Short-Selling and Earnings Announcements: Evidence from NYSE*

Matthew Serfling
University of Arizona
Tucson, AZ. USA
serfling@email.arizona.edu

Wei Zhang
North Dakota State University
Fargo, ND. USA
wei.zhang@ndsu.edu

Abstract

We examine the relationship between short-selling and future returns around earnings announcements for 1334 earnings announcements in NYSE listed stocks for the year 2005. We find a significantly negative relationship between short-selling on announcement days and post-announcement returns. Consistent with existing literature, our results show that short-selling can predict future returns, but the results suggest that short-sellers' ability to predict future returns stems from their ability to process public information.

Introduction

Short-selling is the process in which stocks are borrowed and sold in the hope that stock prices will fall before the borrowed stocks have to be bought back and returned. The role played by short-sellers in the financial market has been an issue of ongoing debate among regulators. Following an extensive study on the impact of uptick rules (see e.g. Diether, Lee, and Werner (2009)), the Securities and Exchange Commission (SEC) eliminated the 70 year old uptick rule in 2007.

During the financial crisis of 2008, the SEC banned the short-selling of financial stocks outright in response to public concerns. More recently, German authorities also banned short-selling in the midst of the sovereign debt crisis in the Euro-zone (The Wall Street Journal, May 26, 2010). In February 2010, the SEC voted 3-2 to adopt an "alternative uptick rule". Among many academics and practitioners, short-sellers are however traditionally regarded as rational, informed agents who help increase information efficiency by correcting short-term deviation of stock prices from fundamental values (Miller (1977), Diamond and Verrecchia (1987)).

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Recent academic literature on short-selling presents overwhelming evidence that short-sellers are informed traders (Akin, Frino, McCorry, and Swan (1998), Asquith, Pathakk and Ritter (2005), Diether, Lee, and Werner (2009), and Boehmer, Jones, and Zhang (2008)). One line of literature focuses on short-selling around public information events. Karpoff and Lou (2010) show that short-selling increases before public disclosure of a firm's financial misconduct. In a study that is closely related to ours, Christophe et al. (2004) find that abnormal short-selling prior to earnings announcements in NASDAQ listed stocks in the last quarter of 2000 is negatively related to post-announcement returns, suggesting that some pre-announcement short-selling may be motivated by private information. Daske, Richardson, and Tuna (2005), however, question whether short-selling prior to public information events is based on private information. Engelberg, Reed, and Ringgenberg (2010) find only weak evidence that short-sellers can predict news events. Their study suggests that short-sellers' advantage arises from their ability to process publicly available information. Motivated by the ongoing discussion on short-selling around public information events, this study reexamines short-selling around earnings announcements in 2005.

Our study is motivated by a number of factors. First, the fall of 2000 coincided with the burst of the internet bubble, a period in which the NASDAQ lost over 41.3% of its market value from the beginning of September to the end of December as mentioned in Christophe et al. (2004). We examine the behavior of short-sellers over the entire year of 2005, a period during which the NYSE Composite rose by about 7%, which is more in line with the U.S. equity market's historical average annual return. We complement the results of Christophe et al. (2004) for NASDAQ listed firms in a deteriorating market by analyzing short-sellers in a time of relative market optimism for NYSE listed firms.

Second, short-sale volume has increased dramatically since the beginning of the new millennium. In 2003, short related volume accounted for over 28% of total NYSE volume (Daske et al. (2005)). Diether et al. (2009) find that the daily average short-sale volume is 23.89% (31.33%) of the total trading volume on the NYSE (NASDAQ) in 2005. In contrast, the average daily short-sale volume in Christophe et al. (2004) for the last quarter of 2000 is about 3% of the total volume. Given the increase in short-sale volume in recent years, it is possible that some short-sale volume prior to public information events may be driven by speculation rather than information.

Third, Regulation Fair Disclosure (Reg FD), fully implemented in late 2000, may have also contributed to the changed market environment. Reg FD, intended to eliminate selective disclosure of private information, may have reduced

informed trading and removed some information advantage of short-sellers (Daske et al. (2005), Gintschel and Markov (2004)).

In this study, we first examine the relationship between pre-announcement short-selling and post-announcement returns within the context of 1334 earnings announcements in NYSE listed stocks for the year 2005. In contrast to Christophe et al. (2004), we do not find evidence of informed trading in pre-announcement short-selling. Using the same methodology, we then extend Christophe et al. (2004) by investigating the relationship between short-selling on announcement days and post-announcement returns. We find a significantly negative relationship between short-selling on announcement days and post-announcement returns. Our results support the idea suggested by Engelberg, Reed, and Ringgenberg (2010) and indicate that short-sellers seem to be more skilled than average investors, and their ability to predict future returns appears to stem from their ability to process public information.

The remainder of our paper is organized as follows. We present in the next section data and empirical methodology, which will be followed by a section on empirical results. Concluding remarks are in the final section.

Data and Methodology

Our process of sample selection follows closely that of Christophe et al. (2004). The initial sample of earnings announcements consists of common stocks in *CRSP*/*Compustat* merged database (*CCM*) that recorded an earnings announcement during the year 2005. Earnings announcements obtained from *CRSP*/*Compustat* merged database (*CCM*) are cross-checked with those in I/B/E/S for accuracy. If the announcement date occurred before or during trading hours on the announcement day, that day is designated as the announcement day (day = 0). If a firm's announcement occurred after trading hours, the next trading day is designated as the announcement day (day = 0). We excluded firms not listed on the NYSE (we only have access to NYSE short-sale data) and only included data for ordinary common shares, defined as a share-code equal to 11 or 12 by the CRSP database. Following Christophe et al. (2004), we confine our analysis to NYSE stocks that met the following conditions: (1) the stock traded everyday during the sample period, and (2) the stock has at least 50 trades per day on average. Following D'Avolio (2002) and Christophe et al. (2004), we delete stocks with share prices below $10 in the 5-day period prior to earning announcements.

We are concerned with the 6-day trading window around the earnings announcement day. We label these days from -5 to 1, where day 0 is the announcement day. To minimize the probability that our results are driven by potentially confounding events, we exclude earnings announcements with

analyst downgrades (data are from I/B/E/S) occurring within the 11-day period around the announcement days (-5, 5). We also exclude earnings announcements with changes in dividends (data are from CRSP/Compustat) occurring within the 11-day period around announcement days.

As part of the Regulation SHO (Reg SHO) mandate, NYSE has made publicly available intraday short-sale data. This study covers the year 2005, during which NYSE short-sale tick data is available to us. The dataset includes ticker, price, volume, date, time (hour, minute, and second), and trader type (exempt vs. non-exempt from short-sale rules) for all NYSE short-sales. Since our interest focuses on whether short-sales are informational motivated trades, we exclude short-sales that are exempt, which are presumed to be from market-making activities. We also exclude firms that are exempt from uptick rules in the SEC pilot study. We estimate a stock's normal level of daily short-selling based on the stock's average daily short-selling for the entire sample period of 2005. Our selection process resulted in a final sample of 1334 earnings announcements from 479 unique firms. Table 1 provides summary statistics of the data during the sample period. Consistent with existing literature, the active-trade filter has resulted in a sample of relatively large firms. Both the average daily short-sale volume during the 5-day pre-announcement period and the average daily short-sale volume on the announcement day are higher than the average daily short-sale volume for the entire sample period. This seems to indicate that there is more short-selling on average prior to and on announcement days. However, the median daily short-sale volume during the pre-announcement period and the median daily short-sale volume on the announcement day are similar to the median daily short-sale volume for the entire sample period. This suggests that the higher averages are in part due to higher short-selling in selected firms.

In our sample, the average relative short-sale, defined as the average daily number of shares sold short divided by the average daily number of shares traded is about 17% during the pre- announcement period, on the announcement day, and during the entire sample period. The average relative short-sale in Christophe et al. (2004) for the last quarter of 2000 is about 3%. Consistent with existing literature, there have been tremendous increases in short-selling as a percentage of the market 5 years into the new millennium. Following the methodology of Christophe et al. (2004), we first examine the short-selling pattern during the 5 days preceding earnings announcements (days-5 to -1) with respect to the short-selling pattern for the entire year of 2005. To test whether short-sellers can predict earnings-related information prior to earnings announcements, we define abnormal short-selling *ABSS* as the percentage difference in (1) the average daily short-sale volume during the 5 days before an earnings announcement and (2) the average daily short-sale volume over the entire sample period.

Table 1: Summary Statistics

Notes: This table summarizes the sample data. The pre-announcement period is over a 5-day period prior to the announcement day. The sample period is over the year 2005. Market capitalization (in $M) is the daily market value of equity at the end of 2004. Book-to-market ratio is also that at the end of 2004. We obtain short-sale data from the Regulation SHO database and the rest of the data from CRSP/Compustat.

	Mean	Median	Std. Dev.
Market cap. (in $M)	7501	2437	18683
Book-to-market ratio	0.655	0.310	1.62
Pre-announcement period average daily short-sale volume (in 000's)	192	103	258
Pre-announcement period average daily trade volume (in 000's)	1098	525	1848
Announcement-day average daily short-sale volume (in 000's)	337	159	498
Announcement-day average daily trade volume (in 000's)	2001	826	3923
Sample period average daily short-sale volume (in 000's)	187	114	222
Sample period average daily trade volume (in 000's)	1055	584	1493

Specifically, we calculate a stock's abnormal short-selling during the 5 days before an earnings announcement as:

$$ABSS(-5,-1) = \frac{SS(-5,-1)}{AVESS} - 1 \tag{1}$$

where SS (-5,-1) is the average daily short-sale volume during the 5 days before an earnings announcement, and AVESS is the average daily short-sale volume over the entire sample period. To link abnormal short-selling to information about upcoming announcements, we estimate the following the equation:

$$ABSS(-5,-1) = \beta_0 + \beta_1 RET(0,1) + \beta_2 RET(-5,-1) + \beta_3 ABVOL(-5,-1) + \varepsilon \quad (2)$$

where RET (-5,-1) is the return over the 5 days prior to an earnings announcement, RET (0,1) is the 2-day return following an earnings announcement, and ABVOL (-5,-1) is the average abnormal trading volume over the 5 days prior to an earnings announcement, measured as the average daily trading volume in the pre-announcement period divided by the average daily trading volume over the sample period of 2005, all minus 1.

To test the hypothesis of informed trading before earnings announcements, we focus on the coefficient of RET (0, 1), β_1. If there is an increase (decrease) short-selling before unfavorable (favorable) earnings reports, then β_1 must be negative and significantly different from zero. As stated in Christophe et al. (2004), a non-negative β_1 would fail to affirm the hypothesis of informed trading. The variable RET (-5,-1) represents the movement of stock prices during the 5 days before the announcement and is included to control for the possibility that some short-sellers may speculate on upcoming earnings reports by shorting what they perceive as "over-valued" stocks. To control for the possibility that stocks experiencing sudden increases in volume may be easier to short, we include the variable ABVOL (-5, -1) that accounts for the potential contemporaneous correlation between abnormal short-selling and sudden spikes in volume.

To test whether short-sellers can efficiently process earnings-related information after an earnings announcement as suggested by Engelberg et al. (2010), we re-estimate our data and focus on abnormal short-selling on the announcement day, ABSS (0), and its relationship to future returns as follows:

$$ABSS(0) = a_0 + a_1 RET(1) + a_2 RET(0) + a_3 ABVOL(0) + \varepsilon \quad (3)$$

where 0 denotes the announcement day and 1 denotes the day after the announcement day. Similar to equation (2), we control for contemporaneous price movements and abnormal trading volume.

Following Christophe et al. (2004), we also consider an alternative specification to test our results. We examine the link between a firm's relative short-selling during the pre-announcement period, RELSS (-5,-1), and pre and post-announcement returns while controlling for the firm's normal level of short-

selling as a percentage of trading volume. Specifically, we estimate the following equations:

$$RELSS(-5,-1) = c_0 + c_1 RET(0,1) + c_2 RET(-5,-1) + c_3 NORMRELSS + \varepsilon \quad (4)$$

$$RELSS(0) = d_0 + d_1 RET(1) + d_2 RET(0) + d_3 NORMRELSS + \varepsilon \quad (5)$$

where RELSS is the relative short-selling, measured as the ratio of shorted shares over traded shares, and NORMRELSS is the relative short-selling over the entire sample period of 2005. As in the prior discussion, a non-negative c_1 (d_1) would fail to affirm the hypothesis of informed trading.

Empirical Results

Table 2: Abnormal Short-Selling Prior to Earnings Announcements

The results of OLS estimation of equations (2) and (4). ABSS (-5,-1) is the average daily abnormal short-selling in the pre-announcement period , measured as the average daily short-sale volume in the pre-announcement period divided by the average daily short-sale volume over the sample period of 2005, all minus 1. RELSS (-5,-1) is the relative short-selling, measured as the ratio of shorted shares over traded shares in the pre-announcement period. RET (-5,-1) is the return over the 5 days prior to an earnings announcement. RET (0,1) is the 2- day return following an earnings announcement. ABVOL (-5,-1) is the average abnormal trading volume over the 5 days prior to an earnings announcement, measured as the average daily trading volume in the pre-announcement period divided by the average daily trading volume over the sample period of 2005, all minus 1. NORMRELSS is the relative short-selling over the entire sample period of 2005.

Explanatory Variable	**Dependent Variable**	
	ABSS (-5,-1)	RELSS (-5,-1)
Intercept	-0.02239**	0.0067
	(-2.40)	*(0.94)*
RET (0,1)	0.3056	0.0251
	(0.2)	*(0.82)*
RET (-5,-1)	1.6409***	0.2828***
	(4.64)	*(4.48)*
ABVOL (-5,-1)	0.7726***	N/A
	(17.55)	
NORMRELSS	*N/A*	0.9661***
		(25.71)
Adjusted R^2	0.5039	0.3384

N	1334	1334

Heteroskedasticity-consistent T-statistics are reported in parentheses
* indicates significance at the 10% level
** indicates significance at the 5% level
*** indicates significance at the 1% level

We estimate the models in equations (2) and (4) using OLS for the sample of 1334 earnings announcements from 479 unique firms. The results are presented in Table 2. In contrast to Christophe et al. (2004), our results, in both model specifications, do not provide evidence that abnormal short-selling is driven by information about the forthcoming earnings report. The coefficient β_1 (c_1) is insignificant, indicating that abnormal short-sale volume prior to earnings announcements contains no information about the forthcoming earnings announcements.

Also, in contrast to Christophe et al. (2004), there is a significant positive relationship, in both model specifications, between pre-announcement returns, RET (-5,-1), and abnormal short-selling before the announcement, ABSS (-5,-1). This suggests that short-selling increases (decreases) in "over-valued" ("under-valued") stocks based on contemporaneous price movements prior to earnings announcements. This provides evidence that at least some portion of short-selling prior to earnings announcements are driven by contemporaneous price movements. Finally, the coefficient of ABVOL (-5,-1) is positive and significant, indicating that abnormal trading volume is positively related to abnormal short-selling, consistent with Christophe et al. (2004).

Table 3: Pre-Announcement Short Selling: NYSE 2005 vs. NASDAQ 2000

Explanatory Variable	**Dependent Variable: ABSS (-5, -1)**	
	NYSE, 2005	*NASDAQ 2000*
Intercept	-0.02269**	0.233***
	(0.00932)	*(0.051)*
RET (0,1)	0.30625	-1.035***
	(0.21555)	*(0.309)*
RET(-5,-1)	1.66178***	-0.200
	(0.35392)	*(0.396)*
ABVOL (-5,-1)	0.77248***	1.088***
	(0.04405)	*(0.179)*
Adjusted R^2	0.5046	0.151
N	1334	913

Heteroskedasticity-consistent standard errors are reported in parentheses

* indicates significance at the 10% level

** indicates significance at the 5% level

*** indicates significance at the 1% level

Our results are tabulated with results from NASDAQ listed stocks in 2000 from Christophe et al. (2004) in Table 3 for easy comparison. The most striking difference is that our estimated coefficient for RET (0, 1), β_1, is not significant. We attribute the difference between our results and those of Christophe et al. (2004) to the following reasons as suggested by Daske et al. (2005): (1) The increase of short-sale volume as a percentage of total volume in 2005 may contain some short-selling based on speculation rather than information. As a result, the informativeness of short-selling may have been diluted; (2) Regulation FD, fully implemented in 2005, may have leveled the playing field somewhat and reduced the information advantage of some short-sellers. We also noted from Table 3 that our results show a significant positive relationship between pre-announcement returns, RET (-5,-1), and abnormal short-selling before the announcement, ABSS (-5,-1). This indicates that short-sellers are heavily influenced by contemporaneous price movements and suggests that short-sellers actively process market information as it becomes available.

Table 4: Abnormal Short-Selling on Announcement Days

The results of OLS estimation of equations (3) and (5). ABSS (0) is the average daily abnormal short-selling on the announcement day, measured as the average daily short-sale volume on the announcement day divided by the average daily short-sale volume over the sample period of 2005, all minus 1. RELSS (0) is the relative short-selling on the announcement day, measured as the ratio of shorted shares over traded shares on the announcement day. RET (0) is the return on the announcement day. RET (1) is the 1- day return following the announcement day. ABVOL (0) is the abnormal trading volume on the announcement day, measured as the trading volume on the announcement day divided by the average daily trading volume over the sample period of 2005, all minus 1. NORMRELSS is the relative short-selling over the entire sample period of 2005.

Explanatory Variable	**Dependent Variable**	
	ABSS (0)	RELSS (0)
Intercept	0.0809***	0.0037
	(4.13)	*(0.94)*
RET (1)	-1.049**	-1.0209*
	(-2.39)	*(1.86)*
RET (0)	5.353***	0.4206***
	(6.62)	*(8.21)*
ABVOL (0)	0.8406***	N/A
	(28.63)	

NORMRELSS	*N/A*	0.99981***
		(18.86)
Adjusted R^2	0.7057	0.2665
N	1334	1334

Heteroskedasticity-consistent T-statistics are reported in parentheses

* indicates significance at the 10% level

** indicates significance at the 5%level

*** indicates significance at the 1% level

To test whether short-sellers can efficiently process earnings-related information, we estimate the models in equations (3) and (5) using OLS for the sample of 1334 earnings announcements from 479 unique firms. As presented in Table 4, the results show a significantly negative relationship between ABSS (0) and RET (1). This supports the hypothesis that at least some portion of abnormal short-selling on the announcement day can predict future returns. In addition, our results also suggest that abnormal short-selling is significantly and positively affected by contemporaneous returns, indicated by a positive and significant coefficient of RET (0). Finally, the positive and significant coefficient of ABVOL (0) indicates that abnormal volume supports abnormal short-selling.

As a robustness test, we perform a Chi-square test on the association between the levels of abnormal short-selling prior to earnings announcements and the stock's post-announcement returns, following Dechow, Hutton, Meulbroek, and Sloan (2001) and Christophe et al. (2004).

Table 5: Chi-square Test for Pre-Announcement Abnormal Short-Selling

The test evaluates whether a classification into the highest or lowest return quintile based on their abnormal short-selling. ABSS (-5,-1) is the average daily abnormal short-selling, measured as the average daily short-sale volume in the pre-announcement period divided by the average daily short-sale volume over the sample period of 2005, all minus 1. RET (0,1) is the 2- day return following an earnings announcement.

		Lowest RET (0,1) quintile	Moderate RET (0,1) quintiles	Highest RET (0,1) quintile	Total
ABSS (-5,-1)	Expected %	20	60	20	100
Highest quintile	Observations	*54*	*154*	*59*	*267*
	Percentage	20.22	57.6	22.10	100

Other quintiles	Observations	212	647	208	1067
	Percentage	*19.9*	*60.6*	*19.6*	*100*
				Chi-square stat.	8.23
				p-value	0.9417

We split the sample into quintiles according to abnormal short-selling prior to earnings announcements, ABSS (-5,-1), and examine how these quintiles are distributed across quintiles according to post-announcement returns, RET (0,1). If abnormal short-selling prior to earnings announcements contains information about the forthcoming announcements, then we should expect the following: (1) the highest ABSS (-5,-1) quintile should fall disproportionally (greater than 20%) into the lowest RET (0,1) quintile, suggesting that short-sellers could identify which stocks to short prior to announcement; or (2) the highest ABSS (-5,-1) quintile should fall disproportionally (less than 20%) into the highest RET (0,1) quintile, suggesting that short- sellers know which stocks to avoid prior to announcements.

As presented in Table 5, about 20% of the stocks in the highest ABSS (-5,-1) quintile fall into the lowest RET (0,1) quintile while 22% of the stocks in the highest ABSS (-5,-1) quintile are in the highest RET (0,1) quintile. For the other ABSS (-5,-1) quintiles, the corresponding proportions are 19.9% and 19.6%. Furthermore, the Chi-square statistic is not significant, and the hypothesis of independence between ABSS (-5,-1) and RET (0,1) cannot be rejected. Consistent with our regression results, these Chi-square tests do not provide evidence that abnormal short-selling prior to earnings announcements is motivated by information contained in earnings reports.

As a robustness test, we perform a Chi-square test on the association between the levels of abnormal short-selling prior to earnings announcements and the stock's post-announcement returns, following Dechow, Hutton, Meulbroek, and Sloan (2001) and Christophe et al. (2004).

Table 6: Chi-square for Abnormal Short-Selling on Announcement Days

The test evaluates whether a classification into the highest or lowest return quintile based on their abnormal short-selling. ABSS (0) is the average daily abnormal short-selling on the announcement day, measured as the daily short-sale volume on the announcement day divided by the average daily short-sale volume over the sample period of 2005, all minus 1. RET (1) is the 1- day return the day following an earnings announcement.

		Lowest RET (0,1) quintile	Moderate RET (0,1) quintiles	Highest RET (0,1) quintile	Total
ABSS (0)	Expected %	20	60	20	100
Highest quintile	Observations	*54*	*176*	*37*	*267*
	Percentage	20.22	65.9	13.85	100
Other quintiles	Observations	212	625	230	1067
	Percentage	*19.86*	*58.57*	*21.55*	*100*
				Chi-square stat.	27.69
				p-value	0.0344

In addition, we perform a Chi-square test on the association between the levels of abnormal short-selling on earning-announcement days and the stock's post-announcement returns. We split the sample into quintiles according to abnormal short-selling prior to earnings announcements, ABSS (0), and examine how these quintiles are distributed across quintiles according to post-announcement returns, RET (1). If short-sellers can process information efficiently on earnings-announcements day, then we should expect the following: (1) the highest ABSS (0) quintile should fall disproportionally (greater than 20%) into the lowest RET (1) quintile, suggesting that short-sellers can identify which stocks to short on announcement days; or (2) the highest ABSS (0) quintile should fall disproportionally (less than 20%) into the highest RET (1) quintile, suggesting that short-sellers know which stocks to avoid on announcement days. Table 6 presents the Chi-square test results for the relationship between ABSS (0) and RET (1). While 20% of the stocks in the highest ABSS (0) quintile fall into the lowest RET (1) quintile, only 13.85% of the stocks in the highest ABSS (0) quintile are in the highest RET (1) quintile. This suggests that some short-sellers on the announcement day can *avoid* firms in the highest RET (1) quintile by processing earnings information. For the other ABSS (0) quintiles, the corresponding proportions are 19.86% and 21.55%. Moreover, we note that in

Table 6 the Chi-square statistic is significant, and the null hypothesis of independence between ABSS (0) and Ret (1) is rejected.

Table 7: Return and Abnormal Short-Selling: Pre-Announcement vs. Announcement Day

The results of OLS regression of returns on abnormal short-selling and other related variables. RET (-5,-1) is the return over the 5 days prior to an earnings announcement. RET (0) is the return on the announcement day. ABSS (-5,-1) is the average daily abnormal short-selling in the pre-announcement period , measured as the average daily short-sale volume in the pre-announcement period divided by the average daily short-sale volume over the sample period of 2005, all minus 1. ABSS (0) is the average daily abnormal short-selling on the announcement day, measured as the average daily short-sale volume on the announcement day divided by the average daily short-sale volume over the sample period of 2005, all minus 1 RET (-5,-1) is the return over the 5 days prior to an earnings announcement. RET (0,1) is the 2- day return following an earnings announcement. ABVOL (-5,-1) is the average abnormal trading volume over the 5 days prior to an earnings announcement, measured as the average daily trading volume in the pre-announcement period divided by the average daily trading volume over the sample period of 2005, all minus 1. RET (1) is the 1- day return following the announcement day. ABVOL (0) is the abnormal trading volume on the announcement day, measured as the trading volume on the announcement day divided by the average daily trading volume over the sample period of 2005, all minus 1.

Explanatory Variable	**Dependent Variable**	
	RET(0,1)	*RET (1)*
Intercept	*0.00352***	*0.00259***
	(2.24)	*(1.98)*
ABSS(-5,-1)	*0.0008*	*N/A*
	(0.2)	
ABSS(0)	*N/A*	*-0.00258***
		(-2.39)
RET(-5,-1)	*-0.13970****	*N/A*
	(-3.02)	
RET(0)		*-0.00916*
		(-0.40)
ABVOL (-5,-1)	*-0.0005*	*N/A*
	(-0.11)	
ABVOL (0)	*N/A*	*0.00160*
		(1.49)
N	1334	1334

Heteroskedasticity-consistent standard errors are reported in parentheses
* indicates significance at the 10% level
** indicates significance at the 5% level
*** indicates significance at the 1% level

To further examine the relationship between post announcement return and abnormal short-selling, we regress post announcement returns on abnormal short-selling and other related variables, and present the results in Table 7 (We are in debt to an anonymous referee for this suggestion). As shown in Table 7, there is a negative and significant relationship between Ret (1) and ABSS (0), indicating that abnormal short-selling on announcement days has some predictive powers on post announcement returns. Table 7 also shows that there is no significant relationship between Ret (0, 1) and ABSS (-5,-1). This is consistent with our previous results in that short-sellers' informational advantage stems from their ability to process public information.

Concluding Remarks

Short-sale volume as a percentage of total trading volume has increased dramatically in the years since 2000. Our study contributes to the ongoing discussion in the literature on short-selling around public information events by investigating the relationship between short-selling and future returns within the context of 1334 earnings announcements in NYSE listed stocks for the year 2005. In contrast to Christophe et al. (2004), we do not find a negative association between pre-announcement short-selling and post-announcement returns. In addition, our results show a significant and positive relationship between pre-announcement returns and abnormal short-selling before the announcement. This indicates that short-sellers are heavily influenced by contemporaneous price movements and suggests that short-sellers actively process market information as it becomes available.

Our investigation of the relationship between short-selling on announcement days and post-announcement returns documents a significant and strong negative association between short-selling on announcement days and post-announcement returns, consistent with the results in prior literature in that short-selling can predict future returns. Our results suggest that short-sellers' ability to predict future returns appears to stem from their ability to process public information.

References

Aitken, M., A. Frino, M. McCorry, and P. Swan (1998). Short sales are almost instantaneously bad news: Evidence from the Australian Stock Exchange. *Journal of Finance* 53, 2205-2223.

Asquith, P., P. Pathak, & J. Ritter (2005). Short Interest, institutional ownership, and stock returns. *Journal of Financial Economics* 78, 243-276.

Boehmer, E., C. Jones, & X. Zhang (2008). Which shorts are informed? *Journal of Finance* 63, 491-527.

Christophe, S, M. Ferri, & J. Angel (2004). Short-selling prior to earnings announcements, *Journal of Finance* 59, 1845-1875.

Daske, H., S. Richardson, & A. Tuna (2005). Do short sale transactions precede bad news events? Working Paper, University of Pennsylvania.

D'Avolio, G (2002). The market for borrowing stock, *Journal of Financial Economics* 66, 271-306.

Dechow, P., A. Hutton, L. Meulbroek, & R. Solan (2001). Short-sellers, fundamental analysis, and stock returns. *Journal of Financial Economics* 61, 77-106.

Diamond, D. & R. Verrecchia (1987). Constraints on short-selling and asset price adjustment to private information. *Journal of Financial Economics* 18, 277–311.

Diether, K., I. Werner and K. Lee, 2009. Short-sale strategies and return predictability, *Review of Financial Studies*. 22, 575-607

Engelberg, J. Reed, and Ringgenberg (2010). How are shorts informed? Short sellers, news, and information processing. Working papers, University of North Carolina.

Gintschel, P and S. Markov. (2004). The Effectiveness of Regulation FD. *Journal of Accounting and Economics* 37, 293-314.

Karpoff, J. and X. Lou (2010). Short sellers and financial misconduct. *Journal of Finance* 65, 1879-1913.

Miller, E., 1977. Risk, uncertainty, and divergence of opinion. *Journal of Finance* 32, 1151-68.

Biographies

Matthew Serfling is a PhD student in Eller College of Management, University of Arizona. He graduated from North Dakota State University in 2010 where he served as the Vice President of the Bison Fund, a student-managed investment fund.

Wei Zhang is an associate professor in the College of Business, North Dakota State University where he is also the co-advisor of the Bison Fund. He has recently published articles in the *Financial Analysts Journal*, *Finance Research Letters*, and the *Journal of Futures Markets.*