (time-weightee divided by shares (is the average daily <i>ie</i> is the average di <i>i</i> the numbers of bu 1), expressed as do outstanding.	<i>y</i> volume divided aily dollar stock Jyer- and seller- llars and
In Panel B, <i>Return</i> and <i>Standard Deviation of Return</i> are the mean and standard deviation of daily stock return, respectively. <i>Idiosyncratic Volatility</i> and <i>R-Squared</i> are, respectively, the standard deviation of residuals and R-Squared from the regression of daily stock excess return on CRSP value-weighted market excess return. <i>Beta</i> is the coefficient estimate of the same regression. $ Daily AR(I) $ and $ Intraday AR(I) $ are the absolute value of first-order autocorrelation of returns, calculated using daily returns and 30-minute interval returns, respectively. $ Variance Ratio (5) - I $ is the absolute deviation of the 5-day variance ratio in Lo and MacKinlay (1988) from 1.	the mean and standard of uared from the regression and $ Intraday AR(I) $ and atto (5) - $I $ is the absolution of the state of the st	deviation of daily in of daily stock es tre the absolute va ute deviation of th	stock return, respec cess return on CRS lue of first-order au 5-day variance rat	nean and standard deviation of daily stock return, respectively. <i>Idiosyncratic Volatility</i> and <i>R-Squared</i> are, I from the regression of daily stock excess return on CRSP value-weighted market excess return. <i>Beta</i> is the $ Intraday AR(I) $ are the absolute value of first-order autocorrelation of returns, calculated using daily return 5) - $I $ is the absolute deviation of the 5-day variance ratio in Lo and MacKinlay (1988) from 1.	<i>ic Volatility</i> and <i>R</i> - narket excess retur rrns, calculated usi inlay (1988) from	- <i>Squared</i> are, n. <i>Beta</i> is the ng daily returns 1.
The last column shows the mean measures of Portfolio 4 minus Portfolio 1. Industry- and time-clustered t-statistics of the differences are in parentheses. *, **, and *** denote 10%, 5%, and 1% significance, respectively. N = 846	ninus Portfolio 1. Indus	stry- and time-clus	tered t-statistics of	the differences are	in parentheses. *, *	**, and ***
Panel A: Liquidity Measures (Changes in Issuing Firm Minus Changes in Control Firm)	leasures (Changes	in Issuing Firr	n Minus Chang	es in Control F	irm)	
		Portfolic	Portfolios based on SI_%Shrout	%Shrout		
	All	P1 (Smallact)	P2	P3	P4	P4-P1
Short Interest/Shares Outstanding (%)	2.462***	0.252	0.875***	3.003^{***}	(Laigosi) 5.726***	5.473***
	(12.29)	(1.22)	(3.17)	(5.80)	(16.21)	(13.38)
log Turnover	0.209***	0.048	0.184***	0.223***	0.379***	0.331***
log Number of Trades	(10.09) 0.162^{***}	(1.40) 0.041	(4.44) 0.185^{***}	(5.39) 0.134^{***}	(8.84) 0.289***	(6.04) $0.248***$
٥	(1.66)	(1.13)	(4.36)	(3.13)	(6.41)	(4.30)
log Dollar Volume	0.321***	0.076	0.319***	0.356***	0.531***	0.455***
log Amihud	(10.34) -0.334***	(50.1) -0.123**	-0.317***	-0.351^{***}	(/c·/) -0.545***	(5.29) -0.422***
D	(-11.45)	(-2.46)	(-6.13)	(-5.74)	(-8.12)	(-5.04)

Table 3b

Panel A (cont'd) Portfolios based on SI $\sqrt{6}$ P1 P2 Ruallest) P2 (Smallest) 0.033 (0.17) 0.001 0.001 0.001 0.018 0.017 0.018 0.017 0.011 0.017 0.011 0.017 0.011 0.017 1.482 -0.042 0.783 (-1.81) 1.482 -0.042 0.783 (-1.81) 1.482 -0.042 0.783 (-0.26) P1 P2 P2 (0.78) (Smallest) (-0.26) P1 P2 (Smallest) (-0.26) P1 P2 (0.19) (-1.30) (0.19) (-1.30) (0.16) (0.07) P2 (-0.94) (0.16) (0.07) (0.16) (0.07) (0.16) (0.07) (Tał	Table 3b (cont'd)				
vUM (%) r Spread in tage Spread (%) in tage Spread (%) Depth/Shares Outstanding (%) Depth/Shares Outstanding (%) in ared (%) in ared (%) in ared (%) in area (%)		Pa	nel A (cont'd)				
VUM (%) r Spread antage Spread (%) x 1000 Depth/Shares Outstanding (%) x 1000 Depth/Shares Outstanding (%) x 1000 anel B: Return and Price-Effici Panel B: Return and Price-Effici and Deviation of Return (%) and Deviation of Return (%) yncratic Volatility (%) uared (%) vareatic Volatility (%) area (%) area (%) day AR(1) (%) ance Ratio (5) - 1			Portfolio	s based on SI	%Shrout		
VUM (%) r Spread antage Spread (%) Depth/Shares Outstanding (%) x 1000 Depth/Shares Outstanding (%) x 1000 Panel B: Return and Price-Effici rn (%) rn (%) rard Deviation of Return (%) yncratic Volatility (%) uared (%) v AR(1) (%) day AR(1) (%) ance Ratio (5) - 1		All	P1	P2	P3	~ P4	P4-P1
VUM (%) r Spread antage Spread (%) x 1000 Depth/Shares Outstanding (%) x 1000 Depth/Shares Outstanding (%) x 1000 Panel B: Return and Price-Effici rn (%) and Deviation of Return (%) yncratic Volatility (%) uared (%) v AR(1) (%) day AR(1) (%) ance Ratio (5) - 1			(Smallest)			(Largest)	
r Spread mtage Spread (%) x 1000 Depth/Shares Outstanding (%) x 1000 Depth/Shares Outstanding (%) x 1000 Panel B: Return and Price-Effici and Deviation of Return (%) lard Deviation of Return (%) ared (%) wreatic Volatility (%) uared (%) vareatic Volatility (%) area (%) brace (%) brace (%) brace (%) area (%) brace (%) br	OIBNUM (%)	-0.370*	0.233	-0.643	-0.370	-0.696*	-0.929
r Spread intage Spread (%) x 1000 Depth/Shares Outstanding (%) x 1000 Panel B: Return and Price-Effici rn (%) ard Deviation of Return (%) yncratic Volatility (%) uared (%) uared (%) vared (%) are Ratio (5) - 1		(-1.71)	(0.58)	(-1.48)	(-0.85)	(-1.65)	(-1.60)
Intage Spread (%) x 1000 Depth/Shares Outstanding (%) x 1000 Panel B: Return and Price-Effici and Deviation of Return (%) for the turn (%) for turn	Dollar Spread	0.001	0.001	0.001	0.005	-0.003	-0.004
<pre>intage Spread (%) Depth/Shares Outstanding (%) x 1000 Depth/Shares Outstanding (%) x 1000 Panel B: Return and Price-Effici rn (%) ard Deviation of Return (%) ard Deviation of Return (%) ared (%) where a to (%) ance Ratio (5) - 1 area to (%) </pre>		(0.26)	(0.18)	(0.17)	(0.72)	(-0.47)	(-0.47)
Depth/Shares Outstanding (%) x 1000 Panel B: Return and Price-Effici rn (%) rn (%) flard Deviation of Return (%) yncratic Volatility (%) uared (%) / AR(1) (%) day AR(1) (%) ance Ratio (5) - 1	Percentage Spread (%)	-0.045**	0.031	-0.063*	-0.069	-0.077*	-0.107**
Depth/Shares Outstanding (%) x 1000 Panel B: Return and Price-Effici rn (%) ard Deviation of Return (%) yncratic Volatility (%) yncratic Volatility (%) yncratic Volatility (%) ared (%) day AR(1) (%) day AR(1) (%) ance Ratio (5) - 1		(-2.42)	(1.32)	(-1.81)	(-1.62)	(-1.82)	(-2.23)
Panel B: Return and Price-Effici rn (%) rn (%) (%) lard Deviation of Return (%) (%) yncratic Volatility (%) (%) uared (%) (%) day AR(1) (%) (%) ance Ratio (5) - 1 (%)			1.482	-0.942	-0.145	1.880	0.398
Panel B: Return and Price-Effici rn (%) Iard Deviation of Return (%) hard Deviation of Return (%) Iard Deviation of Return (%) yncratic Volatility (%) Iard Deviation of Return (%) yncratic Volatility (%) Iard Deviation of Return (%) anced (%) Iard Deviation of Return (%) iday AR(1) (%) Iard Deviation (5) - 1		(0.48)	(0.78)	(-0.26)	(60.0-)	(1.05)	(0.15)
rn (%) lard Deviation of Return (%) yncratic Volatility (%) uared (%) / AR(1) (%) day AR(1) (%) ance Ratio (5) - 1	Danal R. Daturn and Driva-	Pfficiancy Magenrae	(Changae in Lee	uina Firm Mii	, then are in t	(antrol Firm)	
All P1 P2 $(\%)$ $(\%)$ $(3mallest)$ P2 $(\%)$ $(3mallest)$ $(3mallest)$ P3 $(\%)$ $(3mallest)$ $(3mallest)$ P3 $(\%)$ $(3mallest)$ $(3mallest)$ P3 $(\%)$ $(3mallest)$ $(3mallest)$ $(3mallest)$ (76) $(3mallest)$ (-0.93) (-1.30) (75) (-0.93) (-1.30) (-1.30) (75) (-0.91) (-1.30) (-1.30) (75) (-1.94) (-0.94) (0.07) (-1.94) (-0.94) (0.07) (-1.94) (-0.94) (0.07) (1.42) (-1.94) (-0.94) (0.07) (-1.03) (0.07) (1.42) (0.757) (0.16) (0.07) (-1.03) (0.09) (1.40) (0.75) (-1.03) (0.16) (-1.66) (-1.66) (1.40) (-1.103) (0.09) (-1.66) (-1.66) (-1.66) (1.40) (-1.60) (-1.103)		STITUTION INCOMING	Portfolio	s based on SI	%Shrout		
rn (%)(Smallest)rn (%)(Smallest)rn (%)(Smallest)rn (%)(Smallest)lard Deviation of Return (%) -0.102^{***} lard Deviation of Return (%) -0.130^{*} outset(Smallest)yncratic Volatility (%) -0.130^{*} uared (%) (-1.30) uared (%) (-1.42^{**}) (-1.42^{**}) -0.085 (0.19) (0.19) (0.12) (-1.94) (-1.42^{**}) -0.085 (0.07) (-1.94) (-1.42) (0.16) (0.07) (-1.94) (-1.42) (0.16) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (0.07) (-1.03) (-1.66) (-1.66) (-1.66) (-1.66) (-1.67) (-1.67) (-1.67) (-1.67) (-1.67) (-1.67) (-1.66) (-1.66) (-1.66) (-1.66) (-1.66) (-1.66) (-1.67) (-1.67) (-1.67)		All	P1	P2 -	- P3	P4	P4-P1
m (%) -0.102^{***} -0.032 -0.067 lard Deviation of Return (%) (-4.65) (-0.93) (-1.30) ard Deviation of Return (%) -0.130^{*} -0.079 0.032 yncratic Volatility (%) (-1.77) (-0.90) (0.19) yncratic Volatility (%) (-1.94) (-0.94) (0.07) uared (%) (-1.94) (-0.94) (0.07) (-1.94) (-0.94) (0.07) (-1.94) (0.07) $uared$ (%) (-1.94) (-0.94) (0.07) (-1.94) (0.07) $uared$ (%) (-1.94) (-0.94) (0.07) (-1.03) (0.07) $uared$ (%) (-1.42) (0.16) (0.61) (0.07) (-1.03) (0.09) day AR(1) $(\%)$ (-0.04) (1.16) (-0.66) (-0.66) day AR(1) $(\%)$ (-0.02) 1.103 -0.671 (-0.66) day AR(1) $(\%)$ (-1.03) (-1.03) (-0.66) (-0.66) day AR(1) $(\%)$ (-0.94)			(Smallest)			(Largest)	
lard Deviation of Return (%) (4.65) (-0.93) (-1.30) yncratic Volatility (%) -0.130^* -0.079 0.032 yncratic Volatility (%) (-1.77) (-0.90) (0.19) yncratic Volatility (%) (-1.94) (-0.94) (0.07) uared (%) (-1.94) (-0.94) (0.07) uared (%) (-1.94) (-0.94) (0.07) (-1.94) (-0.94) (0.07) (-1.94) (-0.94) (0.02) 0.757 0.165 0.588 (0.02) 0.022 -0.043 0.006 (1.42) (0.16) (0.61) (0.07) (-1.03) (0.09) (1.61) (0.07) (-1.03) (0.09) $(ay AR(1))$ (%) (-0.04) (1.16) (-0.66) $(ay AR(1))$ (%) (-0.04) (1.16) (-0.66) (1.40) (0.22) 1.103 (0.09) (-0.026) 1.652 -0.302 (1.40) (0.22) (0.52) (-0.15) (0.02) (0.22) (0.89) (-0.15)	Return (%)	-0.102***	-0.032	-0.067	-0.152***	-0.155***	-0.124**
lard Deviation of Return (%) $-0.130^{*} -0.079 0.032$ (-1.77) (-0.90) (0.19) yncratic Volatility (%) $(-1.94) (-0.94) (0.07)$ (-1.94) (-0.94) (0.07) (-1.94) (-0.94) (0.07) (-1.94) (-0.043 0.006 (0.07) (-1.03) (0.06) (0.07) (-1.03) (0.09) (-0.04) (1.16) (-0.66) (-0.04) (1.16) (-0.66) ance Ratio (5) - 1 (0.22) (0.89) (-0.15)		(-4.65)	(-0.93)	(-1.30)	(-4.17)	(-3.41)	(-2.17)
yncratic Volatility (%) (-1.77) (-0.90) (0.19) -0.142^{**} -0.085 0.012 (-1.94) (-0.94) $(0.07)(-1.94)$ (-0.94) $(0.07)(-1.94)$ (-0.94) $(0.07)(-1.42)$ 0.165 $0.588(0.02)$ $0.006(0.07)$ (-1.03) $0.006(0.07)$ (-1.03) $0.006(0.07)$ (-1.03) $(0.09)(0.09)(0.07)$ (-1.03) $(0.09)(0.07)$ (-1.03) $(0.09)(0.09)(0.09)(0.07)$ (-1.03) $(0.09)(0.07)$ (-1.03) $(0.09)(0.09)(0.07)$ (-1.03) $(0.09)(0.07)$ (-1.03) $(0.09)(0.07)$ (-1.03) $(0.09)(0.09)$ $(-0.66)(1.16)$ $(-0.66)(1.22)(1.22)(0.26)$ 1.652 $-0.302(0.20)$ (0.89) (-0.15)	Standard Deviation of Return (%)	-0.130*	-0.079	0.032	-0.358***	-0.118	-0.039
yncratic Volatility (%) -0.142^{**} -0.085 0.012 uared (%) (-1.94) (-0.94) (0.07) (-1.94) (-0.94) $(0.07)(-1.94)$ (-0.07) (-0.04) $(0.61)(0.00)$ (0.01) (-1.03) $(0.09)(0.07)$ (-1.03) $(0.09)(0.07)$ (-1.03) $(0.09)day AR(1) (%) (-0.04) (1.16) (-0.66)(-0.04)$ (1.16) $(-0.66)(-0.04)$ (1.16) $(-0.66)ance Ratio (5) - 1] (0.02) (0.32) (0.32) (1.22)(0.02)$ (0.89) (-0.15)		(-1.77)	(06.0-)	(0.19)	(-3.48)	(-0.64)	(-0.19)
uared (%) (-1.94) (-0.94) (0.07) uared (%) 0.757 0.165 0.588 (1.42) (0.16) (0.61) (0.61) (0.02) -0.043 0.006 (0.07) (-1.03) (0.09) (0.07) (-1.03) (0.09) day AR(1) (%) (-0.04) (1.16) (-0.66) day AR(1) (%) (-0.04) (1.16) (-0.66) ance Ratio (5) - 1 0.026 1.652 -0.302 ance Ratio (5) - 1 (0.22) (0.89) (-0.15)	Idiosyncratic Volatility (%)	-0.142**	-0.085	0.012	-0.354***	-0.142	-0.057
uared (%) 0.757 0.165 0.588 (1.42) (0.16) (0.61) (0.61) γ AR(1) (%) (0.07) (-1.03) (0.09) η ay AR(1) (%) (-0.020) 1.108 -0.671 (-0.04) (1.16) (-0.66) -0.671 day AR(1) (%) 4.152 2.691 6.651 dar artio (5) - 1 (0.026) 1.652 -0.302 $ance$ Ratio (5) - 1 (0.02) (0.89) (-0.15)		(-1.94)	(-0.94)	(0.07)	(-3.23)	(-0.76)	(-0.28)
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	R-Squared (%)	0.757	0.165	0.588	1.014	1.259	1.094
v AR(1) (%) 0.002 -0.043 0.006 (0.07) (-1.03) (0.09) (0.07) (-1.03) (0.09) -0.020 1.108 -0.671 (-0.04) (1.16) (-0.66) 4.152 2.691 6.651 (1.40) (0.32) (1.22) ance Ratio (5) - 1 0.026 1.652 -0.302 (0.02) (0.89) (-0.15)		(1.42)	(0.16)	(0.61)	(1.00)	(1.09)	(0.71)
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Beta	0.002	-0.043	0.006	-0.058	0.104	0.147*
-0.0201.108 -0.671 (-0.04) (1.16) (-0.66) (-0.16) (-0.51) (-0.66) (1.40) (0.32) (1.22) (1.40) (0.32) (1.22) $(0.026$ 1.652 -0.302 (0.02) (0.89) (-0.15)		(0.07)	(-1.03)	(0.00)	(-1.10)	(1.60)	(1.90)
(%) (-0.04) (1.16) (-0.66) (%) 4.152 2.691 6.651 (1.40) (0.32) (1.22) (0.26 1.652 -0.302 (0.02) (0.89) (-0.15)	Daily AR(1) (%)	-0.020	1.108	-0.671	-0.418	-0.097	-1.206
$\begin{array}{cccccc} 4.152 & 2.691 & 6.651 \\ (1.40) & (0.32) & (1.22) \\ 0.026 & 1.652 & -0.302 \\ (0.02) & (0.89) & (-0.15) \end{array}$		(-0.04)	(1.16)	(99.0-)	(-0.46)	(60.0-)	(-0.86)
$\begin{array}{ccccc} (1.40) & (0.32) & (1.22) \\ 0.026 & 1.652 & -0.302 \\ (0.02) & (0.89) & (-0.15) \end{array}$	Intraday AR(1) (%)	4.152	2.691	6.651	8.521	-1.240	-3.930
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(1.40)	(0.32)	(1.22)	(1.35)	(-1.52)	(-0.46)
(0.89) (-0.15)	 Variance Ratio (5) - 1	0.026	1.652	-0.302	-1.506	0.259	-1.392
		(0.02)	(0.89)	(-0.15)	(-0.63)	(0.11)	(-0.45)

The liquidity and efficiency changes are regressed on arbitrage activity (SI %Shrout) and firm characteristics. "Pre-issue period" is the 6 months ending 1 month prior to the	iency changes nent, whicheve , and $\Delta Amihu$ ock volume div ock volume div ar volume. ΔC wely, from the vely, from the is quoted depths first-order au nthly change i are the post-iss	are regre r is earlie A are cha ided by s <i>VIBNUM</i> pre-issue differend differend differend differend al holdin eriod. <i>N</i> 'ear-mon'	and efficiency changes are regressed on arbitrage activity (SI_{SA}) mouncement, whichever is earlier. "Post-issue period" is the 6 mo $\Delta Trades$, and $\Delta Amihud$ are changes in the post-issue log $Turnove$ e daily stock volume divided by shares outstanding. <i>Number of Tv</i> in to dollar volume. $\Delta OIBNUM$, $\Delta Spread$, and $\Delta Depth$ are the pe respectively, from the pre-issue measures. <i>OIBNUM</i> is the avera <i>vrcentage Spread</i> is the difference between bid and ask quotes (tim d and ask quoted depths divided by shares outstanding. $ \Delta VR(5)$ from $I $ are the percentage changes in the post-issue $ Dc$ e value of first-order autocorrelation of daily returns. $ Variance Ra$ is the monthly change in short interest (from the month prior to isso <i>latility</i> are the post-issue equity market capitalization and standar he change in institutional holdings (by 13f institutions) divided by og) price in pre-issue period. <i>NYSE</i> and <i>Public</i> are dummy varial riod. Estimates on the year-month dummies are not reported. (except <i>Pre-issue Price</i>) are expressed as deviation from control fi * ** and *** denote 10% . 5%, and 1% significance. respectively.	trage act ue perioo post-issu anding. 7 and ΔDe_{ij} $\Delta DBNUD_{ij}$ old and a itstandin itstandin returns. the mon italizatic italizatic stitution blic are are not r viation f	ivity (<i>SI_d</i> i' is the 6 e log <i>Turr</i> <i>Vumber o</i> <i>vth</i> are th <i>t</i> is the ax <i>sk</i> quotes sk quotes g. <i>Parianc</i> <i>IVarianc</i> th prior to an and stal s) divided dummy v:	%Shrout mover, l <i>i Trades</i> e percen /erage d. (time-w (time-w (time-w o issuanc ndard de i by shar ariables.	t) and firr beginnin og Numbe is the av ntage char ally absol /eighted), /eighted), AR(I) ar (5) - I is (5) - I is ce) divide res outstal tes outstal tes outstal s (issuer n	n charac g 1 mont gr $of Traa$ erage da nges in th ute diffe expresse expresse expresse s the absu d by the d dby the f daily re ading at i nost is the	h after iss. h after iss des , and l ly numbe e post-iss ence betv d as perco d as perco number o number o turn minu ssuing ca turnol). He	"Pre-issu iuance or og $Amih_i$ og $Amih_i$ ue $OIBN$ ue $OIBN$ ue $OIBN$ ue $OIBN$ intage of atton of 5 atton of 5 f shares c f sh	tivity (<i>SI_96SIrrout</i>) and firm characteristics. "Pre-issue period" is the 6 months ending 1 month prior to the od" is the 6 months beginning 1 month after issuance or announcement, whichever is later. ue log <i>Turnover</i> , log <i>Number of Trades</i> , and log <i>Amihud</i> , respectively, from the pre-issue measures. <i>Turnover Number of Trades</i> is the average daily number of stock transactions. <i>Amihud</i> is the average daily ratio of <i>pph</i> are the percentage changes in the post-issue <i>OBNUM</i> , <i>Percentage Spread</i> , and <i>Total Depth/Shares Mumber of Trades</i> is the average daily absolute difference between the numbers of buyer- and seller-initiated trades divided by ask quotes (time-weighted), expressed as percentage of bid-ask midpoint. <i>Total Depth/Shares Outstanding</i> is neg. post-issue <i>Daily AR(I)</i> and <i>Variance Ratio (5) - 1</i> , respectively, from the pre-issue measures. <i>Daily AR(I)</i> . <i>Variance Ratio (5) - 1</i> is the absolute deviation of 5-day variance ratio from 1. . <i>Variance Ratio (5) - 1</i> is the absolute deviation of 5-day variance ratio from 1. . If point to issuance) divided by the number of shares outstanding in the month prior to issuance. <i>AMarket</i> on and standard deviation of daily return minus the corresponding pre-issue period measures. <i>Amstitutional</i> and divided by shares outstanding at issuing calendar year end from prior calendar year end. <i>Pre-issue Price</i> is dummy variables. <i>APre Post</i> is the number of days between the last day in pre-issue period and the first day in reported.	is the 6 m ment, wh trively, fro ons. <i>Ami</i> ons. <i>Ami</i>	onths endi ichever is ichever is mud is the <i>nead</i> , and <i>nead</i> , an	ng 1 moi later. -issue me average <i>Total D</i> nitiated i <i>th/Share</i> : to issuar to issuar easures. tr end. <i>1</i> e period	th prior to surres. T_{l} aily ratio pth/Share ades divid outstand es. $ Daily$ es. $ Daily$ es. $Daily$ monthe fir- atistics ar	the of $rrnover$ ing is ing is ing is ing is rice is in rice is in the is
issuance or announcement, whichever is earlier. "Post-issue period" is the 6 months beginning 1 month after issuance or announcement, whichever is later.	, and $\Delta Amihu$ ock volume div ar volume. ΔC vely, from the <i>c Spread</i> is the quoted depths quoted depths f first-order au nthly change i are the post-iss	<i>1</i> are cha ided by s <i>VIBNUM</i> pre-issue difference divided he percer tocorrela n short in u e equity al holdin eriod. <i>N</i> 'ear-mon	nges in the j hares outsta , $\Delta Spread$, i measures. (by shares ou by shares ou ntage change tion of daily tion of daily tion of daily tion of laff ir <i>YSE</i> and <i>Pu</i> th dumnies th dumnies and 1% sion	post-issu nding. 7 and ΔDe_q and ΔDe_q oolBNUM oolBNUM via and a site tartandin returns. The mon the mon the mon italizatic nstitution blic are are not r viation 1	e log <i>Turr</i> <i>Vumber of</i> <i>vumber of</i> <i>vumber of</i> <i>t</i> is the av- sk quotes g. <i>Parianc</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-issue</i> <i>post-iss</i>	<i>Trades</i> , l <i>Trades</i> e percen /erage d (time-w (time-w <i>e Ratio</i> : <i>e Ratio</i> : <i>e Ratio</i> : <i>i</i> ssuant ndard de ndard de ariables.	og Numbe is the avvitage charr aily absol reighted), $\langle 5 \rangle - I $ is $\langle 5 \rangle - I $ ii $\langle 5 \rangle$ - $I $ is ce) divide eviation ol res outstal s'(issuer n	<i>er of Tra</i> erage dai liges in th ute diffe expresse expresse expresse and <i>Varia</i> b b the f daily re ding at ost is the ost is the	<i>tes</i> , and l ly numbe e post-iss rence betv rence betv a sperce d as perce d as perce d as perce d as perce d as perce terro fatio alute devii number of turn minu ssuing ca rumber (og $Amihn$ r of stock ue $OIBN$ veen the $and and back of$ intage of $(5) - I $, (5) - I , ation of (5) ation of (5) f shares c s the corr lendar ye of days b	<i>ud</i> , respect <i>UM</i> , <i>Perc</i> <i>UM</i> , <i>Perc</i> numbers o bid-ask m respective 5-day varié outstanding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding responding resp	tively, from the same sector of the same sector sector for the sector se	in the pre ind is the ind seller- <i>Total Dep</i> from 1. onth prior e period m alendar ye: in pre-isst	-issue me average <i>Total D</i> nitiated i <i>th/Share</i> . Le measu to issuar easures. ur end. <i>I</i> e period stered t-s	sures. <i>Tu</i> aily ratio o <i>pth/Share</i> ades divid <i>Outstand</i> es. <i>Daily</i> es. <i>Daily</i> es. <i>A Ma</i> <i>Mnstitutie</i> <i>e</i> - <i>issue P</i> nd the fire atistics ar	trmover of s led by ing is ing is ing is tet true is st day in
Δ Turnover, Δ Trades, and Δ Amihud are changes in the post-issue log Turnover, log Number of Trades, and log Amihud, respectively, from the pre-issue measures. Turnover is the average daily stock volume divided by shares outstanding. Number of Trades is the average daily number of stock transactions. Amihud is the average daily ratio of absolute return to dollar volume. $\Delta OIBNUM$, $\Delta Spread$, and $\Delta Depth$ are the percentage changes in the post-issue $OIBNUM$, Percentage Spread, and Total Depth/Shares Outstanding, respectively, from the pre-issue measures. OIBNUM is the average daily absolute difference between the numbers of buyer- and seller-initiated trades divided by their sum. Percentage Spread is the difference between bid and ask quotes (time-weighted), expressed as percentage of bid-ask midpoint. Total Depth/Shares Outstanding is the sum of bid and ask quoted depths divided by shares outstanding.	<i>) from 1</i> are t ffirst-order au nthly change i are the post-iss	he percen tocorrelat a short in ue equity al holdin eriod. <i>N</i> 'ear-mon'	tage change tion of daily therest (from r market cap gs (by 13f ir <i>YSE</i> and <i>Pu</i> th dummies th dummies and 1% sion	is in the J returns. the mon the mon italization stitution blic are are not r viation J	post-issue <i>Varianc</i> It prior to n and stat s) divided dummy v eported.	<i>e Ratio</i> <i>e Ratio</i> issuanc ndard de by shar ariables.	AR(I) an (5) - I is (5) - I is ce) divide viation ol res outstan . $\Delta Pre P$.	id <i>Varia</i> the absonce absonce absonce absonce above absonce abson	nce Ratio Jute devia aumber of turn minu ssuing ca : number (trol). He	(5) - 1 , ation of 5 f shares c s the corr lendar ye of days b	respective 5-day varia outstanding responding zar end fro etween the	Jy, from 1 ince ratio g in the m g pre-issu m prior a e last day	he pre-issi from 1. onth prior e period m alendar ye: in pre-issi	ue measu to issuan easures. ur end. <i>1</i> e period stered t-s	es. <i>Daily</i> e. <i>A Ma</i> <i>Anstitutic</i> <i>e-issue P</i> nd the fire atistics ar	<i>AR(1)</i> <i>ket</i> <i>mal</i> <i>rice</i> is st day in
$\Delta AR(I) $ and $\Delta VR(5)$ <i>from</i> $I $ are the percentage changes in the f is the absolute value of first-order autocorrelation of daily returns.	nthly change i are the post-iss	a short in ue equity al holding eriod. <i>N</i> . ear-mon	r market cap gs (by 13f irr YSE and Pu th dummies pressed as de	the mon italizatio istitution <i>blic</i> are are not r eviation 1	th prior tc n and star s) divided dummy v: eported.) issuanc ıdard de l by shar ariables.	 ce) divide ces outstan <lices li="" outstan<=""> ces outstan <lices< td=""><td>d by the f daily re nding at i ost is the inus cor</td><td>number of turn minu ssuing ca number (trol). He</td><td>f shares o s the corr lendar ye of days b</td><td>utstanding responding ar end froi etween the</td><td>g in the m g pre-issu m prior cá e last day</td><td>onth prior e period m ılendar yea in pre-issu</td><td>to issuan easures. ur end. <i>1</i> e period stered t-s</td><td> <i>ΔMai</i> <i>ΔInstitutic</i> <i>e-issue P</i> nd the first atistics ar </td><td><i>ket</i> onal rrice is st day in e in</td></lices<></lices>	d by the f daily re nding at i ost is the inus cor	number of turn minu ssuing ca number (trol). He	f shares o s the corr lendar ye of days b	utstanding responding ar end froi etween the	g in the m g pre-issu m prior cá e last day	onth prior e period m ılendar yea in pre-issu	to issuan easures. ur end. <i>1</i> e period stered t-s	 <i>ΔMai</i> <i>ΔInstitutic</i> <i>e-issue P</i> nd the first atistics ar 	<i>ket</i> onal rrice is st day in e in
	e in institution in pre-issue p imates on the y pre-issue Price) 50/	and 1% Slor	٤.	יייייייייייייייייי	rol firms					CATATION	nsistent ir	idustry-clū			
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					-	<u>fimmhr</u>								2011/2	ciicy A	
	∆ Turnover t-stat	t-stat	∆ Trades t	t-stat	∆ Amihud	t-stat (∆ OIBNUM t-stat	[t-stat	∆ Spread	t-stat	Depth	t-stat		t-stat	∆ VR(5)-1	t-stat
Intercept	0.091	(0.58)		(-1.23) -		(-0.65)	0.064	(0.59)	0.030	(0.36)	$ \circ $		1.947	(0.25)	4.948	(1.04)
SI_%Shrout	2.993 * * *	(3.16)	2.474*** (4.23)		-3.042*** (-3.75)	(-3.75)	-0.460	(-1.01)	0.375	(0.85)	1.950^{***}	* (2.69)	-46.239	(-0.71)	-3.528	(-0.17)
AMarket Cap	0.170***	(4.97)	$0.170^{***} (4.97) 0.617^{***} (19.39) - 0.982^{***} (-21.84) - 0.192^{***} (-9.92) - 0.512^{***} (-12.73) - 0.733^{***} (-6.53) - 0.622^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.523^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{***} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} (-6.53) - 0.533^{**} $	(9.39)-0	.982***(.	-21.84)-	(-21.84)-0.192*** (-9.92) -0.512***(* (-9.92)	-0.512**	* (-12.73	-0.733** 5.075**	** (-6.53) * /2 50)	-5.828	(-0.62)	-1.639**	(-2.00)
Δνυιαιμις ΔInstitutional Holdings		(0.47) (8.62) (0.438^{***} (8.62) 0.158^{***} (3.00)		-0.309 -0.468^{***} (-4.15)	-4.15)	-2.294	$(c_{1.07})$	(-2.73) 2.944 (2.70) (-1.07) -0.213*** (-3.69)	* (-2.70) * (-3.69)	(-3.69) $\begin{vmatrix} 0.3.9 \\ -0.116 \end{vmatrix}$		0.811	(0.10)	-0.812	(-0.56)
Pre-issue Price x 100			3.976** ()		1.125		-1.931*		0.325	(0.17)		** (-2.81)	1	(0.70)	-32.742	(-0.36)
NYSE	-0.080**		(-2.27) -0.119*** (-4.22)		-0.020 ((-0.40)	0.048^{**}	(2.02)	-0.016	(-0.84)	0.084	(0.94)	4.034	(1.08)	-0.647	(-0.51)
Public	-0.027	(-0.52)	0.058 ((1.19) (*660.0	(1.71)	-0.037	(-1.55)	0.059*	(1.81)		(66.0-)	-16.484	(-1.11)	3.549	(1.44)
APre Post x 1000	0 1.466*	(1.85)	0.330 ()	(0.60) -	-0.685 ((-0.50)	-0.581	(-1.06)	-0.608	(-1.09)) -0.581	(-0.35)	-14.450	(-0.11)	-24.060	(-1.08)
Z	846		846		846		846		846		846		846		846	
RSq. (%)	36.81		56.36		57.81		33.42		58.03		35.95		10.47		59.58	

	Panel A: Long-Run Returns After Issuance	turns After Issu			
N = 846			lance		
Cumulative Return (Not Annualized)	Issue date	+6 months	+12 months	+18 months	+24 months
Issuing Firm		6.57%	9.22%	12.24%	16.53%
Control Firm		5.47%	8.85%	13.68%	17.66%
Difference		1.10%	0.37%	-1.44%	-1.13%
t-stat		(0.58)	(0.13)	(-0.41)	(-0.31)
Cumulative Return (Not Annualized)	Announcement date +6 months +12 m	+6 months	+12 months	+18 months	+24 months
Issuing Firm		3.94%	6.64%	9.73%	13.82%
Control Firm		6.26%	10.16%	14.00%	18.31%
Difference		-2.32%	-3.52%	-4.27%	-4.49%
t-stat		(-1.14)	(-1.14)	(-1.21)	(-1.21)
N = 348					
Pa	Panel C: Returns Between Announcement and Issuance	nnouncement a	nd Issuance		
Average Daily Return Between Announcement and Issue Dates	cement and Issue Dates				
Issuing Firm			-1.30%		
Control Firm			0.13%		
Difference			-1.43%***		
t-stat			(-6.80)		
Average Number of Trading Days			10.21		

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Table 5 Long-Run Returns

			Identifi	Identification of Arbitrageurs Versus Valuation Shorts:	of Arbi	itragei	urs Ver	A sns.	aluatio	n Sho	rts:					
	An	Analysis of the Impact of Shorting at Announcement Compared to Issue Date	the Im	pact of	Shorti	ng at .	Annoui	nceme	nt Con	npare	d to Iss	ue Da	ite			
The liquidity and efficiency changes are regressed on arbitrage activity (<i>SI_%Shrout</i> and <i>SI_%Shrout_Announcement</i> , calculated based on issuance and announcement, respectively) and firm characteristics. Only issues where issuing and announcement months fall into different monthly short-interest files are included. "Pre-issue period" is the 6 months ending 1 month prior to the issuance or announcement, whichever is earlier. "Post-issue period" is the 6 months beginning 1 month after issuance or announcement, whichever is earlier. "Post-issue period" is the 6 months beginning 1 month after issuance or announcement, whichever is earlier.	ency changes haracteristic prior to the	s are regresse s. Only issu issuance or a	ed on arbiti es where is innouncem	age activit ssuing and lent, which	y (<i>SI_%Sh</i> announcer ever is ear	<i>rout</i> and nent mon lier. "Po	(<i>SI_%Shrout</i> and <i>SI_%Shrout_Announcement</i> , calculated based on issuance and announcement, nnouncement months fall into different monthly short-interest files are included. "Pre-issue period" is ver is earlier. "Post-issue period" is the 6 months beginning 1 month after issuance or announcement,	<i>put_Annc</i> to differe riod" is t	<i>uncement</i> nt monthly he 6 mont	, calcul y short-in hs begin	ated based nterest file ning 1 mo	on issua s are inc nth after	nce and a luded. "P issuance	innounce re-issue or annou	ment, period" is t ncement,	he 6
<i>A Turnover</i> , <i>ΔTrades</i> , and <i>ΔAmihud</i> are changes in the post-issue log <i>Turnover</i> , log <i>Number of Trades</i> , and log <i>Amihud</i> , respectively, from the pre-issue measures. <i>Turnover</i> is the average daily stock volume divided by shares outstanding. <i>Number of Trades</i> is the average daily number of stock transactions. <i>Amihud</i> is the average daily ratio of absolute return to dollar volume. <i>ΔOIBNUM</i> , <i>ΔSpread</i> , and <i>ΔDepth</i> are the percentage changes in the post-issue <i>OIBNUM</i> , <i>Percentage Spread</i> , and <i>Total Depth/Shares Outstanding</i> , respectively, from the pre-issue measures. <i>OIBNUM</i> is the average daily absolute difference between the numbers of buyer- and seller-initiated trades divided by their sum. <i>Percentage Spread</i> is the difference between bid and ask quotes (time-weighted), expressed as percentage of bid-ask midpoint. <i>Total Depth/Shares Outstanding</i> is the sum of bid and ask quoted depths divided by shares outstanding.	and <i>AAmihu</i> volume divic <i>AOIBNUM</i> re-issue mea ne difference livided by sh	<i>id</i> are chang ded by share. , Δ <i>Spread</i> , sures. <i>OIB</i> λ sures. <i>OIB</i> λ thetween bid ares outstand	es in the point of the point of the point of $\Delta Dept$ and $\Delta Dept$ (UM is the function of the point of the ding.	ost-issue lc ng. <i>Numbu</i> <i>h</i> are the p average d uotes (time	g Turnove er of Trade ercentage aily absolu e-weighted	<i>r</i> , log <i>Nu</i> ss is the s changes i the different (), express	<i>umber of T</i> average da in the post ence betwe sed as pere	<i>rades</i> , al ily numb -issue <i>Oi</i> sen the nu centage o	ıd log <i>Am</i> er of stock <i>BNUM</i> , <i>F</i> imbers of f bid-ask ı	<i>ihud</i> , res c transac <i>ercentag</i> buyer- a midpoint	pectively, tions. <i>Am</i> ge <i>Spread</i> nd seller-i . <i>Total D</i>	from the <i>thud</i> is t , and <i>Toi</i> nitiated t <i>pth/Sha</i>	e pre-issu he averag al Depth rades div res Outst	e measur e daily ra Shares (Shares (sided by t ided by t anding is	<i>Turnover</i> , log <i>Number of Trades</i> , and log <i>Amihud</i> , respectively, from the pre-issue measures. <i>Turnover</i> is <i>of Trades</i> is the average daily number of stock transactions. <i>Amihud</i> is the average daily ratio of absolute centage changes in the post-issue <i>OIBNUM</i> , <i>Percentage Spread</i> , and <i>Total Depth/Shares Outstanding</i> , ly absolute difference between the numbers of buyer- and seller-initiated trades divided by their sum. weighted), expressed as percentage of bid-ask midpoint. <i>Total Depth/Shares Outstanding</i> is the sum of bid	<i>er</i> is lute ', f bid
$\Delta AR(I) $ and $\Delta VR(5)$ from $I $ are the percentage changes in the post-issue $ Daily AR(I) $ and $ Variance Ratio(5) - I $, respectively, from the pre-issue measures. $ Daily AR(I) $ is the absolute value of first-order autocorrelation of daily returns. $ Variance Ratio(5) - I $ is the absolute deviation of 5-day variance ratio from 1.	<i>from I</i> are 1 st-order auto	the percenta correlation o	ge changes of daily ret	in the pos urns. <i>Var</i>	t-issue Dc iance Rati	iily AR(1) 2 (5) - 1	and <i>Va</i> is the abs	<i>riance Ru</i> olute dev	<i>ttio (5) - 1</i> iation of 5	, respec	ttively, frc iance ratic	m the pr from 1.	e-issue m	leasures.	Daily AR	7) is
SI $\%$ Shrout and SI $\%$ Shrout Announcement are the monthly change in short interest (from the month prior to issuance and announcement, respectively) divided by the number of shares outstanding in the month prior to issuance and announcement, respectively. Δ Market Cap and Δ Volatility are the post-issue equity market capitalization and standard be deviation of daily return minus the corresponding pre-issue period measures. Δ Institutional Holdings is the change in institutional holdings (by 13f institutions) divided by shares outstanding at issuing calendar year end from prior calendar year end. Pre-issue Price is the average (log) price in pre-issue period. NYSE and Public are dummy variables. Δ Pre Post is the number of days between the last day in pre-issue period and the first day in post-issue period. Estimates on the year-month dummies are not reported.	<i>Mrout_Anno</i> e month prio 1 minus the c alendar year er of days be	<i>uncement</i> and rt to issuance correspondin, end from pr tween the la	e the moni e and annou g pre-issue ior calenda st day in pr	thly change incement, period me r year end. re-issue pe	e in short i respective asures. Δ <i>Pre-issue</i> riod and th	nterest (fi ly. ΔMai <i>institution</i> <i>e Price</i> is le first da	rom the monthe m	onth prio und ΔVoi gs is the ge (log) $_{\rm I}$ ssue peri	r to issuan atility are change in price in pro	ce and a the post instituti e-issue p ates on t	nnouncem -issue equ onal holdi eriod. <i>NY</i> he year-m	ent, resp ity mark ngs (by] <i>SE</i> and J onth dun	ectively) et capitali 3f institu Public ar	divided l ization an trions) di e dummy not repo	in short interest (from the month prior to issuance and announcement, respectively) divided by the numespectively. $\Delta Market Cap$ and $\Delta Volatility$ are the post-issue equity market capitalization and standard usures. $\Delta Institutional Holdings$ is the change in institutional holdings (by 13f institutions) divided by share-issue Price is the average (log) price in pre-issue period. <i>NYSE</i> and <i>Public</i> are dummy variables, od and the first day in post-issue period. Estimates on the year-month dummies are not reported.	ber of ares
All variables (except <i>Pre-issue Price</i>) are expressed as deviation from control firms (issuer minus control). Heteroskedasticity-consistent industry-clustered t-statistics are in parentheses. *, **, and *** denote 10%, 5%, and 1% significance, respectively.	(except <i>Pre-issue Price</i>) are expressed as deviation from (*, **, and *** denote 10%, 5%, and 1% significance, resp	e) are expre 10%, 5%, an	ssed as dev d 1% signi	iation fron ficance, re	a control fi spectively.	irms (issu	ter minus o	control).	Heteroske	edasticity	consister	ıt industr	y-cluster	ed t-statis	stics are in	
					Ι	Liquidity								Efficiency	ency	
	Ē	∆ Turnovor t_stat	∆ Tradae	c t_ctat	∆ Amihud	t_ctat (+ etet OIRNIIM + etet		∆ Snraad	t_stat	∆ Denth	t_ctat		t_ctat	∆ WP(€)-11	t_ctat
Intercept	•	-0.429 (-0.77)	-	1	0.803	(1.07)	0.207	_		(0.05)	0.463	_	-0.324	_		(-0.04)
SI_%Shrout	9.9	9.917** (2.42)	2) 8.812***	(2.73)	-10.752**		-1.766	(-0.93)	-0.668	(-0.44)	6.460		-82.517	(06.0-)	-49.302 ((-0.42)
SI_%Shrout_Announcement		0.638 (0.07)	7) 8.914		-0.938	(-0.11)	0.039	(0.01)		(0.65)			398.006	(1.40)	36.531	(0.27)
ΔMarket Cap ΔVolatilitv	0.28	0.065 (0.33) 8.211*** (3.27)	3) 0.432** 7) 5.204**	* (2.18) * (2.01)	-0.747*** -3.528	(-2.87)	-0.179* -0.826	(-1.74)	-0.495*** (-1.499	(-5.37)	-0.597*** 5.275*	(-2.85)	-0.857	(-0.15)	-3.883 ((-0.59)
ΔInstitutional Holdings					-0.213	(-0.64)	-0.130	(-0.77)	*	(-3.59)		(-1.12)	7.427	(0.71)	1.189	(0.21)
Pre-issue Price x 100	15	15.156 (0.96)	5) 24.156*	* (1.84)	-28.479	(-1.38)	-1.615	(-0.24)	-1.038	(-0.18)	-0.254	(-0.02)	116.379	(0.41)	126.260	(0.48)
NYSE	0-	-0.103 (-0.61)	1) -0.103	(-0.77)	0.200	(0.68)	-0.134	(-1.19)	-0.009	(-0.10)	-0.243	(-1.21)	-4.477	(-1.02)	5.033	(0.84)
Public		-0.080 (-0.36)	6) 0.040	(0.19)	0.069	(0.23)	-0.076	(-0.92)	0.113	(1.58)	0.015	(0.07)	-9.113	(-1.16)	8.748	(86.0)
APre Post x 1000		-1.599 (-0.97)	1	(-1.30)	0.441	(0.13)	-0.140	(90.0-)		(-0.40)	-4.177	(-1.21)	26.510	(0.44)	3	(-0.37)
Z		132	132		132		132		132		132		132		132	
RSq. (%)	7	75.67	82.09		67.82		72.49		88.60	┥	71.24		70.92		78.37	

	Arbitrageurs Versus Valuation Shorts:	/ersus Valua	tion Sh	orts: H	Robusti	T less A	Table 7 bustness Analysis Using Theoretical Convertible Bond Arbitrage (SI)	Using	Theor	etical (Convei	rtible l	30nd A	\\	ıge (SI)	_
	The liquidity and efficiency changes are regressed on theoretical arbitrage activity (<i>SI_%Shrout_Theoretical</i>) and firm characteristics. <i>SI_%Shrout_Theoretical</i> is calculated based on the delta of convertible bond, conversion ratio, and the number of convertible bonds in the issue. It represents the theoretical number of shares required to sell short (divided by total shares outstanding) in order to delta hedge the convertible bond position. "Pre-issue period" is the 6 months ending 1 month prior to the issuance or announcement, whichever is earlier. "Post-issue period" is the 6 months beginning 1 month beginning 1 month beginning 1 month beginning 1 month prior to the issuance or announcement, whichever is earlier.	changes are regress ond, conversion rat rder to delta hedge " is the 6 months b	sed on theo io, and the the conver eginning 1	retical arb number o tible bonc month aft	vitrage acti f convertib d position. cer issuance	vity (SI_{-}^{2}) le bonds "Pre-issu	age activity (<i>SI_%Shrout_Theoretical</i>) and fir onvertible bonds in the issue. It represents the osition. "Pre-issue period" is the 6 months enc issuance or announcement, whichever is later.	<i>heoretica</i> e. It reprises the 6 m whicheve	<i>d</i>) and fir esents the nonths end or is later.	m charac theoretic ling 1 mc	teristics. al number	<i>SI_%Shr</i> t of share to the issu	<i>out_Theor</i> s required ance or a	<i>retical</i> is to sell shannouncer	calculated nort (divid nent, whic	based ed by shever
	Δ Turnover, Δ Trades, and Δ Amihud are changes in post-issue log Turnover, log Number of Trades, and log Amihud, respectively, from the pre-issue measures. Turnover is the average daily stock volume divided by shares outstanding. Number of Trades is the average daily number of stock transactions. Amihud is the average daily ratio of absolute return to dollar volume. $\Delta OIBNUM$, $\Delta Spread$, and $\Delta Depth$ are the percentage changes in the post-issue $OIBNUM$, Percentage Spread, and Total Depth/Shares Outstanding, respectively, from the pre-issue measures. OIBNUM is the average daily absolute difference between the numbers of buyer- and seller-initiated trades divided by their sum. Percentage Spread is the difference between bid and ask quotes (time-weighted), expressed as percentage of bid-ask midpoint. Total Depth/Shares Outstanding is the sum of bid and ask quoted depths divided by shares outstanding.	(Amihud are chan, livided by shares o A , $\Delta Spread$, and Δ ue measures. OIB therence between b d by shares outsta	ges in post- utstanding. <i>Depth</i> are t <i>NUM</i> is th id and ask c nding.	issue log <i>Number</i> <i>Number</i> the percent a average puotes (tin	<i>Turnover</i> , <i>of Trades</i> itage chang daily abso ne-weighte	log <i>Numi</i> is the ave ges in the ges in the diffe d), expre	<i>ber of Trac</i> rrage daily post-issue rence betw sseed as pe	<i>les</i> , and landber of number of <i>number</i> o	og <i>Amihu</i> . of stock tr <i>M</i> , <i>Percen</i> umbers of of bid-ask	d, respec ansactior <i>tage Spr</i> f buyer- <i>i</i> midpoin	tively, fro ls. <i>Amihu</i> , ad , and <i>J</i> ad seller- t. <i>Total D</i>	m the pre d is the a <i>Total Dep</i> initiated i <i>vepth/Sha</i>	-issue me verage da <i>th/Shares</i> trades divi res Outsta	asures. 1 ily ratio c <i>Outstam</i> ided by th ided by th inding is	<i>urnover</i> i of absolute <i>ding</i> , neir sum. the sum o	s the return f bid
	$\Delta AR(I) $ and $\Delta VR(5)$ from $I $ are the percentage changes in the post-issue $ Daily AR(I) $ and $ Variance Ratio(5) - I $, respectively, from the pre-issue measures. $ Daily AR(I) $ is the absolute value of first-order autocorrelation of daily returns. $ Variance Ratio(5) - I $ is the absolute deviation of 5-day variance ratio from 1.	<i>I</i> are the percent der autocorrelation	age change of daily ret	s in the pc urns. $ Va $	ost-issue L triance Rat	aily AR(io (5) - 1	$ I\rangle $ and $ V $ is the ab	<i>ariance R</i> solute dev	<i>latio (5) -</i> /iation of :	1 , respe 5-day vai	ctively, fr iance rati	om the pi o from 1.	e-issue m	leasures.	Daily AR	i (1)
49	Δ <i>Market Cap</i> and Δ <i>Volatility</i> are the post-issue equity market capitalization and standard deviation of daily return minus the corresponding pre-issue period measures. Δ <i>Institutional Holdings</i> is the change in institutional holdings (by 13f institutions) divided by shares outstanding at issuing calendar year end from prior calendar year end. <i>Pre-issue</i> period. <i>Dree Price</i> is the average (log) price in pre-issue period. <i>NYSE</i> and <i>Public</i> are dummy variables. Δ <i>IPre Post</i> is the number of days between the last day in pre-issue period and the first day in post-issue period. Estimates on the year-month dummies are not reported.	<i>ty</i> are the post-issi e change in institu g) price in pre-issi . Estimates on the	tional holdi tional holdi ae period. 7 year-month	arket capi ngs (by 1. <i>VYSE</i> and t dummies	(talization a 3f institutio 1 <i>Public</i> an s are not re	and stand ons) divic e dummy ported.	ard deviat led by sha: / variables	ion of dai tes outsta <i>APre P</i>	ly return r nding at is <i>ost</i> is the	minus the ssuing ca number (correspoi lendar yea of days be	nding pre r end fro tween the	-issue peri m prior ca hast day i	iod meası ılendar ye in pre-iss	ures. 2ar end. <i>Pr</i> 1. ue period	e- and the
	All variables (except <i>Pre-issue Price</i>) are expressed as deviation from control fi parentheses. $*, **$, and $***$ denote 10%, 5%, and 1% significance, respectively.	<i>ue Price</i>) are expr denote 10%, 5%, a	essed as der nd 1% sign	viation frc ificance, 1	um control respectivel	firms (is y.	control firms (issuer minus control). Heteroskedasticity-consistent industry-clustered t-statistics are in oectively.	control).	Heterosk	cedasticit	y-consiste	nt indust	ry-clustere	ed t-statis	tics are in	
					Ι	Liquidity								Efficiency	ency	
		v T			\ \ \ \		γ		Δ.			7 - 7 - 7				
	Intercent	0.032 (0.22)	-0.180	(-1 51)	-0.367 (-1.17) -0.020 (-0.17)	(-1 17) -0 020	-0.00		-0.075 /	(-0.21)	(-0.21) 0.784***	(4 05)	6 308	(0 61)	1 080 1-	(-5131)
	SI_%Shrout_Theoretical	*		(10.85)		(-1.28)				(1.36)	0.660	(0.69)	-17.808		-1.707 23.501*	(00.0-)
	AMarket Cap		0.629***	(19.34)	0.629*** (19.34) - 0.977**(-23.00) - 0.202*** (-8.77)	(-23.00)-	0.202***	(-8.77)-0	<u> </u>	-11.60)-1).758***	(-6.04)	-6.495	(-0.67)	-1.369	(-1.31)
	ΔV0latility ΔInstitutional Holdings	9.825^{***} (5.79) 0.432^{***} (8.93)	0.172***	(6.20) (4.11)	-0.803 -0.477***	(-1.00) (-4.18)	(-1.00) $ -2.366^{***}$ (-4.18) -0.041	(-1.19)-(2.796** (2.36) -0.217*** (-3.76)	: (02.20) (-3.76)	(-3.76) 5.705*** (-3.76) -0.164	(-1.28)	0.317	(0.04)	-0.783	(09.0-)
	Pre-issue Price x 100	0.866 (0.31)	3.990	(1.62)	1.675	(0.52)		(-0.65)	2.213		*	(-3.42)	115.310	(0.49)	73.417	(0.68)
	NYSE		Ÿ	* (-3.33)	-0.023		0.070***		-0.017	(-0.82)	0.065		5.841	(1.23)	-0.586	(-0.39)
		-		(0.38)	0.151^{**}	(2.06)		(-1.62)		(1.76)	-0.096		-19.989	(-1.10)	3.406	(1.30)
	APre Post x 1000	2.114* (1.95)	1	(1.76)	-0.849	(-0.44)	-0.882	(-1.29)	5	(-1.55)	-1.897	(-1.11)	-41.610	(-0.24)	-0.150	(-0.01)
	Z	733	733		733		733		733		733		733		733	
	RSq. (%)	39.50	58.49		58.80		35.83		60.03		37.11		10.57		62.78	

tristance or amouncement, which ending 1 month prior to the iss and "Pre-issue period" is the 6 months ending 1 month prior to the iss tristance or amnouncement, whichever is later. . $\Delta Tranover$ is the average daily stock volume divided by shares ou ily ratio of absolute return to dollar volume. $\Delta OBBVUM$, $\Delta Spread$, $h/Shares Outstanding , respectively, from the pre-issue measures. Odefs divided by their sum. Percentage Spread is the difference betwinShares Outstanding is the sum of bid and ask quoted depths divided byinstrumented SI_{dollar Volume is estimated from a first-stage regressiontitutions) divided by shares outstanding at issuing calendar year endPublic are dummy variables. A Pre Post is the number of days beto thore and Preliation of daily return minus the correspo-titutions) divided by shares outstanding at issuing calendar year endPublic are dummy variables. A Pre Post is the number of days beof a standard deviation of the pre-issue measures. OResearch Distributions are not repone the inter-issue period. Pre-issue hastitutional Holdings is the institutshe divided mate on ever prior to issuance. Conversion Premiumocet at issuance. Estimates on the year-month dummies are not reponesest except Pre-issue Price) are expressed as deviation from control-s. *, ***, and **** denote 10%, 5%, and 1% significance, respectivelyand Holdings 0.408*** (1.43) 0.601**** (1.6.90.0142**** (7.45) 0.0099*** (2.72)0.027 (-0.45) 0.0099*** (-2.2)0.027 (-0.45) 0.0099*** (-2.7)0.027 (-0.45) 0.0099*** (-2.2)0.027 (-0.45) 0.0099*** (-2.2)0.028 (-0.5) 0.0099*** (-2.2)0.028 (-0.5) 0.0099*** (-2.2)0.027 (-0.45) 0.0099*** (-2.2)0.028 (-0.5) 0.0099*** (-2.2)0.023 (0.23) (0.23) (0.23) (0.25) 0.099*** (-2.2)0.023 (0.23) (0.23) (0.25) 0.099*** (-2.2)0.023 (0.23) (0.23) (0.25) 0.099*** (-2.2)0.023 (0.23) (0.23) (0.25) 0.099*** (-2.2)0.023 (0.23) (0.23) (0.23) (0.25) 0.099*** (-2.2)0.023 (0.23) (0.23) (0.25) 0.099*** (-2.2)0.023 (0.23) (0.23) (0.25) 0.099*** (-2.2)0.023 (0.$		S	Simultaneous Equations Estimation:	uation	s Estimat	ion: C	hanges ii	n Liqui	Changes in Liquidity, Prices, and Short Interest	ces, and	Short I	nterest		
		This table presents a simular transform Instrumented SI_%Shrou.not reported. "Pre-issue I month after issuance or an	ultaneous equation syste <i>tt</i> and other variables, w period" is the 6 months nnouncement, whicheve	m of liqui hile Pane ending 1 r er is later.	idity changes I B shows the nonth prior to	and arbitra regression the issuar	age activity (. is of <i>SI_%Sh</i> nce or annour	SI_%Shrou rout on In ncement, w	<i>ut</i>). Panel A strumented <i>i</i> thichever is e	shows the J L <i>iquidity</i> arlier. "Po	regressions o and other va st-issue peric	f liquidity riables. Fi od" is the 6	changes on rst-stage resu months begi	lts are ming 1
		<i>∆ Turnover</i> , <i>∆Trades</i> , an issue period. <i>Turnover</i> i: average daily ratio of abs <i>Total Depth/Shares Outst</i> initiated trades divided by <i>Depth/Shares Outstandin</i>	Id ΔA mihud are, respects the average daily stocl solute return to dollar votanding, respectively, fanding, respectively, for their sum. <i>Percentage</i> is the sum of bid and	trively, log ϵ volume ϵ volume ΔC dume. ΔC rom the pr ϵ <i>Spread</i> i	<i>Turnover</i> , le fivided by shi fivided by shi <i>DIBNUM</i> , ΔS_i re-issue measi s the differen a depths divided by the divided b	og Number ares outsta <i>pread</i> , and ares. <i>OIB</i> 1 ce between ded by sha	<i>^e of Trades</i> , <i>^e</i> nding. Numl I ∆Depth are VUM is the a n bid and ask res outstandi	und log An ber of Trac the percei verage dai quotes (tii ng.	<i>iihud</i> in post- <i>les</i> is the ave ntage changes ily absolute di me-weighted)	issue peric rage daily in the pos ifference b , expressee	d minus the number of sto t-issue <i>OIBN</i> etween the nu d as percenta	correspond ock transac <i>UM</i> , <i>Perc</i> umbers of umbers of ge of bid-a	ling measures ttions. <i>Amihu</i> <i>entage Sprea</i> , buyer- and se sk midpoint.	in pre- d is the t, and ller- <i>Total</i>
		In Panel A, <i>Instrumented</i> market capitalization and (by 13f institutions) divid <i>NYSE</i> and <i>Public</i> are dur year-month dummies are	$^{I}SI_{-}\%Shrout$ is estimat l standard deviation of d ded by shares outstandin mmy variables. ΔPre not reported.	ed from a aily returr g at issuir <i>Post</i> is th	first-stage reg n minus the co ug calendar ye e number of o	gression (so prrespondii car end fro lays betwe	ee main text ng pre-issue J m prior calen en the last da	for specifi period mea dar year e ly in pre-is	cation). Δ <i>Mc</i> usures. Δ <i>Insti</i> nd. <i>Pre-issue</i> isue period an	<i>inket Cap i</i> <i>tutional H</i> <i>Price</i> is t d the first	and <i>A Volatil</i> , oldings is the he average (l day in post-is	<i>ity</i> are the e change ir og) price ii ssue period	post-issue eq i institutional n pre-issue pe l. Estimates c	uity holdings riod. n the
All variables (except <i>Pre-issue Price</i>) are expressed as deviation from control firms (issuer minus control). Heteroskedasticity-consistent ind parentheses. *, **, and *** denote 10%, 5%, and 1% significance, respectively. Panentheses. *, ***, and *** denote 10%, 5%, and 1% significance, respectively. Panel A: Liquidity Changes A Δ	50	In Panel B, <i>Instrumented</i> regressions (see main tex daily return in pre-issue p <i>Dividend</i> is the dividend common stock at issuance	¹ △Liquidity are the diff (t for specification). Pre- period. Pre-issue Institu- rate one year prior to is e. Estimates on the year	erent liqui <i>-issue Do</i> <i>ttional Ho</i> suance. C	idity changes llar Volume i ldings is the Conversion Pr ummies are n	(<i>A Turnov</i> and <i>Pre-is</i> , institution: <i>emium</i> is ot reported	er , <i>ATrades</i> sue Volatility al holdings d the percentag	Admihuc are, respe ivided by s ge amount	<i>t</i> , <i>AOIBNUM</i> sctively, the a shares outstan by which the	1, <i>A Spread</i> verage (log ding at cal conversior	d, <i>ADepth</i>) (g) dollar volu endar year er a price exceet	estimated f me and sta nd prior to ds the marl	rom fürst-stag undard deviati issuance. <i>Pr</i> . ket value of tl	e on of <i>issue</i> ie
Panel A: Liquidity Changes Δ		All variables (except <i>Pre</i> parentheses. *, **, and *	<i>-issue Price</i>) are expres :** denote 10%, 5%, an	sed as dev d 1% sign	viation from c ificance, resp	ontrol firn ectively.	ns (issuer mir	nus control	l). Heteroske	dasticity-co	onsistent indu	ustry-cluste	ered t-statistic	s are in
$\begin{array}{c c c c c c c c c c c c c c c c c c c $						Panel A:	Liquidity C	hanges						
Turnovert-statTradest-statAmihudt-statOIBNUMt-stat -0.124 (-0.72) $-0.237**$ (-2.18) -0.055 (-0.21) 0.076 (0.67) ted SI_%Shrout $10.963***$ (4.43) $6.931***$ (3.81) $-8.073***$ (-3.19) -0.888 (-1.06) Cap $0.142***$ (2.72) $0.601***$ (16.98) -0.055 (-0.21) 0.076 (0.67) (7) $0.142***$ (2.72) $0.601***$ (16.98) $-0.964***$ (-1.06) -1.007 (7) $0.142***$ (7.11) $0.141**$ (2.48) -0.9637 (-0.54) -0.037 (-10.07) (7) $0.142**$ (7.11) $0.141**$ (2.48) $-0.449***$ (-1.00) -0.037 (-10.07) (7) $0.408**$ (7.11) $0.141**$ (2.48) $-0.449***$ (-1.00) -0.037 (-1.00) (7) $0.28**$ (7.19) -0.637 (-0.54) $-2.317***$ (-2.01) (7) $0.28*$ (-2.23) -0.637 (-0.54) $-2.317***$ (-2.01) (7) $0.049**$ (1.32) (-0.45) $-0.98**$ (-2.23) -0.054 (-0.84) (7) 0.028 (0.55) $0.089**$ (-2.23) -0.054 (-0.84) (-1.55) (7) 0.028 (0.28) -0.233 (0.28) -0.050 0.093 (0.00) -0.510 (1000) 0.233 (0.28)			Δ		Δ		Δ		Δ		Δ		Δ	
-0.124 (-0.72) $-0.237**$ (-2.18) -0.055 (-0.21) 0.076 (0.67) (ted SI_%Shrout $10.963***$ (4.43) $6.931***$ (3.81) $-8.073***$ (-3.19) -0.888 (-1.06) Cap $0.142***$ (2.72) $0.601***$ (16.98) $-0.964***$ (-3.19) -0.888 (-10.07) 7 $10.487**$ (7.72) $0.601***$ (7.42) $-0.964***$ (-3.19) -0.888 (-10.07) 7 $10.487**$ (7.11) $0.141**$ (2.48) -0.637 (-0.54) $-2.317***$ (-2.85) nal Holdings $0.408***$ (7.11) $0.141**$ (2.48) -0.637 (-0.54) $-2.317***$ (-2.01) 7 $0.408***$ (7.11) $0.141**$ (2.48) -0.637 (-0.54) $-2.317***$ (-2.05) Price x 100 4.646 (1.32) $6.719***$ (2.79) $-0.449***$ (-3.84) -0.037 (-1.00) Price x 100 0.208 (0.55) $0.089**$ (-2.23) -0.654 $-0.84)$ $0.045*$ (1.92) Price x 100 0.233 (0.53) (0.50) 0.064 (1.04) -0.040 (-1.55) 846 846 846 846 846 846 846 -18.80			Turnover	t-stat	Trades	t-stat	Amihud	t-stat	OIBNUM	t-stat	Spread	t-stat	Depth	t-stat
Cap 0.142^{***} (2.72) 0.601^{***} (16.98) -0.964^{***} (-3.17) -0.000 (-1.00) V 0.142^{***} (7.42) 0.601^{***} (7.42) 0.964^{***} (-18.44) -0.190^{***} (-1007) Nal Holdings 0.487^{***} (7.11) 0.141^{**} (2.48) -0.637 (-0.54) -2.317^{***} (-2.05) Price x 100 4.646 (1.32) 6.719^{***} (2.79) -1.971 (-0.66) -2.194^{**} (-1.00) Price x 100 4.646 (1.32) -0.089^{**} (-2.23) -0.054 (-0.84) 0.045^{**} (-1.00) Price x 100 0.233 (0.55) 0.089^{**} (-2.23) -0.054 (-0.84) 0.045^{**} (-1.55) 0.028 (0.55) 0.089^{**} (-2.23) -0.054 (-0.84) 0.045^{**} (-1.55) $x 1000$ 0.233 (0.28) 0.089^{**} (-2.23) -0.054 (-0.84) (-1.55) 846 846 846 846 846 846 846 -0.960		Intercept Instrumented SI %Shr		(-0.72)	-0.237** 6 021***	(-2.18)	-0.055 8 072***	(-0.21)	0.076	(0.67)	0.004	(0.05)	0.569*** 1 257	(2.61)
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		ΔMarket Cap		(2.72)	0.601 ***	(16.98)	-0.964***	(-18.44)	-0.190***	(-10.07)	-0.516^{***}	(-12.49)	-0.743***	(-5.94)
mal Holdings $0.408**$ (7.11) $0.141**$ (2.48) $-0.449***$ (-3.84) -0.037 (-1.00) Price x 100 4.646 (1.32) $6.719***$ (2.79) -1.971 (-0.66) $-2.194**$ (-2.01) Price x 100 -0.027 (-0.45) $-0.089**$ (-2.23) -1.971 (-0.66) $-2.194**$ (-2.01) 0.028 (0.55) $-0.089**$ (-2.23) -0.054 (-0.84) $0.045*$ (1.92) 0.028 (0.55) $0.089*$ (1.79) 0.064 (1.04) -0.040 (-1.55) $x 1000$ 0.233 (0.28) -0.360 (-0.50) 0.093 (0.00) -0.510 (-1.55) $x 1000$ 0.233 (0.28) -0.360 (-0.50) 0.093 (0.00) -0.510 (-1.55) $x 1000$ 0.233 (0.28) -0.360 (-0.50) 0.093 (0.00) -0.510 (-0.99) $x 18.94$		ΔVolatility	10.487^{***}	(7.64)	9.789***	(7.42)	-0.637	(-0.54)	-2.317***	(-2.85)	2.994***	(2.89)	6.131***	(2.74)
Price x 100 4.646 (1.32) $6.719***$ (2.79) -1.971 (-0.66) $-2.194**$ (-2.01) -0.027 -0.45 $-0.089**$ (-2.23) -0.054 (-0.84) $0.045*$ (-2.01) 0.028 (0.55) $0.089*$ (-2.23) -0.054 (-0.84) $0.045*$ (1.92) 0.028 (0.55) $0.089*$ (1.79) 0.064 (1.04) -0.040 (-1.55) $x 1000$ 0.233 (0.28) -0.360 (-0.50) 0.093 (0.00) -0.510 (-0.99) 846 846 846 846 846 846 846 846 18.94 18.94 -44.25 -46.81 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 -18.94 <t< th=""><th></th><th>AInstitutional Holdings</th><th></th><th>(7.11)</th><th>0.141^{**}</th><th>(2.48)</th><th>-0.449***</th><th>(-3.84)</th><th>-0.037</th><th>(-1.00)</th><th>-0.217***</th><th>(-3.77)</th><th>-0.127</th><th>(66.0-)</th></t<>		AInstitutional Holdings		(7.11)	0.141^{**}	(2.48)	-0.449***	(-3.84)	-0.037	(-1.00)	-0.217***	(-3.77)	-0.127	(66.0-)
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		Pre-issue Price x 100	4.646	(1.32)	6.719***	(2.79)	-1.971	(-0.66)	-2.194**	(-2.01)	0.905	(0.48)	-8.193**	(-2.32)
0.028 (0.55) 0.089^* (1.79) 0.064 (1.04) -0.040 (-1.55) x 1000 0.233 (0.28) -0.360 (-0.50) 0.093 (0.00) -0.510 (-0.99) x 1000 0.233 (0.28) -0.360 (-0.50) 0.093 (0.00) -0.510 (-0.99) x 1000 846 846 846 846 846 18.80		NYSE	-0.027	(-0.45)	-0.089**	(-2.23)	-0.054	(-0.84)	0.045^{*}	(1.92)	-0.010	(-0.53)	0.104	(0.96)
x 1000 0.233 (0.28) -0.360 (-0.50) 0.093 (0.00) -0.510 (-0.99) 846 846 846 846 846 846 18.80 18.94 44.25 46.81 18.80 18.80 18.80		Public	0.028	(0.55)	0.089^{*}	(1.79)	0.064	(1.04)	-0.040	(-1.55)	0.065**	(2.08)	-0.074	(-0.85)
846 846 846 846 846 846 18.94 44.25 46.81 18.80			0.233	(0.28)	-0.360	(-0.50)	0.093	(0.00)	-0.510	(66.0-)	-0.750	(-1.34)	-1.030	(-0.60)
18.94 44.25 46.81 18.80 1		Ν	846		846		846		846		846		846	
		RSq. (%)	18.94		44.25		46.81		18.80		48.68		21.63	

Table 8 (cont'd)

All coefficients are x 1000

			Pan	el B: Sh	Panel B: Short-Interest Changes	Change	0					
When Instrumented	V		Δ		Δ		Δ		Δ		Δ	
ΔLiquidity =	Turnover t-stat	t-stat	Trades	t-stat	Amihud	t-stat	OIBNUM t-stat	t-stat	Spread	t-stat	Depth	t-stat
Intercept	11.448*	(1.78)	12.987*	(1.85)	11.477*	(1.83)	13.528*	(1.90)	13.423*	(1.67)	15.181*	(1.69)
Instrumented ALiquidity	9.686	(0.89)	5.302	(0.71)	-5.270	(-1.47)	-17.790	(-0.77)	-9.180	(-1.55)	-3.730	(66.0-)
Pre-issue Dollar Volume	-0.710	(-0.60)	-1.120	(-1.01)	-1.250	(-1.07)	-1.210	(-1.08)	-1.520	(-1.15)	-1.410	(-1.07)
Pre-issue Volatility	199.239*	(1.95)	175.534**	(1.96)	(1.96) 142.304***	(2.70)	188.692*	(1.73)	146.362**	(2.50)	162.161**	(2.37)
Pre-issue Institutional Holdings	6.785**	(2.15)	5.471*	(1.71)	5.937*	(1.92)	5.227	(1.52)	5.440*	(1.72)	5.493	(1.60)
Pre-issue Dividend	-7.350	(-1.34)	-7.040	(-1.20)	-7.640	(-1.35)	-7.760	(-1.11)	-7.010	(-1.22)	-5.870	(-1.09)
Conversion Premium (%)	-0.050**	(-2.42)	(-2.42) -0.050***	(-2.57)	-0.040*	(-1.88)	-0.060***	(-2.91)	-0.050**	(-2.29)	-0.060***	(-3.24)
NYSE	-7.120*	(-1.82)	-7.400**	(-2.04)	-7.860**	(-2.48)	-7.300**	(-1.96)	-8.180**	(-2.56)	-8.040***	(-2.69)
Public	-6.510**	(-1.96)	-7.460**	(-2.36)	-6.580**	(-2.07)	-7.950**	(-2.21)	-6.790**	(-2.20)	-7.690**	(-2.38)
APre Post x 1000	0.158^{***}	(2.95)	0.176^{***}	(2.97)	0.176^{***}	(2.98)	0.169^{***}	(3.23)	0.175***	(2.92)	0.179***	(3.06)
Z	846		846		846		846		846		846	
RSq. (%)	5.13		4.98		5.51		4.89		4.72		4.06	

Figure 3 Reg-SHO – Short-Selling Activity for Issuers and Control Firms

short-selling activity measure is the change from expected daily short-sales volume divided by total shares outstanding. Expected short-sales volume This chart depicts a short-selling activity during the event window (trading days -20 to +20) for convertible bond issuers and control firms between March 2005 and May 2006. Control firms are matched based on size, book-to-market, and turnover before issuance; exchange, and industry. The is the average short-sales volume from days -40 to -21 relative to issuance.

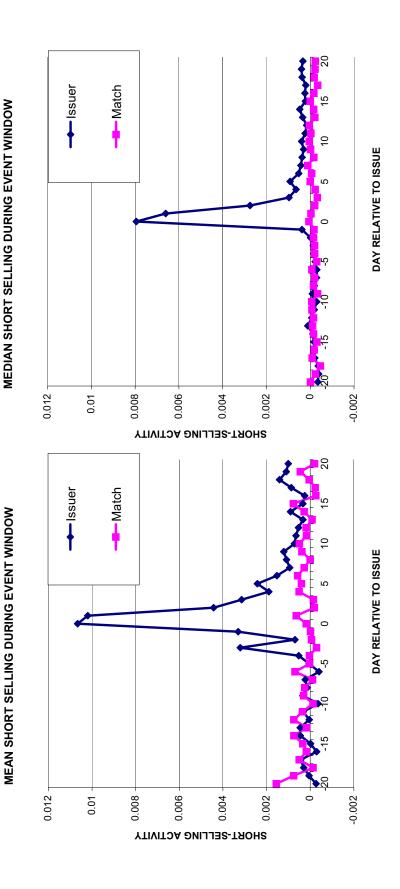


Table 9 Reg-SHO – Changes in Short-Selling Activity Analysis	lling Activity Analysis	
This table shows the short-selling activity in stocks of convertible bond issuers and control firms between March 2005 and May 2006. Short-selling activity is measured using Reg-SHO Data, which contains short-sale transactions data beginning January 2005. "Pre-period" is defined as the 20 trading days ending 1 month prior to issuance or announcement, whichever is earlier. "Post-period" is defined as the 20 trading days beginning 1 month following issuance or announcement, whichever is later. The change is defined as the mean measure in post-period minus the mean measure in pre-period. Control firms are matched based on size, book-to-market, and turnover before issuance; exchange, and industry.	and issuers and control firms be which contains short-sale trans 1 month prior to issuance or ar 1 month following issuance or ost-period minus the mean mea ver before issuance; exchange,	tween March 2005 and actions data beginning unouncement, whichever announcement, sure in pre-period. and industry.
Number of Short Sales is the daily number of stock transactions that involve short sales. Short Sales/Shares Outstanding is the daily short-sales volume divided by the total shares outstanding.	involve short sales. Short Sale	ss/ Shares Outstanding is
Industry- and time-clustered t-statistics of the changes are in parentheses. $*, **$, and $***$ denote changes that are 10%, 5%, and 1% significant, respectively.	eses. *, **, and *** denote ch	anges that are 10%, 5%,
	Issuing Firm	Control Firm
Pre-period Number of Short Sales (log)	6.036	5.474
Post-period Number of Short Sales (log)	6.295	5.623
Change in (log) Number of Short Sales	0.258 * * *	0.149^{**}
t-stat	(4.68)	(2.57)
Pre-period Short Sales/Shares Outstanding (%)	0.298	0.227
Post-period Short Sales/Shares Outstanding (%)	0.345	0.230
Change in Short Sales/Shares Outstanding (%)	0.046^{*}	0.003
t-stat	(1.79)	(0.10)
N	64	64