Convertible Bond Arbitrage, Liquidity Externalities and Stock Prices *

Darwin Choi
Yale School of Management†

Mila Getmansky
University of Massachusetts, Amherst‡

Heather Tookes
Yale School of Management§

September 21, 2006

Abstract

We use convertible bond issuance and equity short interest data to identify convertible bond arbitrage activity and examine its impact on stock market liquidity and prices for the period 1991 to 2005. We find considerable evidence that arbitrage-induced short selling is related to liquidity improvements in the stock. We then link total issuance and our proxy for arbitrage activity to convertible bond arbitrage hedge fund flows and returns data. We find that issuance is sensitive to both the supply of capital from arbitrageurs and to our measure of convertible bond arbitrage activity. The latter finding suggests an important role for arbitrageurs' *use* of the funds that they raise.

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

JEL Classification: G12, G14

*We would like to thank Ben Branch, John Burke, Michael Epstein, Laura Frieder, William Fung, William Goetzmann, Robin Greenwood, Jennifer Jeurgens, Charles Jones, Nikunj Kapadia, Hossein Kazemi, Camelia Kuhnen, Owen Lamont, Laura Lindsay, Thomas Schneeweis, Norman Wechsler, Rebecca Zarutskie and seminar participants at Yale University and the Batten Young Finance Scholars Conference for helpful discussions. We are extremely grateful to Paul Bennett and the NYSE for providing the short interest data. We also thank Eric So for his assistance with the Nasdaq data and Scott Zhu for excellent research assistance. Any errors are our own.

†Darwin Choi, darwin.choi@yale.edu (email), Yale School of Management, P.O. Box 208000, New Haven, Connecticut 06520-8000, (203) 432-5661 (voice).

‡Mila Getmansky, msherman@som.umass.edu (email), Isenberg School of Management, University of Massachusetts, 121 Presidents Drive, Room 308C, Amherst, MA 01003, (413) 577–3308 (voice), (413) 545–3858 (fax).

§Heather Tookes, heather.tookes@yale.edu(email), Yale School of Management, P.O. Box 208000, New Haven, Connecticut 06520-8000, (203) 436-0785 (voice).

1 Introduction

The growth in the issuance of equity-linked debt securities can be attributed, at least in part, to the growing supply of capital provided by hedging strategies. The proliferation of hedge funds has also brought increasing attention to important questions regarding their impact on liquidity and market efficiency [see e.g., SEC (2003)]. In this paper, we focus on one particular strategy: convertible bond arbitrage. The aim of convertible bond arbitrageurs is to exploit mispricing in convertible bonds, typically by buying an undervalued convertible bond and hedging risk by taking a short position in the equity.[1] We estimate the impact of this strategy on both equity market liquidity and stock prices. While we do not have direct data on convertible 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 1991 to 2005, we estimate convertible bond arbitrage activity by calculating changes in short selling intensities 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 we are confident that it captures the strategy of interest, as we observe large increases in short interest near convertible debt offerings during our sample period.

We have two main goals: (1) to identify evidence of convertible bond arbitrage activity from the aggregate data and estimate the impact of this strategy on stock prices and liquidity; and (2) to relate total convertible bond issuance to our proxy for bond arbitrage activity, hedge fund flows and returns. If convertible bond arbitrageurs are important suppliers of capital then understanding the impact of their activities on the market for the underlying stock should be of interest to managers of issuing firms.

The question of whether (and how) the introduction of new securities impacts stock market quality is not new. Significant empirical literature (see e.g., Mayhew (2000) for a survey) focuses on the impact of completing a market through the introduction of derivatives

[1] Due to the conversion option, convertible bonds allow purchasers to 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). Henderson (2005) studies the post-issue performance of convertible bonds and reports that convertible bonds are systematically under priced at issue.

(as in Ross (1976)). A main contribution of this paper is that we identify arbitrage *activity* and estimate its impact on market quality (we use changes in liquidity and price efficiency to measure quality). In this way, we not only provide additional evidence as to how the introduction of new securities markets impacts equity market quality, but we also shed some light on the mechanisms through which quality changes occur (i.e., the positions taken by arbitrageurs).

We find considerable evidence of arbitrage activity (i.e., short selling in the stock) at the bond issuance date. We also find increased equity market liquidity following 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. Taken together, we interpret the liquidity and volatility findings as evidence that convertible bond arbitrage activity tends to affect equity markets positively. In particular, the increased supply to buyers through the short sales of arbitrageurs improves market liquidity.

Our final line of inquiry tests whether arbitrageurs are an important source of capital in primary convertible bond markets and also characterizes times during which arbitrageurs are most active. When we map our aggregate data on issuance and arbitrage activity to convertible bond arbitrage hedge fund flows and returns, we find clear linkages between the issuance of convertible debt, fund flows, returns and arbitrage activity. High flows, returns and arbitrage activity are all followed by high future issuance, consistent with anecdotal evidence that arbitrageurs play an important role in primary issues of convertible debt.[2] As an extension of this analysis, we also test for substitution effects between convertible bond and merger arbitrage strategies.

[2]There is widespread anecdotal belief among practitioners on Wall Street that convertible bond arbitrageurs are the purchasers of primary convertible bond issues. See e.g. WSJ article 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" (WSJ, 12/28/2004, A1). The Financial Times (1/16/2004) reports that hedge funds bought 70 percent of new issues in 2003 and that 95 percent 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.

We believe that using our proxy for arbitrage activity (dollar change in short interest of all issuing firms) in addition to the hedge fund data has incremental value in this analysis for three reasons: First, this variable provides a measure of *positions* taken by arbitrageurs. 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 mis-classification and funds reporting multiple strategies. Finally, even if we measured the assets of the funds perfectly, the positions would still be unobservable due to the use of leverage.

From the perspective of managers of issuing firms, this paper provides evidence that the convertible bond arbitrage strategy impacts equity market quality. It also sheds light on whether these specialized investors are likely to be buyers of the debt offering and may be a useful consideration in the capital structure decision.[3]

This paper is organized as follows. The next section 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. Section 6 presents our analysis of aggregate issuance, arbitrage activity, hedge fund flows and returns. Section 7 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 work (e.g., Grossman (1988); Bias 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

[3]Managers of issuing firms may see convertible debt as a cheap source of financing. Gomes and Phillips (2005) find that the stock price decline associated with issuing convertible bond is less negative than in the case of equity issuance. This is consistent with predictions in Stein (1992) that convertible bonds are a mechanism for adding equity to capital structure with lower adverse selection costs than straight equity issuance.

Shatsri (1998); DeTemple and Jorion (1990)).[4] Mayhew (2000) provides an excellent survey of this literature. The main findings indicate a positive impact on liquidity and no negative impact on 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 that line of research. Our identification (based on short selling) allows us to provide a more direct test of the impact of arbitrageurs.

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 *et al.* (forthcoming, JFE); Boehmer *et al.* (2005); Diether *et al.* (2005); Jones and Lamont (2002); Dechow *et al.* (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 *et al.* (2005)). 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 to prices.

While 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.[5] This is an important distinction since 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. 23) 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

[4]More recently, Basak, Suleyman and Benjamin Croitoru (Forthcoming, JFE) 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 constraints.

[5]Boehmer *et al.* (2005) use proprietary order-level data from the NYSE to quantify the 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).

situations precisely." Our event-based approach takes us further towards 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.

Three recent papers 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.[6] 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.[7] 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 selling activity while our focus is on impact of arbitrage on stock market liquidity and prices.

Although they do not comprise the entire universe of convertible bond arbitrageurs, we are interested in the role played by convertible bond arbitrage hedge funds in primary issues of convertible debt and their impact on stock market quality. Our use of data on convertible bond hedge fund flow and returns is related to recent studies of the risk and performance of convertible bond arbitrage hedge funds (e.g., Agarwal *et al.* (2006)).[8] Our focus on fund flows also links our work to studies of flow-return dynamics in hedge funds. Agarwal, Daniel and Naik (2004), Getmansky (2005), Baquero and Verbeek (2006), Ding, Getmansky, Liang

[6]Selling 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.

[7]I.e., We examine the sensitivity of changes in liquidity and volatility to the magnitude of the increase in short selling due to arbitrage.

[8]Convertible bond arbitrage hedge fund managers typically hedge equity risk (by buying a bond and simultaneously shorting the stock), and may also hedge credit, volatility and interest rate risk.

and Wermers (2006) and Goetzmann, Ingersoll and Ross (2003) study relationships between hedge fund flows and past performance. The empirical regularity is that individual hedge funds that have higher returns experience higher net flows.[9] In this paper, we not only link flows to returns but also to new supplies of convertible debt and our measure of active use of funds (arbitrage activity).

3 Arbitrage, Liquidity and Stock Prices: Predictions

This section outlines our main predictions. In the first part of the analysis, 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. The focus of the second part of the analysis is whether convertible bond arbitrageurs are an important source of capital to issuers.

While the theory suggests a potential role for arbitrageurs in both liquidity and efficiency improvements in the stock, the direction of the effect depends on parameter values and is therefore an empirical question. Our primary goal is to test the following two null hypotheses:

H_0 (Liquidity): The increase in short selling near issuance is not associated with changes in liquidity.

H_0 (Efficiency): The increase in short selling near issuance is not associated 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 liquidity traders (more precisely, liquidity *sellers*) since their presence would increase the supply of shares to buyers (and later provide liquidity to sellers, as they cover their short positions), increasing market liquidity. On the other hand, if short sellers are privately informed, adverse selection costs can increase, and liquidity can decrease.

[9] In the context of mutual funds, Berk and Green (2004), Chevalier and Ellison (1997), Goetzmann and Peles (1997), Gruber (1996), Ippolito (1992), Sirri and Tufano (1998) and Zheng (1999) find positive and convex relationships between flows and performance.

These traders can also impact the efficiency of prices. The impact on price efficiency is ambiguous and depends on whether these traders are privately informed. In particular, mispricing can be reduced if short sellers create downward pressure on prices, correcting over-pricing.[10] If the type of short selling that we identify in the data is related to informational advantage regarding equity market valuation then price efficiency would increase following issuance. If the short sellers are uninformed, their presence would not directly impact efficiency of prices since their trades are uninformative; however, they may provide incentives to informed traders to trade more aggressively (as in Kyle (1985); Glosten and Milgrom (1985); Easley and O'Hara (1987)).

We conjecture that while 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). If this is the case:

P1: The increase in short selling near issuance will be associated with improved market liquidity (via increased supply to buyers).

P2: The increase in short selling near issuance will not impact efficiency of prices (as captured by idiosyncratic volatility, which we interpret as a proxy for the incorporation of firm-specific news into prices).[11]

Because the question is an empirical one, the preceding conjectures regarding the direction of the effect are presented as "predictions" *P1* and *P2*. These conjectures provide a framework for interpreting the empirical results. If, in contrast to *P2*, arbitrageurs are opportunistically exploiting equity overvaluation and convertible bonds make it easier for them to do this (i.e., they relax a short sales constraint by providing a hedging instrument for these short sellers), then efficiency will *increase* as a result of their activity.

In our empirical analysis, we are careful to make a distinction between idiosyncratic and systematic volatility. Bris et al.(2004), construct a market efficiency measure based on the difference in R-squared in market models estimated separately on positive and negative

[10] E.g., Diamond and Verrecchia (1987).

[11] Note that *P2* assumes that the presence of these new uninformed traders would provide incentives to informed traders to trade more aggressively, in proportion to the increase of uninformed traders.

return days and interpret an observed low R-squared as evidence of efficiency. Similarly, we interpret an increase in idiosyncratic volatility as evidence of improved price efficiency since it suggests that more firm-specific information is incorporated into prices.

We are also interested in whether data are consistent with anecdotal evidence that convertible bond arbitrageurs play an important role as providers of capital to issuers. Faulkender and Petersen (2005) provide evidence that market frictions can make the source of capital important in capital structure decisions. In particular, they report that firms with access to public debt markets have higher leverage. Our analysis addresses a similar issue in that we test whether variation in the size and activity of a particular source of capital supply (convertible bond arbitrageurs) impacts issuance patterns. This would occur in the presence of market frictions. In the absence of frictions, the observed level of convertible debt issuance is a function of demand for debt, which depends on the price of debt and demand factors; and the supply of debt, which depends on the price of debt and supply factors. Observed quantity of proceeds will be unrelated to changes in the size and activity level of convertible bond arbitrageurs when there are no constraints on supply of capital. However, in the presence of market frictions (namely supply constraints), convertible bond arbitrageurs may matter in the determination of equilibrium amount of convertible debt financing raised.

P3: If issuers face financing constraints and convertible bond arbitrageurs are important sources of capital then increases in convertible bond arbitrage fund flows and returns will cause future issuance.

If convertible bond arbitrageurs are an important source of supply, then the previous questions regarding the impact of convertible bond arbitrage on underlying stock markets should be of particular interest to managers of issuing firms.

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 1991 through 2005.[12] Issue dates and other characteristics of the issues are from the SDC Global New Issues database. We obtain monthly short interest 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 3 trading days (5 for the first years of our sample) prior to the 15^{th} of each month, we calculate a trade date for each file and use that date to match to the SDC data.[13] We then match these data to the CRSP/COMPUSTAT tapes and NYSE TAQ Database.[14]

Table 1 contains summary statistics on our sample of 1356 convertible bond issues. The issuing firms have a mean (median) market capitalization of \$3.6(\$0.8) billion. The convertible bond issue sizes are significant proportion of equity value, with the mean (median) dollar value of proceeds equal to 20.6 (15.4) percent of equity market capitalization. In addition, Nasdaq issuers outnumber NYSE issuers. We will investigate whether exchange listing is related to the prevalence of this strategy. Finally, note that we do observe short selling in these stocks prior to issuance, with mean (median) short interest during the six months prior to issuance equal to 3.9 (2.5) percent of shares outstanding.

[12]We begin the analysis in 1991 because NYSE data started to provide ticker identifiers in 1991. Moreover, from 1991 we have an improved quality of the hedge fund data due to the increase in the number of firms reporting to TASS and CISDM databases.

[13]It 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 settlement dates which occur during the middle of the month at non-constant days across months. Following the documentation from the short interest files that we received from Nasdaq and the NYSE, we define the settlement date as: 5 trading days before 15^{th} (or the preceding trading day if 15^{th} is not a trading day) through June 1995, and 3 trading days after June 1995. If a convertible bond is issued before the settlement date of that month, that month is used as the issue month. Otherwise, the next month will be used as the issue month. This algorithm is consistent with Bechmann (2004).

[14]The NYSE TAQ data start in January 1993. For analyses that require TAQ data (bid-ask spreads, quoted depths and number of trades per day), issues prior to January 1993 are excluded.

4.2 TASS and CISDM Dataset for Convertible Bond Arbitrage Hedge Funds

Both TASS and CISDM/MAR databases are used for the time series analysis, in which we link total convertible bond issuance and short selling activity in issuers' stock to hedge fund flows and returns. Both Live and Graveyard sub-databases were used to eliminate survivorship bias. These databases cover several hedge fund strategies, including convertible bond arbitrage. The TASS database contains 187 convertible bond arbitrage hedge funds and CISDM database contains 194 convertible bond arbitrage hedge funds. We deleted hedge funds for which no assets under management were reported. All asset values were converted to U.S. dollars. Several funds that report to the TASS database also report to the CISDM database. The TASS and CISDM databases were merged after accounting for hedge funds that report to both databases, resulting in a final sample of 284 unique convertible bond arbitrage hedge funds reporting to either or both databases from January 1990 through December 2005.[15]

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.

[15]Summary statistics on the sample of funds are presented later in the paper (Table 7). In our analysis of the impact of substitute markets on convertible bond arbitrage hedge fund flows, we also obtained data on merger arbitrage funds from TASS and CISDM. The TASS database does not explicitly list merger arbitrage funds. Merger arbitrage funds are listed in the broad "Event Driven" and "Multi Strategy" categories in the TASS database. Therefore, we hand-selected merger arbitrage funds from both of these categories by reading the "Notes" files in both Live and Graveyard TASS sub-samples. After deleting funds for which no assets under management were reported, we identified 210 merger arbitrage hedge funds from the two databases.

5.1 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 since 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). As reported in Figures 1 and 2, both measures capture similar variation in short selling activity. We focus on $SI\_\%Shrout$ in the main analysis due to our interest in the implications of convertible bond arbitrage for the market for the underlying stock.[16]

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. We use this increase as a proxy for convertible bond arbitrage activity.[17] The median increase in short interest relative

[16]However (in unreported tests) we have replicated the analysis using $SI\_\%Issue$. All liquidity results are qualitatively similar. The efficiency results are identical except in the case of idiosyncratic volatility (one of our efficiency proxies). Using that measure, we do find some evidence that this SI measure is positively related to efficiency improvements (the analog to the regression results in Table 5).

[17]While 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 not arbitrage activity, the fact that we capture the

to shares outstanding, $SI\_\%Shrout$, is 1 percent. Finally, the median dollar value increase in short interest relative to issue size, $SI\_\%Issue$, is 10 percent.

Given the large increases during month 0, our analysis focuses on changes in short interest during this month. In our main analysis of changes in liquidity and stock price volatility we examine a relatively short time horizon (six months prior to and following issue) in order to isolate the impact of this strategy.[18] In a working paper, Henderson (2005) finds evidence that new issues of convertible bonds are under priced at issue but that excess returns occur soon after issuance (mainly in the first six months), which may decrease the presence of convertible bond arbitrageurs over longer horizons.

Figure 2 shows the time series behavior of our short interest measures at issue month (t=0). Significant time series variation is clear in these measures, with the highest changes in short interest near the issue date occurring during the earlier part of our sample, while change in short interest as a percent of issue size was greatest during 1999 to 2001. 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 3a provides a description of the time series of convertible bond issuance in our sample. Issuance has steadily increased over time. We have also seen a growth in the total assets managed by convertible bond arbitrage hedge funds during this time period (Figure 3b). The second part of our analysis will investigate potential linkages between supply of convertible bonds and flows and returns in the convertible bond arbitrage fund industry.

increase in shorting over a relatively short horizon makes us confident that our SI measures are, in large part, capturing convertible bond arbitrage. Further, increases in SI due to private information regarding the issue itself are more likely to occur during the months prior to the issue, especially given that the issue is often known in advance (for the public issues in our sample, the mean (median) time between filing and issuance is 150 (43) days).

[18]Convertible bond 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 since callable bonds often have call protection periods, generally greater than six months. See e.g., Asquith (1995).

5.2 Summary of Firm Characteristics, By SI Portfolio

Table 2 provides summary statistics of all of the firms (1 month prior to issuance) in our sample (column "All"). We also divide the sample into four portfolios based on the change in short interest at issue 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, in the full sample, most of the issuers are Nasdaq stocks and these 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, convertible bond arbitrage activity is higher in stocks that already have a high level of short interest, indicating that arbitrageurs choose issues where they believe they will have the ability to short the stock. Finally, as would be expected, the increase in short interest following issuance is positively and significantly related to the conversion ratio (number of shares into which the bond can be converted).

Panel B of Table 2 reports stock liquidity measures. Consistent with the observation that the convertible bond arbitrage strategy is more evident in issuers with higher pre-issue short interest, we also observe more evidence of the strategy in more liquid issuers (presumably easier to short). Share volume, dollar volume and number of trades are all significantly higher in the largest SI portfolio than the smallest. Similarly, percentage spreads are lower for the largest SI portfolio. We do not observe systematic differences in quoted depths or the Amihud (2002) illiquidity measure across SI portfolios.

In Panel C of Table 2 we present descriptive statistics on a variety of return and efficiency measures. We observe higher convertible bond arbitrage activity in stocks with higher average returns, higher betas and R-squared parameters (estimated from a market model regression). We also calculate autocorrelation of returns which we will use as an additional measure 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 see that stocks with the least change in short interest following issuance have greater negative return autocorrelation. This suggests that arbitrageurs are attracted to stocks that are already

more efficiently priced.

5.3 Impact of Convertible Bond Arbitrage on Liquidity and Prices

In Table 3a, we present results from our examination of the impact of convertible bond arbitrage on stock market liquidity and prices. All changes are defined as the "post-event" period mean (the 120 trading days ending 20 trading days from the bond issue) minus the "pre-event" period mean (120 trading days beginning 20 days following the bond issue).[19] Along with changes in short interest, we measure changes in the following liquidity proxies: volume, dollar volume, share turnover, number of trades, opening quotes and the illiquidity measure developed by Amihud (2002). The latter 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 (no statistically significant change). Consistent with our prediction *(P1)*, these improvements increase systematically with arbitrage activity, $SI\_\%Shrout$. These findings suggest that convertible bond arbitrageurs supply (uninformed) liquidity to equity markets. Importantly, 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 volatility, we examine the following measures: average daily returns, standard deviation of daily returns, idiosyncratic volatility, R-squared, beta and AR(1) parameters. Standard deviation of returns is included so that we can compare our results with the empirical regularity of decreases in volatility following the introduction of options markets. We separately examine idiosyncratic volatility which we interpret as a measure of price efficiency. If arbitrageurs improve stock price efficiency and the incorporation of information into prices, then we would expect an increase in idiosyncratic volatility following issuance. Further, we would interpret a decrease in stock return synchroneity (R-squared)

[19] We exclude the +/-20 days around the bond issue 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.)

with the market as an increase in efficiency and the incorporation of firm-specific news into prices. Finally, if arbitrageurs impact stock price efficiency, then we would expect decreases in return predictability, as captured by the AR(1) parameters.

Panel B of Table 3a provides results of analysis of changes in stock price movements. The evidence of the impact of convertible bond arbitrage on stock price efficiency is very weak. Consistent with prior work, we do find an *average* decrease 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). R-squared and beta both increase following issuance and the R-squared increase is highest in the largest SI portfolio. Note also that the changes in beta are raw changes, and do not yet account for the mechanical leverage impact on beta. Regression analysis (below) will further investigate the causes of these changes. We do not observe significant changes in the AR(1) parameters. Mean daily AR(1) appears to increase from -.014 to +.001, but it is driven by SI portfolio 3, where the mean increases from +.002 to +.032. Across SI portfolios, the only systematic variation that we observe is in absolute value of daily AR(1) and R-squared. Taken together, the results in Panel B of Table 3a do not indicate an impact of convertible bond arbitrage on stock price efficiency.

It is possible that the results in Table 3a are being driven by market-wide changes in liquidity and volatility. To examine this potentially important issue, we analyze the measures in Table 3a for two sets of matched firms. In Table 3b, we match firms by total assets, profitability and liquidity in the year prior to issuance in order to control for market-wide movements. We also explore the possibility that our results are driven by the impact of short selling activity in general, rather than convertible bond arbitrage. To do this, we match firms in our sample with size- and exchange- matched firms experiencing similar changes in short interest. Results from this matched sample are reported in Table 3c.[20] All results in Tables

[20]In addition, we conduct two "issue matches": We match convertible bond issuers to a sample of straight-debt issuers (by size, exchange and issue size). This distinguishes the effect of convertible bond issuance from a general increase in leverage. Results are similar to Table 3b and are available upon request. In our second "issue match", we match convertible bond issuers to firms issuing seasoned equity since purchasers of the equity issue would not need to manage a short inventory as is the case for convertible bond arbitrage.

3b and 3c are presented as *differences* between the issuer and matched firms. From the tables, it is clear that the liquidity results are robust to matched firm controls. With the exception of the AR(1) parameter, 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.

Table 4 presents results of sorts based on the $SI\_\%Issue$ measure. These results are similar to our main findings, presented in Table 3a.

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. We use regression analysis to estimate the impact of short selling as well as other stock characteristics on changes in liquidity and volatility measures during the six months prior to and following the convertible bond issue:

$$\begin{aligned} &Liquidity\_Change_i \text{ or } Volatility\_Change_i = \\ &\alpha + \beta_1 SI\_\%Shrout_i + \beta_2 \frac{IssueSize_i}{MarketCap_i} + \beta_3 (log) MarketCap_i \\ &\beta_4 NYSE_i + \beta_5 Public_i + \sum_{t=1991Feb}^{2005May} \beta_{6t} YearMonthDum_{i,t} + \epsilon_i \end{aligned} \tag{1}$$

Dependent Variables

- *Liquidity_Change* is one of five measures of liquidity: Change in (log) Turnover; (log) Amihud; number of trades, opening spreads and opening depths. Changes are calculated as the percentage change (or log difference) in the average daily measure during the post-issuance period (120 trading days beginning 20 days following issuance) from

Results are similar to those in Table 3b in that what is (not) significant in Table 3b is (not) significant for the equity issuer match. The only exception is opening spreads in Portfolio 3, which becomes negative and significant (i.e. stronger liquidity results in that there is a greater decrease in spreads for the convertible bond subsample). We thank William Fung for encouraging the equity issuer robustness check.

the pre-issuance period (120 trading days ending 20 days prior to issuance).

- $Volatility\_Change$ is either one of three measures: Change in R-squared; change in idiosyncratic volatility and change in the daily AR(1) parameter.[21]

Explanatory Variables

- $SI\_\%Shrout$ is the short interest intensity measure.
- $IssueSize/MarketCap$ is issue size divided by market capitalization. Because of the mechanical relationships between market risk and leverage, this capital structure control is particularly important for the change in beta regressions (however, it is included in all of the regressions of changes in liquidity and volatility measures).
- $MarketCap$ is the market capitalization measured by average daily shares outstanding times closing stock price.
- $NYSE$ 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.
- $YearMonthDum_t$ are year and month fixed effects, indicating timing of the convertible bond issue.

Results are presented in Table 5. We find strong evidence that market liquidity increases following issuance. More importantly, these liquidity improvements are systematically related to the SI measures (consistent with *P1*). This is true for three of five of our liquidity measures (turnover, Amihud and number of trades). For spreads, we do not find systematic variation in the observed mean decrease. Changes in depth are linked to the issue only through size of the issue relative to market capitalization of the stock, not through

[21] We ran similar regressions for changes in all measures presented in Table 3a and results are similar. Note that for the change in beta regression, we defined change of beta as: beta during the post-event period minus beta during the pre-event period, divided by unlevered beta.

short selling activity. Note also that liquidity improvements are lower for large stocks, and NYSE listing is related to a greater increase in turnover and decrease in the price impact of trade. Taken together, regression analyses of liquidity measures are consistent with the findings from the univariate analysis based on portfolio sorts in Table 3a: Convertible bond arbitrageurs provide liquidity to markets. These findings are generally consistent with the evidence in Kumar, Sarin and Shatsri (1998) who report that liquidity increases following the introduction of options markets. Similar to our analysis, the authors measure liquidity variables using both intraday and daily data (i.e., trading volume, frequency of trades, spreads and depths).

The evidence in Table 5 of the impact of convertible bond arbitrage on stock price efficiency is somewhat different from what the tests in Panel B of Table 3a suggest. While we observed significant increases in R-squared based on simple univariate tests and on our portfolio sorts on SI intensities, our regression results indicate a large positive intercept for change in R-squared that varies only with market capitalization. That is, large stocks experience smaller increases in R-squared following issuance. The change in the idiosyncratic volatility measure is not related to the SI measure. The same is true for the AR(1) measure. We interpret this as weak evidence that these traders enhance efficiency, rather than simply providing uninformed supply, as in our prediction *(P2)*.[22]

5.4 A closer Look at Changes in Short Selling Near Issuance: 2005 Reg-SHO Data

Ideally, in the preceding analysis we would have measured the change in short interest during the few days surrounding the issuance; however, the short interest data are available only on a monthly basis. 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

[22]Our analysis assumes constant volatility. It is also possible that managers attempt to time the debt issue when volatility is high (increasing the option value). On the other hand, the proceeds of the offering could be used for riskier projects, implying an increase in idiosyncratic volatility. If either of these impact volatility changes, we would expect them to be most evident in the intercept, not the coefficients on our SI measures.

capture short sales transactions close to the issue date.[23] If arbitrageurs dynamically hedge, then transactions will provide additional information. The SHO data allow us to supplement the main analysis in three ways: (1) we observe short sales transactions rather than changes in short interest; (2) we are able to observe trading at the issue date; and (3) we can examine changes in short selling activity following issuance. If the convertible bond issuance allows for a relaxation of the short sales constraint then we expect to observe an increase in short selling following issuance.

Figure 4 illustrates short selling activity near the convertible bond issue date for our sample of year 2005 issues. The figure provides further evidence that we are identifying convertible bond arbitrage and not short selling due to other factors. We measure both the number of short sales transactions as well as the volume of short selling as a fraction of shares outstanding. The figures show that short selling increases on the convertible bond issue date. The figure also suggests that the level of short selling activity following issuance is higher during the post event period. We test this observation explicitly in the results presented in Table 6.

Table 6 summarizes changes in short selling activity in stocks of convertible bond issuers between March 2005 and November 2005. The "Pre period" is defined as the 20 trading days month ending 1 month prior to issuance. "Post period" is defined as the 20 trading days beginning 1 month following issuance. The change is defined as the mean (or median) measure in post period minus the mean (median) measure in pre period. For comparison, we also present results for matched firms.[24] "Match 1" are firms matched based on total assets, profitability and liquidity prior to issuance. "Match 2" firms are matched based on size and short interest changes. The key finding in the table is that short selling activity increases

[23]The U.S. Securities and Exchange Commission adopted Regulation SHO in June of 2004.

[24]Diether, 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 matching firms is critical in this study because SHO relaxes the short sales constraints for a sub-sample of stocks. The results in Table 6 indicate that the documented changes in short selling activity for issuing firms are not driven by Regulation SHO. In our sample if 63 issuers, 14 are pilot stocks (in which the "up-tick" 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 in the "Match 1" group and 12 of the "Match 2" stocks are pilot stocks. Therefore, regulation SHO affects all our 3 groups, but the strong results of increased short selling activity in Table 6 is evident only for issuing firms.

following issuance. Moreover, we do not find similar results for our matched firms.

6 Issuance, Fund Flows, Returns and Industry Structure

The cross-sectional results presented in the previous sections indicate that the convertible bond arbitrage strategy has a significant impact on liquidity of the market for the underlying stock. In this section, we conduct analyses of aggregate convertible bond issuance, arbitrage activity and convertible bond hedge fund flows and returns. We have two goals. First, we are interested in whether, in addition to generating liquidity externalities (documented above), convertible bond arbitrageurs are also an important source of financing to issuers. If issuers face financing constraints then supply of capital from arbitrageurs will impact issuance. Our second aim is to characterize times during which convertible bond arbitrageurs tend to be active in markets. This provides potentially important insights to managers considering the timing of a bond issue.

Before turning to the main analysis, it is useful to discuss the new data to be included in the time series analysis. In addition to dollar proceeds (total monthly issuance) and dollar arbitrage activity (calculated as the sum of firm-level changes in short interest at issuance), we add convertible bond arbitrage hedge fund flows and returns data. Convertible bond arbitrage hedge funds are not the only buyers of convertible debt; however anecdotal evidence suggests that they account for 80 to 90 percent of investors in primary convertible bond offerings. The benefit of the hedge fund data is that we are able to observe growth of the assets allocated to the strategy for a large subset of convertible bond arbitrageurs. We are also able to observe performance of the strategy. These are two potential sources of capital supply to issuers that we would be unable to identify with the issuer-level data used in the first part of this analysis. On the other hand, the aggregate SI measure is useful in this portion of the analysis for several reasons: First, the fund flows that we observe do not capture the entire convertible bond arbitrage industry. Second, hedge funds can also use

leverage to supply financing. Finally, hedge funds do not have to immediately use fund flows for convertible bond arbitrage.

We focus on four key variables: Aggregate issuance (proceeds), convertible bond arbitrage hedge fund flows, fund returns and arbitrage activity (dollar changes in short interest or "SI" calculated in the previous section). Hedge fund flows are interpreted as a potential source of financing for issuers. Since fund size can also grow without new flows (through returns), we also consider convertible bond arbitrage fund returns as a potential source of capital. We interpret the aggregate change in short interest variable as an indicator of convertible bond arbitrage activity and opportunities.[25]

6.1 Construction of Variables

Aggregate dollar proceeds and arbitrage activity ("SI") are calculated by summing the dollar values of all convertible bond issues and dollar changes in short interest, respectively, for each month of our sample period. The variables constructed from the hedge fund databases are constructed as follows:

- Asset returns. $Asset\_return$ is calculated as the asset-weighted return for each month. To calculate the quarterly asset return, we compound monthly returns for 3 months.

- Flow of Funds. Consistent with the empirical literature, we define $Flow$ as a percentage change in new assets adjusted for returns.

$$Flow_t = \frac{Assets_t - Assets_{t-1}(1+r_t)}{Assets_{t-1}} \quad (2)$$

[25]Given that most of the returns to the strategy are from the bond side (i.e., the evidence that we presented in Table 3 and 5 do not show significant improvement in the efficiency of stock prices), we interpret high levels of short selling near convertible bond issuance to under pricing in bonds. Getmansky, Lo and Makarov (2004) report high Sharpe ratios for the convertible bond arbitrage strategy. Henderson (2005) studies the post-issue performance of convertible bonds and reports that convertible bonds are under priced at issuance.

where r_t is the asset return at time t, and $Assets_t$ represents the sum of all assets of convertible bond arbitrage funds at time t.[26] To calculate percentage quarterly flows, we sum monthly dollar flows for 3 months and divide them by the previous total assets in the category.

Convertible bond arbitrage hedge fund returns and flows allow us to test the "returns-chasing" hypothesis. Table 7 provides a summary of these variables. Monthly mean return to the convertible bond arbitrage strategy over the 1991 to 2005 period is 0.7 % and the standard deviation is 1.4%. The strategy returns are volatile. Similarly, fund flows fluctuate from -7.6% to 10.8%, indicating that the entire strategy can fall out of favor and experience net outflows.[27]

Figures 5a and 5b show time series for the market short selling at issuance and convertible bond hedge fund flows, respectively. From the figures, these two series move together. For example, flows were particularly high during the 2000-2003 period, as was short selling activity near issuance. Both declined significantly in 2005 in which there was a significant outflows of funds.[28]

Returns exhibit high first order autocorrelation of 33.6%. This serial correlation coefficient is consistent with 22.5% found by Getmansky, Lo and Makarov (2004) in their analysis of individual convertible bond (Long Only) arbitrage hedge fund returns. In fact, the authors report that the convertible bond arbitrage strategy has the highest first order autocorrelation coefficient compared to other hedge fund strategies, consistent with the illiquidity of some of the securities involved.[29] Finally, flows are also sticky. The first order autocorrelation coefficient is 31.1%. This is consistent with findings that flows are persistent for at least 2 quarters (Getmansky (2005) and Ding, Getmansky, Liang and Wermers (2006)).

[26]Returns are net of fees. We assume that fees are withdrawn from the fund. However, sometimes, there is a provision for fees to be reinvested into the fund.

[27]All variables, except assets, are stationary.

[28]At the end of 2005, there were six consecutive quarters of asset loss in this category. In 2005, the convertible arbitrage managers suffered net redemptions of over $8 billion (Tremont Company). At that point, more than 50% of managers left the industry.

[29]The autocorrelation in convertible bond index returns is much higher than other indices: Ibbotson Long-Term Government bonds (6.7%), Ibbotson Long-Term Corporate bonds (15.6%), Ibbotson Large company (8.8%), Vanguard 500 Index Trust (-2.3%) and even Merrill Lynch Convertibles Index (6.4%) (Getmansky, Lo and Makarov, 2004).

Hedge fund investors can choose from among numerous hedge fund strategies. One potential substitute to convertible bond arbitrage strategy is merger arbitrage. Similar to the convertible bond arbitrage strategy, merger arbitrage involves shorting a stock (of the acquirer).[30] In the case of merger arbitrage, acquirer stock is typically short while target stock is bought. Several hedge funds have technology to implement both strategies and they can allocate funds across these based on the potential profitability of each strategy. Therefore, substitutes may play an important role in determining flows to convertible bond arbitrage and the activity of convertible bond arbitrageurs in the market. We add data on merger arbitrage flows and returns in order to explore this possibility.[31]

In our analysis, we concentrate both on monthly and quarterly analyses. Variables directly linked to arbitrage strategies such as proceeds, SI, and market factors are more likely to have an immediate effect (within a month) on flows and returns. However, investor decisions such as when to invest in a particular hedge fund or an industry are more likely to be noticed on longer time intervals (within a quarter). For investors to act on past information may take time, given the fact that hedge funds impose subscription, redemption, notice periods ranging from 30-90 days and lock-up periods averaging 1-2 year that restrict fund flows.

6.2 Results: Proceeds

The findings in Table 8 are results of a regression of total proceeds on past convertible bond arbitrage hedge fund returns, fund flows, and our market-wide convertible bond arbitrage

[30]This is true for stock deals. When there is a cash transaction, there is no need to short an acquirer.

[31]Note that median monthly returns to the merger arbitrage strategy are larger than for the convertible arbitrage strategy (1.0% versus 0.8%, respectively). Standard deviations are 1.2% and 1.4%, respectively. Median (0.6%) percentage flows into merger arbitrage funds are much smaller than median (1.3%) flows to convertible bond arbitrage funds, which can be explained largely by much larger mean ($7,794 million) assets under management for the merger arbitrage category compared to the convertible arbitrage strategy with the mean assets under management of $2,862 million.

measure ("SI").

$$Proceeds_t = \alpha + \beta_1 Asset\_return_{t-1} + \beta_2 Flow_{t-1} + \beta_3 Short\_Interest_{t-1} + \beta_4 Market\_return_{t-1} + \beta_5 Proceeds_{t-1} + \epsilon_t \quad (3)$$

Where:

- *Proceeds* measures the natural logarithm of the dollar value of all convertible bonds issued.
- *Asset_Return* is the asset-weighted convertible bond arbitrage hedge fund return in excess of the risk-free rate.[32]
- *Flow* is defined as the total dollar flow into convertible bond arbitrage hedge funds divided by past assets.
- *Short_Interest* is constructed by summing the SI measures for all issuers generating change in SI as a result of bond issuance in the current month. The SI measure is the dollar value of the change in short interest, that is, the difference between short interest in the current month and short interest in the previous month, times the closing stock price on the issue date.
- *Market_return* is the value-weighted CRSP return in excess of the risk-free rate.

In perfect capital markets, firms will issue new securities when they have profitable investment opportunities. The availability of funds from a particular type of financing source will be unimportant; however, if firms face binding financial constraints and if convertible bond arbitrageurs are an important supplier of funds to issuers then the availability of funds from this source will matter.

[32]The risk-free rate is the one-month Treasury bill rate obtained from Kenneth French's website: *http* : *//mba.tuck.dartmouth.edu/pages/faculty/ken.french/*

Results of estimation in Table 8 strongly suggest that convertible bond arbitrageurs are linked to future issuance. We observe positive relationships between prior returns (estimate is 0.443 and t-statistic is 2.73) and flows (estimate is 0.074 and t-statistic is 1.86) and future proceeds, evidence of *P3*. The results are significant using monthly regressions. Therefore, convertible arbitrage funds are an important supply of funds for issuers and issuers react quickly to tap the new source of funds. Note that these results disappear in quarterly regressions, indicating a quicker response by issuers to changes in supply. We also include the market-wide SI measure since this variable represents actual convertible bond arbitrage activity (beyond changes in supply of funds). We interpret this variable as past arbitrage opportunities, which may have an independent impact on future willingness of arbitrageurs to supply funds to issuers. Interestingly, we also observe a significant and positive estimated coefficient on this variable (estimate is 0.912 and t-statistic is 2.30). This provides further evidence of *P3* and suggests an additional role of using data-driven strategies to infer arbitrage. We include stock market returns (CRSP value-weighted market return) in addition to returns to the convertible bond arbitrage strategy because, to the extent that convertible bond issues are simply "back-door" equity financing (as in Stein (1992)), managers may want to issue bonds following increases in equity market valuations. The estimated sign on this variable is positive, however it is insignificant. Results suggest that past returns to the strategy are more important than market returns for future issuance.

6.3 Results: Fund Flows

Understanding the dynamics of fund flows will help us to establish when convertible bond arbitrageurs are more likely to be active in the market as well as provide an estimate of an important supply of capital to convertible bond issuers. We also study possible return chasing behavior. Flows are measured as dollar flows into convertible bond arbitrage funds per dollar assets during the previous month. The regression specification is as follows:

$$Flow_t = \tag{4}$$
$$\alpha + \beta_1 Asset\_return_{t-1} + \beta_2 Flow_{t-1} + \beta_3 Short\_Interest_{t-1} + \beta_4 Proceeds_{t-1} + \epsilon_t$$

Where:

- *Asset_Return* is the asset-weighted convertible bond arbitrage hedge fund return in excess of the risk-free rate.
- *Flow* is defined as the total dollar flow into convertible bond arbitrage hedge funds divided by past assets.
- *Short_Interest* is constructed by summing the SI measures for all issuers generating change in SI as a result of bond issuance in the current month. The SI measure is the dollar value of the change in short interest, that is, the difference between short interest in the current month and short interest in the previous month, times the closing stock price on the issue date.
- *Proceeds* measures the natural logarithm of the dollar value of all convertible bonds issued.

The flow regressions and asset returns regressions (not reported) are estimated using both monthly and quarterly data. The latter specification is intended to address potential frictions caused by lock-up provisions and redemption periods, which delays the speed at which investors are able to move money to and from the funds.

Results from the fund flows regressions are presented in Table 9 Panel A. First, we see that flows are autocorrelated. We find the return chasing behavior in the quarterly data (coefficient is 0.624 and t-statistic is 2.1), but not at the monthly level. This suggests that it takes time for investors to react to past returns. This may be due to institutional factors such as long subscription periods, notice and withdrawal periods. Even if investors decide to

react to past returns, it might take them several months to withdraw funds. We also find a strong link between monthly measures of arbitrage activity (short selling from the aggregate data) and hedge fund flows. Lagged arbitrage activity is significantly and positively related to current flows. The coefficient of 0.937 on monthly intervals suggests that prior *activity* matters in predicting future flows (t-statistics is 2.0).

In Panel B, we consider the possibility that substitute markets will impact convertible bond arbitrage flows and the presence of arbitrageurs in the market. To address this issue, we propose the following specification:

$$\begin{aligned} Flow_t &= \alpha + \beta_1 Asset\_return_{t-1} + \beta_2 Merger\_Asset\_return_{t-1} \\ &\quad + \beta_3 Flow_{t-1} + \beta_4 Merger\_Flow_{t-1} + \beta_5 Short\_Interest_{t-1} \\ &\quad + \beta_6 Merger\_Short\_Interest_{t-1} + \beta_7 Proceeds_{t-1} \\ &\quad + \beta_8 Target\_Market\_Value_{t-1} + \epsilon_t \end{aligned} \tag{5}$$

Where:

- $Asset\_Return$ ($Merger\_Asset\_Return$) is the asset-weighted convertible bond (merger) arbitrage hedge fund return in excess of the risk-free rate.

- $Flow$ ($Merger\_Flow$) is defined as the total dollar flow into convertible bond (merger) arbitrage hedge funds divided by past assets.

- $Short\_Interest$ ($Merger\_Short\_Interest$) is constructed by summing the SI measures for all issuers (acquirers) generating change in SI as a result of bond issuance (takeover announcement) in the current month. The SI measure is the dollar value of the change in short interest, that is, the difference between short interest in the current month and short interest in the previous month, times the closing stock price on the issue date (announcement date).

- *Proceeds* measures the natural logarithm of the dollar value of all convertible bonds issued.

- $Target\_Market\_Value$ is the natural logarithm of the total target market capitalization for all takeovers announced in the current month.

When we include merger arbitrage data, we find evidence of this substitution effect on monthly basis. The supply of merger activity, proxied by the market value of target firms is negatively related to flows into the convertible arbitrage category: -0.391 (t-statistic is -2.4) on monthly intervals and -2.802 (t-statistic is -2.8) on quarterly intervals.

We also performed similar analyses for asset returns to determine whether fund flows and the supply of convertible bonds impact returns to the strategy. We find the presence of both bond and stock exposures. Returns are also autocorrelated. However, returns are not related to past flows, arbitrage activity or proceeds.

6.4 Results: SI

The specification and interpretation of the arbitrage activity (SI) regression is similar to the flow regression (Table 9). We estimate a model of SI in order to establish when convertible bond arbitrageurs are more likely to be active. We also study possible return chasing behavior.

$$
\begin{aligned}
Short\_Interest_t = \quad & (6) \\
& \alpha + \beta_1 Asset\_return_{t-1} + \beta_2 Merger\_Asset\_return_{t-1} + \beta_3 Short\_Interest_{t-1} \\
& + \beta_4 Flow_{t-1} + \beta_5 Merger\_Short\_Interest_{t-1} + \beta_6 Merger\_Flow_{t-1} \\
& + \beta_7 Proceeds_{t-1} + \beta_8 Target\_Market\_Value_{t-1} + \epsilon_t
\end{aligned}
$$

Where:

- $Asset\_return$ ($Merger\_Asset\_return$) is the asset-weighted convertible bond (merger) arbitrage hedge fund return in excess of the risk-free rate.

- $Flow$ ($Merger\_Flow$) is defined as the total dollar flow into convertible bond (merger) arbitrage hedge funds divided by past assets.

- *Short_Interest* (*Merger_Short_Interest*) is constructed by summing the SI measures for all issuers (acquirers) generating change in SI as a result of bond issuance (takeover announcement) in the current month. The SI measure is the dollar value of the change in short interest, that is, the difference between short interest in the current month and short interest in the previous month, times the closing stock price on the issue date (announcement date).

- *Proceeds* measures the natural logarithm of the dollar value of all convertible bonds issued.

- $Target\_Market\_Value$ is the natural logarithm of the total target market capitalization for all takeovers announced in the current month.

The results of estimation are presented in Table 10. We find that past asset returns, even at the monthly level, are important predictors of future convertible bond arbitrage activity. Specifically, the coefficient on the lagged asset return to convertible bond arbitrage hedge funds is 0.055 (t-statistic is 1.69) in monthly regressions. Note that we obtain this result only when we include the possibility of substitute markets (e.g., merger arbitrage, in Panel B). When we do not include substitute markets (Panel A), the coefficient estimate on asset returns is insignificant. This is due to the significant and negative relationship between convertible bond arbitrage activity and lagged merger arbitrage returns (that is, omitting merger arbitrage returns biases the estimated coefficient on convertible bond arbitrage returns). This highlights the importance of explicitly consideration of substitutes.

Comparison with the results from the Flow regressions (Table 9) provides additional insights. Recall that in the flow regressions (Table 9), returns were only significant in the quarterly data. This is likely to be caused by frictions in the timing of deposits and redemptions in convertible bond arbitrage funds (i.e., long subscription, redemption, notice and lock-up periods). Our SI measure is a measure of convertible bond arbitrage *activity* and is likely to be more responsive to market conditions than the somewhat constrained measure of fund flows. The returns chasing result using the monthly data for SI is consistent with

constraints to fund flows and also suggests the importance of examining arbitrage activity (along with fund flows) when assessing the likelihood that arbitrageurs will be active in a new issue of convertible debt.

To summarize, we have established a close link between short interest, bond issuance and hedge fund activity. Issuance follows increases in the supply of capital to convertible bond arbitrageurs. Closer analysis of fund flows and profitability of the convertible bond arbitrage hedge fund industry indicates that as returns increase, future flows increase. Opportunities in substitute markets (i.e., merger arbitrage) have the opposite effect on flows to convertible arbitrage funds. Fund flows also follow prior periods of high convertible bond arbitrage *activity*, as captured by the amount of short selling near issuance. These dynamic relationships should give managers issuing convertible debt some indication of market conditions faced by a significant source of capital.

7 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. We then map our measures of convertible bond issuance and arbitrage activity to flows and returns in convertible bond arbitrage hedge funds.

What distinguishes our basic approach is that unlike prior studies of the impact of derivatives markets (securities that can help complete markets) on stock markets, 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 equity market trader-type. This helps shed additional empirical light on the issue of how the introduction of new securities that are used by arbitrageurs can impact overall market quality.

In the first part of the analysis, we document changes in liquidity, and price volatility following issuance of convertible debt. We examine linkages between changes in these vari-

ables and proxies for convertible bond arbitrage. We find that convertible bond issuance is associated with increases in stock liquidity and this increase is systematically related to the intensity of convertible bond arbitrage activity. We do not find evidence of a systematic relationship between arbitrage activity and changes in impact on stock volatility and efficiency; however we do find evidence in average changes in these measures near issuance.

Issuers considering the timing of convertible bond issuance should be interested in the question of when convertible bond arbitrageurs likely to be active in the market, given that convertible bond arbitrage improves equity market liquidity and that arbitrageurs may be an important source of capital. We link our data on convertible bond issuance to data on convertible bond hedge funds to examine dynamic relationships between issuance, hedge fund flows, returns and arbitrage activity. We document a strong link between supply of capital (through both hedge fund returns and flows, as well as past arbitrage activity) and future bond issuance.

We also find that flows to the strategy are predictable. Consistent with returns-chasing, fund flows are positively linked to past returns to the strategy. Flows are also higher when substitute markets are smaller (our proxy is the supply of deals for merger arbitrage). From the perspective of issuers, this suggests not only that they should expect liquidity improvements in their stock following issuance but also that supply of capital (i.e., convertible bond arbitrage hedge fund flows) is predictable.

References

Agarwal, Vikas, Naveen D. Daniel and Narayan Y. Naik, 2004, "Flows, performance, and managerial incentives in the hedge fund industry," George State University Working Paper.

Agarwal, V. and N. Naik, 2004, "Risks and Portfolio Decisions Involving Hedge Funds," *Review of Financial Studies* 17, 63–98.

Agarwal, Vikas, William H. Fung, Yee Cheng Loon and Narayan Y. Naik, 2006, "Risk and return in convertible arbitrage: Evidence from the convertible bond market," Working Paper.

Amihud, Yakov, 2002, "Illiquidity and stock returns: Cross-section and time-series effects," *Journal of Financial Markets* 5, 31–56.

Arnold, Tom, Alexander W. Butler, Timothy Falcon Crack and Yan Zhang, 2005, "The information content of short interest: a natural experiment," *Journal of Business* 78(4), 1307–1335.

Asquith, Paul, 1995, "Convertible bonds are not called late," *Journal of Finance* 50(4), 1275–1289.

Asquith, Paul and Lisa Meulbroek, 1996, "An empirical investigation of short interest," Harvard Business School Working Paper No. 96-012.

Asquith, Paul, Parag A. Pathak and Jay R. Ritter, 2005, "Short interest, institutional ownership and stock returns," *Journal of Financial Economics* (Forthcoming).

Baquero, Guillermo and Marno Verbeek, 2006 "A Portrait of Hedge Fund Investors: Flows, Performance and Smart Money," Erasmus University Rotterdam Working Paper.

Basak, Suleyman and Benjamin Croitoru, 2005 "On the role of arbitrageurs in rational markets," *Journal of Financial Economics* (Forthcoming).

Bechmann, Ken L., 2004, "Short sales, price pressure, and the stock price response to convertible bond calls," *Journal of Financial Markets* 7, 427–451.

Berk, Jonathan B. and Richard C. Green, 2004, "Mutual fund flows and performance in rational markets," *Journal of Political Economy* 112, 1269–1295.

Boehme, Rodney D., Bartley R. Danielsen, and Sorin M. Sorescu, 2005, "Short sale constraints, differences of opinion, and overvaluation," *Journal of Financial and Quantitative Analysis* (Forthcoming).

Beohmer, Ekkehart, Charles M. Jones and Xiaoyan Zhang, 2005, "Which shorts are informed?," Working Paper.

Bias, Bruno and Pierre Hillion, 1994 "Informed trading in stock and options markets," *Review of Financial Studies* 74, 743–780.

Bris, Arturo, William N. Goetzmann and Ning Zhu, 2004, "Efficiency and the bear: Short sales and markets around the world," Yale International Center for Finance Working Paper No. 0245.

Christophe, Stephen E., Michael G. Ferri and James J. Angel, 2004, "Short-selling prior to earnings announcements," *Journal of Finance* 59(4), 1845–1876.

Chevalier, Judith, and Glenn Ellison, 1997, "Risk taking by mutual funds as a response to incentives," *Journal of Political Economy* 105, 1167–1200.

Dechow, Patricia, Amy Hutton, Lisa Meulbroek and Richard Sloan, 2001, "Short sellers, fundamental analysis and stock returns," *Journal of Financial Economics* 61(1), 77–106.

DeTemple, Jerome and Philippe Jorion, 1990,"Option listing and stock returns," *Journal of Banking and Finance* 14, 781–801.

Diether, Karl, Kuan Hui Lee and Ingrid Werner, 2005, "It's SHO Time! Short Sales Price Tests and Market Quality," Ohio State University Working Paper.

Diamond, Douglas W. and Robert E. Verrecchia, 1987, "Constraints on short-selling and asset price adjustment to information," *Journal of Financial Economics* 18, 277–311.

Ding, Bill, Mila Getmansky, Bing Liang and Russ Wermers, 2006, "Market volatility, investor flows, and the structure of hedge fund markets," Working Paper.

Easley, David and Maureen O'Hara, 1987, "Price, trade size and information in securities markets," *Journal of Financial Economics* 19, 69–90.

Easley, David, Maureen O'Hara and P.S. Srinivas, 1998, "Option volume and stock prices: Evidence on where informed traders trade," *Journal of Finance* 53(2), 431-465.

Faulkender, Michael and Mitchell Petersen, 2005, "Does the Source of Capital Affect Capital Structure?" *Review of Financial Studies* 19(1), 31–79.

Getmansky, M., Lo, A. and I. Makarov, 2004, "An Econometric Analysis of Serial Correlation and Illiquidity in Hedge-Fund Returns," *Journal of Financial Economics* 74 (3), pp.529–610.

Getmansky, Mila, 2005, "The life cycle of hedge funds: Fund flows, size and performance," University of Massachusetts, Amherst Working Paper.

Glosten, Lawrence and Paul Milgrom, 1985, "Bid, ask, and transaction prices in a specialist market with heterogeneously informed traders," *Journal of Financial Economics* 14(1), 71–100.

Goetzmann, William N., Ingersoll, Jonathan and Stephen Ross, 2003, "High-Water Marks and Hedge Fund Management Contracts," *Journal of Finance* 58, 4, 1685–1717.

Goetzmann, William N.and Nadav Peles, 1997, "Cognitive dissonance and mutual fund investors," *Journal of Financial Research* 20, 145–158.

Gomes, Armando and Gordon Phillips, 2005, "Why do firms issue private and public securities?," Working Paper.

Grossman, Sanford J., 1988, "An analysis of the implications for stock and futures price volatility of program trading and dynamic hedging strategies," *Journal of Business* 61(3), 275–298.

Gruber Martin J., 1996,"Another puzzle: The growth in actively managed mutual funds," *Journal of Finance* 51, 783–810.

Henderson, Brian J., 2005, "Convertible bonds: New issue performance and arbitrage opportunities," Working Paper.

Ingersoll, Jonathan, 1977, "An examination of corporate call policies on convertible securities," *Journal of Finance* 32(2), 463–78.

Ippolito, Richard A., 1992,"Consumer reaction to measures of poor quality: Evidence from the mutual fund industry," *Journal of Law and Economics* 35, 45–70.

Jones, Charles M. and Owen Lamont, 2002, "Short-sale constraints and stock returns," *Journal of Financial Economics* 66, 207–239.

Kumar, Raman, Atulya Sarin and Kuldeep Shastri, 1998, "The Impact of options trading on the market quality of the underlying security: An empirical analysis," *Journal of Finance* 53, 717–732.

Kyle, Albert S., 1985, "Continuous auctions and insider trading," *Econometrica* 53(6), 1315-35.

Lamont, Owen A and Jeremy C. Stein, 2004 "Aggregate short interest and market valuations," *American Economic Review, AEA Papers and Proceedings* (May) 29–34.

Mayhew, Stewart, 2000 "The impact of derivatives on cash markets: What have we learned?," University of Georgia Working Paper.

Mitchell, Mark, Todd Pulvino and Erik Stafford, 2004, "Price pressure around mergers," *Journal of Finance* 59(1), 31–63.

Ross, Stephen, 1976, "Options and efficiency," *Quarterly Journal of Economics*, 90 (1), 75–89.

Securities and Exchange Commission, 2003, "Implications of the growth of hedge funds," Staff Report (9/2003).

Sirri, Erik R. and Peter Tufano, 1998, "Costly search and mutual fund flows," *Journal of Finance* 53, 1589–1622.

Stein, Jeremy C., 1992, "Convertible bonds as a backdoor to equity financing," *Journal of Financial Economics* 32, 3–21.

Zheng, Lu, 1999, "Is money smart? A study of mutual fund investors' fund selection," *Journal of Finance* 54, 910–933.

Table 1
Issuing Firms and Characteristics

This table presents summary statistics on our sample of convertible bond issues between January 1991 and May 2005. *Market Cap* is the issuing firm's equity market capitalization. *Debt/Equity* is the ratio of long term debt to equity market capitalization in the fiscal year prior to issuance. *NYSE* and *Nasdaq* are dummy variables. *Daily Dollar Volume* is the average daily dollar volume of the stock. *Beta* is the coefficient estimate of the regression of daily stock excess return on CRSP value-weighted market excess return. *Issue Size* is the face value of the convertible bond times its offer price. *Issue Size/Market Cap* is *Issue Size* divided by *Market Cap* . *Level of Short Interest* is the average monthly short interest prior to the issue month.

All daily and monthly measures are calculated using data from the 6 months ending 1 month prior to issuance. Variables with percentage sign (%) are in percentage terms.

N = 1356

	Mean	Median	Standard Deviation
Market Cap ($ million)	3,625	814	11,136
NYSE	0.45	0	0.50
Nasdaq	0.54	1	0.50
Debt/Equity	0.53	0.16	1.35
Daily Dollar Volume ($ million)	31.50	7.48	93.05
Beta	1.25	1.17	0.84
Issue Size ($ million)	228.83	135.00	306.28
Issue Size/Market Cap (%)	20.57	15.40	33.44
Level of Short Interest (000 Shares)	4,154	1,390	12,213
Short Interest/Shares Outstanding (%)	3.92	2.48	4.59

Figure 1
Mean and Median Short Interest Intensities During Event Window

The charts show the mean and median short interest intensities during the event window (months -6 to +6). *SI_%Issue* is the dollar value of the 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 issue date, divided by issue size (face value of the convertible bond times offer price). *SI_%Shrout* is the change in short interest divided by the number of shares outstanding in the prior month.

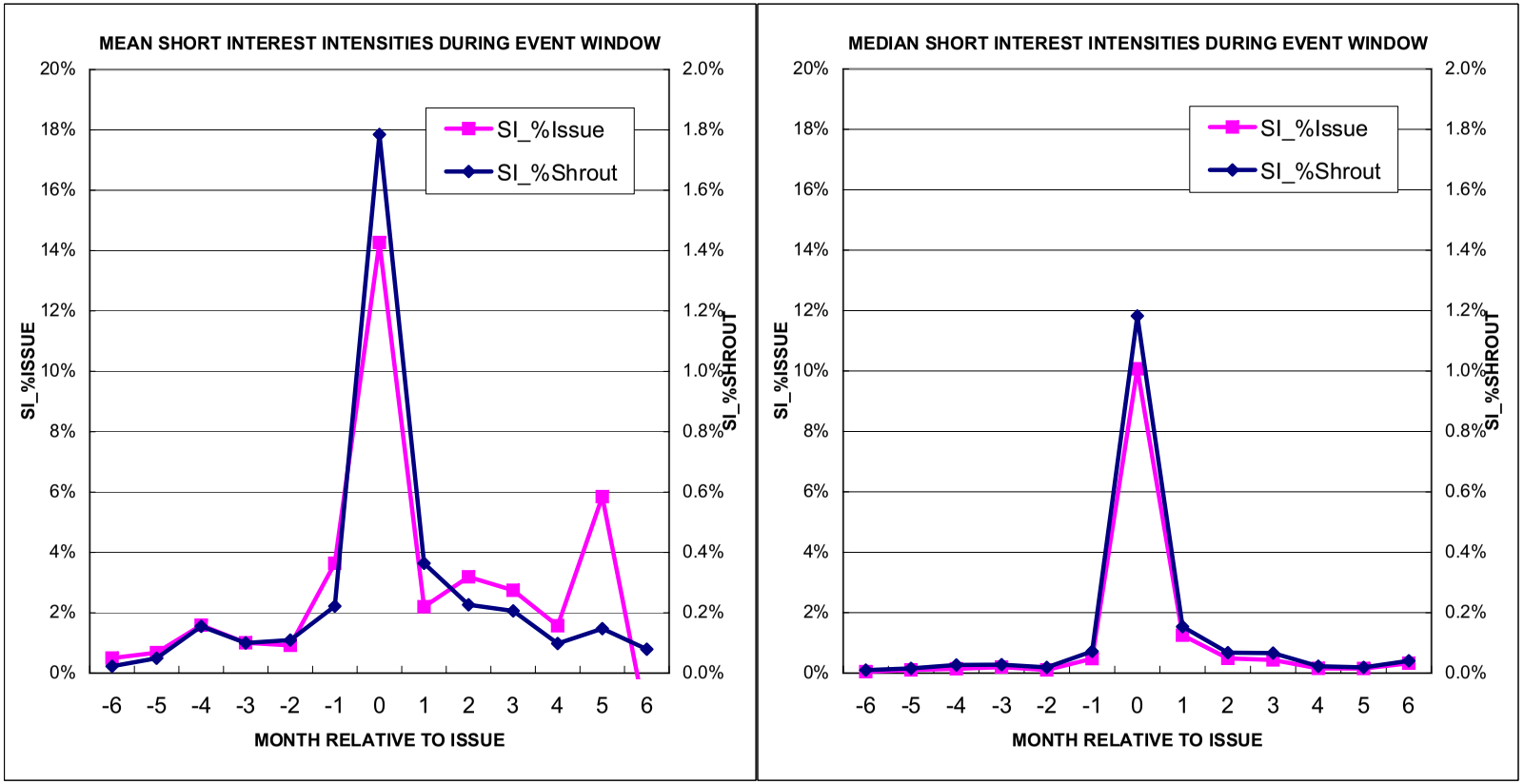


Figure 2
Median Short Interest Intensities at Issue Month

The following chart shows the annual median short interest intensities at the issue month from 1991 to 2005. *SI_%Issue* is the difference between short interest in the current month and short interest in the previous month, multiplied by the closing stock price on the issue date and divided by issue size (face value of the convertible bond times offer price). *SI_%Shrout* is the change in short interest divided by the number of shares outstanding in the prior month. For each year, the median monthly short interest intensities (mean *SI_%Issue* or *SI_%Shrout* of all issuers in a given month) is reported.

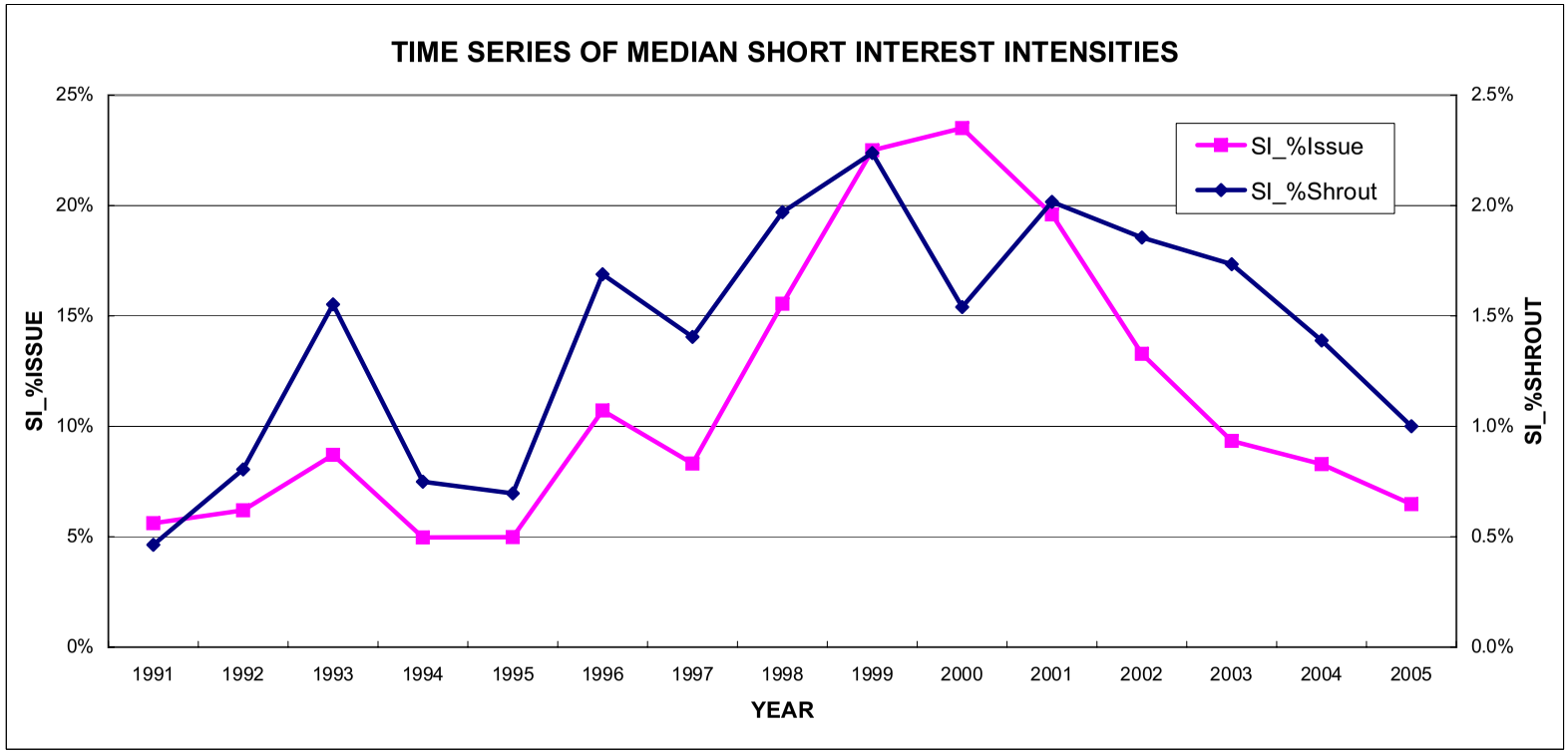


Figure 3a
Yearly Dollar Value of Proceeds and Number of Issues

The charts show the total dollar value of proceeds from convertible bonds and the number of issues in each year from 1991 to 2005.

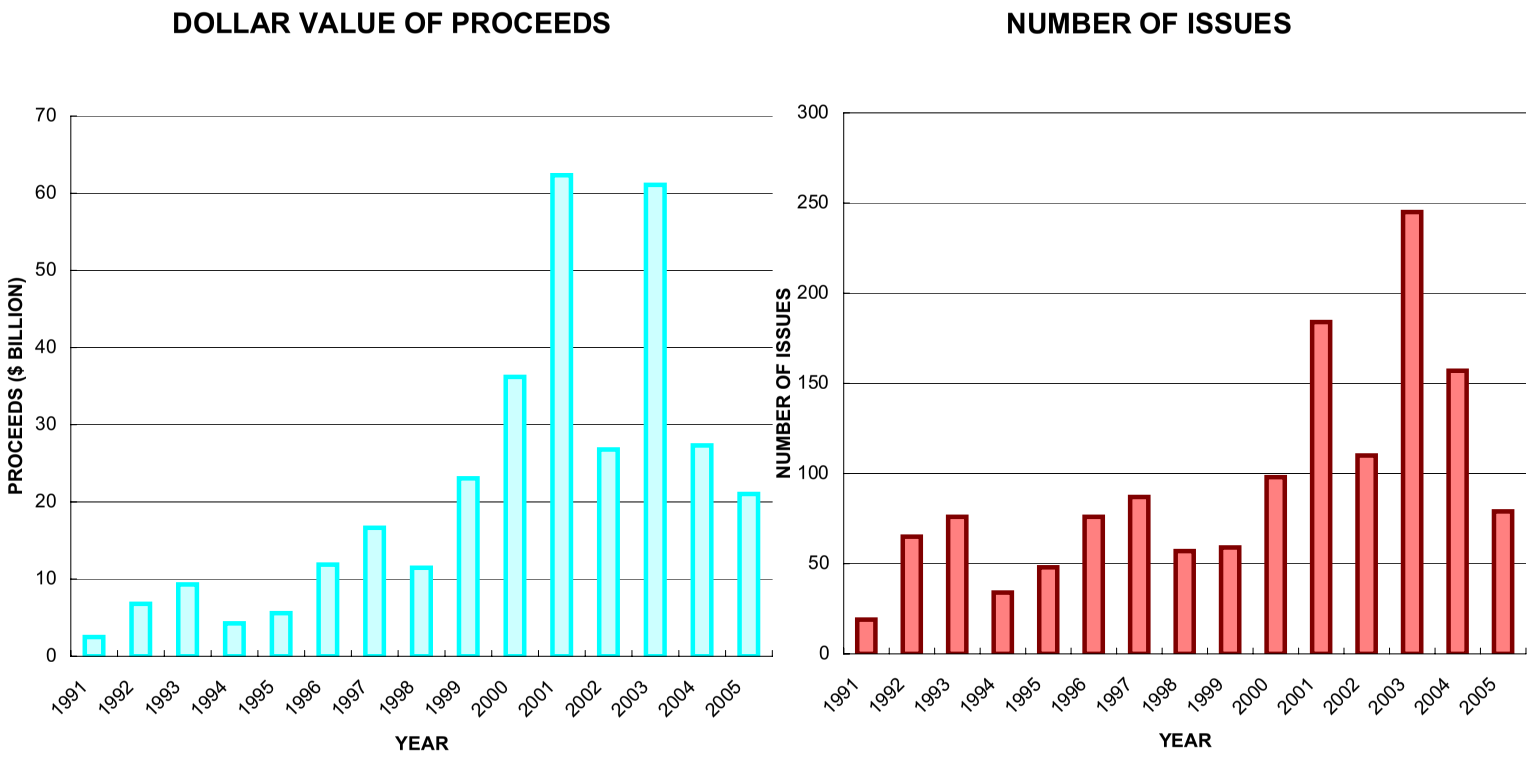


Figure 3b
Total Assets of Convertible Bond Arbitrage Hedge Funds

The chart shows the total assets of convertible bond arbitrage hedge funds from January 1991 to December 2005.

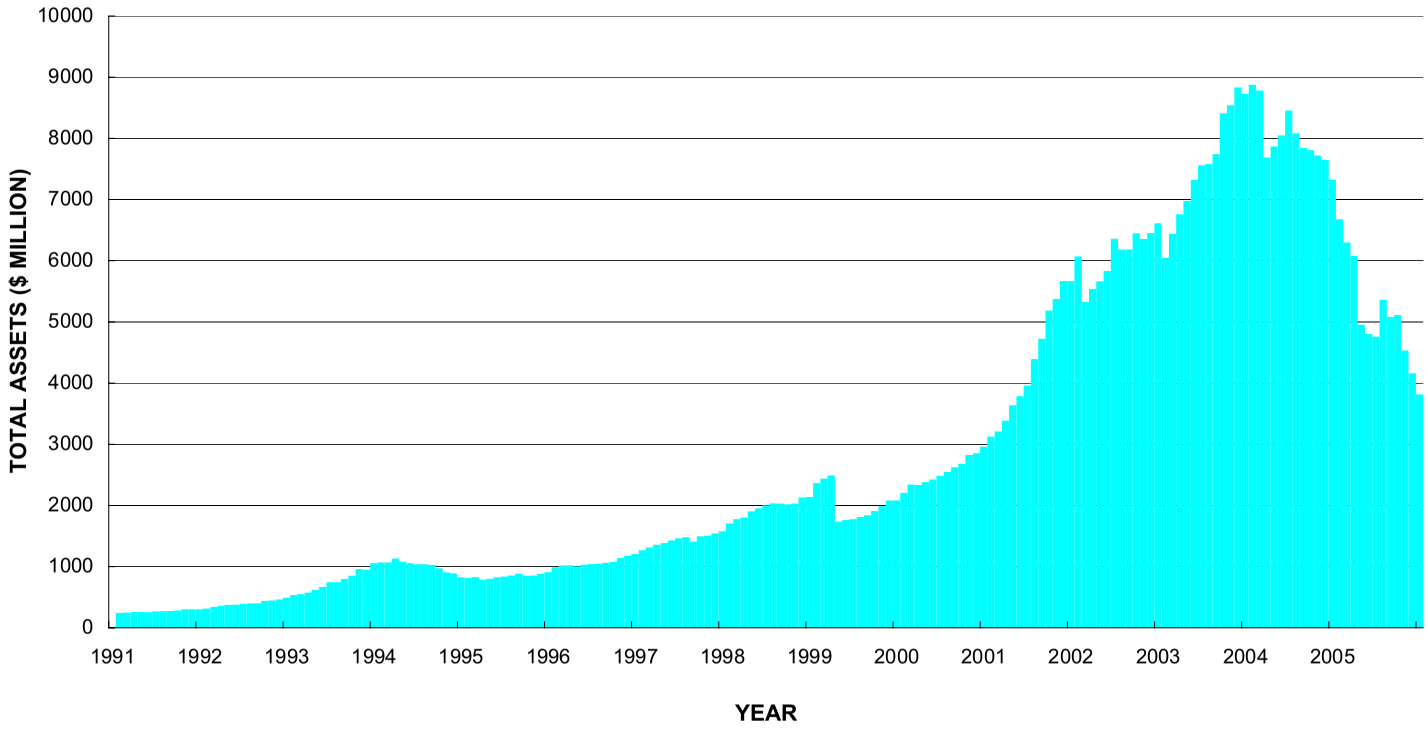


Table 2
Firm Characteristics by Short Interest Portfolios

This table presents firm characteristics prior to issuance. Portfolios are based on arbitrage activity (*SI_%Shrout*) at issuance. The first column ("All") provides summary statistics for all issues. Portfolio 1 (4) corresponds to the smallest (largest) short interest change.

Panel A shows the firm and issue characteristics. *NYSE* and *Nasdaq* are dummy variables, with 1 indicating that the firm is listed on NYSE and Nasdaq, respectively. *Public* is 1 if the convertible bond is a public offering, 0 if private. *Market Cap* is the equity market capitalization. *Level of Short Interest* is the average monthly short interest of the stock prior to the issue month. *Conversion Ratio* is the number of shares of common stock that could be obtained by converting each share of a convertible bond. *Premium* is the percentage amount by which the conversion price exceeds the market value of the common stock at issuance (from SDC).

Liquidity measures are presented in Panel B. *Volume and Dollar Volume* are the average daily stock volume and dollar volume. *Turnover* is the average daily volume divided by shares outstanding. *Amihud* is the average ratio of daily absolute return to dollar volume. *Number of trades* is the average daily number of transactions of the stock. *Dollar Spreads* and *Percentage Spreads* are the difference between bid and ask quotes, expressed as dollars and percentage of bid-ask midpoint, respectively. *Bid Depth/ Out* and *Ask Depth/ Out* are bid and ask depths divided by shares outstanding. Both spreads and depths are calculated using the daily opening quotes on the firm's primary exchange.

Panel C shows stock price and returns measures. *Return* and *Standard Deviation of Return* are the mean and standard deviation of daily stock return. *Idiosyncratic Volatility* and *R-Squared* are the standard deviation of residuals and R-Squared from the regression of daily stock excess return on CRSP value-weighted market excess return. *Beta* is the coefficient estimate of the same regression. *Daily AR(1)* and *Intraday AR(1)* are the first-order autocorrelation of returns, calculated using daily returns and 30-minute interval returns, respectively.

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. Spreads, quotes and intraday measures do not include issues before July 1993. The last two columns show the mean measures of Portfolio 4 minus Portfolio 1 and the t-statistics of the difference between the means. * and ** denote 10% and 5% significance, respectively. Variables with percentage sign (%) are in percentage terms.

N = 1356

Panel A Firm and Convertible Bond Characteristics

		Portfolios based on SI_%Shrout					
	All	1 (Smallest)	2	3	4 (Largest)	P4-P1	t-stat
NYSE	0.449	0.443	0.547	0.447	0.357	-0.085**	-2.253
Nasdaq	0.537	0.521	0.441	0.553	0.634	0.113**	2.952
Public	0.268	0.259	0.315	0.276	0.222	-0.037	-1.110
log Market Cap	20.584	20.331	21.052	20.648	20.303	-0.028	-0.197
log Level of Short Interest	13.649	13.165	13.920	13.805	13.704	0.540**	2.744
Conversion Ratio	39.938	34.322	29.118	45.567	52.908	18.586*	1.716
Premium (%)	33.428	31.201	33.801	33.783	34.902	3.701	0.828

Table 2 (cont'd)

Panel B: Liquidity Measures							
		Portfolios based on SI_%Shrout					
	All	1 (Smallest)	2	3	4 (Largest)	P4-P1	t-stat
log Volume	12.455	12.005	12.758	12.551	12.504	0.500**	3.419
log Dollar Volume	15.351	14.670	15.761	15.555	15.414	0.744**	3.882
log Turnover	-5.221	-5.628	-5.287	-5.084	-4.886	0.742**	8.849
log Amihud	-20.051	-19.755	-20.450	-20.158	-19.842	-0.087	-0.571
log Number of Trades	5.847	5.497	6.188	5.845	5.862	0.364**	2.595
Opening Dollar Spreads	0.236	0.216	0.207	0.300	0.217	0.001	0.030
Opening Percentage Spreads (%)	1.207	1.693	1.032	1.044	1.091	-0.602**	-4.319
Opening Bid Depth/ Out (%) x 100	0.372	0.474	0.278	0.339	0.396	-0.078	-0.993
Opening Ask Depth/ Out (%) x 100	0.426	0.499	0.338	0.406	0.462	-0.037	-0.533

Panel C: Prices and Returns Measures							
		Portfolios based on SI_%Shrout					
	All	1 (Smallest)	2	3	4 (Largest)	P4-P1	t-stat
Return (%)	0.219	0.120	0.231	0.264	0.262	0.142**	4.366
Standard Deviation of Return (%)	3.802	3.922	3.476	3.681	4.131	0.210	1.164
Idiosyncratic Volatility (%)	3.484	3.677	3.145	3.336	3.780	0.103	0.584
R-Squared (%)	15.913	13.879	17.699	16.405	15.663	1.784*	1.734
Beta	1.255	0.989	1.289	1.375	1.366	0.377**	5.736
Daily AR(1)	-0.014	-0.045	-0.007	0.002	-0.005	0.040**	3.969
Intraday AR(1)	-0.175	-0.803	0.048	0.008	0.006	0.810	1.030

Table 3a
Changes in Firm Characteristics by Short Interest Portfolios

This table presents the change in firm characteristics, by portfolios that are formed based on change in short interest (*SI_%Shrout*) at issuance. Changes are defined as the average measure in post period minus the pre period measure. "Pre period" is defined as the 6 months (2 months for *Intraday AR(1)*) ending 1 month prior to issuance. "Post period" is the 6 months (2 months for *Intraday AR(1)*) starting 1 month after issuance. The first column ("All") is the portfolio of all issues. Portfolio 1 (4) corresponds to the smallest (largest) short interest change.

Panel A shows the changes in issuing firm liquidity measures. *Level of Short Interest* is the average monthly short interest of the stock. *Volume* and *Dollar Volume* are the average daily stock volume and dollar volume. *Turnover* is the average daily volume divided by shares outstanding. *Amihud* is the average ratio of daily absolute return to dollar volume. *Number of trades* is the average daily number of transactions of the stock. *Dollar Spreads* and *Percentage Spreads* are the difference between bid and ask quotes, expressed as dollars and percentage of bid-ask midpoint, respectively. *Bid Depth/ Out* and *Ask Depth/ Out* are bid and ask depths divided by shares outstanding. Both spreads and depths are calculated using the daily opening quotes on the firm's primary exchange.

Panel B presents the changes in stock price and returns measures. *Return* and *Standard Deviation of Return* are the mean and standard deviation of daily stock return. *Idiosyncratic Volatility* and *R-Squared* are the standard deviation of residuals and R-Squared from the regression of daily stock excess return on CRSP value-weighted market excess return. *Beta* is the coefficient estimate of the same regression. *Daily AR(1)* and *Intraday AR(1)* are the first-order autocorrelation of returns, calculated using daily returns and 30-minute interval returns, respectively. *Abs Daily AR(1)* and *Abs Intraday AR(1)* are the absolute value of *Daily AR(1)*

Changes that are significant at the 1% level are in bold. The last two columns show the mean measures of Portfolio 4 minus Portfolio 1 and the t-statistics of the difference between the means. * and ** denote 10% and 5% significance, respectively. Variables with percentage sign (%) are in percentage terms.

N = 1356

Panel A: Changes in Liquidity Measures

		Portfolios based on SI_%Shrout					
	All	1 (Smallest)	2	3	4 (Largest)	P4-P1	t-stat
log Level of Short Interest	**0.832**	**0.219**	**0.703**	**1.008**	**1.393**	1.174**	13.217
log Volume	**0.357**	**0.220**	**0.284**	**0.406**	**0.517**	0.297**	6.309
log Dollar Volume	**0.375**	**0.161**	**0.295**	**0.496**	**0.548**	0.387**	5.677
log Turnover	**0.229**	**0.094**	**0.171**	**0.288**	**0.365**	0.271**	6.288
log Amihud	**-0.391**	**-0.221**	**-0.385**	**-0.449**	**-0.510**	-0.289**	-4.260
log Number of Trades	**0.324**	**0.130**	**0.261**	**0.372**	**0.515**	0.385**	7.579

Table 3a (cont'd)

Panel A (continued)							
	Portfolios based on SI_%Shrout						
	All	1	2	3	4	P4-P1	t-stat
Opening Dollar Spreads	0.003	0.043	-0.029	0.041	**-0.041**	-0.084	-1.041
Opening Percentage Spreads (%)	**-0.088**	0.079	-0.067	**-0.161**	**-0.188**	-0.267**	-3.341
Opening Bid Depth/ Out (%) x 100	-0.015	-0.001	0.053	-0.058	-0.046	-0.045	-0.954
Opening Ask Depth/ Out (%)x 100	0.009	0.011	0.089	-0.045	-0.012	-0.023	-0.766

Panel B: Changes in Prices and Returns Measures							
	Portfolios based on SI_%Shrout						
	All	1 (Smallest)	2	3	4 (Largest)	P4-P1	t-stat
Return (%)	**-0.195**	-0.056	**-0.221**	**-0.250**	**-0.252**	-0.196**	-4.668
Standard Deviation of Return (%)	**-0.155**	-0.142	**-0.217**	-0.089	-0.171	-0.029	-0.198
Idiosyncratic Volatility (%)	**-0.169**	-0.140	**-0.195**	-0.114	-0.224	-0.084	-0.583
R-Squared (%)	**1.334**	1.060	-0.361	**1.781**	**2.857**	1.797**	1.997
Beta	**0.076**	0.094	-0.012	0.078	**0.146**	0.052	0.853
Daily AR(1)	**0.015**	0.002	0.011	**0.030**	0.019	0.017	1.372
Abs Daily AR(1)	-0.001	0.006	-0.002	-0.002	-0.008	-0.016*	-1.701
Intraday AR(1)	0.188	0.803	-0.009	-0.005	0.008	-0.795	-1.002
Abs Intraday AR(1)	-0.218	-0.783	-0.147	0.000	0.011	0.794	1.019

Table 3b
Match #1: Changes in Firm Characteristics by Short Interest Portfolios

The changes (from pre- to post-issue periods) in issuing firm characteristics *minus* the changes in the matching firm characteristics are shown in the table. "Match #1" firms are matched on total assets, profitability and liquidity in the year prior to issuance. The portfolios are formed using *SI_%Shrout* of the issuers. The first column ("All") is the portfolio of all issues that have matching firms. Portfolio 1 (4) corresponds to the smallest (largest) short interest change.

Panel A shows the liquidity measures. *Volume* and *Dollar Volume* are average daily stock volume and dollar volume. *Turnover* is the average daily volume divided by shares outstanding. *Amihud* is the average ratio of daily absolute return to dollar volume. *Number of trades* is the average daily number of transactions of the stock. *Dollar Spreads* and *Percentage Spreads* are the difference between bid and ask quotes, expressed as dollars and percentage of bid-ask midpoint, respectively. *Bid Depth/ Out* and *Ask Depth/ Out* are bid and ask depths divided by shares outstanding. Both spreads and depths are calculated using the daily opening quotes on the firm's primary exchange.

Panel B presents the stock price and returns measures. *Return* and *Standard Deviation of Return* are the mean and standard deviation of daily stock return. *Idiosyncratic Volatility* and *R-Squared* are the standard deviation of residuals and R-Squared from the regression of daily stock excess return on CRSP value-weighted market excess return. Beta is the coefficient estimate of the same regression. *Daily AR(1)* and *Intraday AR(1)* are the first-order autocorrelation of returns, calculated using daily returns and 30-minute interval returns, respectively. *Abs Daily AR(1)* and *Abs Intraday AR(1)* are the absolute values of *Daily AR(1)* and *Intraday AR(1)* .

Spreads, quotes and intraday data begin July 1993. t-statistics are shown in parentheses. * and ** denote 10% and 5% significance, respectively.

N=1324

Panel A: Liquidity Measures (Changes in Issuing Firm minus Changes in Match #1)

		Portfolios based on SI_%Shrout			
	All	1 (Smallest)	2	3	4 (Largest)
log Volume	0.230**	0.160**	0.171**	0.216**	0.369**
	(10.27)	(2.94)	(4.53)	(5.33)	(8.35)
log Dollar Volume	0.252**	0.127*	0.165**	0.284**	0.426**
	(8.86)	(1.85)	(3.48)	(5.86)	(7.10)
log Turnover	0.184**	0.093*	0.124**	0.205**	0.310**
	(8.93)	(1.87)	(3.32)	(5.70)	(7.67)
log Amihud	-0.241**	-0.162**	-0.198**	-0.211**	-0.391**
	(-8.34)	(-2.28)	(-3.77)	(-4.20)	(-7.03)
log Number of Trades	0.366**	0.249**	0.486**	0.309**	0.420**
	(9.88)	(3.32)	(5.40)	(4.85)	(6.26)
Opening Dollar Spreads	0.007	-0.040	0.020	0.060	-0.016
	(0.29)	(-0.99)	(0.30)	(0.95)	(-0.98)

Table 3b (cont'd)

Panel A (continued)					
		Portfolios based on SI_%Shrout			
	All	1	2	3	4
Opening Percentage Spreads (%)	-0.074*	-0.140	0.009	-0.044	-0.123**
	(-1.94)	(-1.15)	(0.14)	(-0.72)	(-2.34)
Opening Bid Depth/ Out (%) x 100	-0.096	-0.209	0.081	-0.029	-0.223
	(-1.40)	(-1.31)	(0.78)	(-0.26)	(-1.38)
Opening Ask Depth/ Out (%) x 100	-0.036	-0.147	0.070	0.045	-0.114
	(-0.48)	(-0.96)	(0.63)	(0.27)	(-0.75)

Panel B: Prices and Returns Measures (Changes in Issuing Firm minus Changes in Match #1)					
		Portfolios based on SI_%Shrout			
	All	1 (Smallest)	2	3	4 (Largest)
Return (%)	-0.154**	-0.069*	-0.176**	-0.204**	-0.162**
	(-8.66)	(-1.75)	(-5.79)	(-5.51)	(-4.73)
Standard Deviation of Return (%)	-0.076	-0.195	-0.072	0.013	-0.057
	(-1.20)	(-1.05)	(-0.80)	(0.13)	(-0.51)
Idiosyncratic Volatility (%)	-0.076	-0.193	-0.060	0.019	-0.077
	(-1.22)	(-1.05)	(-0.69)	(0.18)	(-0.69)
R-Squared (%)	0.234	0.791	-1.075	0.351	0.865
	(0.62)	(1.10)	(-1.49)	(0.47)	(1.02)
Beta	0.042	0.099	-0.016	0.007	0.079
	(1.38)	(1.16)	(-0.33)	(0.13)	(1.53)
Daily AR(1)	0.021**	0.011	0.024**	0.036**	0.012
	(3.17)	(0.95)	(2.06)	(3.16)	(0.71)
Abs Daily AR(1)	0.003	-0.001	0.004	-0.004	0.011
	(0.49)	(-0.09)	(0.44)	(-0.44)	(0.76)
Intraday AR(1)	0.134	0.618	-0.056	-0.014	0.038
	(0.53)	(0.68)	(-0.68)	(-0.03)	(1.30)
Abs Intraday AR(1)	-0.225	-1.130	-0.026	0.107	0.038
	(-0.93)	(-1.28)	(-0.31)	(0.21)	(1.30)

Table 3c
Match #2: Changes in Firm Characteristics by Short Interest Portfolios

The changes (from pre- to post-issue) in issuing firm characteristics *minus* the changes in the matching firm characteristics are shown in the table. "Match #2" firms are matched based on size, exchange and short interest changes around issuance. The portfolios are formed using *SI_%Shrout* of the issuers. The first column ("All") is the portfolio of all issues that have matching firms. Portfolio 1 (4) corresponds to the smallest (largest) short interest change.

Panel A shows the liquidity measures. *Volume* and *Dollar Volume* are average daily stock volume and dollar volume. *Turnover* is the average daily volume divided by shares outstanding. *Amihud* is the average ratio of daily absolute return to dollar volume. *Number of trades* is the average daily number of transactions of the stock. *Dollar Spreads* and *Percentage Spreads* are the difference between bid and ask quotes, expressed as dollars and percentage of bid-ask midpoint, respectively. *Bid Depth/ Out* and *Ask Depth/ Out* are bid and ask depths divided by shares outstanding. Both spreads and depths are calculated using the daily opening quotes on the firm's primary exchange.

Panel B presents the stock price and returns measures. *Return* and *Standard Deviation of Return* are the mean and standard deviation of daily stock return. *Idiosyncratic Volatility* and *R-Squared* are the standard deviation of residuals and R-Squared from the regression of daily stock excess return on CRSP value-weighted market excess return. *Beta* is the coefficient estimate of the same regression. *Daily AR(1)* and *Intraday AR(1)* are the first-order autocorrelation of returns, calculated using daily returns and 30-minute interval returns, respectively. *Abs Daily AR(1)* and *Abs Intraday AR(1)* are the absolute value of *Daily AR(1)* and *Intraday AR(1)* .

Spreads, quotes and intraday data begin July 1993. t-statistics are shown in parentheses. * and ** denote 10% and 5% significance, respectively.

N = 1160

Panel A: Liquidity Measures (Changes in Issuing Firm minus Changes in Match #2)

		Portfolios based on SI_%Shrout			
	All	1 (Smallest)	2	3	4 (Largest)
log Volume	0.156**	0.166**	0.142**	0.169**	0.148**
	(6.78)	(2.86)	(3.69)	(4.09)	(3.13)
log Dollar Volume	0.155**	0.136**	0.135**	0.218**	0.127**
	(5.21)	(2.09)	(2.48)	(3.91)	(2.01)
log Turnover	0.111**	0.094*	0.103**	0.154**	0.089**
	(5.40)	(1.93)	(2.81)	(4.14)	(2.08)
log Amihud	-0.195**	-0.165**	-0.178**	-0.226**	-0.203**
	(-6.56)	(-2.46)	(-3.25)	(-4.16)	(-3.26)
log Number of Trades	0.067**	0.205**	0.042	-0.008	0.063
	(2.24)	(2.88)	(0.73)	(-0.16)	(1.04)
Opening Dollar Spreads	-0.053	-0.210*	-0.098	0.069	-0.022
	(-1.39)	(-1.84)	(-1.01)	(0.99)	(-1.12)

Table 3c (cont'd)

Panel A (continued)					
		Portfolios based on SI_%Shrout			
	All	1	2	3	4
Opening Percentage Spreads (%)	-0.017	-0.162	0.080	0.018	-0.030
	(-0.46)	(-1.30)	(1.21)	(0.35)	(-0.56)
Opening Bid Depth/ Out (%) x 100	0.009	0.051	0.078*	-0.048	-0.022
	(0.32)	(0.52)	(1.67)	(-1.13)	(-0.42)
Opening Ask Depth/ Out (%) x 100	0.003	-0.026	0.097	-0.065	0.009
	(0.12)	(-0.39)	(1.39)	(-1.41)	(0.18)

Panel B: Prices and Returns Measures (Changes in Issuing Firm minus Changes in Match #2)					
		Portfolios based on SI_%Shrout			
	All	1	2	3	4
		(Smallest)			(Largest)
Return (%)	-0.087**	-0.010	-0.152**	-0.091**	-0.086**
	(-4.68)	(-0.28)	(-4.57)	(-2.39)	(-2.18)
Standard Deviation of Return (%)	-0.024	-0.029	-0.070	0.097	-0.099
	(-0.44)	(-0.21)	(-0.68)	(1.00)	(-0.97)
Idiosyncratic Volatility (%)	-0.019	-0.036	-0.046	0.111	-0.109
	(-0.35)	(-0.26)	(-0.47)	(1.15)	(-1.08)
R-Squared (%)	-0.189	0.426	-1.294	-0.183	0.332
	(-0.42)	(0.48)	(-1.33)	(-0.22)	(0.36)
Beta	-0.012	0.045	-0.058	-0.001	-0.027
	(-0.43)	(0.67)	(-1.05)	(-0.01)	(-0.51)
Daily AR(1)	0.016**	-0.002	0.007	0.035**	0.020*
	(2.54)	(-0.11)	(0.57)	(2.94)	(1.68)
Abs Daily AR(1)	0.001	-0.008	0.005	0.006	-0.001
	(0.15)	(-0.69)	(0.61)	(0.61)	(-0.14)
Intraday AR(1)	0.828	1.036	-0.025	2.519	-0.189
	(1.10)	(0.93)	(-0.22)	(0.96)	(-0.99)
Abs Intraday AR(1)	-1.046	-1.143	-0.170	-2.683	-0.174
	(-1.40)	(-1.05)	(-1.51)	(-1.02)	(-0.92)

Table 4
Changes in Firm Characteristics by Short Interest (SI_%Issue) Portfolios

This table presents the change in firm characteristics, by portfolios that are formed based on change in short interest (*SI_%Issue*) at issuance. Changes are defined as the average measure in post period minus the pre period measure. "Pre period" is defined as the 6 months (2 months for *Intraday AR(1)*) ending 1 month prior to issuance. "Post period" is the 6 months (2 months for *Intraday AR(1)*) starting 1 month after issuance. The first column ("All") is the portfolio of all issues. Portfolio 1 (4) corresponds to the smallest (largest) short interest change.

Panel A shows the changes in issuing firm liquidity measures. *Level of Short Interest* is the average monthly short interest of the stock. *Volume* and *Dollar Volume* are the average daily stock volume and dollar volume. *Turnover* is the average daily volume divided by shares outstanding. *Amihud* is the average ratio of daily absolute return to dollar volume. *Number of trades* is the average daily number of transactions of the stock. *Dollar Spreads* and *Percentage Spreads* are the difference between bid and ask quotes, expressed as dollars and percentage of bid-ask midpoint, respectively. *Bid Depth/ Out* and *Ask Depth/ Out* are bid and ask depths divided by shares outstanding. Both spreads and depths are calculated using the daily opening quotes on the firm's primary exchange.

Panel B presents the changes in stock price and returns measures. *Return* and *Standard Deviation of Return* are the mean and standard deviation of daily stock return. *Idiosyncratic Volatility* and *R-Squared* are the standard deviation of residuals and R-Squared from the regression of daily stock excess return on CRSP value-weighted market excess return. *Beta* is the coefficient estimate of the same regression. *Daily AR(1)* and *Intraday AR(1)* are the first-order autocorrelation of returns, calculated using daily returns and 30-minute interval returns, respectively. *Abs Daily AR(1)* and *Abs Intraday AR(1)* are the absolute value of *Daily AR(1)* and *Intraday AR(1)*.

Changes that are significant at the 1% level are in bold. The last two columns show the mean measures of Portfolio 4 minus Portfolio 1 and the t-statistics of the difference between the means. * and ** denote 10% and 5% significance, respectively. Variables with percentage sign (%) are in percentage terms.

N = 1356

Panel A: Changes in Firm Characteristics and Liquidity Measures

		Portfolios based on SI_%Issue					
	All	1 (Smallest)	2	3	4 (Largest)	P4-P1	t-stat
log Level of Short Interest	**0.832**	**0.318**	**0.904**	**0.985**	**1.117**	0.799**	9.043
log Volume	**0.357**	**0.219**	**0.310**	**0.374**	**0.524**	0.305**	6.610
log Dollar Volume	**0.375**	**0.150**	**0.361**	**0.443**	**0.546**	0.396**	5.830
log Turnover	**0.229**	**0.098**	**0.224**	**0.269**	**0.326**	0.228**	5.511
log Amihud	**-0.391**	**-0.234**	**-0.400**	**-0.414**	**-0.517**	-0.282**	-4.247
log Number of Trades	**0.324**	**0.112**	**0.281**	**0.335**	**0.538**	0.426**	7.785

Table 4 (cont'd)

Panel A (continued)							
	Portfolios based on SI_%Issue						
	All	1	2	3	4	P4-P1	t-stat
Opening Dollar Spreads	0.003	0.025	0.054	-0.024	-0.036	-0.061	-0.739
Opening Percentage Spreads	**-0.088**	0.067	-0.096	**-0.164**	**-0.142**	-0.209**	-2.455
Opening Bid Depth/ Out x 100	-0.015	0.050	-0.013	-0.044	**-0.043**	-0.094	-0.139
Opening Ask Depth/ Out x 100	0.009	0.099	-0.004	-0.011	**-0.037**	-0.135	-1.497

Panel B: Changes in Prices and Returns Measures							
	Portfolios based on SI_%Issue						
	All	1 (Smallest)	2	3	4 (Largest)	P4-P1	t-stat
Return (%)	**-0.195**	-0.058	**-0.183**	**-0.236**	**-0.301**	-0.243**	-5.506
Standard Deviation of Return (%)	**-0.155**	-0.158	**-0.284**	**-0.239**	0.062	0.221	1.572
Idiosyncratic Volatility (%)	**-0.169**	-0.156	**-0.266**	**-0.237**	-0.016	0.140	0.959
R-Squared (%)	**1.334**	1.187	-0.129	**1.857**	**2.423**	1.235*	1.858
Beta	**0.076**	0.089	0.000	0.099	**0.118**	0.029	0.806
Daily AR(1)	**0.015**	0.003	0.020	**0.028**	0.011	0.008	0.488
Abs Daily AR(1)	-0.001	0.005	0.002	-0.008	-0.005	-0.010**	-2.055
Intraday AR(1)	0.188	0.749	0.007	0.061	**-0.008**	-0.758*	-1.692
Abs Intraday AR(1)	-0.218	-0.872	0.003	-0.064	-0.002	0.870	0.031

Table 5
Regression of Liquidity and Prices Changes on Short Interest Intensities and Firm Characteristics

The liquidity and prices changes are regressed on arbitrage activity (*SI_%Shrout*) and firm characteristics. "Pre period" is the 6 months ending 1 month prior to the issue date. "Post period" is the 6 month beginning 1 month after issuance.

Chg. log Turnover , *Chg. log Amihud* and *Chg. log Num Trades* are log *Turnover* , log *Amihud* and log *Number of Trades* in the post period minus the corresponding measures in the pre period. *Turnover* is the average daily stock volume divided by shares outstanding. *Amihud* is the average daily ratio of absolute return to dollar volume. *Number of trades* is the average daily number of stock transactions. *Chg. Open % Spreads and Chg. Open Total Depth* are the percentage change in the post *Percentage Spreads* and *Total Depth* from the pre measures. *Percentage Spreads* are the difference between bid and ask quotes divided by the bid-ask midpoint. *Total Depth* is the sum of bid and ask depths divided by shares outstanding. Both spreads and depths are calculated using the daily opening quotes on the firm's primary exchange.

Chg. R-Squared , *Chg. Idio* and *Chg. Abs Daily AR(1)* are the percentage change in the post *R-Squared* , *Idio* and *Abs Daily AR(1)* from the pre measures. *R-Squared* and *Idio* are the R-Squared and standard deviation of residuals from the market model regression. *Daily AR(1)* is absolute value of the first-order autocorrelation of returns, calculated using daily returns.

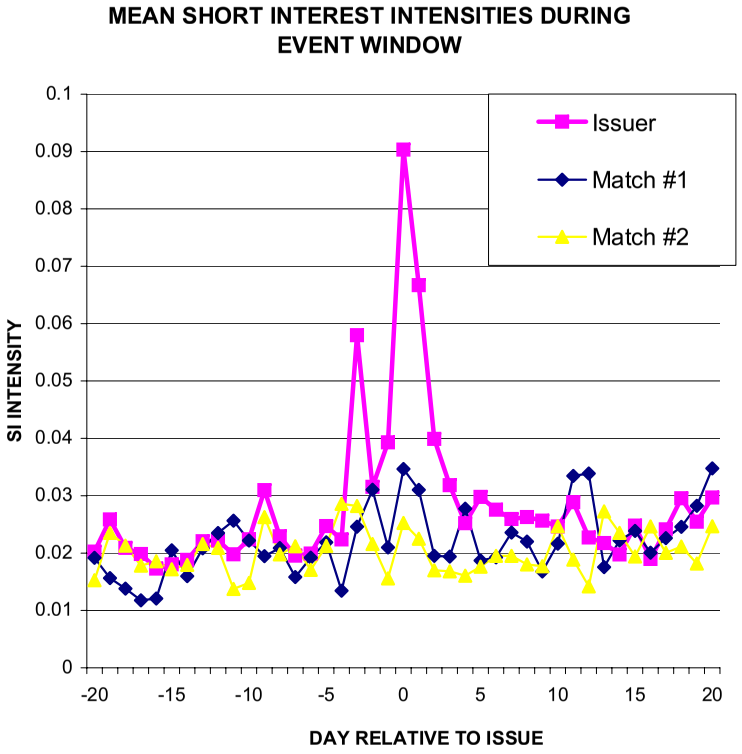
The short interest intensities measure is *SI_%Shrout* . It is the change in short interest (change in short interest from the month prior to issuance to the issue month) divided by the number of shares outstanding in the month prior to issuance. *Issue Size/Market Cap* is the issue size divided by equity market capitalization. *Market Cap* is the equity market capitalization. *NYSE* and *Public* are dummy variables, with 1 indicating that the firm is listed on NYSE and the convertible bond is a public offering, respectively. Coefficient estimates on the year-month dummies are not reported.

Spreads and quotes measures do not include issues before July 1993. * and ** denote 10% and 5% significance, respectively. t-statistics are in parentheses.

	Liquidity					Prices		
	Chg. log Turnover	**Chg. log Amihud**	**Chg. log Num Trades**	**Chg. Open % Spreads**	**Chg. Open Total Depth**	**Chg. R-Squared**	**Chg. Idio**	**Chg. Abs Daily AR(1)**
Intercept	1.540**	-1.508**	0.433	-0.769	0.562	1347.999	0.104	0.015
	(4.90)	(-3.21)	(1.04)	(-1.07)	(1.17)	(1.31)	(0.44)	(0.16)
SI_%Shrout	3.377**	-3.582**	3.717**	-1.019	-1.156	-294.042	-0.506	0.220
	(5.93)	(-4.20)	(5.41)	(-0.87)	(-1.47)	(-0.16)	(-1.19)	(1.23)
Issue Size/Market Cap	-0.054	-0.033	-0.092	0.212	0.622**	-51.404	-0.002	0.005
	(-1.11)	(-0.45)	(-0.82)	(1.08)	(4.74)	(-0.33)	(-0.05)	(0.36)
log Market Cap	-0.048**	0.034**	0.004	0.058**	-0.019	-78.762**	0.004	0.001
	(-4.52)	(2.15)	(0.29)	(2.32)	(-1.12)	(-2.25)	(0.49)	(0.23)
NYSE	0.066**	-0.148**	-0.055	-0.186**	-0.056	118.433	-0.045*	0.012
	(2.07)	(-3.11)	(-1.41)	(-2.73)	(-1.22)	(1.14)	(-1.90)	(1.17)
Public	0.016	-0.051	0.032	-0.006	0.021	197.964	-0.041	-0.005
	(0.42)	(-0.90)	(0.67)	(-0.07)	(0.38)	(1.59)	(-1.46)	(-0.40)
N	1330	1330	1215	1173	1173	1330	1330	1330
RSq. (%)	11.72	17.45	14.46	6.39	9.72	4.67	17.13	4.52

Figure 4
Daily Short Interest Intensities During Event Window, 2005

This charts short interest intensities during the event window (trading days -20 to +20) for convertible bond issues between March 2005 and November 2005. "Match #1" are firms matched based on total assets, profitability and liquidity prior to issuance. "Match #2" firms are matched based on size, exchange and short interest changes around issuance. The short interest intensity measure is the dollar value of short sales (short sale volume times stock price), divided by the issue size (face value of the convertible bond times offer price).



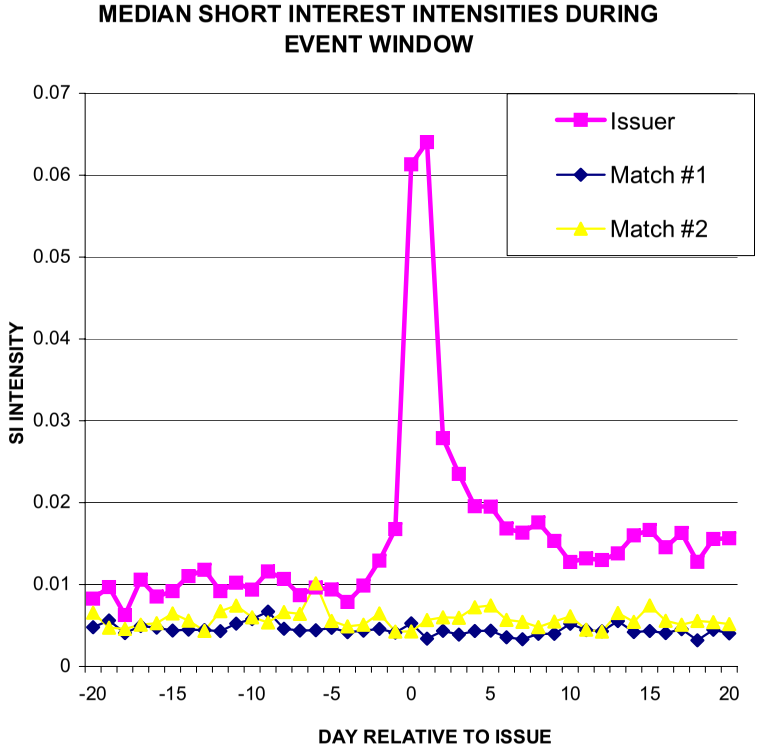


Table 6
Changes in Short Selling Activity, 2005

This table shows short selling activity in stocks of convertible bond issuers and matching firms between March 2005 and November 2005. Short sales are measured using Reg SHO Data, which contains short sale transactions data beginning January 2005 through the pilot period ending April 2006. "Pre period" is defined as the 20 trading days month ending 1 month prior to issuance. "Post period" is defined as the 20 trading days beginning 1 month following issuance. The change is defined as the mean (or median) measure in post period minus the mean (median) measure in pre period. "Match #1" are firms matched based on total assets, profitability and liquidity prior to issuance. "Match #2" firms are matched based on size, exchange and short interest changes around issuance.

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.

* and ** denote changes that are 10% and 5% significant, respectively.

	Issuer	Match #1	Match #2	Issuer	Match #1	Match #2
Variable		**Mean**			**Median**	
Pre Number of Short Sales (log)	5.224	4.589	4.542	5.368	4.730	5.133
Pre Short Sales/Shares Outstanding (%)	0.215	0.150	0.184	0.149	0.135	0.122
Post Number of Short Sales (log)	5.452	4.517	4.389	5.763	4.727	4.908
Post Short Sales/Shares Outstanding (%)	0.290	0.140	0.167	0.245	0.113	0.095
Change in (log) Number of Short Sales	0.228**	-0.072	-0.153	0.144**	-0.124	-0.046
p-value (%)	0.076	23.942	25.312	1.114	17.700	68.349
Change in Short Sales/Shares Outstanding (%)	0.075**	-0.010	-0.017	0.047**	-0.014	-0.006
p-value (%)	0.076	56.172	34.529	0.012	5.806	34.089
N	63	55	54			

Table 7
Convertible Bond Arbitrage Hedge Fund Statistics

This table presents summary statistics on convertible bond arbitrage hedge fund data. *Asset Return* is the asset-weighted return. *Flow* is defined as the total monthly dollar flow into the category divided by total assets in the prior month. *Assets* represent the total assets under management by hedge funds in the current month, calculated over the 1991-2005 sample period. *HHI* is a 4-firm concentration measure. It is measured as the sum of squared weights for the largest four assets under management in the current month. Variables with percentage sign (%) are in percentage terms.

	Asset Return (%)	**Flow (%)**	**Assets ($ million)**	**HHI**
Mean	0.696	1.648	2862	0.323
Median	0.761	1.301	1772	0.320
Maximum	4.344	10.847	8839	0.444
Minimum	-4.811	-7.574	207	0.250
Standard Deviation	1.362	3.340	2601	0.045
Skewness	-0.478	0.288	0.910	0.304
Kurtosis	1.742	0.513	-0.579	-0.409
First Order Autocorrelation	0.336	0.311	0.993	0.951
N	180	180	180	180

Figure 5a
Market Short Interest

This shows the arbitrage activity (Market Short Interest, SI) from January 1991 to December 2005. Market Short Interest is constructed by summing the SI measures for all stocks generating change in short interest as a result of bond issuance in the current month. The SI measure is the dollar value of the change in short interest, that is, the difference between short interest in the current month and short interest in the previous month, times the closing stock price on the issue date.

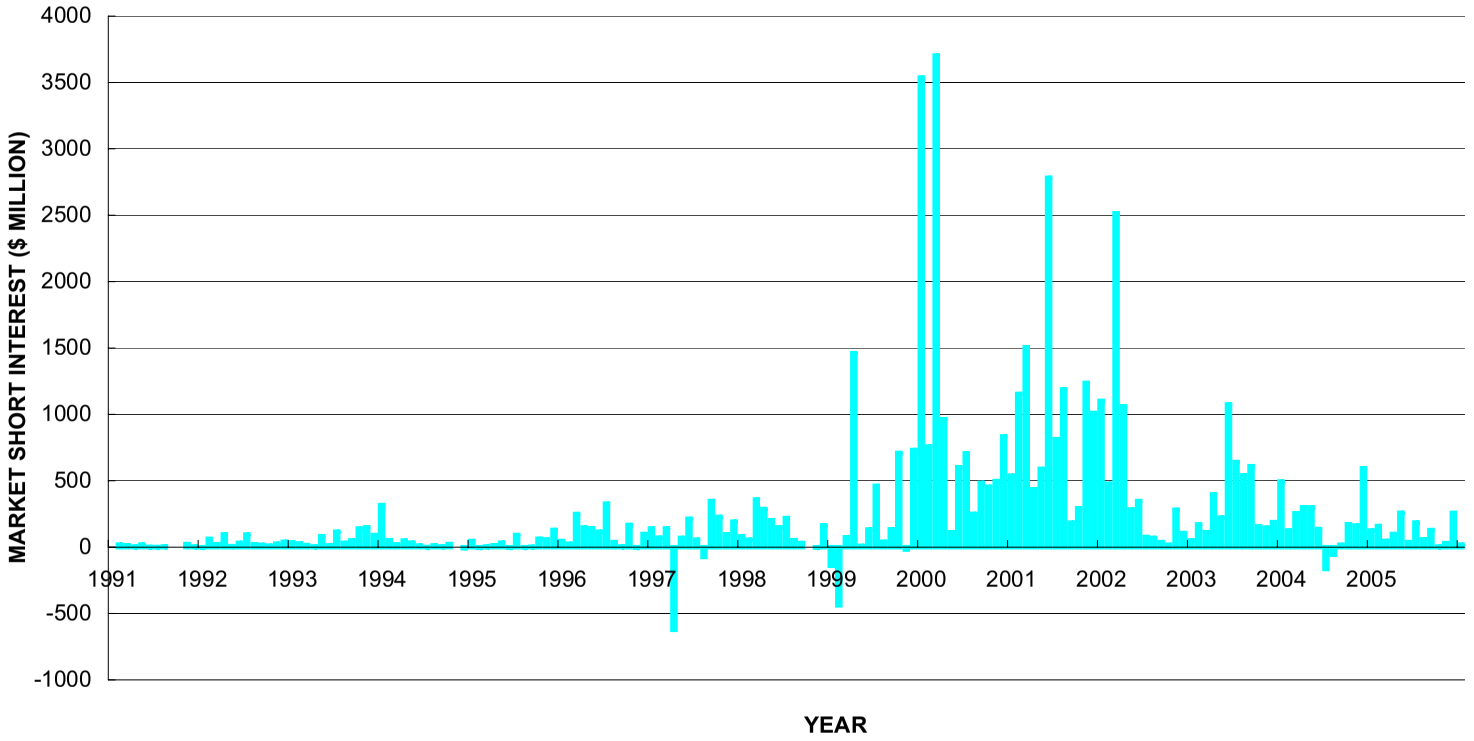


Figure 5b
Total Flows into Convertible Bond Arbitrage Hedge Funds

The chart shows the total flows into convertible bond arbitrage hedge funds from January 1991 to December 2005.

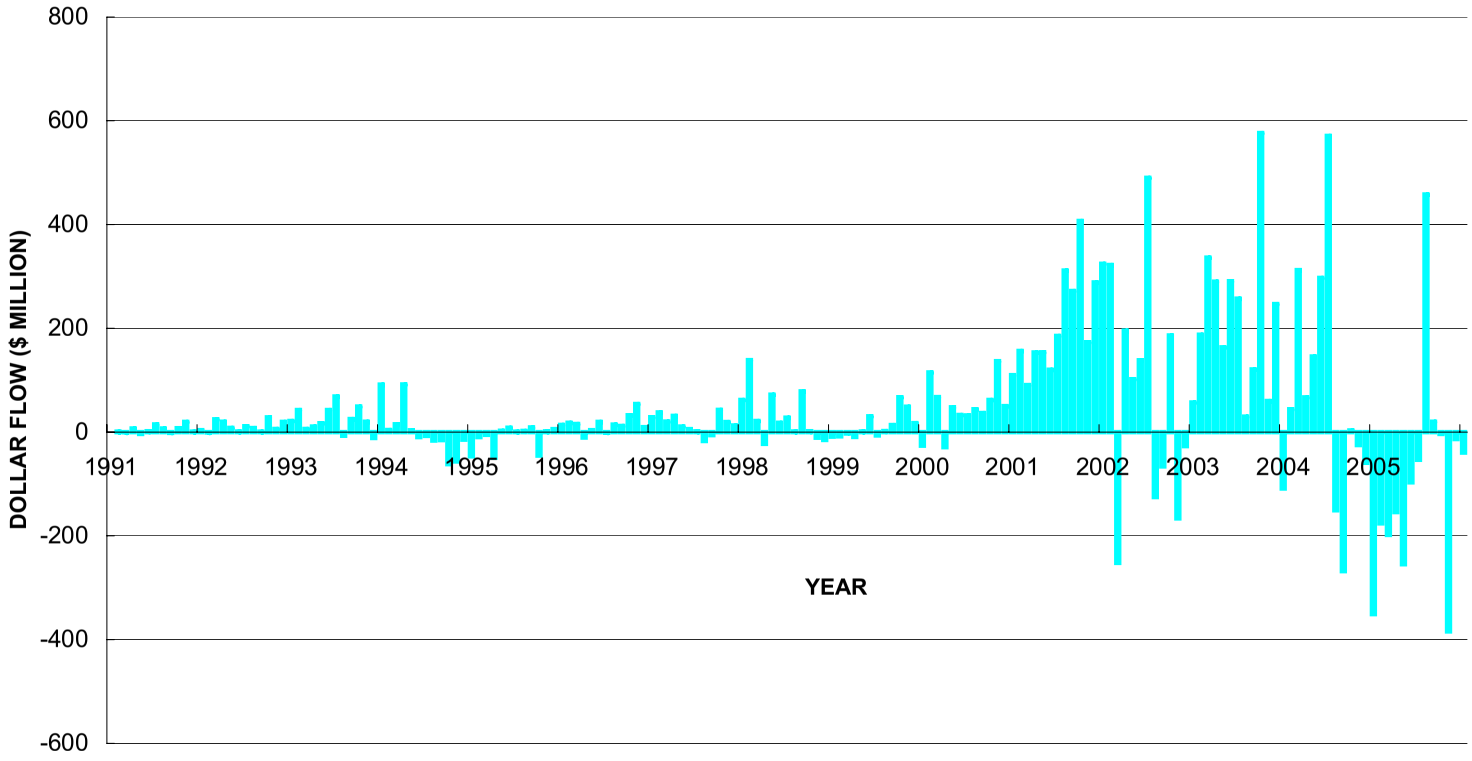


Table 8
Dynamics of Convertible Bond Proceeds

This table presents regression results of convertible bond proceeds on market variables and convertible bond arbitrage hedge fund characteristics. The dependent variable is *log Proceeds* , the (log) sum of all proceeds of convertible bonds issued during period t.

Asset Return is the asset-weighted convertible bond arbitrage hedge fund return in excess of risk-free rate. *Flow* is defined as total monthly dollar flow into convertible bond arbitrage hedge funds divided by total assets in the prior month. *Short Interest* is constructed by the summing dollar change in short interest (SI) in all firms issuing convertible bonds in the current month. *Excess Market Return* is the CRSP value-weighted market return in excess of risk-free rate. All lagged measures refer to the measures in the previous month.

All regressions are repeated using quarterly data. * and ** denote 10% and 5% significance, respectively. t-statistics are in parentheses. Variables with percentage sign (%) are in percentage terms.

	Monthly		Quarterly	
	log Proceeds	**t-stat**	**log Proceeds**	**t-stat**
Intercept	16.505**	(11.13)	7.040**	(2.48)
Lagged Asset Return (%)	0.443**	(2.73)	0.027	(0.73)
Lagged Flow (%)	0.074*	(1.86)	-0.007	(-0.44)
Lagged Short Interest ($ billion)	0.912**	(2.30)	0.037	(0.34)
Lagged log Proceeds	0.151**	(2.03)	0.680**	(5.11)
Lagged Excess Market Return (%)	0.077	(1.44)	-0.012	(-0.83)
N	179		58	
RSq. (%)	13.69		48.65	

Table 9
Dynamics of Convertible Bond Arbitrage Hedge Fund Flows

Panel A of this table presents the regression results of convertible bond arbitrage hedge fund flows on market variables and convertible bond arbitrage hedge fund characteristics. The dependent variables is *Flow*, which is defined as the monthly dollar flow divided by total assets in the prior month.

Asset Return is the asset-weighted convertible bond arbitrage hedge fund return in excess of risk-free rate. *Short Interest* is constructed by summing the dollar change in short interest (SI) in all firms issuing convertible bonds in the current month. *Proceeds* are the sum of proceeds of convertible bonds.

Panel B includes merger arbitrage hedge fund characteristics (substitute market) as independent variables. *Merger Asset Return* is the asset-weighted merger arbitrage hedge fund return in excess of risk-free rate. *Merger Flow* is the monthly dollar flow into merger arbitrage hedge funds divided by total assets of merger arbitrage hedge funds in the prior month. *Merger Short Interest* is the dollar change in SI in all acquirers announcing takeovers in the current month. *Target Market Value* is the total market capitalization for all target firms in takeovers announced in the current month.

All regressions are repeated using quarterly data. All lagged measures refer to the measures in the previous month or quarter. * and ** denote 10% and 5% significance, respectively. t-statistics are in parentheses. Variables with percentage sign (%) are in percentage terms.

Panel A: Convertible Bond Arbitrage				
	Monthly		**Quarterly**	
	Flow (%)	**t-stat**	**Flow (%)**	**t-stat**
Intercept	0.794	(0.46)	28.337	(1.17)
Lagged Asset Return (%)	0.136	(0.76)	0.624**	(2.12)
Lagged Flow (%)	0.296**	(4.09)	0.492**	(4.22)
Lagged Short Interest ($ billion)	0.937**	(2.04)	2.009**	(2.11)
Lagged log Proceeds	0.003	(0.04)	-1.286	(-1.13)
N	179		58	
RSq. (%)	10.35		35.65	

Table 9 (cont'd)

Panel B: Convertible Bond Arbitrage and Merger Arbitrage				
	Monthly		Quarterly	
	Flow (%)	t-stat	Flow (%)	t-stat
Intercept	8.523**	(2.32)	37.692	(1.39)
Lagged Asset Return (%)	0.171	(0.82)	0.634*	(1.83)
Lagged Merger Asset Return (%)	-0.164	(-0.68)	-0.086	(-0.21)
Lagged Flow (%)	0.270**	(3.68)	0.287**	(2.17)
Lagged Merger Flow (%)	-0.049	(-0.37)	0.199	(0.96)
Lagged Short Interest ($ billion)	1.051**	(2.29)	1.437*	(1.79)
Lagged Merger Short Interest ($ billion)	0.317	(1.08)	0.766	(1.44)
Lagged log Proceeds	0.058	(0.65)	1.384	(1.37)
Lagged log Target Market Value	-0.391**	(-2.38)	-2.802**	(-2.75)
N	179		58	
RSq. (%)	11.67		39.37	

Table 10
Dynamics of Convertible Bond Arbitrage Activity

Panel A of this table presents the regression results of convertible bond arbitrage activity on market variables and convertible bond arbitrage hedge fund characteristics. The dependent variables is *Short Interest. Short Interest* is constructed by summing the dollar change in short interest (SI) in all firms issuing convertible bonds in the current month.

Asset Return is the asset-weighted convertible bond arbitrage hedge fund return in excess of risk-free rate. *Flow* is the monthly dollar flow divided by total assets in the prior month. *Proceeds* are the sum of proceeds of convertible bonds.

Panel B includes merger arbitrage hedge fund characteristics (substitute market) as independent variables. *Merger Asset Return* is the asset-weighted merger arbitrage hedge fund return in excess of risk-free rate. *Merger Flow* is the monthly dollar flow into merger arbitrage hedge funds divided by total assets of merger arbitrage hedge funds in the prior month. *Merger Short Interest* is the dollar change in SI in all acquirers announcing takeovers in the current month. *Target Market Value* is the total market capitalization for all target firms in takeovers announced in the current month.

All regressions are repeated using quarterly data. All lagged measures refer to the measures in the previous month or quarter. * and ** denote 10% and 5% significance, respectively. t-statistics are in parentheses. Variables with percentage sign (%) are in percentage terms.

Panel A: Convertible Bond Arbitrage				
	Monthly		**Quarterly**	
	Short Interest ($ billion)	**t-stat**	**Short Interest ($ billion)**	**t-stat**
Intercept	-0.187	(0.70)	-3.647	(-1.00)
Lagged Asset Return (%)	0.020	(0.74)	-0.006	(-0.14)
Lagged Flow (%)	0.023**	(2.00)	0.014	(0.78)
Lagged Short Interest ($ billion)	0.353**	(4.94)	0.521**	(3.64)
Lagged log Proceeds	0.016	(1.15)	0.182	(1.06)
N	179		58	
RSq. (%)	16.78		40.38	

Table 10 (cont'd)

Panel B: Convertible Bond Arbitrage and Merger Arbitrage				
	Monthly		Quarterly	
	Short Interest ($ billion)	t-stat	Short Interest ($ billion)	t-stat
Intercept	-0.967*	(1.70)	-9.409**	(-2.67)
Lagged Asset Return (%)	0.055*	(1.69)	-0.013	(-0.29)
Lagged Merger Asset Return (%)	-0.077**	(-2.06)	-0.067	(-1.25)
Lagged Flow (%)	0.026**	(2.29)	0.010	(0.58)
Lagged Merger Flow (%)	0.001	(-0.07)	-0.023	(-0.85)
Lagged Short Interest ($ billion)	0.341**	(4.80)	0.369**	(3.54)
Lagged Merger Short Interest ($ billion)	-0.012	(0.26)	0.133*	(1.91)
Lagged log Proceeds	0.010	(0.74)	0.551**	(4.17)
Lagged log Target Market Value	0.041	(1.61)	-0.093	(-0.70)
N	179		58	
RSq. (%)	19.05		57.93	