IS ‘NOT-TRADING’ INFORMATIVE? EVIDENCE FROM CORPORATE INSIDERS’ PORTFOLIOS

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Luke DeVault

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As members of the Dissertation Committee, we certify that we have read the dissertation prepared by Luke DeVault, titled “Is ‘Not-Trading’ Informative? Evidence from Corporate Insiders’ Portfolios" and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

_____ Date: 4/08/2016
Kathleen Kahle

_____ Date: 4/08/2016
Richard Sias

_____ Date: 4/08/2016
Scott Cederburg

_____ Date: 4/08/2016
Tiemen Woutersen

Final approval and acceptance of this dissertation is contingent upon the candidate’s submission of the final copies of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

_____ Date: 4/08/2016

Committee Chair: Richard Sias

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SIGNED: Luke DeVault

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TABLE OF CONTENTS

LIST OF FIGURES AND TABLES 6

ABSTRACT 7

1. Introduction 8

2. Background 15

3. Data 17

3.A. Portfolio insider sample 17

3.B. Types of portfolio insiders 19

4. Do not-sold securities outperform not-purchased securities? 21

5. Traded versus not-traded securities 23

6. Are portfolio insider trades more informative than single-firm insider trades 25

7. Source of abnormal returns 27

7.A. Post Sarbanes Oxley 28

7.B. Evidence from internet search volume 30

8. Robustness 32

8.A. Blackout periods 32

8.B. Options exercise 33

8.C. Out of sample: Do not-sold securities outperform not-purchased securities 34

7. Conclusion 35

Appendix A. Simulated portfolio insider trading decisions 49

Appendix B. Equal-weighted and value-weighted maket returns: Daily compounding 56

References 59

LIST OF TABLES AND FIGURES

Table 1. Positions held by portfolio insiders 37
Table 2. Summary statistics 38
Table 3. Univariate 30 day risk-adjusted returns following a trade 39
Table 4. Not-bought vs not-sold: panel regressions 40
Table 5. Univariate 30 day risk-adjusted returns to portfolio insider traded and not-traded securities 41
Table 6. Traded vs not-traded security excess returns: panel regressions 42
Table 7. Univariate 5-day and 30-day risk-adjusted returns: Post Sox 43
Table 8. Portfolio insider trades vs single-firm insider trades: panel regressions 44
Table 9. Pre and post SOX returns following purchases and not-sold securities 45
Table 10. Google trends and portfolio insider trades 46
Table 11. Univariate 30 day risk-adjusted returns following a trade: blackout periods 47
Table 12. Out of sample: Univariate 30 day risk-adjusted returns following a trade 48
Table A-1. Simulated insider trading decisions: realized abnormal returns 55
Table B-1. Value weighted and equal weighted market returns 58
Figure A-1. Alternative Measures of Financial Leverage and Sample Periods 54

ABSTRACT

Some corporate insiders hold insider equity holdings in multiple companies (portfolio insiders). I hypothesize that information can be garnered not only from their trades (e.g., an insider sale of firm A on day *t*), but from their not-traded securities (e.g. the insider's decision not to sell firms B and C on day *t*). Specifically, an insider's decision not to sell (purchase) security B at the time of the sale (purchase) of security A, is a positive (negative) signal for security B, the not-sold (not-bought) security. The paper presents three major empirical findings. First, portfolio insider not-sold securities following a sale earn large risk-adjusted returns outperforming the not-purchased securities following a purchase. Second, portfolio insiders' purchases are more informative than single-firm insiders' purchases. Finally, the results suggest that abnormal returns associated with insider purchases result from markets reacting to the revelation of the insider purchase while abnormal returns associated with not-sold securities appear to result from insiders delaying sales prior to positive firm-specific events.

1. Introduction

Trading on inside information is illegal; doing so can result in fines, lawsuits, and prison sentences. However (to the best of my knowledge), no insider has ever been convicted of not-trading on insider information.[1] Consider the following example: Elaine Ullian is a Professor of Medicine at Boston University and a Lecturer at Harvard University. She serves on the boards of two different pharmaceutical companies, Thermo Fisher Scientific and Vertex Pharmaceuticals. On April 30, 2012, she sold 7,500 shares of Thermo Fisher (choosing not to sell Vertex). On May 7, 2012 Vertex announced a successful clinical trial of the cystic fibrosis drug Ivacaftor. Vertex's price increased dramatically following the announcement and Dr. Ullian earned a 5-day (May 1st through May 7th) return of 53.26% on her Vertex position. Two days following the announcement (May 9, 2012), Dr. Ullian sold 20,000 shares of Vertex. Although Dr. Ullian not trading Vertex was legal, ex-post, she clearly was better off liquidating her Thermo Fisher first and postponing the Vertex trade.

While it is well recognized that insider trades sometimes contain information about the underlying securities, the above example illustrates that the trades of insiders with inside holdings at multiple companies (henceforth, portfolio insiders) may contain information about both the stock they trade (e.g. insider *K*'s sale of stock *A* on day *t*), and the insider positions they choose not to trade (e.g. insider *K*'s decision to not sell stocks *B* and *C* on day *t*). That is, directly analogous to an insider's incentive to sell when their security is overvalued and purchase when their security is undervalued, an insider has an incentive to not sell when their security is undervalued and not purchase when their security is overvalued. Thus, I hypothesize that: 1) a

[1] Fried (2003) mentions that the SEC's safe harbor permits insiders to arrange trading plans while aware of material nonpublic information and to cancel the plans while aware of material nonpublic information. This fairly explicitly demonstrates that not-trading on inside information is legal.

portfolio insider sale is, on average, a positive signal for the other inside securities the portfolio insider holds and chooses not to sell ("portfolio insider not-sold securities"), and 2) a portfolio insider purchase is, on average, a negative signal for the other securities the portfolio insider holds but chooses not to purchase ("portfolio insider not-purchased securities"). This leads to the primary empirical prediction: focusing on only the not-traded inside positions, portfolio insider not-sold stocks will outperform portfolio insider not-bought securities.

The motives for insider sales include liquidity, diversification, and mis-valuation while mis-valuation is the primary motive for insider purchases, elucidating the extant literatures' evidence that subsequent returns are more strongly related to insider purchases than insider sales.[2] The differing potential motives for insider sales versus insider purchases has direct implications for differences in the average informational content of insider not-bought securities versus insider not-sold securities. To see this, first consider an investor who is an insider in two companies, *A* and *B* and makes a purchase when either security is undervalued. Further, assume each stock is equally and independently likely to be undervalued, fairly valued, or overvalued. Ignoring identical valuation cases (e.g., both overvalued) leaves three scenarios: 1) one fairly valued and one undervalued; 2) one undervalued and one overvalued; 3) one fairly valued and one overvalued. When purchasing, mis-valuation of the security he is *buying* primarily determines the investors' *purchase* decision, i.e., when he holds an undervalued security, he buys it (cases 1 and 2). Thus, the not-purchased security is overvalued in 50% of the two cases (case 2) associated with an insider purchase. Alternatively, consider an investor who, for liquidity or diversification purposes, must execute an insider sale regardless of valuation. Consequently mis-valuation of the security he is *not-selling* sometimes drives the *sale* decision. Specifically, in

[2] For example Lakonishok and Lee (2001), Iqbal and Shetty (2002), Jenter (2005).

scenario 1, he sells the fairly valued security to keep the undervalued security. Considering all three scenarios, the not-sold security is informative (i.e., undervalued) in 67% of cases (cases 1 and 2) and uninformative (i.e., fairly valued) in only 33% of cases (case 3). Thus, in this simple example, given an insider sale, there is a 67% chance the not-sold security is undervalued. In contrast, given an insider purchase, there is only a 50% chance the not-purchased security is overvalued, explicating the hypothesis that: on average subsequent abnormal returns will be more strongly related to not-sold securities than not-purchased securities.[3]

The empirical results support both the primary hypothesis and the asymmetry of information in not-sold and not-purchased securities. On both a raw and risk-adjusted basis, portfolio insider not-sold securities outperform portfolio insider not-purchased securities over the 30 trading day period following a portfolio insider trade. Moreover, consistent with asymmetric informativeness, the return difference is primarily driven by not-sold securities—while the not-sold securities earn large positive abnormal returns (averaging annualized abnormal returns of 7% to 8% depending on risk-adjustment method), not-purchased securities' returns do not differ significantly from zero.

The hypothesis that information can be garnered from not-traded portfolio insider securities assumes portfolio insiders, at least sometimes, consider mis-valuation when making security selection decisions within their inside portfolios. This observation yields several additional empirical predictions. First, holding everything else constant, an insider always has an incentive to sell the most overvalued insider position and purchase the most undervalued insider position. Thus, 1) the securities sold by insiders should subsequently underperform the securities not-sold

[3] This simple example is for illustrative purposes only. I provide a more detailed and realistic simulation in the next section which generates the same predicted asymmetry.

by insiders, and 2) securities purchased by insiders should subsequently outperform the securities not-purchased by insiders. The advantage of these tests is that the comparisons (of sold versus not-sold or purchased versus not-purchased) directly control for time-variation in economic conditions, market conditions, and insider "fixed effects." Put simply, the tests ask if the subsequent abnormal return of a stock an insider trades today differs from the subsequent abnormal return of the stock(s) the insider chooses not to trade today. The results continue to support my hypotheses—portfolio insider purchased securities meaningfully outperform their not-purchased securities (purchased securities earn average annualized market-adjusted returns of 19.7%, outperforming the not-purchased securities by 18.5%), and insider sold securities meaningfully underperform their not-sold securities (not-sold securities earn average annualized market-adjusted returns of 8.0% outperforming the sold securities by 7.6%).

I next propose that the larger inside information set portfolio insiders possess may result, on average, in greater informational content for portfolio insider trades than single-firm insider trades. A portfolio insider holding two undervalued securities, for example, may only purchase the single most undervalued stock. Analogously, portfolio insider sales, on average, may subsequently underperform single-firm insider sales (as the portfolio insider sells only the most overvalued security). My empirical results provide mixed support for the hypothesis that portfolio insider trades are more informative than single firm insider trades. Consistent with portfolio insiders focusing their purchases on the most undervalued securities, portfolio insider purchases subsequently outperform (using raw and abnormal returns) single-firm insider purchases over the next month, while the market does not appear to completely recognize this information. However, the evidence regarding insider sales is mixed as the results are sensitive to the risk-adjustment method (e.g., DGTW versus size or market adjusting).

There are at least two (non-mutually exclusive) potential explanations for the documented return patterns. First, insider traded and not-traded securities may be associated with subsequent abnormal returns because markets infer information from the insider transaction, e.g., the market recognizes that an insider selling *A*, but holding *B*, is a negative signal for *A* and a positive signal for *B*. Second, insider traded and not-traded securities may be associated with subsequent firm-specific information events (e.g., an insider sells security *A* because he knows security *B* will soon announce positive news) following trades.

To examine the first possibility (markets observing insider traded and not-traded securities, infer information, and adjust prices accordingly), I exploit changes in insider reporting requirements associated with Sarbanes Oxley (SOX) legislation. Specifically, prior to August 2002, insiders had until the 10th day of the following month (approximately 30 trading days maximum) to report inside transactions. Following SOX, insiders had two trading days to report. If markets infer information from insider traded/not-traded securities, then the abnormal returns should primarily be captured in the *t*+6 to *t*+30 event window prior to SOX, and in the *t*+0 to *t*+5 event window following SOX.[4] The empirical results suggest that the abnormal returns patterns associated with portfolio insider traded securities result, at least in part, from the market's reaction to the observed trade. For example, the abnormal returns insider purchased securities earn are concentrated in the *t*+6 to *t*+30 event window in the pre-SOX period but move to the *t*+1 to *t*+5 period in the post-SOX period. I find no evidence, however, that markets recognize information content in portfolio insiders' not-sold or not-purchased transactions. For example, the not-sold stocks abnormal returns are positive and economically meaningful in both the *t*+1 to *t*+5-day and the *t*+6 to *t*+30-day window in both pre- and post-SOX periods.

[4] The *t*+1 to *t*+5-day return should be a fairly traditional test of market reaction. If the trade is announced on the second day after the trade, days *t*+1 to *t*+5 would be event days -1, 0, 1, 2, and 3 relative to the announcement date.

To examine the second possibility—that insider trades/non-trades predict company specific information events— I examine the company's internet search volume. Specifically, I use Google Trends data (www.google.com/trends) that records aggregate weekly search frequency for each company's name. I hypothesize that a firm specific event results in increased company search volume, (e.g., a new product release spikes search volume). The empirical results reveal that not-sold securities, on average, experience a 200-300% standard deviation increase in search volume the week following a sale, supporting the hypothesis that not-sold securities garner positive abnormal returns because they are associated with subsequent positive firm-specific events. In contrast, insider purchased and sold securities exhibit no meaningful relation with future search volume. In sum, the evidence suggests 1) markets infer information from insider transactions explaining, at least in part, the abnormal returns associated with securities insiders' trade, and 2) insider not-sold securities, on average, foretell positive firm-specific events explaining, at least in part, the positive abnormal returns that occur soon after an insider "not-sold" event.

My study is related to extant work focusing on returns following individual insider transactions (e.g., Cohen, Malloy, and Pomorski (2012), Scott and Xu (2004)) as opposed to aggregate insider trades within a firm.[5] While there is a rich literature studying the information content of insider transactions, only one paper (of which I am aware) has attempted to use non-transactions to identify information.[6] In an interesting study, Gao, Ma, and Ng (2015) study

[5] Several studies also use reporting or publication dates, in lieu of transaction dates, to examine market reaction to insider trades (e.g., Jaffe (1974), Chang and Suk (1998), Fidrmuc, Goergen, and Renneboog (2006), Ravina and Sapienza (2010)) and typically find positive reaction to purchase and little reaction to sales.

[6] Related studies examining insider trading informativeness include: Lorie and Neiderhoffer (1968), Pratt and DeVere (1970), Jaffe (1974), Baesel and Stein (1979), Seyhun (1986, 1988, 1992, 1998), Rozeff and Zaman (1988, 1998), Lin and Howe (1990), Karpoff and Lee (1991), Eysell and Reburn (1993), Bettis, Vickery, and Vickery (1997), Lee (1997), Kahle (2000), Lakonishok and Lee (2001), Hillier and Marshall (2002), Jeng, Metrick, and Zeckhauser (2003), Piotroski and Roulstone (2005), Marin and Oliver (2008), Fernandes and Ferraira (2009),

periods of 'insider silence' (no insider trading within a company), positing that insiders will not trade before extremely good or bad news. Their findings show stocks likely to have bad news (high short interest stocks) earn lower returns during periods of insider silence than insiders selling. While related in that we both examine 'not-trading,' they study how the illegality of trading on private information creates silence periods and helps identify private information events. I examine the implications of a trade for the not-traded securities within a portfolio of insider holdings.[7]

This study makes several contributions to the literature. I am first to identify and explicitly study the traded and not-traded securities of *portfolio* insiders. Second, I show that insider not-traded securities contain value-relevant information. Further, consistent with my hypothesis, the informational content of insider not-traded securities primarily arises from insider not-sold securities rather than insider not-purchased securities. Next, I show that the portfolio insiders' larger inside information set helps them make more informative purchases than single-firm insiders. The evidence on sales, however, is mixed. Finally, I show that the market appears to infer information from insider purchases (partially explaining the observed abnormal returns), but not from not-sold securities, suggesting possible market informational inefficiencies. Instead, it appears that abnormal returns associated with not-sold securities result from subsequent firm-specific news events, suggesting that insiders' strategically time their "not-sold" securities to profit from firm-specific events.

The remainder of the paper proceeds as follows. Section 1 describes the related literature. Section 2 describes the data. Section 3 tests if not-sold securities outperform not-bought

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Ravina and Sapienza (2010) and in general find insider purchases are informative. Further, Sias and Whidbee (2010) find a negative relation between aggregate insider trading and institutional investor demand. Clacher, Hillier, and Lhaopadchan (2009) provide an excellent review of all the literature on insider trading.

[7] For further discussion of Gao, Ma, and Ng (2015) as well as other related literature see section 2.

securities. Section 4 tests if insiders trade profitably within their inside portfolios. Section 5 compares portfolio and single-firm insider trades. Section 6 investigates the source of abnormal returns. Section 7 present robustness tests. Section 8 concludes.

2. Background

The study of insider trading is a rich literature extending back several decades. The majority of this literature focuses on the information contained in insider trades. The primary finding, with few exceptions, is that insider trades contain predictive power for future returns (e.g., Neiderhoffer (1968), Pratt and DeVere (1970), Jaffe (1974), Baesel and Stein (1979), Seyhun (1986, 1988), Seyhun (1992), Rozeff and Zaman (1988), Hillier and Marshall (2002), Ravina and Sapienza (2010)).[8] The literature also finds that the informational content associated with insider transactions primarily arises from their purchases. In general, insider sales are found to possess little value-relevant information about future returns (Lakonishok and Lee (2001), Jeng, Metrick, and Zeckhauser (2003), and Jenter (2005)). Further, insiders are typically found to be contrarian in nature; they buy value stocks, sell growth stocks, and sell stocks with high short-term past returns (Rozeff and Zaman (1998), Lakonishok and Lee (2001)). This evidence suggests that the profitability of a simple contrarian strategy explains some, but not all of the profitability of insider transactions (e.g., Piotroski and Roulstone (2005)).

While a great deal of work studies the information content of insider trades, little work studies not-traded securities. One notable exception is Gao, Ma, and Ng (2015), who study information in periods of 'insider silence,' periods where all insiders at a particular firm stop trading that firm's shares. They posit that insiders will not trade before extreme news events and

[8] One primary exception is Eckbo and Smith (1998) who, using three different measures of performance, find no abnormal returns from insiders in the six months following insider trades in their sample of firms on the Oslo stock exchange.

use criteria (first merger targets and then short interest) to separate the sample based on expected good news or expected bad news. They find stocks likely to have bad news (high short interest) have significantly lower returns when insiders do not trade than when insiders sell the security.

While similar in the sense that Gao, Ma, and Ng (2014) also examine not-trading, their study varies significantly from mine. Specifically, as briefly mentioned in the introduction, they examine situations where insider trading regulations *prevent* insiders from profiting on private information, causing insiders to not trade. I examine situations where regulations *allow* insiders to profit from inside information by not-trading specific securities. Further, they investigate aggregate trading within a single firm. I investigate insiders trading within their own personal portfolio of inside holdings. The portfolio approach allows me to generate specific directional hypotheses for not-sold and not-purchased securities using only insider trades with no additional information (such as short interest). In sum, while both Gao, Ma, and Ng and I both use not-traded securities to identify information, we use different measures of not-traded securities, to study different hypotheses, with different economic implications.

Finally, two notable papers focus on insiders with multiple inside positions. First, in an important study, Cook and Wang (2011) test the effectiveness of 2003 NYSE and NASDAQ listing standards that required a majority of independent board members and as a result increased the number of independent directors with multiple inside positions (independent multi-firm directors). They test the effectiveness of the listing standard change by comparing the portfolio performance of the trades of independent multi-firm directors with single-firm directors. They find independent multi-firm directors can effectively value their entire portfolio of insider holdings by showing a zero investment portfolio, long multi-firm director purchases (not-sold securities) and short not-purchased (sold) securities, earns larger profits than single-firm insider

trades. Second, Karamanou, Pownall, and Prakash (2014) use multi-firm insider sales to distinguish between directional and liquidity based sales (they include all insiders including block holders). They define a directional sale as a sale of one inside security when an insider buys a different inside position that same month and find non-liquidity-based sales earn negative abnormal returns. Conversely, I demonstrate that portfolio insiders' (both officers and directors) not-sold securities contain information about future returns on average (even liquidity sales), disentangle the informational source, and examine if the market is aware of this information.

3. Data

3.A. Portfolio insider sample

The data for this study come from four sources. First, insider trades are from SEC Form 3 and Form 4 filings provided by Thomson Reuters. Any insider with decision-making authority over the operations of the firm, board-member, or beneficial owner of more than 10% of the company's stock is required to file these forms. When an individual becomes an insider, they are required to file a Form 3 report reporting their current number of shares held in the firm even if that value is zero. This form is used as a starting point to determine what stocks insiders hold in their portfolios. Corporate insiders report their trades using Form 4. If an insider held no stock in the company when they filed a Form 3, then a Form 4 purchase would designate the day of their first position in the company. Included in the sample of trades are all open market purchases and sales of common stock (share codes 10 and 11) by insiders in New York Stock Exchange, the American Stock Exchange, NASDAQ, or ARCA (exchange codes 1, 2, 3, or 4) companies with trading day closing share prices greater than five dollars.[9] Options and derivatives transactions

[9] Observations are only included with Thomson Reuters cleanse codes equal to 'R,' 'H,' or 'L' and transaction codes equal to 'P' or 'S.'

are excluded. Second, returns, prices, and shares outstanding are from the Center for Research in Security Prices (CRSP), and third, book-to-market values are calculated using quarterly Compustat data.[10] The sample period is January 1986 through December 2012; however the first identified portfolio insider trade is in November 1992 (the Thomson sample is poorly populated from 1986 to 1995). Finally, Google Trends (www.google.com/trends) data are used to identify firm-specific events. This data, described in section 6, extends from January 2004 through December 2012.

Investors' insider portfolio holdings are constructed as follows. A stock is first defined as a part of an insider's portfolio either the day he files a Form 3 holdings report (assuming he holds the security) or the first day he trades the security (as revealed by a Form 4).[11] That stock is then defined as a part of that insider's portfolio until the last observed day he trades the stock. For example, if an insider first reported ownership of GM via Form 3 in February 1998 and the last observed trade of GM was in January of 2002, then GM is considered as in the insider's portfolio from February 1998 to January 2002. This methodology is used as a conservative estimate of the number of stocks held in the insider's portfolio. Insiders are not required to report their complete holdings (at all firms) at any point. Further, when an insider is fired or retires from a company, he or she is no longer required to report their trades in the company (unless they hold greater than 10% of the company's stock). Therefore, an insider's exact holdings cannot be tracked over the whole sample. It is not possible to empirically identify whether a lack of trading means the insider still holds the stock or they are no longer an insider (or large shareholder) in the firm, and therefore are no longer required to report their trades. However, with this methodology, the

[10] Book-to-market is defined as common ordinary equity divided by price at quarter end times shares outstanding (using Compustat variables: book-to-market=CEQQ/(PRCCQ*CSHOQ)). Book to market data is lagged one quarters (e.g., December 2001 book-to-market values are assigned to securities beginning April 2002.

[11] I construct an alternative sample where the stock is first placed in the insiders portfolio the date he or she files a Form 3, independent of whether he reports holdings or not. The results remain economically unchanged.

insider should be required to report his decisions over the entire time series between the two trades (unless the insider was fired and rehired within the time period, or was a large shareholder whose ownership dropped below 10% of shares outstanding and he continued to trade the stock). Finally, an insider is defined as a *portfolio insider* if there is overlap in the time periods in which they are defined as holding an insider position in more than one company.

3.B. Types of portfolio insiders

The SEC requires a diverse group of individuals file Form 3 and Form 4 insider filings, including large shareholders, necessitating an understanding of the positions portfolio insiders hold. I define four possible insider roles (director, officer, large shareholder, and other) for each insider at each of their inside company's based on the insider's reported Thomson role code. This creates 15 different possible combinations of portfolio insider types. An insider can either serve solely as a director, an officer, a large shareholder, or other for all of the stocks they hold. Additionally, an insider can hold multiple roles including any combination of two or more of the roles. For example, an insider could be a director at one company and an officer at another. Table 1 reports the number of insiders of each specific type and the percentage of the total trades these insiders make. Most portfolio insiders either serve as a director at more than one company (41.78% of portfolio insiders; 24% of trades) or as an officer at one company and a director at another company (32% of portfolio insiders; 25.67% of trades). Large shareholders make up a very small portion of the sample (5.8% are exclusively large shareholders), but trade actively (accounting for 9.32% of portfolio insider trades).

Panel B reports summary statistics based solely on the insider type of the *traded* security. If an insider is both an officer for GM and a board member for IBM, and trades IBM, she is defined

as a board member for that trade. This captures what type of insider trades most heavily, independent of the other position types held. The results reveal that although Directors and Officers account for the vast majority of traded positions, large shareholders account for 30% of the total sample of trades.

A great deal of the existing literature on insider trades excludes large shareholders as well as the insiders defined here as 'others.' Further, the hypotheses in this paper are most related to insiders either serving on the board or as an officer, because they are most likely to possess private information. To remain consistent with the literature and focus on most relevant hypothesized insiders, for the tests in the paper, I restrict the sample to observations where the insider trading the security reports being a director or officer at the company traded. This reduces the sample to 67,764 observations (in Panel B 51,116+16,648). In unreported tests I construct a sample where I require insiders serve as officers or directors at all inside positions (i.e., both the traded and all non-traded securities)—the results are qualitatively and statistically similar (i.e., the results differ by less than 10bps). Table 2 presents summary statistics of the 67,764 director and officer trades included in the sample.

Panel A of Table 2 reports that the average portfolio insider holds 2.41 (median=2) stocks at the time of a trade. There is substantial variation in the number of holdings. The insider with the largest number of holdings (Bank of America Corp) is identified as holding 70 stocks at one time.[12] Further portfolio insiders average 3.41 purchases and 6.54 sales. These values are highly skewed, however, as the medians are 1 purchase and 2 sales. Panel B reports portfolio insiders

[12] Clearly Bank of America is not an insider in the traditional sense. However, they do report being a board member for some of their trades leading to their inclusion in the sample. To ensure that observations such as these do not drive the results all the main tests are repeated when restricting the sample to insiders with fewer than 10 holdings. The results remain effectively unchanged.

make up 8.28% of the total insiders in the database (8,603 of 103,894); but hold a fairly large sample of 5,165 securities.

4. Do not-sold securities outperform not-purchased securities?

This section tests the primary hypothesis—that portfolio insider not-sold securities will outperform their not-bought securities. I use the insider trade as the event date and compare the subsequent 30-trading day performance of not-purchased and not-sold securities. Because insiders often spread their trades out over a few days (e.g., Aboody, Hughes, and Liu (2005)), I only include an insider's first weekly purchase and first weekly sale (using calendar weeks starting on Sundays) for each stock in their portfolio. For example, if an insider purchased IBM on December 1st and December 2ne, 2000, only the trade on December 1st is included.

I use three abnormal return measures—market-adjusted, size-adjusted, and Daniel, Grinblatt, Titman, and Wermers (DGTW)-adjusted returns. Specifically, market-adjusted returns are computed as the stocks' cumulative return less the CRSP value-weighted market index. Size-adjusted returns are analogously computed based on the firm's beginning of month size decile using NYSE breakpoints. Finally, DGTW returns are calculated as the stocks cumulative return less the return for a portfolio with similar size, value, and momentum characteristics (see Wermers (2004) for additional detail).[13]

I begin with univariate tests comparing not-sold securities to not-purchased securities. Specifically, for each insider purchase (sale), I compute the average 30-day return for the other securities the insider held, but did not purchase (sell). For instance, if a portfolio insider held

[13] DGTW returns are calculated as in Daniel, Grinblatt, Titman, and Wermers (1997) and Wermers (2004). The DGTW benchmarks are available via http://www.smith.umd.edu/faculty/rwermers/ftpsite/Dgtw/coverpage.htm. I use their stock assignments to calculate value-weighted portfolio returns using CRSP daily stock returns.

three inside positions and sold shares of company *A* on day *t*, but did not sell shares of companies *B* and *C* on day *t*, I compute the return on the insider's not-sold position as the average return for companies *B* and *C*. Thus, each portfolio insider purchase (sale) is associated with a single observation in the not-purchased (not-sold) sample.

Table 3 reports the pooled cross-sectional average abnormal returns for the not-sold securities, the not-bought securities, and their differences. Regardless of the risk adjustment method, the results reveal that the securities insiders do not sell meaningfully outperform the securities they do not purchase (statistically significant at the 1% level in all cases). In addition, consistent with my asymmetry prediction, the difference in abnormal returns between not-sold securities and not-purchased securities primarily arises from large positive abnormal returns associated with securities insiders choose not to sell. Specifically, regardless of the risk adjustment method, not-sold securities average large positive abnormal returns (ranging from 58bp/month to 93bp/month) that differ meaningfully from zero (at the 1% level). In contrast, the abnormal returns for securities insiders do not purchase do not differ meaningfully from zero in any case.

To control for other factors that may influence insider's decisions, I examine abnormal returns associated with insider transactions in a panel regression framework—effectively identical to the methodology in Cohen, Malloy, and Pomorski (2012).[14] Specifically, the dependent variable is the market-adjusted return for the not-traded security and the independent variables include size, book to market ratios, past month returns, and past year return to control for the contrarian nature of insider trading (e.g., Piotroski and Roulstone (2005)) and tax-loss

[14] Cohen, Malloy, and Pomorski (2012) examine returns in the calendar month following an insider trade while I focus on the 30 days following an insider trade. In addition, I use market-adjusted (rather than raw) returns as the dependent variable. These tests are also similar to those in Ravina and Sapienza (2010).

selling (see Cohen, Malloy and Pomorski for additional discussion). For insiders that hold more than two securities (and therefore the not-traded portfolio consists of more than one security), I compute the cross-sectional average of the subsequent market adjusted return and control variables (e.g., average book-to-market ratio) to use as the dependent and independent variables, respectively. Last, I include a dummy variable that equals one for not-sold transactions and zero for not-purchased transactions. I also repeat the analysis with monthly fixed effects to capture potential time dependence in trading patterns (e.g., insiders trading in recessions). Standard errors are clustered at the insider level.

The results, reported in Table 4, reveal that insider's not-sold securities meaningfully outperform their not-bought securities consistent with my hypothesis that there is information in the stocks portfolio insiders do not trade. Specifically, similar to the univariate tests, securities not sold by insiders average market adjusted returns 58bp higher (statistically significant at the 1% level) than securities not purchased by insiders over the following 30 days. Results are similar when including monthly fixed effects.

5. Traded versus not-traded securities

The hypothesis that information is contained in portfolio insider not-traded securities assumes that portfolio insiders, at least sometimes, attempt to trade profitably *within* their inside portfolios. This observation leads to two additional empirical predictions: 1) the securities sold by insiders should subsequently underperform the securities not-sold by insiders, and 2) securities purchased by insiders should subsequently outperform the securities not-purchased by insiders.[15] I begin testing the predictions using a univariate test directly analogous to the previous

[15] Cook and Wang (2011) find that multi-firm independent directors, a sup-sample of the portfolio insiders in my study, trade profitably within their portfolio, by forming a zero investment portfolio long stocks purchased (not-

section. For each portfolio insider trade, I calculate the risk-adjusted return to the traded security, the average risk-adjusted return to the not-traded security, and their difference (i.e., for each insider trade there is one traded return, one not-traded return, and one difference). Table 5 presents the univariate mean portfolio returns and differences. The advantage of these tests is by directly comparison of traded and not-traded securities' performance, the tests naturally control for time effects, market conditions, and insider effects.

Table 5 shows that, in all tests, portfolio insiders trade profitably within their inside holdings portfolio. The purchased securities outperform the not-purchased securities (by between 205 and 210bps over the next 30 days), driven by the large risk-adjusted returns of the purchased securities. Further, the sold securities underperform the not-sold securities (by between 82 and 89bps over the next 30 days). This underperformance primarily arises from the strong abnormal returns associated with not-sold securities (58 to 93bps depending on the risk-adjustment; statistically significant at the 1% level in all cases). Nonetheless, insider sales result in, on average, negative abnormal returns when using size- or DGTW-adjusted returns. When using market-adjusted returns, however, the subsequent returns of sold securities do not differ meaningfully from zero.

Table 6 presents results using pooled regressions similar to those in Table 4 with two differences. First, I have two indicator variables: "Sell" equals one if the insider sold the security and zero otherwise and "Buy" equals one if the insider purchased the security and zero otherwise. Second, unlike the previous section, I do not average characteristics over an insider's

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sold) and short stocks not-purchased (sold) by insiders over the next 6 months to one year. Conversely, I directly test for the trading performance of each individual portfolio insiders trades within their portfolio by comparing the performance of the traded security to that insiders portfolio of untraded securities.

not-traded securities. Rather, I include each non-traded security (and its characteristics) in the panel.[16]

The first two columns in Table 6 limit the sample to securities bought and securities not-bought by insiders. The second column reveals that, when including monthly fixed effects, insider purchased securities outperform their not-purchased securities by 162 basis points over the subsequent 30 trading days. Analogously, the third and fourth columns are based on the sample of sold and not-sold securities. The results in the fourth column reveal that, when including monthly fixed effects, securities sold by insiders average returns 91bps lower than not-sold securities over the next 30 days.

6. Are portfolio insider trades more informative than single-firm insider trades?

Portfolio insiders benefit from a larger inside information set than single-firm insiders, possibly leading to more informative trades compared to single-firm insider trades. For example, a portfolio insider may hold two undervalued securities, but only purchase the most undervalued security. As a result, the average return associated with a portfolio insider purchase may be greater than the average return associated with a single firm insider purchase, further there is some evidence that independent multi-firm directors are more skilled traders than independent single-firm directors, (Cook and Wang (2011)), suggesting that, if their findings are generalizable to all portfolio insiders, the market should be aware of the potential informational advantage in multi-firm director trades.[17]

[16] I include firms separately to ensure the initial averaging across not-traded securities does not drive the results. However, in unreported tests, I use the average characteristics and returns and the results are qualitatively and statistically similar (if not slightly stronger).

[17] Independent multi-firm directors make up a maximum of 24,652/67,764=36.4% (see Panels A and B of Table 1)) of the sample of portfolio insider trades. This is an upper bound because I do not distinguish between independent multi-firm directors and non-independent multi-firm directors.

To test both if 1) portfolio insiders trades contain greater information than single-firm insiders trades and 2) if the market is aware of this additional information, I compare the average subsequent 5- and 30-day abnormal returns associated with portfolio insider and single firm insider trades. I restrict the sample to the Post-Sox period to ensure market participants are aware of all trades within the subsequent 5-day window.[18] The results, reported in Table 7, reveal that portfolio insider purchases are more informative than single firm insider purchases over both the next 5- and 30-trading-days. Specifically, portfolio insider purchases outperform single-firm insider purchases by between 60 and 117bps (Column 6), depending on risk adjustment, over the subsequent 30 days.

If the market efficiently responds to the greater information content of portfolio insider trades the subsequent 5-day return should capture the difference in performance and then the stocks should perform similarly subsequently. However, the results show that, while the market does react more strongly to portfolio insider purchases than single-firm insider purchases, bidding up portfolio insider purchased security prices by between 41 and 48bps higher than single-firm insider purchased security prices over the 5-subsequent trading days, the outperformance of portfolio insider purchases continues to increase over the next 30-trading days (increasing to between 60 and 117 bps). This result suggests the market fails to completely impound the additional information in portfolio insider trades in a timely manner.

The results comparing portfolio insider sales to single firm insider sales, however, are mixed. First, the absolute magnitude of the difference between portfolio insider and single firm insider sales is smaller than it is for purchases. Moreover, the sign of the difference (for sales) depends

[18] When including the full 1992-2012 sample, portfolio insider purchases outperform single-firm insider purchases by 70, 56, and 77 bps using market-, size-, or DGTW-adjusted returns respectively;.

on the risk-adjustment method. This lack of information is consistent with the literature that finds little information in insider sales especially when compared to purchases (e.g., Lakonishok and Lee (2001), Ravina and Sapienza (2010)).

To further examine the performance difference between portfolio insiders and single firm insiders' trades, I evaluate the returns in a panel regression framework (for 30-trading day returns only for the sake of brevity). I define two dummy variables: "Portfolio insider purchase" equals one if the insider purchase came from a portfolio insider and zero if it came from a single firm insider. Analogously, "Portfolio insider sale" equals one if the insider sale came from a portfolio insider and zero if it came from a single firm insider. I include the same control variables as in the previous panel regressions.

The results, presented in Table 8 show that portfolio insider purchases are more informative than single-firm insider purchases (consistent with the univariate tests). When including monthly fixed effects, portfolio insider purchases outperform single-firm insider purchases by 67 basis points over the next 30 trading days. Once again, the magnitude of the results is substantially smaller for insider sales. Moreover, I find no evidence that portfolio insider sales are more informative than single firm insider sales. In fact, the point estimates suggest that single firm insider sales are more informative than portfolio insider sales (marginally significant at the 10% level).

7. Source of abnormal returns

There are at least two non-mutually exclusive explanations for the relation between institutional trades/non-trades and subsequent abnormal return. First, the abnormal returns could result from traders inferring information from the insider trades. Second, the abnormal returns

could result from information events following portfolio insider trades. This section examines these two possible abnormal return sources. Given insider trades and non-trades differ in both their legal restrictions and the ease of visibility (i.e., insiders must directly report their trades, but do not report their non-trades), I hypothesize that the relative importance of markets inferring information versus subsequent firm-specific shocks also varies across traded and non-traded stocks. Specifically, because insider trades are reported (and easily observable), I expect that the market reaction to the insider trade plays an important role in explaining abnormal returns associated with insider trades. Conversely, because 1) insider trading prior to private firm specific information is illegal, but not trading prior to such information is legal, and 2) there is no direct reporting of non-trades, I expect that abnormal returns associated with insider non-trades are more strongly related to subsequent firm-specific information rather than the market reaction to the non-trade.

7.A. Post Sarbanes Oxley

Prior to the enactment of Sarbanes Oxley (SOX) in August of 2002, insiders had 40 calendar days to report their transactions (a maximum of 30-trading days before the market could observe the trade). Following SOX, however, insiders had only two business days to report their transactions. This change in reporting structure creates a natural test of the extent to which markets infer information from insider's trades/non-trades. Specifically, if markets infer information from insider trades, then prior to SOX, abnormal returns should primarily accrue in the t+6 to t+30 trading day period while post-SOX, abnormal returns should primarily accrue in the t+1 to t+5 trading day period.[19] Thus, I examine the 5-day and t+6 to t+30-day market-

[19] I cannot observe at what time of day the stock is traded, so I assume it is the day-end and study returns starting day t+1. If an insider trades and immediately reports that day, I will miss some of the market reaction biasing my results towards zero.

adjusted returns in both the pre- and post-SOX period. Because the sold and not-purchased portfolios do not systematically garner abnormal returns that differ meaningfully from zero (e.g., see Table 5), I focus on insider purchases and insider not-sold transactions. Given the focus of this test is how return patterns *change* following SOX implementation, I only report results for market-adjusted returns (although the results are similar when examining size or DGTW adjusted returns).

Panel A of Table 9 reports the results for insider purchases. Consistent with the hypothesis that abnormal returns associated with insider purchases arise, in large part, because markets infer information from the revelation of the insider purchase itself, the bulk of the abnormal return migrates from the t+6 to t+30 event window in the pre-SOX period to the t+1 to t+5 event window in the post-SOX period. Specifically, t+6 to t+30 market-adjusted returns are meaningfully larger than t+1 to t+5 market-adjusted returns in the pre-SOX period (last column in the first row, statistically significant at the 1% level based on a paired t-test). In contrast, t+1 to t+5 market adjusted returns are meaningfully larger than t+6 to t+30 market adjusted returns in the post-SOX period (second row, last column, statistically significant at the 1% level). Further consistent with the hypothesis that market reactions to the trade itself plays an important role in explaining abnormal returns associated with insider purchases, the last row reveals that t+1 to t+5 market adjusted returns are significantly larger (at the 1% level, based on a t-test for difference in means) than t+6 to t+30 day returns in the post-SOX period while the relation reverses in the post-SOX period (again, statistically significant at the 1% level).

Panel B repeats the test for not-sold securities. Although the results reveal that abnormal returns associated with not-sold securities are lower following SOX (for both t+1 to t+5 and t+6 to t+30 periods), there is no evidence that the importance of t+1 to t+5 period relative to the t+6

to t+30 period has increased in the post-SOX period. Moreover, in both the pre- and post-SOX periods, the large majority of abnormal returns associated with insider non-sales occur in the t+6 to t+30 period (expected given the period is three times longer). In short, the pre- and post-SOX returns patterns reveal no evidence that abnormal returns associated with insider non-sales primarily arise from markets inferring information directly from the non-sale.

7.B. Evidence from internet search volume

In this section I attempt to objectively measure the extent of firm-specific information revealed following an insider non-trade by using internet search volume. That is, I hypothesize that when a company experiences a news shock (e.g., a technology company announces a new product), they will simultaneously experience an increase in internet search volume. Specifically, I use Google Trends (google.com/trends) data to collect weekly search volume statistics for portfolio insider companies.

Google both standardizes and scales the provided Trend data. First, to account for time-series variation in searches, for each data point Google controls for total aggregate search volume within the region and time period specified. Second, Google then scales the resulting values to a range of 0 to 100 (e.g., MSFT's value is adjusted for time-trends in overall U.S. search volume and then rescaled so its time-series values range between 0 and 100).[20] To construct my sample, I create a database of time-series Trend values for every company name reported in CRSP for the

[20] In the help section at google.com/trends the adjustment is described as follows: "Google Trends adjusts search data to make comparisons between terms easier…To do this, each data point is divided by the total searches of the geography and time range it represents, to compare relative popularity. The resulting numbers are then scaled to a range of 0 to 100." For my sample 'the geography' is the United States.

sample period Google Trends data is available (January 2004 through December 2012).[21] I limit the sample to search volume within the United States and only include firms that have a weekly time series available (for unpopular searches Google provides a default monthly series only) resulting in 1,585 firms with available data.[22]

Search volume is seasonal for many companies. For example, a retail company may have greater search volume during the holidays while a hotel chain may have greater search volume in the summer. I use two methods to control for seasonality. First, for each firm, I subtract the average weekly trend value from the previous calendar year (i.e., for IBM in August of 2010 I subtract the average weekly IBM trend values for August 2009). Second, I subtract the trend value for the same calendar week of the previous year (i.e., for IBM in the 42nd week of 2010 I subtract the 42nd week of 2009). Further, Trend values are only included during the time period the firm is listed on CRSP. For example, if a company's Trend series starts in June of 2004, but the first reported CRSP return is August 2004 then the Trend values from June 2004 through July 2004 are excluded. I exclude these observations to eliminate changes in search volume related to a company going public.

Because my hypothesis relates to firm-specific abnormal search volume (e.g., IBM experiences abnormal search volume relative to its mean volume) rather than cross-sectional abnormal volume (e.g., IBM enjoys greater search volume than a small company) I conduct a time-series test. First, I create a time-series of subsequent differences in company Trend values,

[21] I use the Google beta feature that allows for misspelling, e.g., "Microsot" is interpreted as "Microsoft." For some companies the beta search function is not available. This is because the company is not searched for frequently enough to be recognized using this function. These companies are excluded from the sample.

[22] The sample is similar to that used by Da, Engelberg, and Gao (2011) to capture investor attention. While both studies use Trend data, Da, Engelberg, and Gao construct a sample of searches for company tickers, while I rely on beta searches for company names. Our difference in approach is driven by our different objectives. They seek to capture investor attention to stocks and investors likely search for tickers. I want to capture company specific news events. When major news occurs, such as the death of a CEO, it appears more likely individuals search for the company name than the company ticker.

which I call dTrend (the difference in the deseasonalized Trend value for company *i*, between week *t*+1 and week *t*). Next, for each firm, I calculate the difference in the average dTrend (for both deseasonalized measures) in weeks following a non-sale(s) and in weeks with zero prior week non-sales, providing one difference for each firm.[23] I repeat this exercise for sales, buys, and non-buys. Table 10 reports the cross-sectional mean differences and *t*-statistics (from a paired *t*-test). Panel C reports cross-sectional summary statistics of the 1,585 firm-level time-series average dTrend values (i.e., I report summary statistics of the 1,585 mean dTrend values, for both deseasonlized measures).

The results show that based on both deseasonalized changes in Google Trend measures, the not-sold portfolio realizes an economically meaningful increase in search volume the week following a non-sale. On average, company search volume increases by between 213% (Panel A; 0.530/0.249) and 317% (Panel B; 0.795/0.251) of the cross-sectional standard deviation of mean weekly changes (Panel C) for all firms following a non-sale, supporting the hypothesis that insiders avoid selling securities before positive information events. I find no evidence that insider purchases or sales (or non-purchases) are meaningfully related to search volume.

8. Robustness

8.A. Blackout periods

Many firms have "blackout" periods that forbid insider trading outside of a prescribed period. Bettis, Coles, and Lemmon (2000) report that the most common blackout period structure allows insiders to exclusively trade from the third to the twelfth day following an earnings announcement. Thus, to examine how insiders non-trading in blackout periods may influence my

[23] This procedure is equivalent to running a time series regression of dTrend values on dummy variables equal to 1 if there was a trade in the previous week and zero otherwise.

results, I compare the fraction of trades and non-trades that occur with the third to 12th days following earnings announcement. Specifically, it is possible that portfolio insiders simply trade the securities they own that are not in blackout periods while non-traded securities are in the blackout period. If this is in fact the case, then a meaningfully larger percentage of the securities traded should not be in blackout periods compared to those securities not-traded. Using the Bettis, Cole, and Lemmon (2000) blackout window structure, 30.4% of portfolio insider traded securities and 18.8% of not-traded securities fall within the respective companies trading window (untabulated; the difference is statistically significant at the 1% level). I also examine the difference when defining the blackout window as months other than the 30 trading days immediately following the earnings announcement (following Ke, Huddart, and Petroni (2003)). Using this definition, 58.2% of traded securities and 45.3% of not-traded securities fall within the trading window (untabulated; difference is statistically significant at the 1% level). Both tests suggest that blackout windows influence when insiders traded.

To ensure blackout periods do not drive the results, I restrict the sample to trades where all not-traded securities fall in the 30-trading day window (i.e., a non-blackout period using the Ke, Huddart, and Petroni (2003) metric) following an earnings announcement and repeat the Table 3 univariate analysis. The results, reported in Table 11, are slightly stronger than the results using the entire sample (i.e., Table 3). The not-sold securities, in this sample, outperform the not-bought securities by between 70 and 104 basis points depending on risk adjustment method (compared to between 53 and 82 basis points in Table 3).

8.B. Option exercises

Another possibility is that portfolio insiders simply sell securities immediately upon exercising call options. That is, an insider purchases a security via option exercise (this purchase is not included in my sample because I only examine open market purchases and sales) and then immediately liquidates this position (this sale is include in my sample because it is an open-market sale). Fortunately, Thomson flags these sales (optionsell indicator in the Thomson database is equal to 'A' or 'P'). Thus, I repeat the univariate tests excluding these sales.[24] This reduces the number of sales to 17,432. However, the results remain largely unchanged. The abnormal returns to portfolio insider sales in the 30-day window following a sale do not differ meaningfully from zero using market-adjusted returns. The average market-adjusted subsequent 30-trading day not-sold security portfolio return is 89 basis points, significant at the 1% level and similar to the 93 basis point average return reported using the full sample (Table 3; results are also similar using DGTW and size-adjusted returns). In short, excluding open market sales related to option exercise purchases does not impact my results.

8.C. Out of sample: Do not-sold securities outperform not-purchased securities?

To ensure the main results presented in Table 3 are not sample period specific I perform an out of sample test. The main test (Table 3) uses the sample period January 1, 1992 to December 31, 2012 and uses overlapping trading windows to construct an insiders' portfolio. For the out of sample test I construct a new sample of portfolio insider trades occurring between January 1, 2013 and December 31, 2014. To do so, I first create each insiders portfolio for the 2013 to 2014 sample period. The main obstacle is that the use of overlapping trading windows greatly reduces the number of observations in the last year of the sample (only the second to last

[24] For further discussion see Ravina and Sapienza (2010). Any purchase related to exercise of an insider call option is recorded in the Table 2 options file provided by Thomson Reuters.

trade is included). To address this issue I alter the initial methodology slightly and do not require a subsequent trade for inclusion in the insider's portfolio if the insider trades the security during or after 2010. While the constraint relaxation potentially adds observations where ore or more of an insider' securities identified in his or her portfolio is not actually in that insider's portfolio (e.g., they got fired after a trade in 2010), these observations should only serve to add noise to sample and decrease the test's power.

While the trades used to form the portfolio are not out of sample, importantly all traded and not-traded observations used in the test are out of sample.[25] However, because the portfolio formation occurs in sample I cannot rule out that the portfolio insiders in my sample are especially skilled (though this scenario does not change the inferences of the paper). I then repeat the not-sold compared to not-purchased tests presented in Table 3. DGTW-adjusted returns are not presented based on data availability.[26] The results presented in Table 12, provide strong evidence that the information in portfolio insider not traded securities is not sample period specific. In the much smaller 2013-2014 sample the not-sold securities earn market-adjusted returns of 84 basis points outperforming the not-purchased securities by a statistically significant 83 basis points (compare to 82 basis points in the 1992-2012 full sample). The results are similar for size adjusted returns. The not-sold securities earn an average 60 basis points in the 1992-2012 sample compared to 64 basis points in the 2013-2014 sample.

9. Conclusion

I hypothesis that information can be garnered not only from the securities insiders trade, but also from the securities they choose not to trade. Consistent with my hypothesis, securities

[25] The 2013-2014 data was never used nor downloaded until it was needed for this test.
[26] The data provided by Russ Wermers website extends through 2012.

insiders choose not to sell meaningfully outperform the securities they choose not to purchase in the subsequent 30 days. Further consistent with my hypothesis, the return difference between not-sold and not-purchased securities primarily arises from large abnormal returns associated with the securities insiders choose not to sell.

Additional tests continue to support my hypotheses. Stocks insiders sell subsequently underperform those they choose not to sell primarily due to the large positive abnormal returns associated with the securities they choose not to sell. Stocks insiders purchase subsequently outperform those they choose not to purchase primarily due to the large positive abnormal returns associated with the securities they purchase. Moreover, I find strong evidence that portfolio insiders focus their purchases on the most undervalued securities in their insider portfolio. Specifically, portfolio insider purchases garner meaningfully large positive abnormal returns than single-firm insider purchases.

Last, consistent with the hypothesis that abnormal returns associated with insider purchases primarily arise form markets inferring information from insider transactions, the bulk of abnormal return migrates from the t+6 to t+30 window pre-SOX to the t+1 to t+5 window post-SOX. In contrast, I find no evidence that the abnormal return window has shortened pre- versus post-SOX for portfolio insider non-sales. Rather, in the case of non-sales, evidence from internet search volume data suggests abnormal returns result from release of firm-specific information following the non-sale.

Table 1
Positions held by portfolio insiders

This table outlines the possible positions held by portfolio insiders. For each company a portfolio insider works at they are defined as having one of four positions director, officer, big shareholder, and other. This table then presents all the possibilities for combinations of positions they could hold in panel A. For example only director means the individual is a director in all the companies her or she reports holdings. 'officer and other' means the individual works as an officer for one insider holding and is defined as 'other' for an additional holding. 'number of individuals' reports the number of individual falling into each category. Panels B presents the sample split based on the insiders position in the security traded only, leaving only 4 possible insider types.

Positions held by portfolio insiders	number of individuals	percent of total	number of trades	percent of total trades
Panel A: all possible position combinations				
Only director	3162	41.78	24652	24.00
Only officer	386	5.10	2432	2.37
Only big shareholder	442	5.84	9570	9.32
Only other	30	0.40	84	0.08
Director and officer	2422	32.00	26363	25.67
Director and big	250	3.30	5662	5.51
Officer and big	38	0.50	1778	1.73
Director and other	208	2.75	2649	2.58
Officer and other	66	0.87	269	0.26
Big and other	141	1.86	5354	5.21
Director, Officer, and other	171	2.26	4252	4.14
Director, big, and other	112	1.48	8459	8.24
Officer, big, and other	28	0.37	1692	1.65
Director, officer, and big	65	0.86	4578	4.46
All	47	0.62	4903	4.77
Total	7568	100.00	102697	100.00
Panel B: Insider types by security traded only				
Director			51116	49.77
Officer			16648	16.21
Big shareholder			30983	30.17
Other			3950	3.85
Total			102697	100.00

Table 2
Summary statistics

Presented in the table are summary statistics of the portfolio insider sample. Panel A presents average trading information at the insider level. # holdings/insider is the number of stocks held per portfolio insider. # of buys/insider (# of sales/ insider) is the number of buys (sales) each portfolio insider makes in the entire sample. Panel B presents totals across the sample. For example 'number of sales' means there were 68136 total sales by portfolio insiders for the sample. 'stocks held port insiders' means there were a total of 5,165 stocks held by portfolio insiders at some point in the sample.

Panel A: portfolio insider level summary statistics

	mean	median	std	min	max
# of holdings/ insider	2.41	2.00	2.18	2.00	70.00
# of buys/ insider	3.41	1.00	11.68	0.00	656.00
# of sells/ insider	6.54	2.00	19.14	0.00	563.00

Panel B: totals

	number of sales	number of buys	portfolio insiders	total insiders	stocks held port insiders
Number of observations	44,525	23,239	6,813	103,894	5,165

Table 3
Univariate 30 day risk-adjusted returns following a trade

This table presents average future 30 trading day risk-adjusted returns following portfolio insider trades. The sample includes only observations where the insider trading the security is an officer, or director of the company traded. In Panel A the returns are adjusted for the valued-weighted market return. In Panel B returns are adjusted based on their beginning of month NYSE size decile portfolio. Panel C returns are DGTW-adjusted returns. Each not-sold and not-purchased observation is calculated by taking the average of each insiders not-traded securities performance for the 30 days following a trade (e.g., if an insider held stocks A, B, and C on day t and sold stock A, the not-sold return would be the average risk-adjusted return of stocks B and C from days t+1 to t+30). The sample in the first (second) column presents the average return of all portfolio insider not-sold (not-purchased) portfolios. The third column presents the difference in columns one and two and the p-value from a t-test of equality of means in parentheses. The sample period includes November 1992 through December 2012.

	Panel A: Market-adjusted return		
	(1)	(2)	(3)
	Not-sold	Not-purchased	Difference
Return following trade	0.93	0.12	0.82
	(0.001)	(0.333)	(0.001)
	Panel B: Size-adjusted return		
	(1)	(2)	(3)
	Not-sold	Not-purchased	Difference
Return following trade	0.58	0.05	0.53
	(0.001)	(0.659)	(0.001)
	Panel C: DGTW-adjusted return		
	(1)	(2)	(3)
	Not-sold	Not-purchased	Difference
Return following trade	0.60	-0.01	0.61
	(0.001)	(0.916)	(0.001)
Number of Purchases=15,305			
Number of sales=25,686			

Table 4
Not-bought vs not-sold: panel regressions

This table presents average future 30 trading day risk-adjusted returns following portfolio insider trades. The sample includes only observations where the insider trading the security is an officer or director of the company traded. In Panel A the returns are adjusted for the valued-weighted market return. In Panel B returns are adjusted based on their beginning of month NYSE size decile portfolio. Panel C returns are DGTW-adjusted returns. Each not-sold and not-purchased observation is calculated by taking the average of each insiders not-traded securities performance for the 30 days following a trade (e.g., if an insider held stocks A, B, and C on day t and sold stock A, the not-sold return would be the average risk-adjusted return of stocks B and C from days *t*+1 to *t*+30). The sample in the first (second) column presents the average return of all portfolio insider not-sold (not-purchased) portfolios. The third column presents the difference in columns one and two and the *p*-value from a t-test of equality of means in parentheses. The sample period includes November 1992 through December 2012.

	(1)	(2)
Intercept	1.91	
	(0.081)	
Not-sold	0.58	0.47
	(0.004)	(0.033)
Size	-0.07	-0.09
	(0.181)	(0.075)
Ln(bm)	0.28	0.22
	(0.102)	(0.184)
Past month return	2.26	0.43
	(0.043)	(0.712)
Past year return	0.57	0.67
	(0.006)	(0.003)
Fixed effects	none	month
Number of observations	47,566	47,566

Table 5
Univariate 30 day risk-adjusted returns to portfolio insider traded and not-traded securities

This table presents average future 30 trading day risk-adjusted returns following portfolio insider trades. The sample includes only observations where the insider trading the security is an officer or director of the company traded. . In Panel A the returns are adjusted for the valued-weighted market return. In Panel B returns are adjusted based on their beginning of month size decile portfolio (using the value weighted size decile portfolio provided by Kenneth French). Panel C returns are DGTW-adjusted returns. The first row (second row) in each panel presents returns following a portfolio insider purchase (sale). The sample in the first column presents the future return of a stock following a portfolio insider trade. The sample in the second column presents the average return of each insider's not-sold or not-purchased securities so that there is one observation for each insider purchase or sale. P-values for all average returns are reported parenthetically. Column 3 presents the difference in the return of the traded and not-traded securities as well as a *p*-value from a paired t-test of equality of means.

	Panel A: Market-adjusted return		
	(1)	(2)	(3)
	Traded	Not-traded	Difference
Return following purchase	2.18	0.12	2.06
	(0.001)	(0.461)	(0.001)
Return following sale	0.05	0.93	-0.89
	(0.628)	(0.001)	(0.001)
	Panel B: Size-adjusted return		
	(1)	(2)	(3)
	Traded	Not-traded	Difference
Return following purchase	2.10	0.05	2.05
	(0.001)	(0.859)	(0.001)
Return following sale	-0.25	0.58	-0.83
	(0.011)	(0.001)	(0.001)
	Panel C: DGTW-adjusted return		
	(1)	(2)	(3)
	Traded	Not-traded	Difference
Return following purchase	2.09	-0.01	2.10
	(0.001)	(0.454)	(0.001)
Return following sale	-0.22	0.60	-0.82
	(0.020)	(0.001)	(0.001)
Number of Purchases=15,305			
Number of sales=25,686			

Table 6
Traded vs not-traded security excess returns: panel regressions

This table reports pooled regressions of market-adjusted 30 trading day returns on indicators of traded vs not-traded stocks. The sample only includes the first trade of each type (both the first buy and first sell) for each stock each week for each manager. 'Ln(bm)' is the natural log of the stocks book to market ratio. Sell is equal to one if the insider sold the stock and zero otherwise. Buy is equal to one if the insider bought the stock and zero otherwise. In columns 1 and 2 (3 and 4) the sample includes for each insider the stock the insider sold (bought) as well as the stocks the insider held at the time, but did not sell (buy). Size is the natural log of the stocks market capitalization the day of the trade. Past month return is the return of the stock over the previous 21 trading days. Past year return is the return over the previous 12 calendar months, excluding the previous months return. The sample period covers November 1992 through December 2012. Columns 2 and 4 include monthly fixed effects. Standard errors are clustered at the stock level. All numbers are expressed in percent (i.e., 1 is 1%).

	(1)	(2)	(3)	(4)
Intercept	0.41		0.73	
	(0.006)		(0.001)	
Sell			-0.93	-0.91
			(0.001)	(0.001)
Buy	1.65	1.62	0.00	0.00
	(0.001)	(0.001)		
Size	-0.38	-0.37	-0.28	-0.27
	(0.001)	(0.002)	(0.005)	(0.006)
Ln(bm)	-0.04	-0.05	0.07	0.12
	(0.851)	(0.819)	(0.653)	(0.365)
Past month return	-0.48	-2.40	1.45	1.35
	(0.654)	(0.05)	(0.335)	(0.909)
Pasty year return	-0.38	-0.33	0.59	0.64
	(0.073)	(0.173)	(0.011)	(0.005)
Fixed effects	none	monthly	none	monthly
Number of observations	47,335	47,335	63,946	63,946

Table 7

Univariate 5-day and 30-day risk-adjusted returns: Post Sox

This table presents average future 5- (columns (1)-(3) and 30- (columns (4)-(6)) trading day risk-adjusted returns following portfolio insider trades. The sample includes only observations where the insider trading the security is an officer or director of the company traded. In Panel A the returns are adjusted for the valued-weighted market return. In Panel B returns are adjusted based on their beginning of month size decile portfolio (using the value weighted size decile portfolio provided by Kenneth French). Panel C returns are DGTW-adjusted returns. The first column (second column) in each panel presents returns following a portfolio (single-firm) insider trade. The third row presents the difference in the return of the first two rows and a p-value from a t-test of equality of means. P-values for all average returns are reported parenthetically. The sample period extends from October 1, 2002 through December 31, 2012 (the Post Sox Period).

	5-day returns			30-day returns		
	Panel A: Market-adjusted return					
	(1) Portfolio	(2) Single-firm	(3) Difference	(4) Portfolio	(5) Single-firm	(6) Difference
Return following purchase	1.40	0.92	0.48	2.31	1.14	1.17
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Return following sale	-0.07	-0.15	0.07	0.28	-0.10	0.38
	(.047)	(.001)	(.072)	(.001)	(.001)	(.001)
	Panel B: Size-adjusted return					
	(1) Portfolio	(2) Single-firm	(3) Difference	(4) Portfolio	(5) Single-firm	(6) Difference
Return following purchase	1.36	0.95	0.41	1.98	1.38	0.60
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Return following sale	-0.10	-0.12	0.02	-0.02	0.16	-0.18
	(.009)	(.001)	(.668)	(.834)	(.001)	(.08)
	Panel C: DGTW-adjusted return					
	(1) Portfolio	(2) Single-firm	(3) Difference	(4) Portfolio	(5) Single-firm	(6) Difference
Return following purchase	1.30	0.87	0.42	1.97	0.90	1.07
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Return following sale	-0.10	-0.17	0.07	0.02	-0.36	0.38
	(.02)	(.001)	(.095)	(.819)	(.001)	(.001)

Number of portfolio insider purchases=6,640

Number of portfolio insider sales=15,253

Number of single-firm insider purchases=64,881

Number of single-firm insider sales=252,655

Table 8
Portfolio insider trades vs single-firm insider trades: panel regressions

This table reports pooled regressions of market-adjusted 30 trading day returns following both portfolio and single-firm insider trades on an indicators equal to one if an insider holds a portfolio and zero otherwise. The sample only includes the first trade of each type (both the first buy and first sell) for each stock each week for each manager. 'Ln(bm)' is the natural log of the stocks book to market ratio. Size is the natural log of the stocks market capitalization the day of the trade. Past month return is the return of the stock over the previous 21 trading days. Past year return is the return over the previous 12 calendar months, excluding the previous months return. The sample period covers November 1992 through December 2012. Columns 2 and 4 include monthly fixed effects. Standard errors are clustered at the insider level. P-values are reported parenthetically. All numbers are expressed in percent (i.e., 1 is 1%).

	(1)	(2)	(3)	(4)
Intercept	1.29		-0.41	
	(0.001)		(0.001)	
Portfolio insider purchase	0.69	0.67		
	(0.001)	(0.001)		
Portfolio insider sale			0.26	0.26
			(0.095)	(0.087)
Size	-0.26	-0.17	-0.08	-0.07
	(0.001)	(0.002)	(0.032)	(0.04)
Ln(bm)	-0.05	-0.03	0.17	0.19
	(0.543)	(0.68)	(0.)	(0.001)
Past month return	-2.25	-4.26	0.93	0.16
	(0.001)	(0.001)	(0.011)	(0.635)
Past year return	0.09	0.08	0.39	0.45
	(0.487)	(0.554)	(0.001)	(0.001)
Fixed effects	none	monthly	none	monthly
Number of observations	137,325	137,325	414,362	414,362

Table 9
Pre and post SOX returns following purchases and not-sold securities

Presented are average future market adjusted returns to portfolio insider purchased securities (Panel A) and portfolio insider not-sold securities (Panel B). Column 1 (2) reports the average returns for days t+1 to t+5 (days t+6 to t+30). Column 3 reports the difference ins columns 1 and 2 as well as the p-value for t-test for the equality of means. Row 1 (2) of each panel reports the average returns for all trades occurring up until (starting after) August 31, 2002 the implementation of Sarbanes Oxley. Column 3 reports the difference between the pre and post period and the difference. The sample includes only observations where the insider trading the security is an officer or director of the company traded and only individual is allowed to make a trade of each times once a week. P-values are reported parenthetically.

	Panel A: purchased security		
	(1) return t+1 to t+5	(2) return t+6 to t+30	(3) difference (1)-(2) diff
Pre Sarbanes Oxley	0.37	1.68	-1.30
	(0.001)	(0.001)	(0.001)
Post Sarbanes Oxley	1.40	0.79	0.61
	(0.001)	(0.001)	(0.001)
Difference pre and post	-1.03	0.88	
	(0.001)	(0.002)	
Number of purchases pre SOX=8,665			
Number of purchases post SOX=6,640			
	Panel B: not-sold securities		
	(1) return t+1 to t+5	(2) return t+6 to t+30	(3) difference (1)-(2) diff
Pre Sarbanes Oxley	0.36	0.89	-0.52
	(0.001)	(0.001)	(0.009)
Post Sarbanes Oxley	0.16	0.49	-0.33
	(0.001)	(0.001)	(0.001)
Difference pre and post	0.20	0.40	
	(0.029)	(0.045)	
Number of sales pre SOX=10,428			
Number of sales post SOX=15,247			

Table 10
Google trends and Portfolio insider trades

The table presents the cross-sectional average of firm-level differences in two de-seasonalized change in Google Trend measures (called dTrend). For each firm I calculate the difference in the average dTrend the week following a non-sale and in weeks with no non-sales in the previous week. I then repeat the exercise for sold not-bought, and bought securities. Reported are the cross-sectional average differences across all firms. In panel A the trend is deseasonalized by subtracting first the average level of each weekly trend value in the same calendar month of the previous year. In panel B the trend value is deseasonalized by subtracting the trend vale from the same calendar week of the previous year. Panel C presents the cross-sectional descriptive statistics of the time-series mean dTrend values for each individual firm. The first (second) row is for dTrend for Panel A (B).

	Panel A: subtract average Trend of same month one year prior			
Not-sold	0.530			
	(3.09)			
Sold		-0.033		
		(-0.20)		
Not-bought			-0.317	
			(-1.40)	
Bought				-0.405
				(-1.36)
Number of firms	1154	1129	1033	880
	Panel B: subtract previous year Trend			
Not-sold	0.795			
	(3.55)			
Sold		0.141		
		(0.64)		
Not-bought			0.011	
			(0.04)	
Bought				-0.056
				(-0.16)
Number of firms	1154	1129	1033	880
	Panel C: Cross-sectional average of time series descriptive statistics			
	mean	min	max	Std. dev
dTrend Panel A	-0.018	-1.110	9.040	0.249
dTrend Panel B	-0.020	-0.951	9.000	0.251

Table 11
Univariate 30 day risk-adjusted returns following a trade: blackout periods

This table presents average future 30 trading day risk-adjusted returns following portfolio insider trades. The sample includes only observations where the insider trading the security is an officer or director of the company traded. Further, only trades where all not-traded securities occur in the 30-trading days following an earnings announcement are included. In Panel A the returns are adjusted for the valued-weighted market return. In Panel B returns are adjusted based on their beginning of month NYSE size decile portfolio. Panel C returns are DGTW-adjusted returns. Each not-sold and not-purchased observation is calculated by taking the average of each insiders not-traded securities performance for the 30 days following a trade (e.g., if an insider held stocks A, B, and C on day *t* and sold stock A, the not-sold return would be the average risk-adjusted return of stocks B and C from days *t*+1 to *t*+30). The sample in the first (second) column presents the average return of all portfolio insider not-sold (not-purchased) portfolios. The third column presents the difference in columns one and two and the *p*-value from a *t*-test of equality of means in parentheses. The sample period includes November 1992 through December 2012.

	Panel A: Market-adjusted return		
	(1)	(2)	(3)
	Not-sold	Not-purchased	Difference
Return following trade	1.01	-0.03	1.04
	(0.001)	(0.857)	(0.001)
	Panel B: Size-adjusted return		
	(1)	(2)	(3)
	Not-sold	Not-purchased	Difference
Return following trade	0.60	-0.10	0.70
	(0.001)	(0.544)	(0.001)
	Panel C: DGTW-adjusted return		
	(1)	(2)	(3)
	Not-sold	Not-purchased	Difference
Return following trade	0.66	-0.08	0.74
	(0.001)	(0.598)	(0.001)
Number of Purchases=7,978			
Number of sales=16,898			

Table 12

Out of sample: Univariate 30 day risk-adjusted returns following a trade

This table presents average future 30 trading day risk-adjusted returns following portfolio insider trades. The sample includes only observations where the insider trading the security is an officer, director, or committee member of the company traded. In Panel A the returns are adjusted for the valued-weighted market return. In Panel B returns are adjusted based on their beginning of month NYSE size decile portfolio. Each not-sold and not-purchased observation is calculated by taking the average of each insiders non-traded securities performance for the 30 days following a trade (e.g., if an insider held stocks A, B, and C on day t and sold stock A, the non-sold return would be the average risk-adjusted return of stocks B and C from days t+1 to t+30). The sample in the first (second) column presents the average return of all portfolio insider not-sold (not-purchased) portfolios. The third column presents the difference in columns one and two and a the p-value from a t-test of equality of means in parentheses. The sample period includes January 1, 2013 through December 31, 2014.

	Panel A: Market-adjusted return		
	(1)	(2)	(3)
	Not-sold	Not-purchased	Difference
Return following trade	0.84	0.01	0.83
	(0.043)	(0.978)	(0.002)
	Panel B: Size-adjusted return		
	(1)	(2)	(3)
	Not-sold	Not-purchased	Difference
Return following trade	0.64	-0.28	0.92
	(0.003)	(0.445)	(0.02)
Number of Purchases=1,057			
Number of sales=4,432			

Appendix A. Simulated portfolio insider trading decisions

As noted in the introduction, previous work finds that insider purchases contain significant value- relevant information about future returns, while insider sales appear to offer little to no value- relevant information. Most authors ascribe this asymmetry to variation in the motives for insider sales versus insider purchases. Specifically, while insider sales may be motivated by diversification, liquidity needs, or mis-valuation, insider purchases are viewed as arising from perceived mis-valuation (e.g., Lakonishok and Lee (2001)). As the example in the introduction reveals, however, the asymmetry in the motives for insider purchases and sales also leads to an asymmetry in the expected informational content for insider not-purchased securities and insider not-sold securities

In this section, I more formally examine the asymmetry in insider not-sold and not-purchased stock by simulating a scenario where there are two portfolio insiders at the same two companies—insider *P* will purchase when either security is undervalued. In contrast, insider *S* must sell each quarter for liquidity needs (regardless of whether either security is overvalued). The advantage of this approach is it allows me to examine differences in traded and not-traded portfolio performance driven by differing transactional incentives (a purchase compared to a sale) while controlling for other differences in portfolio insiders (e.g., insiders working at different companies).

I begin with the following assumptions. First, the insiders are identical in every way except the decision they must make (whether to buy a security versus which security to sell). Thus, the insiders hold identical inside positions at the same two companies over identical time periods, and they are both equally diversified across the two securities (i.e., neither would prefer to trade

one of the stocks to better diversify his portfolio). I assume that although insiders have firm-specific private information, they cannot perfectly forecast realized returns. Thus, each company's realized t+1 return consists of two components, 1) alpha (α), which insiders view perfectly at time t (and realize at time t+1), and 2) an idiosyncratic shock (ε). Thus, the t+1 abnormal return garnered by a trader is $\alpha + \varepsilon$. The idiosyncratic shock is designed to both: 1) capture the unexpected component of returns which even real world insiders with superior information cannot anticipate and 2) approximately match the moments of the empirical distribution of stock returns.

Insider *P* must decide whether or not to make a purchase at time *t*. Because he wants to maximize his expected portfolio value, he will buy the stock with the largest *positive* alpha. If neither stock has a positive alpha, he does not make a purchase. Conversely, insider *S* must sell a security each period for liquidity purposes. Because insider *S* will maximize his period t+1 expected portfolio value and must sell each period, he will sell the security with the smallest observed alpha regardless of whether the alpha is positive or negative.[27] As summarized in Figure A-1, this generates three possible scenarios for insider *P*'s purchase decision (buy neither stock, buy stock 1, or buy stock 2), and two possible scenarios for insider *S*'s sale decision (sell stock 1 or sell stock 2).

My simulation requires estimates of both alphas and idiosyncratic shocks. I generate random alphas from a mean-zero normal distribution with standard deviation of sigma (I present results for several values of sigma). I generate a distribution of monthly idiosyncratic shocks by computing the difference between realized monthly stock returns and the returns for value

[27] In unreported tests I allow the insiders to either purchase or sell both securities if both observed alphas are either .5 or 1 standard deviation greater than zero. This shrinks the point estimates slightly, but does not change the rank-order of the portfolios. Further, the statistical inferences remain unchanged.

weighted portfolios matched on momentum, value, and size (i.e., DGTW residuals) for the sample of all NYSE, AMEX, and Nasdaq stocks between January 1986 and December 2012 to match the same time period as the insider trades used in the paper.[28]

To begin the simulation, I select two random alphas and two random idiosyncratic shocks and then form two portfolios based on insider *P*'s decision (a purchased portfolio and a not-purchased portfolio) and two portfolios based on insider *S*'s decision (a sold portfolio and a not-sold portfolio). I repeat the procedure to generate 25,000 purchased/not-purchased decisions and 25,000 sold/not-sold decisions, resulting in 25,000 insider sold and not-sold securities, and fewer than 25,000 insider purchased and not-purchased securities. That is, sometimes insider *P* chooses not to purchase a security (because neither security has a positive alpha) resulting in zero purchased or not-purchased securities (i.e., Figure A-1, scenario 1 for insider *P*).[29] I choose 25,000 purchase and sale decisions to approximately match the actual number of portfolio insider purchases and sales in the actual insider trade sample used in the main empirical tests. I then calculate the average return and associated *t*-statistic (based on the null that the average return does not differ from zero) for each of the four portfolios (e.g., the mean of the 25,000 sold securities).

To aid in statistical inference, I repeat the simulation procedure 1,000 times and report the average portfolio returns across all 1,000 simulations and the fraction of the 1,000 simulations that exhibit a mean portfolio return statistically different from zero (in the predicted direction) at the 5% level. Thus, as shown in the first cell in Panel A of Table A-1, when alpha is selected from a mean zero distribution with a standard deviation of 0.2%, the securities insiders purchase

[28] I demean the DGTW-adjusted returns to ensure that the distribution of idiosyncratic shock terms is mean zero.
[29] Note that because insider *P* does not purchase either stock, we do not observe a "not-purchased" stock. That is, my hypothesis requires a purchase as a necessary signal for the not-purchased stock.

average monthly abnormal returns of 0.18% and the mean realized return for the insider purchased portfolio is meaningfully different from zero in 28.7% of the 1,000 simulations.

Because insider *P* only purchases securities after receiving positive inside information (i.e., $\alpha>0$), the securities he buys average positive abnormal returns. Moreover, as expected, the portfolio of not-bought securities average negative abnormal returns. Analogously, because insider *S* sells the security with the lowest alpha, the securities he sells average negative abnormal realized returns, while the security he chooses not to trade average positive abnormal returns.

To examine the asymmetry between purchased and sold securities, I compute differences between the portfolio return for purchased securities and the negative of the return for the portfolio of sold securities. Thus, a positive value means that the average positive abnormal return associated with an insider purchase is larger than the negative of the average negative abnormal return associated with insider sales, i.e., insider purchases are more informative than insider sales. Consistent with existing empirical evidence, the results reported in the first row of Panel B in Table A-1 reveal that, in my simulation, insider purchases are more informative than insider sales. Moreover, the magnitude of the simulated abnormal returns associated with insider purchases and sales are roughly similar to empirical estimates in the literature.[30]

[30] Across three recent papers studying short-term returns following insider trades (Lakonishok and Lee (2001), Ravina and Sapienza (2010), and Cohen, Malloy, and Pomorski (2012)), insider purchased security risk-adjusted equivalent monthly returns (e.g., Lakonishok and Lee find 5-day purchase returns equal to 0.59% or approximately 2.48%=(21/5)*.59 per month) range from 0.94% to 2.95% and sold security returns range from -0.13% to 0.71%. The simulated purchased and sold security returns fall at the lower end of this range; however, Cohen, Malloy, and Pomorski, use both the most similar sample period and return measurement period (calendar month returns), they find mean purchase returns equal to 0.94% and sold security returns equal -0.386% (both values are weighted averages of routine and opportunistic trades), well within the simulated range.

Analogously, the second row of Panel B reports the difference between the mean return for the not-sold portfolio and the mean return for the not-purchased portfolio. Thus, a positive value means that the average positive abnormal return associated with the not-sold portfolio is larger than the negative of the average negative abnormal return associated with the portfolio of not-purchased securities, i.e., insider not-sold events are more informative than insider not-purchased events. For both rows, I report the *p*-values based on a difference in means test of the 1,000 simulations. The results reveal that the variation in the motives for insider purchases and sales yields an asymmetry not only in the returns associated with insider purchases versus insider sales (i.e., first row of Panel B), but also an asymmetry in the returns associated with insider not-purchased securities versus insider not-sold securities. Specifically, the informational content associated with insider not-sold stocks is significantly greater than the informational content associated with insider not-purchased stocks. In fact, as shown in Panel A, the not-purchased portfolio garners abnormal returns that reliably differ from zero only when the standard deviation of insider's observed signal (α) is quite high.[31]

In short, the simulation results reported in Table A-1 reveal that portfolio insider purchases will tend to be more informative than insider sales, and portfolio insider not-sold events will tend to be more informative than portfolio insider not-purchased events. Moreover, portfolio insider sales and not-purchased events may only generate abnormal returns that differ meaningfully from zero if the standard deviation of observed alphas is very high.

[31] For example, Pastor and Stambaugh (2001) assume sigma ranges from 0 to 2% per year and also present results for sigma equal to infinity. A monthly standard deviation of .022 translates to an annual standard deviation of about 7.6%.

Figure A-1
Insider trading decisions

The figure presents the potential scenarios and decisions made by the fictional insiders who maximize expected future portfolio value. α^1 is the realized alpha for company 1 that the insider observes perfectly at time *t*, and ε^1 is the realized idiosyncratic shock earned during period *t*+1.

		time=*t*			**time=*t+1***
		Observed alphas at time *t*	Portfolio	Security	Realized abnormal return
Insider *P*	scenario 1	$\max[\alpha^1,\alpha^2,0]=0$	Bought	None	None
			Not-bought	None	None
	scenario 2	$\max[\alpha^1,\alpha^2,0]=\alpha^1$	Bought	1	$\alpha^1+\varepsilon^1$
			Not-bought	2	$\alpha^2+\varepsilon^2$
	scenario 3	$\max[\alpha^1,\alpha^2,0]=\alpha^2$	Bought	2	$\alpha^2+\varepsilon^2$
			Not-bought	1	$\alpha^1+\varepsilon^1$
Insider *S*	scenario 1	$\max[\alpha^1,\alpha^2]=\alpha^1$	Sold	2	$\alpha^2+\varepsilon^2$
			Not-sold	1	$\alpha^1+\varepsilon^1$
	scenario 2	$\max[\alpha^1,\alpha^2]=\alpha^2$	Sold	1	$\alpha^1+\varepsilon^1$
			Not-sold	2	$\alpha^2+\varepsilon^2$

Table A-1
Simulated insider trading decisions: realized abnormal returns

The table presents the mean portfolio realized alpha for 1,000 simulations of 25,000 portfolio insider trades. The realized alpha consists of two components. First alpha, which captures the expected change in time *t*+1 firm value, which insiders view perfectly at time *t*. Second, an unexpected shock. Alphas are simulated from a distribution with mean zero and monthly standard deviation sigma. I present results for sigma ranging from .002 (column 1) to .022 (column 8). The unexpected shocks are randomly selected DGTW monthly stock returns chosen without replacement from all CRSP stock returns from January 1986 through December 2012. The DGTW shock term is standardized to have mean zero. Each simulation involves one purchase and one sale decision made by two different insiders over the same two securities. Insider 1, must decide whether to purchase one of the securities and insider 2 must choose which security to sell. Therefore the same securities are frequently in more than one portfolio. The insiders make their decision based on alpha, which they both observe perfectly. For example, if security A has an alpha of .05 and security B has an alpha of -.01 then security A is placed in the purchased and not-sold portfolios and security B is placed in the sold and not-purchased portfolios. In parentheses I report the percentage of simulations with a mean significant at above the 5% level. Specifically, for the purchased and not-sold securities (sold and not-bought securities) I report the percentage of simulations with a *t*-statistic greater than 1.96 (less than -1.96). Panel B presents the average of the 1000 differences between both the purchased (not-purchased) portfolio return and negative one times the sold (not-sold) portfolio return as well as *p*-value of the difference reported parenthetically.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Simulated portfolio abnormal returns (% simulations statistically significant)							
	Monthly standard deviation of alpha							
	0. 200	0.400	0.600	0.800	1.60	1.80	2.00	2.20
Purchased	0.180	0.324	0.489	0.845	1.393	1.573	1.751	1.939
	(28.7%)	(84.3%)	(99.7%)	(100%)	(100%)	(100%)	(100%)	(100%)
Sold	-0.117	-0.227	-0.339	-0.452	-0.904	-1.016	-1.128	-1.244
	(29.1%)	(77.1%)	(99.8%)	(100%)	(100%)	(100%)	(100%)	(100%)
Not-purchased	-0.081	-0.138	-0.205	-0.276	-0.582	-0.654	-0.726	-0.808
	(0.0%)	(0.0%)	(0.0%)	(0.0%)	(99.8%)	(99.9%)	(100%)	(100%)
Not-sold	0.116	0.227	0.338	0.451	0.904	1.015	1.127	1.243
	(27.7%)	(78.1%)	(98.3%)	(100%)	(100%)	(100%)	(100%)	(100%)
	Panel B: Differences (*p*-values)							
	Monthly standard deviation of alpha							
	0.200	0.400	0.600	0.800	1.60	1.80	2.00	2.20
Purchased-(-1*Sold)	0.063	0.097	0.151	0.212	0.489	0.557	0.623	0.694
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Not-sold-(-1*Not-purchased)	0.035	0.089	0.133	0.175	0.322	0.361	0.401	0.435
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
	N=1,000 simulations							

Appendix B. Equal-weighted and value-weighted market returns: Daily compounding

As mentioned in footnote 7 there are microstructure issues arise when compounding daily equal-weighted returns. This is the result of the implicit rebalancing that occurs in daily equal-weighted portfolios. Equal-weighted market portfolios consist of primarily small stocks that frequently do not trade every day. For example, consider the situation where the market experiences a positive shock on day *t*. Large securities that trade regularly will experience positive returns on average. However, some of the small securities will not trade, their prices remain the same, and they become underweighted in the portfolio. On day *t+1* the portfolio is rebalanced giving additional weight to the not-traded securities. If the small securities trade on day *t+1* they experience a positive realization and the market portfolio return is overstated as a result of the additional weight given to the small not-traded securities. The value-weighted portfolio does not experience the issue to the same extent because the securities most likely impacted are given less weight.

Next, I provide a brief empirical analysis of the issues arising from compounding daily equal-weighted returns. Table B-1 presents the time series average of monthly value-weighted and equal-weighted CRSP market indices (in percent) from November 1992 to December 2012 (the sample period in the paper). In column 1 the returns are the average of the monthly market indices. Column 2 presents the average returns where each months return is computed by compounding the daily market index returns. Column 3 presents their differences and a *p*-value from a *t*-test of equality of means. Column 3 shows that the value-weighted index monthly returns are not statistically different using monthly index returns or daily compounded index returns. However, when using the equal-weighted index the monthly index returns are 72 basis points lower on average than the compounded daily index returns.

Row 3 demonstrates that the difference in value-weighted and equal-weighted market returns is much larger when compounding daily returns as opposed to using monthly returns. Using monthly index returns (Column 1) the value-weighted market returns are a marginally significant 31 basis points lower than the equal weighted market returns. However, when compounding daily returns the value-weighted market return is 108 basis points lower than the equal-weighted market return. This 78 basis point difference is statistically significant at above the 1% level. The results suggest compounded daily equal-weighted market returns should be used with caution.

Table B-1

Value weighted and equal weighted market returns

The table presents the time series averages of monthly market returns. The market returns are the value-weighted and equal-weighted CRSP market index. Column 1 presents the average of the two monthly indices. Column 2 presents the monthly returns computed by compounding the daily index. Column 3 presents the difference in Columns 1 and 2 and the *p*-value from a paired t-test of equality of means. Row 3 reports the difference in the value weighted and equal-weighted indices and the *p*-value from a t-test of equality of means. P-values are in parentheses.

	monthly	daily	difference
Value weighted index	0.79	0.74	0.06
	(0.001)	(0.001)	(0.60)
Equal weighted index	1.10	1.82	-0.72
	(0.001)	(0.001)	(0.001)
Difference	-0.31	-1.08	0.78
	(0.087)	(0.001)	(0.001)

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