The role of the media in disseminating insider trading news

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Abstract

We use the disclosure of insiders' trades to investigate whether the way in which news is disseminated by the media affects the securities market response. To do this, we utilize recent changes in the disclosure rules governing insider trades and an exogenous change in media coverage to cleanly identify media effects. Using high-resolution intraday data and a plausibly exogenous change in media coverage, we find clear effects of media disclosure in price and volume responses to news. These results help resolve open questions regarding the importance of investor inattention and help explain why apparently "second hand" news affects securities prices.

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I. Introduction

A recent literature explores the role of the media in financial markets and, in particular, whether and how the media influences security prices and trading volume, both at the market level and for individual firms. While there is growing consensus that the media plays an important role in reducing information asymmetry [1] and affecting market responses to information releases,[2] we still lack a clear understanding of the mechanism through which that influence occurs. Our study contributes to this literature by isolating the effect of the media's dissemination of news, as opposed to its information creation role (e.g., expanding the information set through analysis), using two research settings that enable us to cleanly identify the effect of dissemination.

The disclosure of insiders' trades provides a useful setting for evaluating whether the *dissemination* of news by the media—that is, simply repeating information already in the public domain without adding additional analysis, context, or news—affects the way in which markets react to news. First, these are mandatory disclosures, resulting in limited managerial discretion over the timing or content of the news (in contrast to, say, earnings announcements where management has a good deal of discretion over timing and content). Second, the media coverage that immediately follows such events simply regurgitates facts about the trade—who made the trade, when, how many shares, and at what price. Finally, the new disclosure regime provides precise information on the timing of not only the initial public disclosure (through EDGAR) but also the subsequent media coverage, which allows us to cleanly identify a media effect by investigating the intraday market responses to these events.

[1] See, for example, Bushee, Core, Guay, and Hamm, 2010; Blankespoor, Miller, and White, 2012.
[2] See, for example, Tetlock, 2007; Engelberg and Parsons, 2011; Li, Ramesh, and Shen, 2011; Dougal, Engelberg, Garcia, and Parsons, 2012.

Over the last ten years the SEC has changed two key aspects of the rules covering the mandatory disclosure of insider trades. First, in 2002, as part of the Sarbanes-Oxley legislation, the SEC substantially shortened the time between an insider trade and when information about that trade had to be filed with the SEC. Prior to the change, insiders had up to 10 days after the end of the calendar month in which the trade occurred to file the requisite information (Form 4) with the SEC. This often led to delays of more than a month between the trade and its disclosure. After the rule change in 2002, insiders were required to make these filings within two business days of the trade, leading to substantially shorter filing delays (more than 85% of insider trades are now filed within the two business day requirement).[3] Second, prior to 2002, it was not clear exactly when the insider trade information was made public through SEC filings.[4] In June 2003, the SEC required that these filings be made electronically, via its online EDGAR system, meaning that the information is instantaneously available to outside investors and that there is no ambiguity about when it becomes publicly available (there is a time stamp).[5]

Recent evidence on investor inattention and the role of the media in securities markets suggests that how news is disseminated can affect the market response. If investors' ability to process information is limited, as suggested by the inattention literature, more visible dissemination of news—over prominent wire services as opposed to the public but relatively opaque EDGAR filings—is likely to trigger investor attention and an associated market response

[3] See Brochet (2010) and the evidence we report below.

[4] Lakonishok and Lee (2001) discuss the difficulty of ascertaining exactly when insiders' trades were made public under the previous disclosure regime, which led to a market for intermediaries that accessed and disseminated the information to interested investors (in particular, they use CDA/Investnet's Insider Trading Monitor). They indicate that this service typically took several days to report the filing information, with the implication that this delayed the associated price response. More generally, studies of the information content of SEC filings such as Form 10-K filings often have trouble establishing precisely when filings actually become available to the public because that information was not recorded or made available (Carter and Soo, 1999; Alford, Jones, and Zmijewski, 1994).

[5] Some firms voluntarily filed Form 4 documents electronically prior to the required June 2003 date. In May 2002, the SEC added the time-stamp, which we require, to the actual filings.

(Barber and Odean, 2008; Cohen and Frazzini, 2008; Dellavigna and Pollet, 2009; Hirshleifer, Lim, and Teoh, 2009). Further, dissemination by the media can directly affect how investors interpret and react to news. All of this presumes there are non-trivial market frictions that impede its ability to quickly and fully impound news, and so provides an opportunity for the media to affect price formation (e.g., Davies and Canes, 1978; Huberman and Regev, 2001; Tetlock, 2011). We view the new disclosure regime for insider trading as a powerful place to test these ideas.

We focus on the disclosure of information on insiders' trades for three reasons. First, as we report later, a large fraction of these filings are made during the trading day, which facilitates tests based on intraday data.[6]

Second, insider trading news is less likely to be accompanied by ancillary information produced by other market agents. In contrast, the release of earnings news very quickly results in the production of various forms of analysis by market commentators, including the media, analysts, and investors. This additional commentary makes it hard to separate the effect of the news from the way it is disseminated because more news is immediately produced and that production is likely to both affect, and be affected by, the nature of the earnings news. Further, managers strategically time the release of earnings news based on various attributes of that news (such as its sign and magnitude), which further complicates identification.[7]

Finally, insider trading filings are important informational events. It has been known for some time that insider trading is profitable (Lorie and Niederhoffer, 1968; Seyhun, 1986) but the

[6] Our evidence indicates that over 90% of earnings announcements are now reported outside trading hours.
[7] See, for example, Patell and Wolfson (1982) and Bagnoli, Kross, and Watts (2002) for evidence on the relation between earnings news and the timing of its disclosure. Dellavigna and Pollet (2009) provide evidence that prices are less responsive to earnings news on Fridays, which is likely related to managers' disclosure incentives (a cause, effect, or both). Doyle and Magilke (2009) provide recent evidence on the intraday timing of earnings announcements and how these relate to managerial disclosures.

evidence was less clear on whether the disclosure of news about insiders' trades affects stock prices. Using data from the new regulatory regime, Brochet (2010) reports that there is a positive and significant daily returns reaction to filings of insider purchases under the new post-SOX regime but that there was little evidence of a reaction prior to SOX, a finding consistent with prior evidence (e.g., Lakonishok and Lee, 2001).

Our research also contributes to the insider trading literature. It is well-established that corporate insiders profit from their trades but less clear whether other investors can profit by trading on public information about those trades.[8] Whether outside investors can profit from the information in insiders' trades depends on when the information in those trades (1) is publicly disclosed, and (2) is fully impounded into price. Because of various institutional and data constraints, most previous research on the profitability of insider trading has faced difficulty observing and measuring when these events occur (e.g., Jeng et al., 2003). We use data that allow us to identify exactly when and how the information in insiders' trades is made available to external investors, enabling us to determine whether and when outside investors profit from insider information.

We use an extensive dataset on insiders' trades (from Form 4 filings), time-stamped data on the corresponding SEC EDGAR filings, and time-stamped data on the dissemination of those filings over Dow Jones newswires, as well as intraday price quote and trade data from TAQ. These data allow us to take two complementary approaches to identifying the effect of media coverage on the market response to insider trading news.

First, we gather precise (to the second) intraday information on the timing of both the underlying news release and the subsequent media coverage of that news, which allows us to

[8] Some representative papers are Jaffe (1974), Finnerty (1976), Seyhun (1986), Lakonishok and Lee (2001), and Jeng, Metrick, and Zeckhauser (2003).

separate the effects of the news from the effects of its coverage by the media. To identify the public disclosure of the insider trading news, we download time-stamped Form 4 filings from the SEC's EDGAR database. We then examine how the dissemination of that news during the same trading day through Dow Jones newswires affects the way it is incorporated into security prices and generates volume effects.

Second, we exploit a natural experiment in which Dow Jones initiated coverage of insider trading filings. The initiation of coverage (dissemination) is plausibly exogenous with respect to the underlying production and content of the news, and so offers a relatively clean way of identifying the causal effect of that coverage.

Our evidence supports the conclusion that there is a media effect. We find that the way intraday prices (more precisely, bid-ask midpoint quotes) and abnormal volume adjust to SEC filings of insiders' trades is affected by both the existence and timeliness of the accompanying Dow Jones media coverage. First, we use intraday data to show that price and volume respond at the time when Dow Jones disseminates news about insider trades rather than when the news first becomes publicly available through EDGAR. Second, when we compare the response of the market in periods with and without Dow Jones coverage of the insider filings, we find clear evidence that the market response differs in a way that is consistent with the dissemination of the news via Dow Jones affecting the market response.

More generally, our research addresses how changes in information technology and associated changes in the media affect security prices. Over the last 10-15 years there have been significant declines in the cost of processing and disseminating information, which have resulted in a dramatic increase in the production of information. There is now almost instantaneous 24/7 coverage of any type of information, including information about firms. Yet it is unclear how

these changes affect price formation and liquidity in securities markets. Our paper shows that the media plays an important role in how information is impounded by securities markets.

The next section provides more details of our sample and data. Section III reports our tests. Section IV provides a summary and conclusion.

II. Sample and data

Our primary source of insider trade data are SEC Form 4 filings, available from EDGAR. The data start in July 2002 because this is when the SEC first provides insider filings with time stamps in significant numbers (the SEC first required electronic filing on June 30, 2003 but some firms elected to begin making these filings before this date). We obtain media coverage from RavenPack (RP), which provides time-stamped data for all news items disseminated via Dow Jones Newswires. These news items are analyzed and categorized in a number of ways; we use RP to obtain the timing and content of media coverage. In particular, RP is our source for when the news contained in SEC filings is disseminated in the media.

Because we use intraday TAQ data on market transactions and quotes, we restrict our analysis to news released during the trading day. There is evidence (e.g., Bagnoli, Clement, and Watts, 2006; Doyle and Magilke, 2009) that earnings announcements are increasingly made after trading hours. When news is released after hours, it is hard to separate the market response to the news from the response to its subsequent dissemination by the media. Consequently, we chose to restrict our analysis to an event that is frequently announced during trading hours.

Figure 1 plots the percentage of insider filings that occur during trading hours for our full sample period, reported separately for purchases and sales. The time of day is obtained from the EDGAR time stamps. There are 184,299 insider filings summarized on this plot. For

comparison, we also plot the percent of earnings news that is announced during trading hours. Because we do not have underlying SEC filings for earnings announcements,[9] we use the timing of the associated Dow Jones Newswire article from RP to proxy for the time earnings news is released.[10]

It is clear from Figure 1 that the large majority of earnings news is released outside of trading hours. At the beginning of our sample period in the latter part of 2002, around 10% of earnings news was released during trading hours. This percentage falls to 5% or less by 2010. Although there is likely some measurement error here because we are using the media coverage time rather than the timing of the release itself, it is clear that the large majority of earnings news is now released outside of trading hours, making it unsuitable for intraday analysis.

A higher fraction of insider trading news is released during trading hours, although this fraction also declines over the sample period. For insider purchases, the fraction of announcements made during trading hours ranges between roughly 60% to 70% in the early part of the sample period and then stabilizes at around 50% to 55% over 2007-2010. For insider sales, the fraction begins at around the same level but declines to the 30% to 40% range by 2009-2010.[11] As discussed more fully below, because previous research finds that insider purchases are more informative than insider sales, most of our tests focus on insider purchases, roughly half of which are reported during the trading day.

[9] Beginning March 28, 2003, the SEC requires firms to file earnings announcements and related information on Form 8-K. Previously, there was no requirement to file earnings announcements with the SEC, although that information was subsequently included in the quarterly 10-Q filing.

[10] Specifically, we identify the time of release using the first article on or after the earnings announcement date whose category includes "earnings" or "revenue" per RavenPack (on a given day). To increase the odds that the story is truly an earnings release, we eliminate all instances which do not fall within ten days of an IBES earnings announcement, resulting in 121, 307 observations.

[11] The fact that a larger and increasing fraction of insider sales are filed after trading hours suggests that insiders have discretion over when filings occur. This is less of a concern for purchases because insiders are less likely to have incentives to hide the content of these trades (managers are more likely to want to the market to know they are bullish about the firm).

Table I reports on the delay between the date of insiders' trades and the date the corresponding Form 4 is filed with the SEC under both the old and new disclosure regulations. This evidence is based on just over 600,000 SEC filings over the period from January 1, 1990 to the end of August 2002 (before the new requirements came into force) and a similar number of filings over the period from the end of August 2002 to the end of 2010. Consistent with Brochet (2010), the new disclosure rules have reduced the filing delay very significantly. Under the old reporting regime the median delay was 18 (trading) days with an interquartile range of 14 days. Under the new regime the median delay is 2 days with an interquartile range of 1 days.

III. Empirical Tests

A. Media coverage delays

We begin by examining the timing of the media coverage for insider trading events. We define news as SEC (EDGAR) filings of insider trades, and use variation in when information about these trades is disseminated by Dow Jones to identify the dissemination effect. To obtain data on the initial media release of the insider trade filings, we match the SEC filings to the associated Dow Jones Newswire articles. This match is complicated by the fact that the RP data on the Dow Jones article does not include the identity of the insider, and so does not allow us to match the article to the SEC filings in those cases where there are multiple insider filings by a given firm in a short period of time. To ensure an exact match, we eliminate observations in which two filings for a given firm occur within 15 minutes of one another. We collect trade details (e.g., transaction price, number of shares, etc.) from Thomson Reuters. Table II summarizes sample selection.

We start with around 429,000 insider sales and purchases by officers, directors, and committee members from Thomson Reuters over 2004 to 2010.[12] Our sample begins in 2004 because Dow Jones (RP) does not initiate coverage of insider filings until January of that year. Approximately 50,000 observations cannot be matched to SEC filings. After removing observations with multiple Form 4 filings for a given firm within a 15 minute interval, the sample size is reduced to around 280,000 observations. The sample is then reduced to around 117,000 observations after we require that filings occur between 9:40 a.m. and 3:30 p.m. each trading day (to facilitate the use of the TAQ data and avoid possible beginning and end of trading day effects). The sample size is further reduced by matching to Dow Jones/RP (to get media release times) and to TAQ, resulting in a sample of 80,139 trades. Once we also require that the transaction price falls within the daily trading range on CRSP (to remove possible data errors), we are left with 75,855 insider trades.

Figure 2 provides a histogram of reporting delays for the sample of insider filings, defined as the elapsed time (in seconds) between the initial EDGAR filing and the corresponding Dow Jones release time, reported separately for insider purchases and sales. These data make it clear that insider news is disseminated extremely rapidly. Most purchases are reported on Dow Jones within 60, 70, or 80 seconds of the SEC filing, with the distribution heavily right skewed. The very large majority of filings are disseminated via Dow Jones within five minutes of the EDGAR filing. Insider sales are typically reported a bit more slowly, with most being reported 60 to 90 seconds after the initial filing, with a heavier right tail.

To investigate whether the information content of the filing affects the length of the delay between the EDGAR filing and dissemination by Dow Jones, Table III regresses coverage delay

[12] We identify this group as having rolecode1 equal to any of the following: CB, D, DO, H, OD, VC, AC, CC, EC, FC, MC, SC, AV, CEO, CFO, CI, CO, CT, EVP, O, OB, OP, OS, OT, OX, P, S, SVP, VP.

(in seconds) on year fixed effects and three variables likely to capture variation in information content—the size of the trade, past trades by the same insider over the prior year, and a CEO dummy. It is clear from the adjusted R^2s of these regressions that most of the variation in delay is due to calendar year effects – over time, the delay becomes shorter, presumably due to continuing improvements in the way Dow Jones captures and distributes the news. The year fixed effects provide an adjusted R^2 of just over 50%, a number that is barely affected by the inclusion of the information variables, which nonetheless are statistically (if not economically) significant. For our purposes, the key takeaway is that the delay is not related in any important respect to the information content of the release, strengthening our working assumption that delay is plausibly exogenous with respect to the information content of the news.

B. Intraday analysis of insider filings

Our main analysis examines how the timing of the media release affects the way the news is assimilated into prices and affects volume. This requires: (i) quantitative information on the insider trades, to estimate their profitability, which we obtain from Thomson Reuters via WRDS; (ii) TAQ trade and price quote data. This means that we ultimately match data from four sources: (i) the SEC filings via EDGAR, (ii) Dow Jones Newswire data from RP, (iii) insider and insider trade data from Thomson Reuters, and (iv) TAQ data. While firm matches can be made using firm CIK numbers, the insider data must be matched by name using a text matching algorithm. Finally, we require that the delay between the Form 4 filing and the Dow Jones coverage is more than 30 but no more than 300 seconds, reducing the final sample to 71,105 insider trades, comprising19,672 purchases and 51,433 sales. We truncate filing delays over 300 seconds because over 97% of purchases fall within this window and this avoids undue influence

by outliers. In our regression analyses, we require reporting delays of more than 30 seconds to ensure our measurement of the market response to the media coverage does not overlap the market response to the SEC filing.

We use price and volume measures to provide evidence on how markets respond to insider trading news and its dissemination. The prices are second-by-second midpoints of the quoted bid-ask spread. The use of bid-ask midpoints mitigates two problems associated with actual transaction prices. First, if investors (and market makers) hold homogeneous beliefs, it is possible for the fundamental value of the firm to change without trading (e.g., Verrecchia, 2001). This issue is especially important for thinly traded stocks. Second, and more importantly, transaction prices include the effect of bid-ask bounce making them a noisy proxy for fundamental value, especially in short windows (McInish and Wood, 1992).

We report the price series in Figure 3, Panel A, and the volume series in Panel B, with purchases and sales shown separately. The plots are designed to show the relative trading advantage of differentially informed traders, both insiders themselves as well as traders who obtain information at different points during the dissemination process. The purchases line in Panel A begins at approximately 0.35%, which indicates that a trader who is able to buy at the spread midpoint at the exact time (second) of the SEC filing is buying at a price that is 0.35% less favorable (higher) than the purchase price reported by the insider on the SEC filing. Put differently, this says that the insider benefits to the tune of an amount of 0.35% of price before other traders are first able to access the news. The horizontal axis shows event time, measured in seconds after the EDGAR filing.

The purchases line for prices shown in Figure 3, Panel A is initially almost flat, showing little evidence of response to the EDGAR filing. The line begins to slope up around the 30

seconds mark, roughly coincident with the earlier Dow Jones dissemination times (Figure 2). The line then moves steeply upwards between 30 and 60 seconds, which coincides with the timing of a large number of Dow Jones releases. This upward movement continues through 60 seconds and flattens out by 90 seconds, after which there is further upward drift. Once again, this pattern lines up with the frequency of the timing of the Dow Jones releases, shown in Figure 2. Overall, the evidence here is consistent with prices responding to the Dow Jones releases but not to the initial EDGAR filings, consistent with a Dow Jones dissemination effect. We link the way prices adjust to the dissemination of news more formally below.

In terms of economic magnitudes, the price movement from the EDGAR filing through the end of the window shown in Figure 3, Panel A is around 0.31%, which means that this drift is smaller than that between the date of the insider trade and the EDGAR filing. Of this total drift, 44% occurs in the first 60 seconds after the filing, with most of this occurring in the 30 second through 60 second window which, as noted above, coincides with the Dow Jones releases. This result indicates that outsiders can profit from insider traders by an amount (0.31% of price) that is approximately equal to the average gain earned by an insider from the time of her trade through the time the trade is made public on EDGAR (this will understate the full return to outsiders (and insiders) if the drift continues after our 5 minute event window).

Figure 3, Panel A also shows the price response to insider sales. It is clear that the response to insider sales is relatively small in economic terms. This is consistent with previous studies (e.g., Lakonishok and Lee, 2001) that show that insider trades based on purchases are more profitable than those based on sales. Consequently, we drop insider sales from the remainder of the analysis.

Panel B of Figure 3 reports on the volume measures. We measure volume as percentage abnormal volume. This ratio shows cumulative abnormal volume as a percentage of average volume during the same 300 second window in surrounding weeks. Specifically, abnormal volume (the numerator) is the actual cumulative volume through a given point in event time less average cumulative volume for the same day, time, and period for the 52 weeks surrounding the event date. Given our event window of 300 seconds on a particular day, we scale the cumulative abnormal volume for each second during the window by the average volume for that firm during the same 300 seconds (same day of week and time of day) in the surrounding 52 weeks as a benchmark for the "normal" total volume. For example, by 60 seconds following the SEC filing the average abnormal volume is already 73% of the "normal" volume for the full 300 second window.

The volume graphs in Panel B of Figure 3 also support the view that markets respond to the dissemination of the news but not to its initial public availability on EDGAR. As with the price evidence, abnormal volume is essentially zero for up to around 30 seconds after the filing but then arcs upward beginning around 30 seconds and continues steeply upward through 60 seconds after the filing. As indicated above, this timing coincides with that of the Dow Jones releases, and so is consistent with dissemination causing the volume response. Abnormal volume continues to climb for the full 300 second window although not as strongly as it does through around 60 seconds, consistent with a gradual accumulation of releases. The fact that volume remains elevated for longer periods after the release than prices is consistent with previous research on how prices and volume respond to news.

We next provide more formal evidence on our main research question: whether the timing of the news release affects the way markets respond to the news. If markets are fully

efficient and frictions are small, the market response to news, which first becomes publicly available at time of the filing,[13] should not vary as a function of the manner in which it is disseminated through Dow Jones. To test this, we examine whether the price response varies according to the length of the delay between the time of SEC filing and its initial dissemination through Dow Jones, as summarized in Figure 2. To do this, we sort observations into two buckets according to the length of the delay. The "short delay" bucket contains the bottom one-third of observations (for which delay is shortest); the "long delay" bucket contains the top one-third of observations (up to 300 seconds), for which delay is longest. These two buckets capture the extreme groups from the distribution of delays reported in Figure 2.

As discussed above, the regressions in Table III provide evidence that delay is not related in any important way to information variables. To examine this further, Table IV compares certain descriptive statistics for observations in the short delay and long delay groups. Consistent with the regressions, the evidence here indicates that, if anything, the long delay group is associated with more informative trades in that trade size is larger for the long delay group than for the short delay group, although the differences are not large in economic terms (mean and median trade size is $104,466 and $23,113 for the long delay group compared to $65,814 and $17,250 for the short delay group). The evidence in Table IV also shows little in the way of difference between the groups in terms of insider type, another common indicator of the information content of the trade (e.g., Clayton and Trzcinka, 2012).

We report the results graphically in Figure 4, including whether the differences between the short and long delay groups are statistically significant. Once again, we report prices in Panel A and volume in Panel B. This figure provides visual (and statistical) evidence of an

[13] This assumes that the insider trades themselves are not informative (i.e., that the insiders camouflage their trades) so that non-insiders first become aware of the insider trades through the SEC filings.

effect of the Dow Jones coverage delay: the price response for observations in the short delay bucket occurs distinctly earlier than for observations in the long delay bucket, which is more gradual. Further, the price line for the short delay observations remains above that of the long delay observations for most of the period, with the differences being statistically significant at the 5% level or better for much of the first 120 seconds after the filing point.[14] After 120 seconds, the lines begin to move together, as expected, as the news is essentially fully disseminated for both groups by this time (Figure 2 shows that the bulk of the news is released by 120 seconds). This pattern is consistent with the differential delay in media coverage: the mean (median) delay for the short sample is 68 (55) compared to 152 (110) for the long sample (Table IV). To give a sense for magnitudes, over the first 30 seconds prices adjust by about 2.5 basis points (bps) for the short delay group versus about 0.6 bps for the long delay group. After one minute, prices for the short delay group have increased by about 13 bps versus 11 bps for the long delay group.

Panel B of Figure 4 reports the abnormal volume results. Similar to the evidence for the price response, abnormal volume responds earlier for the short delay group than for the long delay group, with differences statistically significant at the 5% level for much of the interval up to 50 seconds (specifically, from 12 to 48 seconds). The magnitude of the volume response is substantial, with abnormal volume for both groups reaching approximately 50% after about 50 seconds (short is 53% and long is 49%). After 50 seconds, abnormal volume continues to climb for both groups, indicating that market participants continue to trade on the news, consistent with the continuing drift evident in Panel A. However, differences between the short and long delay groups are no longer significant after 50 seconds.

[14] More specifically, the differences are significant at the 5% level over the following intervals (in seconds): 9-81, 85-93, 95, 99-107, 110-114, 117-119.

Overall then, as summarized in Table V, our evidence shows that there are statistically and economically significant differences in the price and volume responses between the short and long delay groups. This is evidence that the rapidity with which the media disseminates news affects the market response, holding constant its information content and when it reaches the public domain.

Table VI reports a somewhat different test of whether Dow Jones coverage affects the evolution of the price and volume responses. To gauge this for price in Panel A, we regress the price response (change in bid-ask midpoint) for the 30 seconds after the Dow Jones release on the filing return (price change for the 30 seconds after the filing, to control for the content of the news), as well as the delay length (in seconds). For delay length, we include polynomial terms of up to degree four to try and capture the non-linear response shown in Figure 4. The goal is for the control variables (the filing return and the delay terms) to capture the evolution of price absent any Dow Jones (media) coverage effect. Under the assumption that this works reasonably well, the intercept provides an estimate of the magnitude of the media coverage effect. We use the same set of observations to estimate these regressions as formed the basis of Figure 3, but exclude observations for which the coverage delay is less than 30 seconds to ensure that there is no overlap between the filing return window and the Dow Jones release window. A similar analysis based on the volume response is reported in Panel B of Table VI.

The regression analyses for purchases shows that the polynomial delay terms are significant, with delay negatively related to the Dow Jones reaction (the longer the delay, the smaller the response to the news release) with this effect occurring at an increasing rate in the

delay.[15] More important, in all specifications the regression intercept is positive and highly significant, indicating that after holding the normal price response pattern constant, there is a positive and statistically significant effect of Dow Jones coverage. In the full specification (including all the delay terms), the intercept is 0.14%, and so has a magnitude about one third the size of the initial price advantage of the insider (of 0.35%, reported above), which implies that it is economically significant.

Panel B reports similar findings for the volume specifications. We again in these regressions that the intercept is positive and strongly significant in all specifications, indicating that there is a response to the Dow Jones coverage controlling for the magnitude of the news and the normal reaction to the news. Moreover, this effect is economically meaningful, with the 30 second abnormal volume varying from 25% to 91% of normal volume for the benchmark period, depending on the specification.

Overall, the results in Table VI, combined with those reported in Figure 4, provide evidence that coverage by Dow Jones systematically affects the way prices and volume respond to news about insider purchases. Notice that the current specification effectively assumes that any difference disappears by the end of the 30 second window. If this is not completely true, which seems likely, the intercept is understated, which means the estimated effect is understated. This result is evidence that the media does have an effect on prices over and above the price effect of the underlying news.

Additional confirmation of this result is provided in Figure 5, Panel A, which plots price changes in event time (measured in seconds) around the time of the Dow Jones release. Note that this information is not available in Figure 4, where event time is defined relative to the time

[15] This regression clusters observations by date. We also cluster by firm with similar results. We also estimate these regressions using 15 second intervals (as opposed to 30 second intervals) without any material differences in results.

of the EDGAR filing, as opposed to the time of the Dow Jones release. While the plot is generally increasing, which reflects the upward drift in price shown in Figure 4, there is an observable kink at the time of the Dow Jones release, consistent with the coverage effect that is evident in the Table VI regressions. In an attempt to extrapolate the plot, we use the percent change in price prior to the media coverage to predict the slope following the kink in the absence of media coverage and, thereby, provide a counterfactual price response. Specifically, we predict the percent returns after the media coverage using the data from 15 seconds prior to the media coverage and a second order polynomial of the time elapsed. This counterfactual price response, assuming no media coverage, is shown as the dashed line in Panel A of Figure 5. The difference between the predicted response line and that observed, consistent with the previous analysis, suggests that there is an effect of Dow Jones coverage.

We obtain similar confirmatory evidence using volume, shown here in Figure 5, Panel B. Once again, we use fitted values from the regression to produce a counterfactual volume path in a world without the Dow Jones release. As is clear from the figure, the actual line diverges from this path in an upward direction, consistent with a volume response to the Dow Jones coverage after conditioning on how volume would respond to the news absent Dow Jones coverage.

C. Analysis of presence/absence of Dow Jones coverage

We next use a variation on this setting to examine the effect of Dow Jones reporting on the price response to the release of insider trading news. To understand this setting, Figure 6 provides a timeline for our sample period around January 2004 showing: (i) the set of insider transactions, per Thomson Reuters, (ii) the set of SEC filings of insider trades, and (iii) Dow Jones' coverage of the SEC filings, per RP. Figure 6 shows that Dow Jones initiates coverage of

the insider trade filings in mid-January 2004, around 18 months after time stamps on electronic EDGAR filings of insider trades on Form 4 first became available. This allows us to compare the price response to filings before and after initiation of coverage by Dow Jones, where coverage can be viewed as exogenous (i.e., Dow Jones' initiation of coverage is plausibly unrelated to the news content). This initiation forms the basis for our tests in this section.

To conduct this test, we need to match insider transactions before and after Dow Jones initiates coverage as closely as possible. To do this, we restrict attention to firms that report insider purchases in both three month periods before and after coverage initiation in January 2004. This strict criterion reduces sample size substantially: there are 95 firms with data available data for these tests. We eliminate eight pairs due to large differences in trade size (the trade size between the pre and post-DJ coverage windows differed by more than $100,000), resulting in a sample of 87 firms. To evaluate how well this matching process works, Table VII compares observations in the before and after groups, and shows that the two groups are very similar, at least with respect to trade size and titles/position of the insiders.

We report the results of the analysis in Figure 7. There are four panels, two for price tests and two for volume tests. In Figure 7, we report the market response in event time (measured in seconds) relative to the time of the Dow Jones release and a pseudo-Dow Jones release and compare responses across the groups— the coverage (by Dow Jones) and no-coverage (before Dow Jones) observations. For the non-covered trades, we define a pseudo-Dow Jones release time using the delay in media coverage for the matched covered trade. The results in Panel A for price show clear evidence of a coverage effect, with the cumulative return jumping upwards for the covered ("Dow Jones") observations in the first 30-60 seconds and then continuing in a generally upward trend. This series then continues generally upwards for the full five minute

period shown. In contrast, the series for the non-covered ("No Dow Jones") group is essentially flat (or slightly negative) for the first two minutes, before moving upwards briefly. Differences between the series are statistically significant at the 5% level for most of this period (specifically, for the 9-41, 85-89, and 91-97 second intervals). Overall, Panel A shows clear evidence of a Dow Jones price effect.

As an alternative way of assessing market response, Panel B reports the percentage of observations in each group with positive returns at a given point in event time. Specifically, the "covered" (Dow Jones) series is above the "uncovered" (No Dow Jones) series for most of the 5 minute period, with differences significant at the 5% level over the 1-7 second period but not otherwise.

Panels C and D of Figure 7 provide the same analysis using the abnormal volume measure. While the cumulative abnormal volume shown in Panel C does not show an effect of Dow Jones coverage, the figure in Panel D is consistent with a coverage effect. Specifically, Panel D shows the proportion of firms with positive cumulative abnormal volume at each point in time for the covered and non-covered trades, with the covered trades consistently having more positive abnormal volume. These differences are statistically significant at the 5% level over the 1-9, 14-15, and 40-65 second intervals.

To the extent the differences we observe in Figure 7 are meaningful (in terms of economic significance), they are consistent with the view that Dow Jones coverage affects the price response to insider purchase filings. Perhaps most importantly, in Panel A we find clear evidence that prices respond to the news when it is covered by Dow Jones but that there is little evidence of any response absent such coverage, which is consistent with an effect of media coverage. Effects for the other tests are less strong, perhaps because of the relatively small and

restricted sample available for this test (for example, these could be firms in which insiders trade relatively frequently, reducing the informativeness of their trades).[16]

IV. Conclusions

We use a change in the regime under which insiders file and report their trades to obtain precise data on the timing of these filings. We use this setting and exploit plausibly exogenous variation in the media's coverage of these filings to better understand whether the *dissemination* of publicly-available information affects how it is impounded into security prices and affects trading volume, an important issue given recent interest in the role of the media and the importance of various "frictions" that result in puzzling inefficiencies (such as investor inattention) in the way that securities markets process public information.

To do this we utilize the insider trading disclosures in two ways that allow us to directly assess the effect of the dissemination of insider trading news on prices and volumes. We find evidence that the speed of adjustment and perhaps the overall price effect itself are affected by the existence and timeliness of media coverage—we find that prices adjust more rapidly to SEC filings of insider trading news when there is accompanying media coverage and that coverage is more timely, both of which suggest that the media plays an economically important role in the price formation process in securities markets.

In addition to these main findings, this setting allows us to clearly differentiate the profitability of insiders' trades from the profits available to outside investors. Our results show that insiders earn a return of 0.35% from the time of their trade through the time their trades are made public. This compares to a return of 0.31% that outsiders could earn if they bought when

[16] We have looked at the size of these firms, and do not find systematic differences relative to the size of the firms available in the full sample of RP firms.

trade information was first made public on EDGAR and held for five minutes after the trade. Thus, relative to the profits available to insiders, our evidence shows that outside investors can earn significant returns from trading on publicly-available news about the trade.

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Figure 1: Proportion of information releases during the trading day for earnings announcements and insider trading

This figure examines the proportion of earnings announcements and insider trading filings that occur during the trading day. The window starts with July 2002 because this is the first date when a substantial number of insider trading filings with the SEC have a corresponding time stamp. The time of release of earnings announcements is obtained from the first Dow Jones article whose category includes "earnings" or "revenue" per Raven Pack and that occurs within 10 days of an IBES earnings announcement, resulting in 121,307 observations. The release time of insider trading filings are obtained from the SEC Form 4 filings (excluding observations with more than one filing in a 15 minute window), resulting in 184,299 observations.

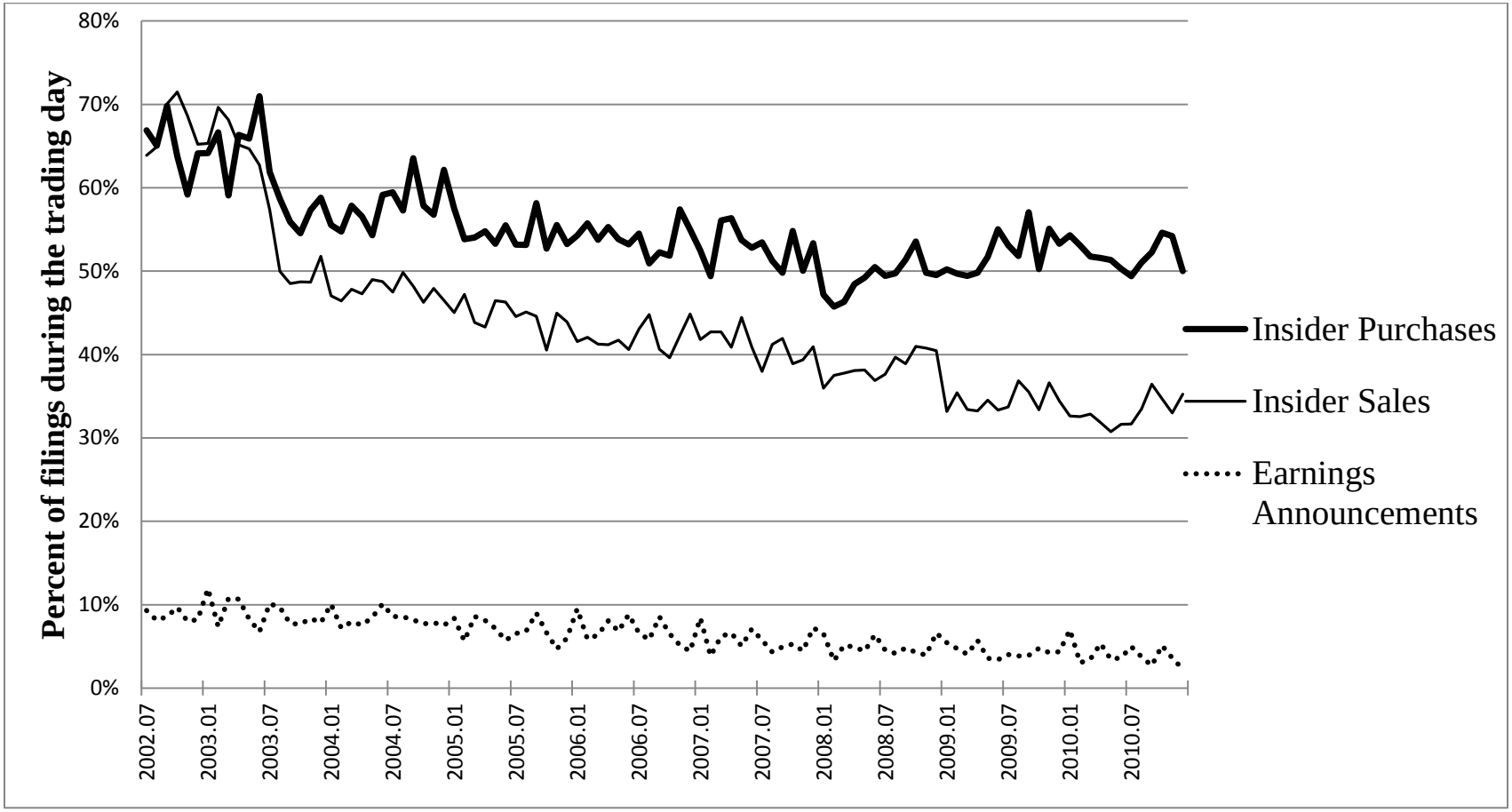


Figure 2: Histogram of media dissemination delays

This histogram details the distribution of media coverage delays (difference, in seconds, between the SEC Form 4 filing and the first Dow Jones story) for insider purchases and sales. The sample is based on the 75,855 total observations described in the next to last line of Table 2.

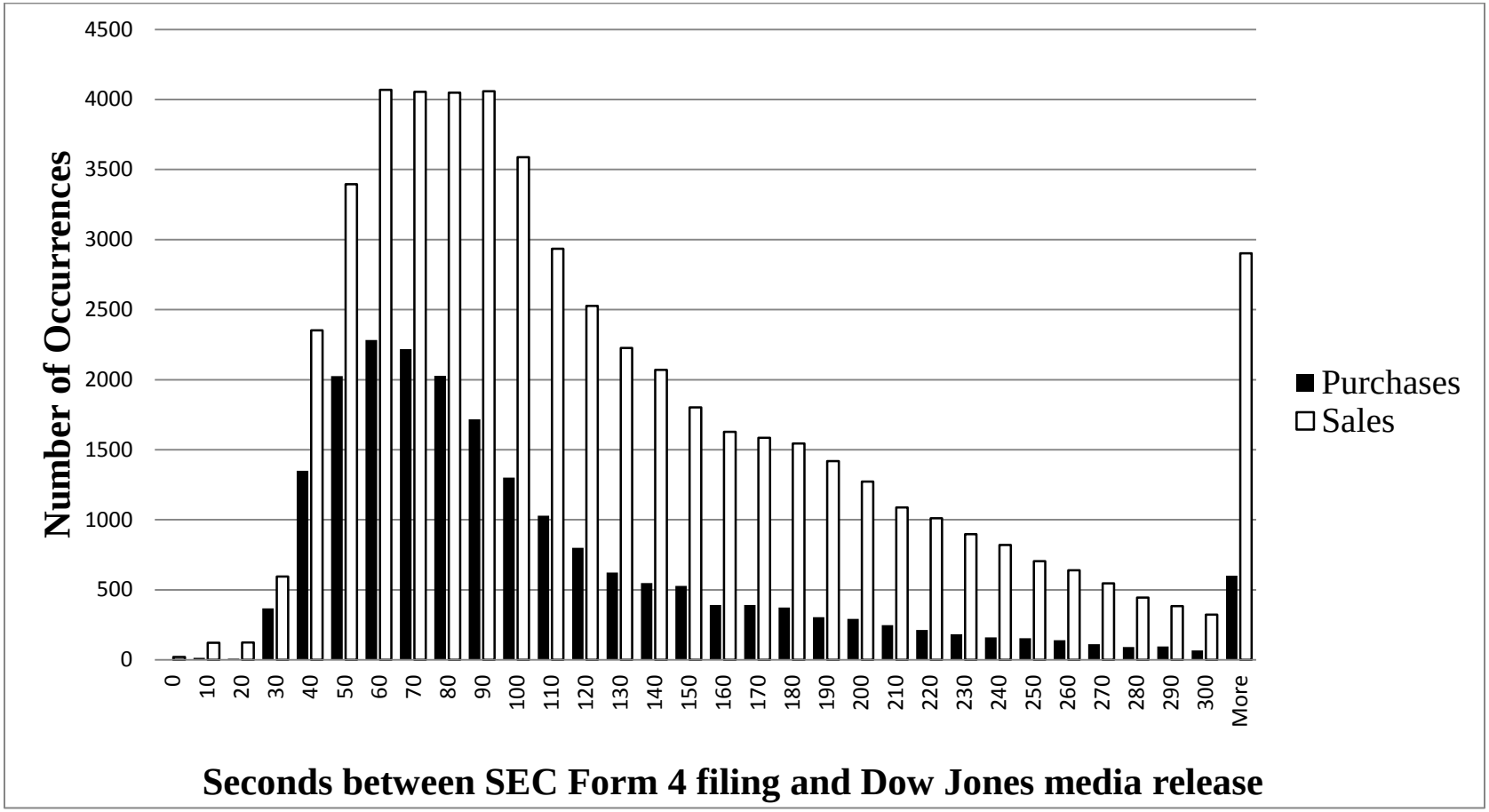
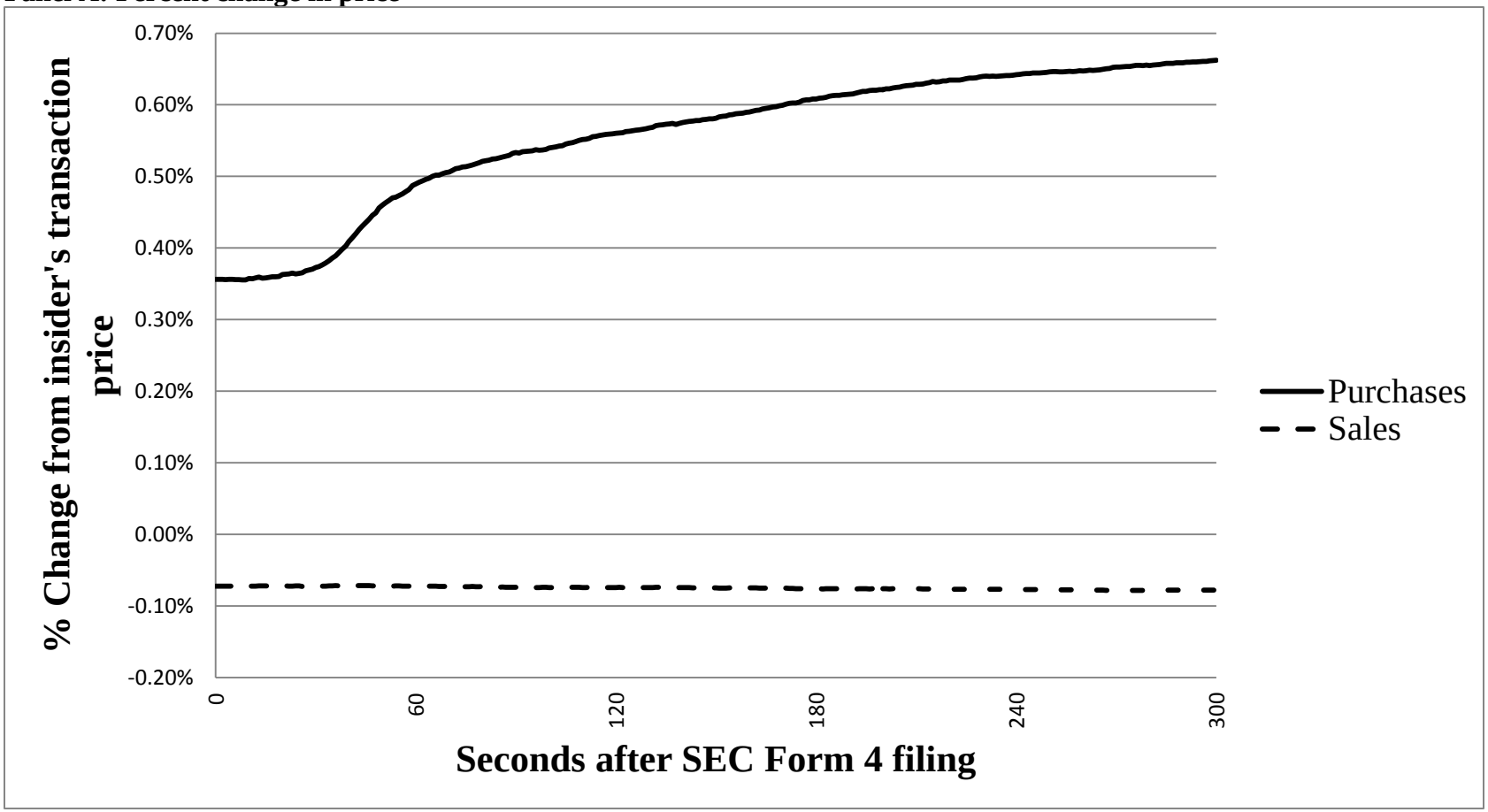


Figure 3: Price and abnormal volume movements after insider trading SEC filings

These graphs detail the price and volume response following the SEC filing of the Form 4. The solid (dashed) line details price and volume movements of insider purchases (sales). The sample is based on the 20,663 purchase and 55,192 sale observations described in the next to last line of Table 2. The horizontal axis is the number of seconds after the SEC filing. In Panel A, the vertical axis captures the percent change between the current price and the insider's transaction price. Thus, for example, the purchase line begins at approximately 0.35% because, on average, the price is 0.35% higher at the time of the SEC filing relative to the insider's purchase price. In Panel B, the vertical axis captures the percent change in abnormal volume, equal to the difference between the cumulative volume less the average cumulative volume for the same day, time, and number of seconds for the surrounding 52 weeks, divided by the average volume for the same 300 second window in the surrounding 52 weeks.

Panel A: Percent change in price



Panel B: Percent change in abnormal volume

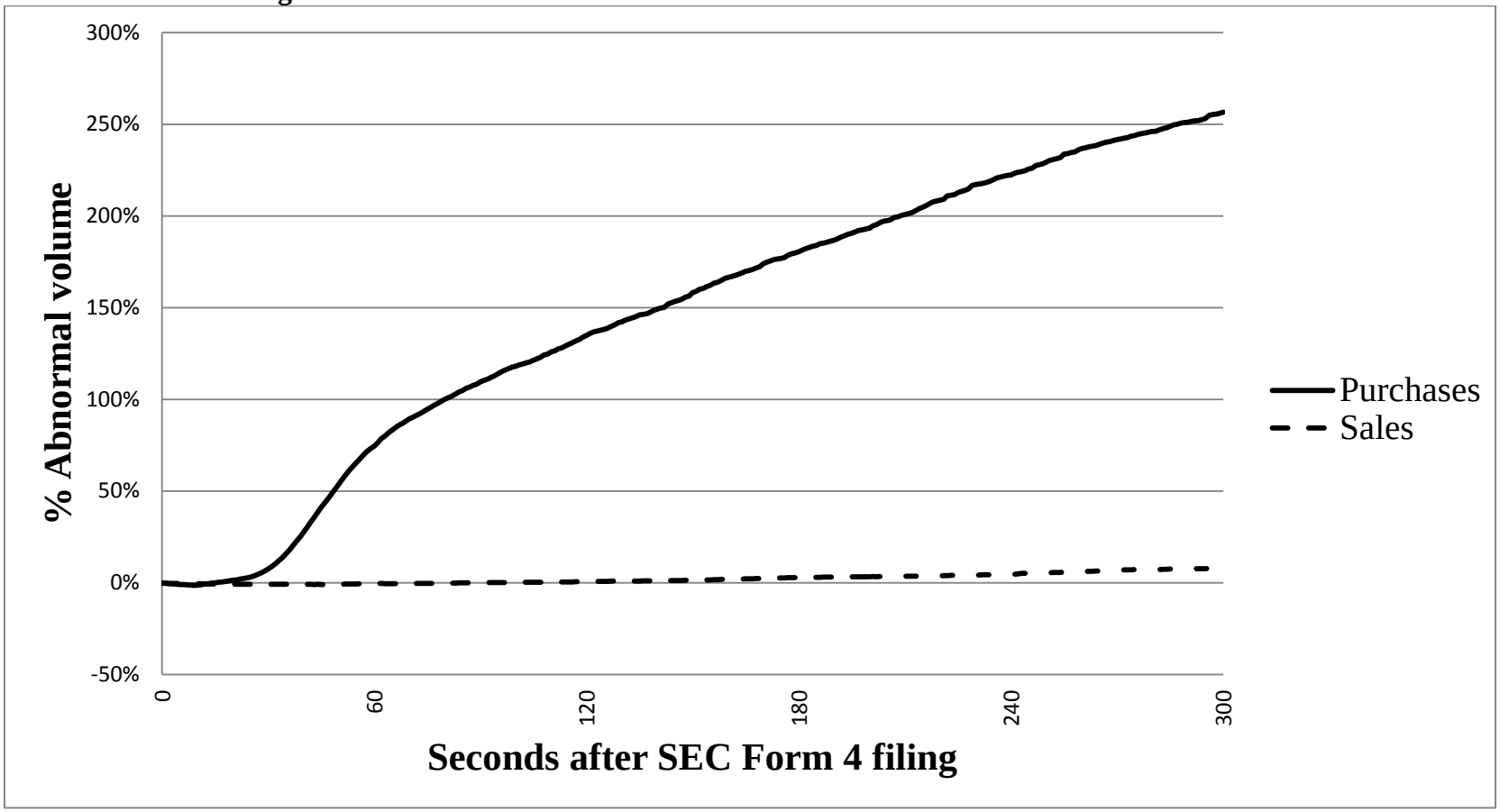
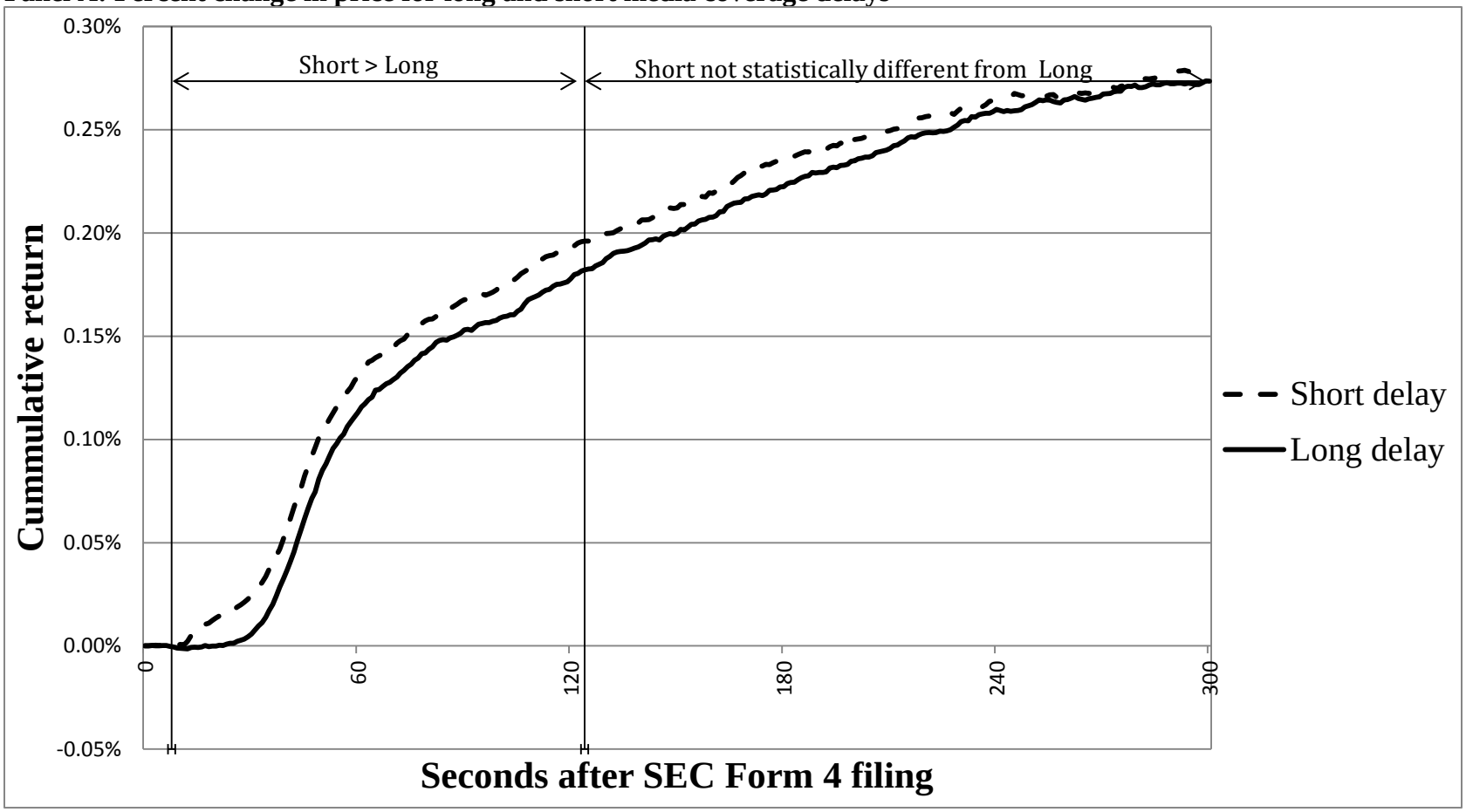


Figure 4: Price movements after insider trading SEC filings for purchases with long and short media coverage delays

These figures show price and volume movements after Form 4 insider purchase filings with the SEC for those filings that are covered by the media relatively quickly ("short" delays) and those that are covered after a longer delay ("long" delays). Media coverage delays in the bottom one-third of observations in Figure 3 are classified as "Short" and those in the top one-third are classified as "Long". Panel A shows the percent price response following the SEC Form 4 filing. Panel B shows the abnormal volume response following the SEC Form 4 filing, equal to the difference between the cumulative volume less the average cumulative volume for the same day, time, and number of seconds for the 52 weeks surrounding the event date, divided by the average volume for the same 300 second window in the surrounding 52 weeks. Statistical differences noted at the top are based on t-tests of long vs. short delays at each second following the Form 4 filing (significance is based on p-values < 0.10).

Panel A: Percent change in price for long and short media coverage delays



Panel B: Percent change in abnormal volume for long and short media coverage delays

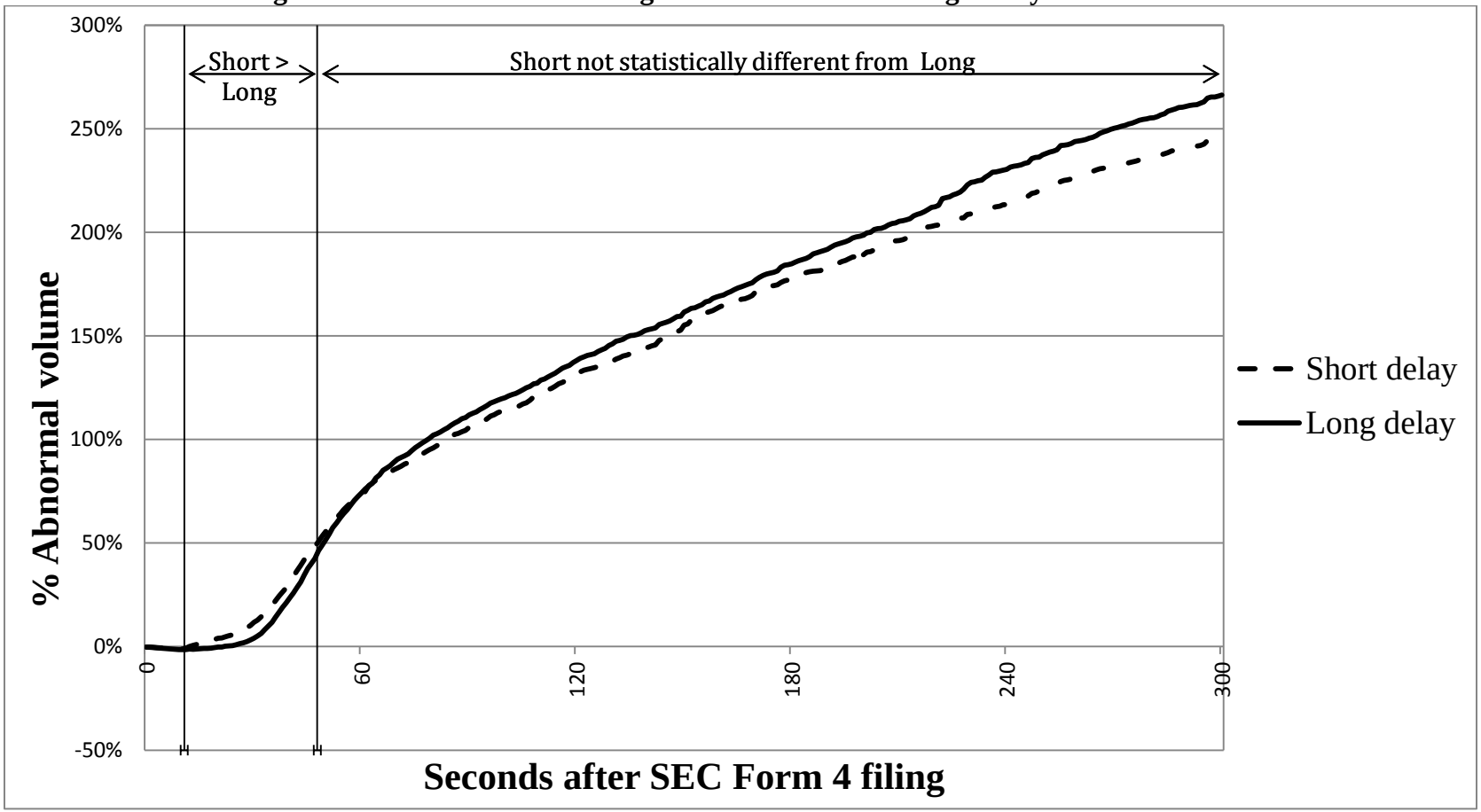
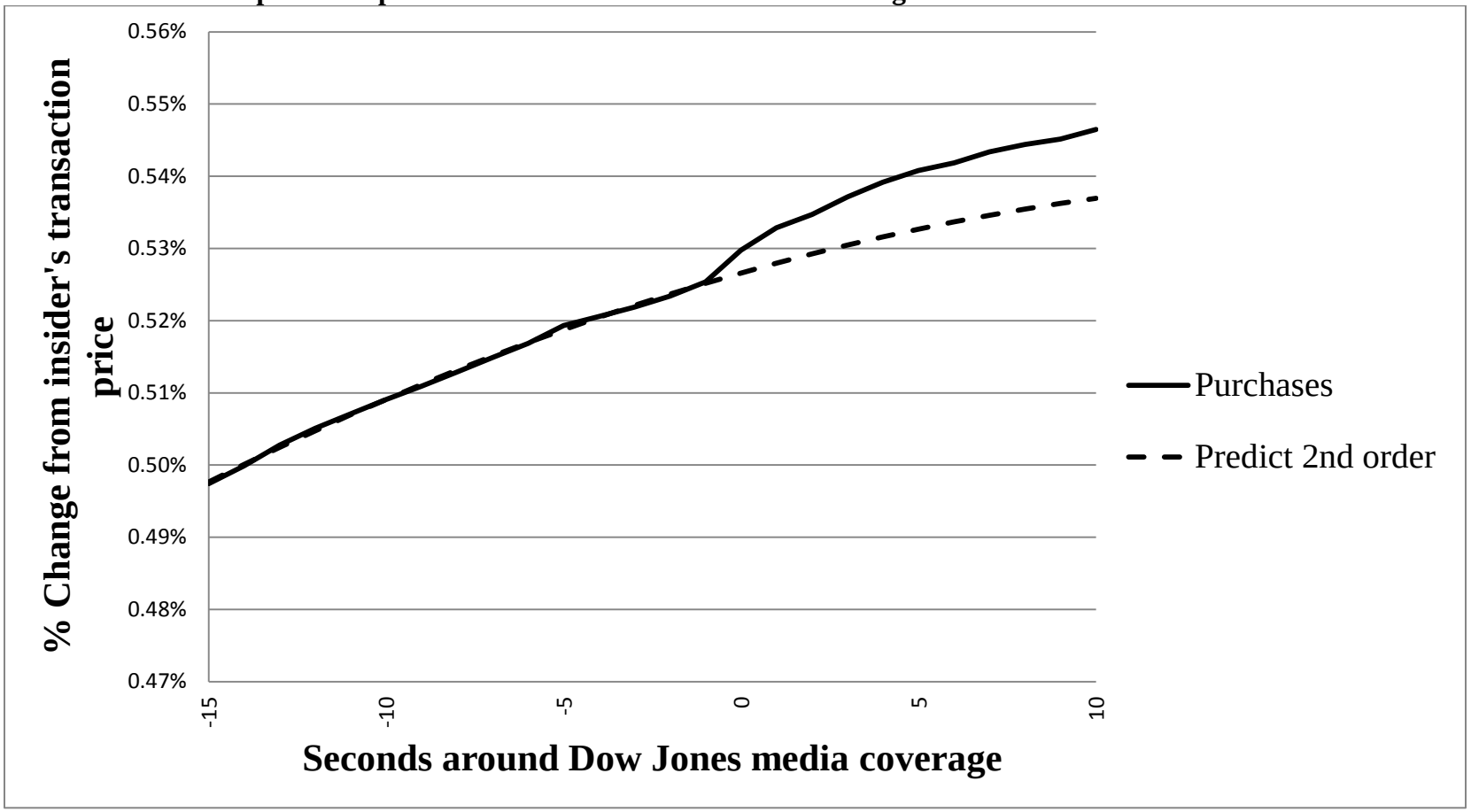


Figure 5: Price and volume movements (actual and predicted) around Dow Jones media coverage of insider trading
These figures show price movements in Panel A and abnormal volume movements in Panel B around the Dow Jones coverage of insider purchases. Abnormal volume is equal to the difference between the cumulative volume less the average cumulative volume for the same day, time, and number of seconds for the surrounding 52 weeks, divided by the average volume for the same 300 second window in the surrounding 52 weeks. Time zero is the second at which the first Dow Jones article is disseminated. The solid line shows the actual price movements ("Purchases"). The dashed line shows the predicted responses to the media coverage where the predicted values are derived using the coefficients from a regression of the percent change in price on a second order polynomial of time using the actual return data from -15 seconds to -1 second.

Panel A: Actual and predicted price movements around the media coverage



Panel B: Actual and predicted abnormal volume movements around the media coverage

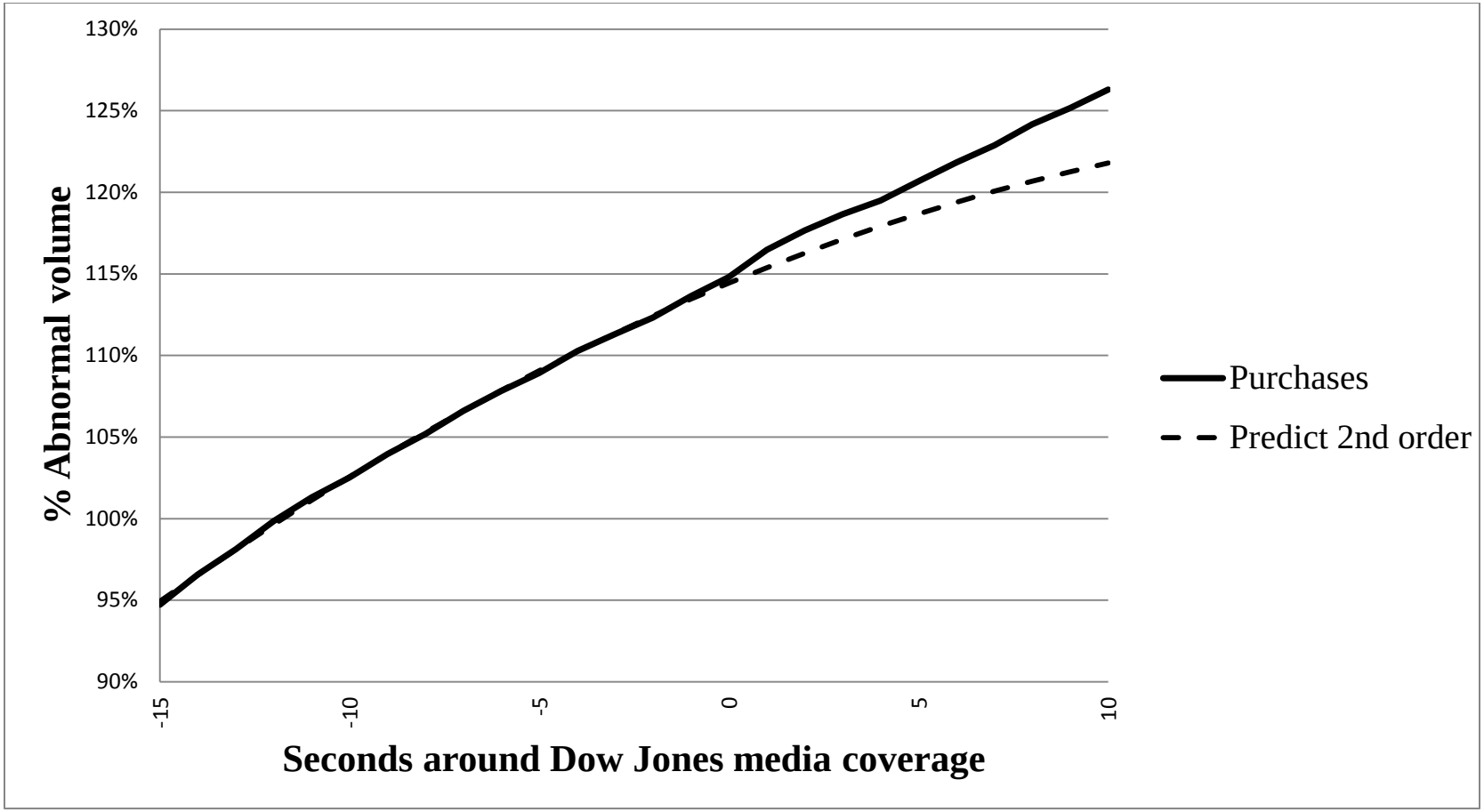


Figure 6: Comparison of insider trading coverage around the initiation of Dow Jones coverage

This figure shows the number of SEC Form 4 filings (SEC), insider trading filing events covered in Thomson Reuters (TR), and insider trading events with Dow Jones (DJ) coverage in RavenPack around January 20, 2004 when Dow Jones began covering insider trading (Form 4) activity.

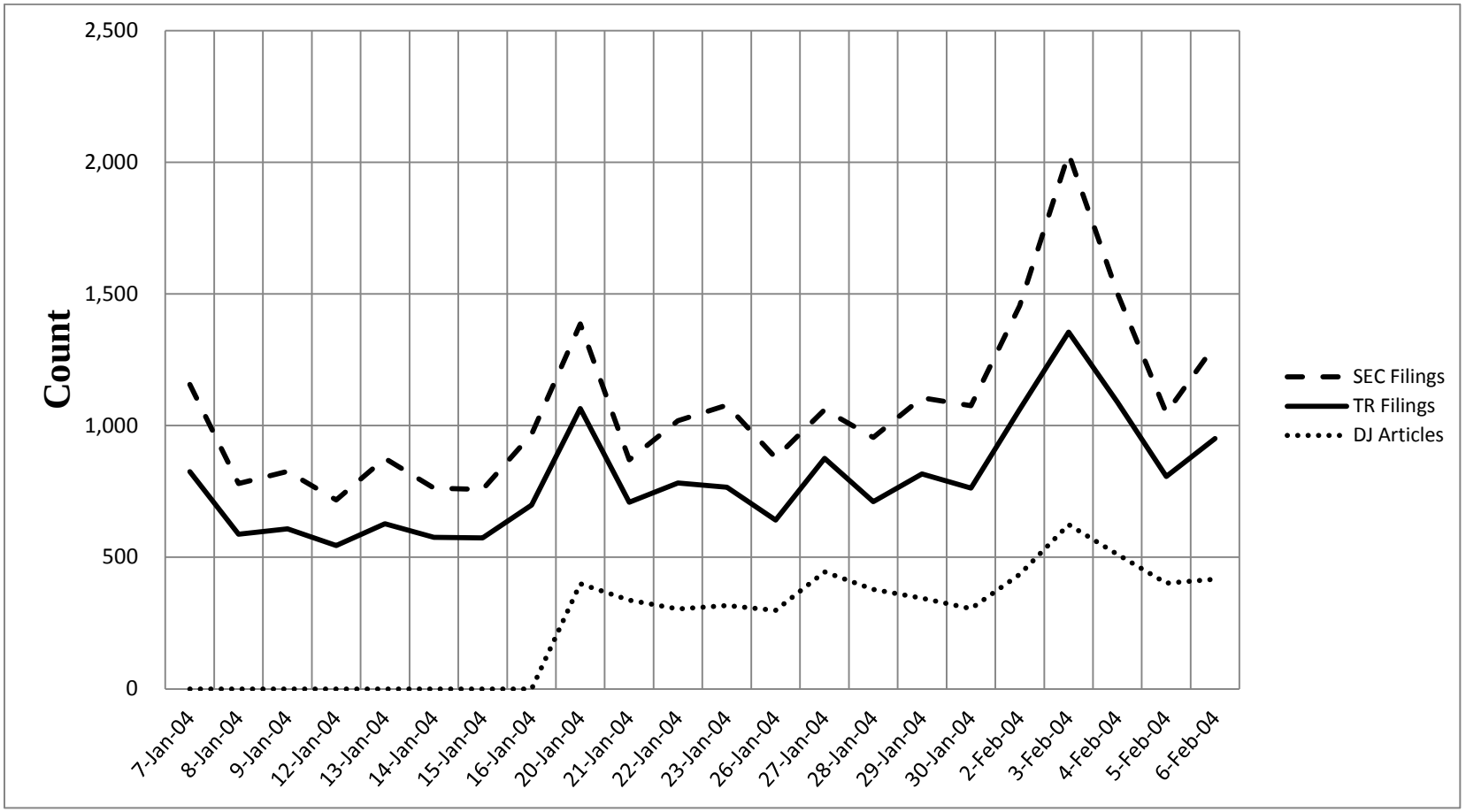
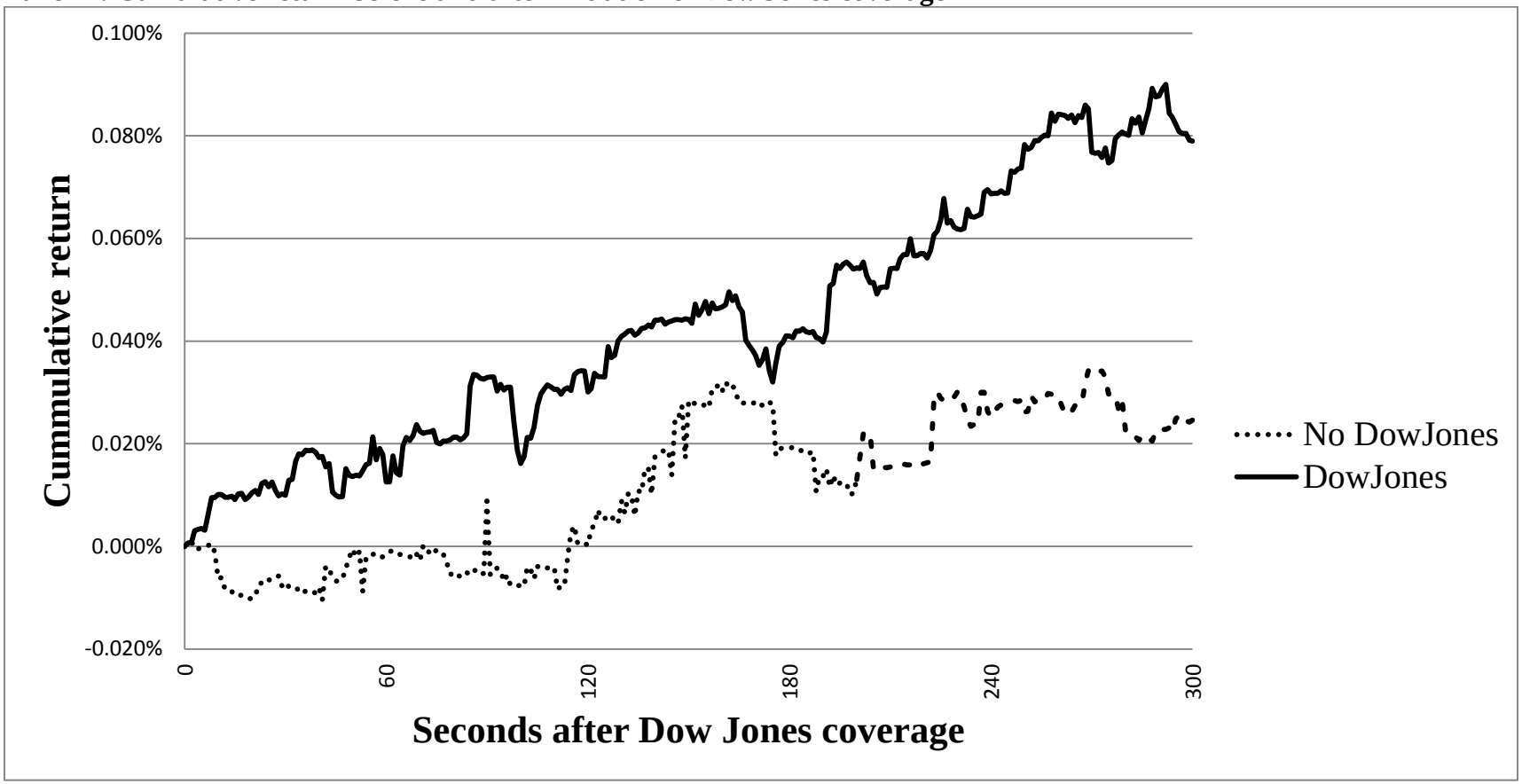


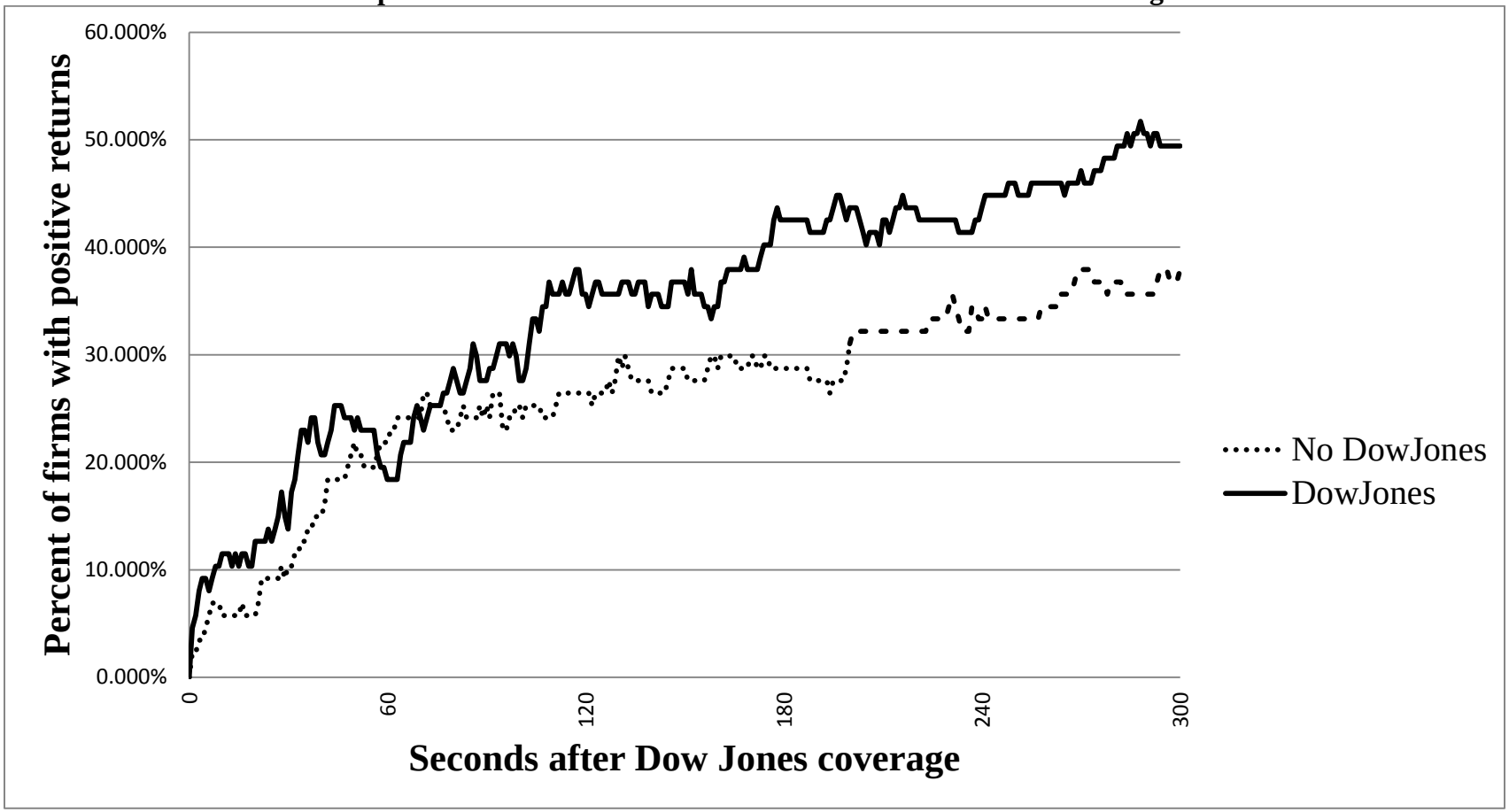
Figure 7: Natural Experiment – Dow Jones initiation of Insider Trading coverage

These figures graph price and volume movements before and after the initial Dow Jones coverage of insider purchase filings with the SEC for the 87 firms with at least one filing in the three months prior to the initiation of Dow Jones insider trading coverage on January 20, 2004 and at least one filing in the three months following. If a firm has more than one insider purchase *after* coverage was initiated, we retain the first trade. If a firm has more than one insider purchase *before* coverage was initiated we retain the trade that is closest in size (based on dollar-value) to the covered trade. The sample of 87 firms excludes those with a trade size difference greater than $100,000 between the covered and non-covered trade (8 firms are lost due to this constraint). Panel A shows the distribution of cumulative returns following the initial Dow Jones coverage of the trade and for a similar period following the non-covered matched trade. Panel B shows the same information for abnormal volume.

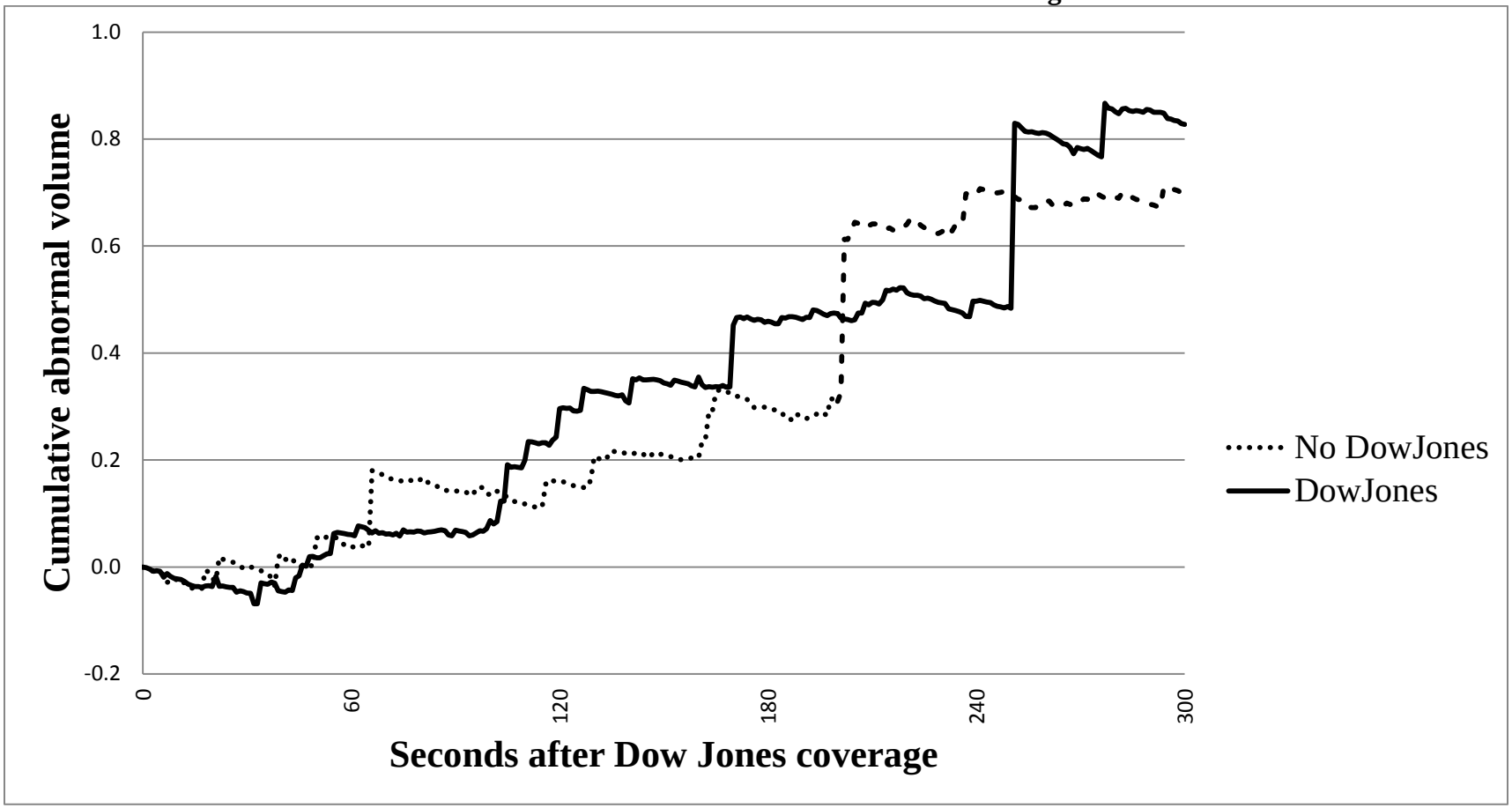
Panel A: Cumulative return before and after initiation of Dow Jones coverage



Panel B: Percent of firms with positive returns before and after initiation of Dow Jones Coverage



Panel C: Cumulative abnormal volume before and after initiation of Dow Jones coverage



Panel D: Percent of firms with positive abnormal volume before and after initiation of Dow Jones Coverage

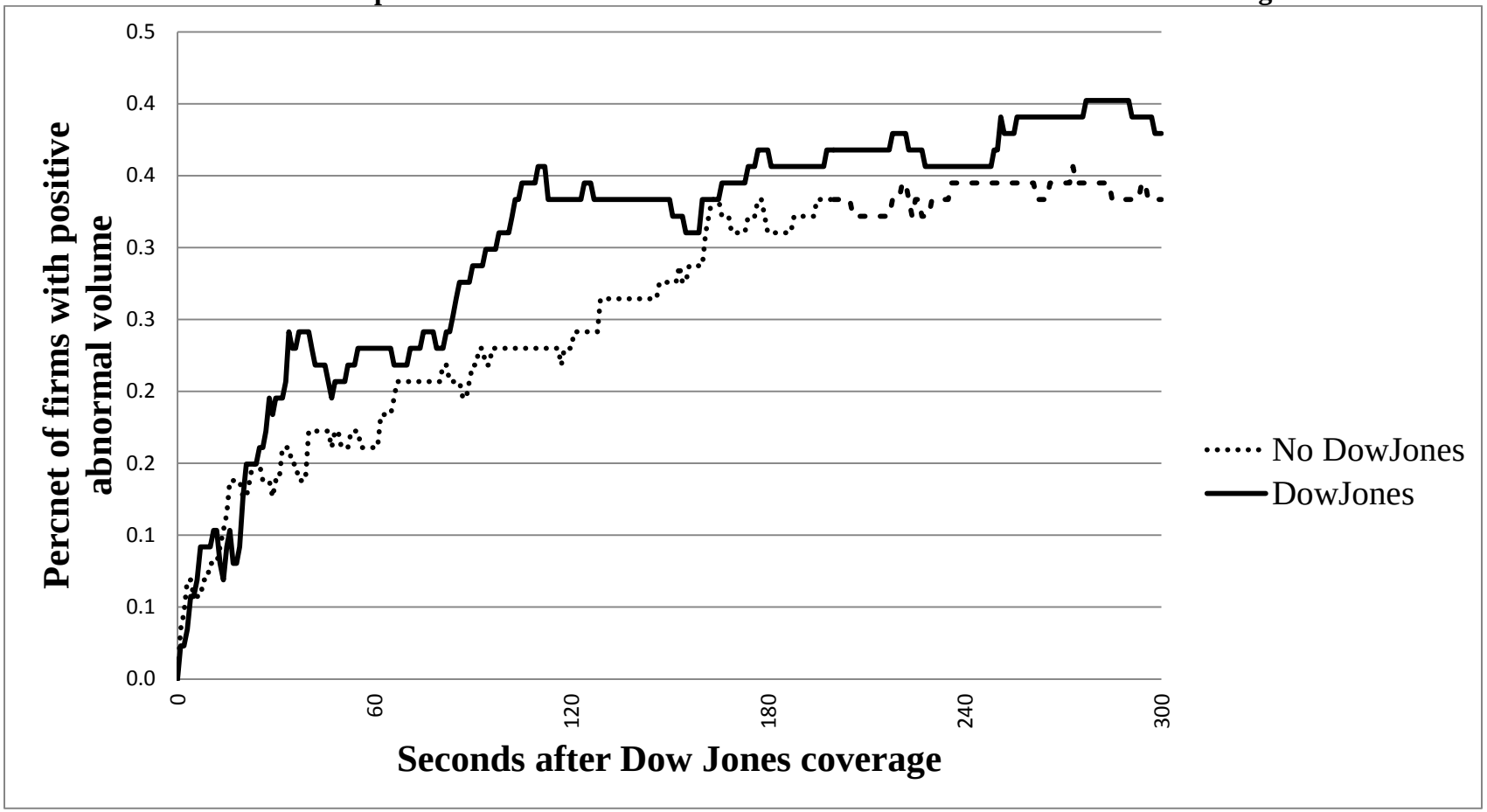


Table I
Distribution of days between insider trade and Form 4 filing around the implementation of Section 403 of Sarbanes-Oxley

This table provides the distribution of reporting delays (in trading days) between the date of the insider trade and the date of the Form 4 filing reporting the trade with the SEC. The pre-Sarbanes Oxley (pre-SOX) period is from January 1, 1990 through August 28, 2002. The post-Sarbanes Oxley (post-SOX) period begins on August 29, 2002, the date that Section 403 became effective, and ends on December 31, 2010. The sample includes all Form 4 insider trading filings that are covered by the Thomson Reuters database.

	# Trade Days Delay			
	PURCHASES		SALES	
	Pre-SOX	Post-SOX	Pre-SOX	Post-SOX
99%	326	318	230	121
95%	117	39	63	5
90%	48	8	30	2
75% Q3	25	2	24	2
50% Median	17	2	18	2
25% Q1	11	1	11	1
10%	7	0	8	0
5%	5	0	6	0
1%	2	0	3	0

Table II
Sample construction

This table describes the sample construction procedures. The table begins with Thomson Reuters insider trading data. We then merge in data from three other sources. First, we add in the Form 4 insider trading time-date stamps obtained from the SEC's EDGAR filing system. Second, we merge in details about the Dow Jones media coverage of the filings. Finally, we incorporate TAQ data. The details on sample attrition for the full sample, as well as purchases and sales separately, are provided below.

	Total Trades	Purchases	Sales	% Purchases
Starting sample from Thomson Reuters (stock not options, Form 4, 2004-2010, including Officers, Directors and Committee members)	428,637	128,508	300,129	30.0%
Able to match company CIK and insider name to SEC filings on EDGAR	377,231	103,178	274,053	27.4%
Restrict to a "isolated" Form 4 filings (excluding multiple filings within 15 minutes of each other)	279,520	75,886	203,634	27.1%
Filed with SEC 9:40am to 3:30pm EST	117,284	37,614	79,670	32.1%
With RavenPack (Dow Jones) coverage	80,967	23,502	57,465	29.0%
With TAQ data	80,139	23,268	56,871	29.0%
Insider's last transaction price within daily trading range on CRSP	75,855	20,663	55,192	27.2%
Time between the Form 4 filing and Dow Jones report is between 30 and 300 seconds	71,105	19,672	51,433	27.7%

Table III
Determinants of Dow Jones coverage delays

The following regressions show the delay in media coverage by Dow Jones (in seconds) regressed on potential determinants of the coverage delay. In the first column, the delay is regressed on year indicators. In the second column, control variables are included for the dollar value of the insider purchase (*Trade size*), the total amount of purchase activity, in dollars, that the insider engaged in during the prior 365 days (*Past trades*), and an indicator for whether the insider is a CEO (*CEO*). Standard errors are clustered at the firm level.

	Panel A		**Panel B**	
	Coeff	**t-stat**	**Coeff**	**t-stat**
Intercept	218.190600	123.77	216.993300	122.71
Trade size			0.000005	3.31
Past trades			0.000001	2.87
CEO			4.258840	3.45
Year indicators	YES		YES	
Adj R-square	0.517		0.521	
N	20,663		20,663	
# clusters	3,469		3,469	

Table IV
Descriptive statistics of trades with long versus short delays

This table provides descriptive statistics of the trades with long versus short Dow Jones coverage delays. As in Figure 4, media coverage delays in the bottom one-third of observations in Figure 3 are classified as "Short" and those in the top one-third are classified as "Long." Panel A provides the mean and median media coverage delay (in seconds) for the two samples. Panel B compares the mean and median trade sizes between the two delay group. The p-value of the means is from a t-test and the p-value of the medians is from a Wilcoxon rank-sum test. Panel C provides the frequency distribution of the primary role code for the insiders trading within each delay group.

	Short Delay	Long Delay	Difference (p-value)
Panel A: Delay descriptives (in seconds)			
Mean	68	152	
Median	55	110	
Panel B: Trade Size (in dollars)			
Mean	65,814	104,466	0.00
Median	17,250	23,113	0.00
Panel C: Primary rolecode of insider			
CB (Chairman of the Board)	143	256	
CEO (Chief Executive Officer)	822	1,138	
CFO (Chief Financial Officer)	439	344	
CI (Chief Investment Officer)	16	12	
CO (Chief Operating Officer)	77	75	
CT (Chief Technology Officer	18	25	
D (Director)	4,201	3,594	
DO (Director and Beneficial Owner)	164	284	
EC (Member of Executive Committee)	5	4	
EVP (Executive Vice President)	0	2	
H (Officer, Director, and Beneficial Owner)	12	35	
MC (Member of Committee or Advisory Board)	0	1	
O (Officer)	793	825	
OB (Officer and Beneficial Owner)	5	3	
OD (Officer and Director)	69	81	
OS (Officer of Subsidiary)	30	42	
OT (Officer and Treasurer)	50	42	
OX (Divisional Officer)	13	15	
P (President)	147	163	
SVP (Senior Vice President)	1	0	
VP (Vice President)	0	1	
	7,005	6,942	

Table V
Tests of returns and abnormal volume between long and short delays following insider purchase filings with the SEC

This table shows a summary of the results of tests of differences in returns and abnormal volume between long and short delays for each second following the Form 4 insider purchase filings with the SEC. The abnormal volume is equal to the difference between the cumulative volume less the average cumulative volume for the same day, time, and number of seconds for the surrounding 52 weeks, divided by the average volume for the same 300 second window in the surrounding 52 weeks. As in Figure 4, media coverage delays in the bottom one-third of observations in Figure 3 are classified as "Short" and those in the top one-third are classified as "Long." T-tests are used to test the differences between the long and short samples at each second following the filing and significance is determined based on p-values < 0.10.

<table>
<tr><th>Second interval</th><th>Returns</th><th>Abn. Volume</th></tr>
<tr><td>1
:
7</td><td>Long and Short not statistically different</td><td rowspan="2">Long and Short not statistically different</td></tr>
<tr><td>8
:
10</td><td rowspan="3">Long < Short</td></tr>
<tr><td>11
:
48</td><td>Long < Short</td></tr>
<tr><td>49
:
124</td><td rowspan="2">Long and Short not statistically different</td></tr>
<tr><td>125
:
300</td><td>Long and Short not statistically different</td></tr>
</table>

Table VI

Regressions of media dissemination price and abnormal volume response

The following regressions provide a statistical test of whether DJ coverage affects the evolution of market prices (based on NBBO quote midpoints) and volume. In Panel A, we regress the 30 second return response immediately following Dow Jones media coverage (*DJ Return)* on the 30 second return response immediately following the SEC filing (*Filing Return*) and the delay in seconds between the filing and media coverage. The first column includes the delay, in seconds, and the second, third, and fourth columns add the delay in a 2nd, 3rd, and 4th degree polynomial function, respectively. In Panel B, we perform the same regressions using the 30 second abnormal volume response immediately following the Dow Jones media coverage (*DJ Abn. Volume*) and the 30 second abnormal volume response following the SEC filing (*Filing Abn. Volume*). The abnormal volume is equal to the difference between the cumulative volume less the average cumulative volume for the same day, time, and number of seconds for the surrounding 52 weeks, divided by the average volume for the same 300 second window in the surrounding 52 weeks. Observations are clustered by date.

Panel A: Regression of returns following media coverage

	DJ Returns							
	Coeff	**t-stat**	**Coeff**	**t-stat**	**Coeff**	**t-stat**	**Coeff**	**t-stat**
Intercept	0.03082%	13.22	0.04953%	10.12	0.10051%	11.05	0.14251%	8.28
Filing Return	5.56653%	3.3	5.12263%	3.04	4.82899%	2.87	4.73358%	2.82
Delay	-0.00006%	-2.87	-0.00042%	-5.13	-0.00193%	-8.28	-0.00362%	-5.83
Delay^2			1.34E-08	4.71	1.35E-07	7.74	0.00004%	4.68
Delay^3					-2.78E-10	-7.18	-1.35E-09	-3.73
Delay^4							1.78E-12	2.99
Adj R-square		0.002		0.004		0.006		0.007
N		19,672		19,672		19,672		19,672
# clusters		1,680		1,680		1,680		1,680

Panel B: Regression of abnormal volume following media coverage

	DJ Abn. Volume							
	Coeff	**t-stat**	**Coeff**	**t-stat**	**Coeff**	**t-stat**	**Coeff**	**t-stat**
Intercept	0.247836	14.65	0.275748	7.76	0.499052	7.43	0.913241	7.51
Filing Abn. Volume	0.443454	13.83	0.442585	13.83	0.439740	13.81	0.438046	13.78
Delay	-0.000199	-1.43	-0.000745	-1.23	-0.007350	-4.24	-0.024015	-5.54
Delay^2			0.000002	0.99	0.000055	4.28	0.000270	5.16
Delay^3					0.000000	-4.27	-0.000001	-4.72
Delay^4							1.76E-09	4.29
Adj R-square		0.053		0.053		0.054		0.055
N		19,672		19,672		19,672		19,672
# clusters		1,680		1,680		1,680		1,680

Table VII

Natural Experiment – Descriptive statistics of trades surrounding the Dow Jones initiation of Insider Trading coverage

This table provides descriptive statistics of the trades made under the Dow Jones coverage and non-coverage regimes used in the natural experiment. The "No DowJones" window covers the three months before the Dow Jones started covering insider trading filings (on January 20, 2004). The "DowJones" window covers the three months after Down Jones started disseminating information about the insider trade filings. The sample consists of the 87 firms that had insider purchase filings during each of these windows. Panel A compares the mean and median trade sizes between the two regimes. The p-value of the means is from a t-test and the p-value of the medians is from a Wilcoxon rank-sum test. Panel B provides the primary role code for the title of the insiders trading within each regime.

	DJ Coverage	No DJ Coverage	Difference (p-value)
Panel A: Trade Size (in dollars)			
Mean	28,504	24,967	0.56
Median	11,947	11,738	0.52
Panel B: Primary rolecode of insider			
CB (Chairman of the Board)	2	0	
CEO (Chief Executive Officer)	8	7	
CFO (Chief Financial Officer)	6	2	
CI (Chief Investment Officer)	2	0	
CO (Chief Operating Officer)	2	2	
D (Director)	55	54	
DO (Director and Beneficial Owner)	0	1	
O (Officer)	9	16	
OS (Officer of Subsidiary)	0	1	
OT (Officer and Treasurer)	1	1	
P (President)	2	3	
	87	87	