Is 'Not Trading' Informative? Evidence from Corporate Insiders' Portfolios[1]

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ABSTRACT

Some individuals, e.g., those holding multiple directorships, are insiders at multiple firms. When they execute an insider trade at one firm, they may reveal information about the value of all—both the traded insider position and not-traded insider position(s)—the securities held in their "insider portfolio." We find that insider "not-sold" stocks outperform "not-bought" stocks. Implementable trading strategies that buy not-sold stocks following the disclosure of a sale earn alphas up to 4.8% per year after trading costs. The results suggest that even insider sales that are motivated by liquidity and diversification needs can provide value-relevant information about insider holdings.

Keywords: Insider trading, informed trading, portfolio insider

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"Action is not only doing but no less omitting to do what possibly could be done." – Ludwig Von Mises

It is well recognized that insider trades contain value-relevant information. Insider buys are particularly informative. Conversely, prior work finds that differing motives for insider sales, such as diversification and liquidity needs, result in sales containing little to no information especially when compared with insider buys.[2] This study focuses on a setting in which an insider sale reveals that one or more stocks are likely undervalued, albeit the revealed information is not about the stock they sold. We hypothesize that trades of insiders with inside holdings at multiple companies, called here "portfolio insiders," 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 an overvalued stock or buy an undervalued stock, an insider has incentives to not sell an undervalued stock and to not buy an overvalued stock. This reasoning suggests that, on average, a portfolio insider sale (buy) provides a positive (negative) signal for the other inside securities the portfolio insider chooses not to trade.

We empirically study whether the trades of portfolio insiders are informative about the stocks they choose not to trade. Portfolio insiders profitably trade within their portfolio of inside holdings on average (i.e., bought stocks outperform not-bought stocks and sold stocks underperform not-sold stocks), such that they do seem to consider private information when deciding which stock to trade. For reasons discussed later, we expect that insider trades will be particularly informative about not-sold stocks. Consistent with this hypothesis, we find that on average not-sold stocks earn large abnormal returns following a portfolio insider's sale. This abnormal performance is long lasting.

[2] For example, Lakonishok and Lee (2001), Iqbal and Shetty (2002), and Jenter (2005) find insider purchases, but not sales, are informed. There are some exceptions. For example, Brooks et al. (2012) document significant negative abnormal returns following sales that result from exercising stock options.

Insider sales reveal economically important information about the not-sold stocks that is not quickly incorporated into market prices. We hence study implementable trading strategies that buy not-sold stocks following the required disclosure of portfolio insider sales. The strategies earn significant alphas even after incorporating trading costs, and strategies that use longer holding periods are particularly successful after costs given their lower turnover and the long-term nature of the positive signals about not-sold stocks. These results indicate that portfolio insider sales may provide practitioners profitable trading opportunities.

The different motives for insider purchases and sales lead to our prediction that trades are more informative about not-sold stocks compared with not-bought stocks. Specifically, insider needs for liquidity or diversification can cause sales to provide more information about the not-traded stocks than buys.[3] As an illustration, consider a hypothetical individual who is on the board of directors at two companies. 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, and (3) one fairly valued and one overvalued. If in need of liquidity or diversification, the insider may sell something in any of the three scenarios, but she can still use her information about each stock in her portfolio to trade optimally. In scenario 1, for example, she can sell the fairly valued stock and keep the undervalued stock. Considering all three scenarios, the insider sale provides information that the not-sold stock is undervalued in two-thirds of cases (scenarios 1 and 2) and fairly valued in the remaining one-third of cases (scenario 3). In contrast, a portfolio insider would likely not buy either

[3] Risk aversion, taxes, mis-valuation, behavioral concerns, etc., are all potential reasons for insider transactions. For example, Kelly (2018) shows that loss aversion causes insiders to sell stocks with past losses when they have especially bad information and avoid selling otherwise. Goergen et al. (2019) find that, when making trading decisions, executives consider information about other companies besides their own as well as industry and market trends.

stock in scenario 3, such that the not-bought stock is fairly valued in half of cases (scenario 1) and overvalued in the other half (scenario 2).

Empirically, the not-sold stocks outperform the not-bought stocks on average following portfolio insider trades, consistent with our predictions. The performance differences are primarily attributable to the large, positive abnormal returns of the not-sold stocks. These stocks earn, on average, 77 basis points (bps) in excess of the market in the 30 trading days following an insider sale. Abnormal performance is persistent, and the average market-adjusted return grows to 284 bps at a 150-trading-day horizon. We also find significant abnormal performance after controlling for firm size, book-to-market, and momentum; i.e., the abnormal returns do not result from previously documented return patterns or insider contrarianism.

The evidence that not-sold stocks earn larger abnormal returns over longer measurement windows suggests market participants do not immediately price in the positive signals embedded in portfolio insider sales. As such, we consider implementable trading strategies over the period January 1997 to November 2020. Each strategy purchases recently not-sold stocks following required insider sale disclosures and has a holding period of one, three, six, or 12 months. We incorporate average trading costs of a large institutional investor from Frazzini et al. (2018) when measuring strategy performance.

The not-sold trading strategies produce large, significant abnormal returns. Alphas relative to the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) and the four-factor model of Carhart (1997) are relatively stable across holding periods before accounting for transaction costs, reflecting the long-term nature of the information content. The persistence in information combined with lower effective trading costs of lower-turnover strategies result in better performance after trading costs for the semiannual and annual holding periods. With an annual holding period, for example, the not-sold portfolio earns a monthly CAPM alpha of 39 bps (annualized 4.7% alpha,

statistically significant at the 5% level) and a monthly Carhart alpha of 37 bps (annualized 4.5% alpha, significant at the 1% level). We also show that the not-sold signal can complement other trading strategies by demonstrating that buying not-sold stocks that are also past winners (i.e., stocks expected to perform well based on the momentum effect of Jegadeesh and Titman, 1993) earns particularly high alphas. Overall, these results suggest that traders can capitalize on the information about not-sold stocks revealed by portfolio insider sales.

This study contributes to extant work on stock returns following insider trades and to a growing literature studying insider inaction. Our results demonstrate that a specific insider action, the decision not to sell an inside security, contains value-relevant information in the cross section. Whereas prior literature typically finds little to no information in sales even from sophisticated market participants (e.g., Lakonishok and Lee, 2001), our findings show that diversification- or liquidity-motivated sales by some insiders—those with multiple inside positions—are informative, albeit the information is about the stocks they choose *not* to sell.

Background and Motivation

Related literature. The insider trading literature finds, with few exceptions, that insider trades contain predictive power for future returns or performance (e.g., Lorie and Neiderhoffer, 1968; Pratt and DeVere, 1970; Jaffe, 1974; Baesel and Stein, 1979; Seyhun, 1986, 1988, 1992, 1998; Rozeff and Zaman, 1988; Lin and Howe, 1990; Karpoff and Lee, 1991; Eysell and Reburn, 1993; Bettis et al., 1997; Lee, 1997; Kahle, 2000; Lakonishok and Lee, 2001; Hillier and Marshall, 2002; Jeng et al., 2003; Piotroski and Roulstone, 2005; Marin and Olivier, 2008; Fernandes and Ferreira, 2009; Ravina and Sapienza, 2010; Cziraki et al., 2021).[4] The literature also finds that the informational content

[4] Eckbo and Smith (1998) is an exception. Using three different performance measures, the authors find no abnormal returns from insiders in the six months following insider trades in their sample of firms on the Oslo Stock Exchange.

associated with insider transactions primarily arises from purchases (Lakonishok and Lee, 2001; Jeng et al., 2003; Jenter, 2005).[5] Several studies 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 et al., 2006; Ravina and Sapienza, 2010) and typically find positive reaction to buys and little reaction to sales. Further, insiders are typically found to be contrarian traders; 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). Clacher et al. (2009) provide an excellent review of the literature on insider trading.

In contrast to the broad literature on insider trades, a very limited literature considers not-traded securities. Gao et al. (2015) examine periods of "insider silence,"—periods in which all insiders at a particular firm stop trading that firm's shares. The authors suggest that insiders stop trading before extreme news events and use two criteria (merger targets and short interest) to separate the sample based on expected good news or expected bad news. They find that insider silence stocks likely to have bad news (high short interest) exhibit significantly lower returns than stocks with similar short interest but no insider silence. Similarly, Hong and Li (2019) find that when insiders do not make routine transactions (i.e., liquidity sales), this lack of trading predicts abnormal information in both sales and purchases.

Two related studies examine individuals who are insiders at multiple companies. Cook and Wang (2011) study multi-firm independent directors (not officers) to examine the efficacy of changes in NYSE and NASDAQ listing standards requiring more independent directors, which resulted in an

[5] Scott and Xu (2004) find some insider sales are actually *positive* signals about future returns. The evidence that sales are uninformative extends beyond corporate insiders.

increase in the number of independent directors with multiple inside positions. The authors use non-traded securities as the short (long) side of an arbitrage strategy demonstrating that securities bought (sold) by multi-firm independent directors outperform for six- to 12-month horizons. Karamanou et al. (2021) use multi-firm insider sales to distinguish between information-based sales (i.e., a sale when an insider buys another security the same month) and liquidity-based sales. The authors find that information-based sales precede negative abnormal returns.

Empirical predictions. In this section, we discuss our performance predictions for portfolio insiders' not-traded stocks. Assuming portfolio insiders, on average, use private information about their inside holdings to make beneficial trading decisions, their trades may be informative about not-traded stocks.[6] Insider trades provide positive (negative) signals for not-sold (not-bought) stocks, so we expect not-sold stocks to outperform relative to not-bought stocks.

We further predict asymmetry in the information content of trades for not-bought versus not-sold stocks. This asymmetry prediction relies on differing motives for purchases and sales. Table 1 illustrates the asymmetric effects for not-bought and not-sold stocks depending on the trade motive. In the table, stocks *A* and *B* are each undervalued, fairly valued, or overvalued. Panel A (B) shows scenarios associated with an insider purchase (sale). The gray shading indicates the scenarios in which stock *A* is traded, such that stock *B* is the not-traded security in these cases.

[Insert Table 1 about here]

Panel A of Table 1 illustrates a portfolio insider purchase motivated by mis-valuation. Empirical evidence on market reactions and performance following insider buys suggests they often signal undervaluation. An insider buy may be highly informative about the bought stock, but a portfolio

[6] In addition to the private information channel, portfolio insiders may be better at valuing their inside securities using publicly available information compared with most investors. Ravina and Sapienza (2010) find independent directors are skilled market participants, such that insiders may hold an advantage. Whether trades reflect private information or skill at processing information, they can provide valuable signals to other market participants.

insider's not-bought stock could be overvalued, fairly valued, or undervalued (albeit less undervalued than the bought stock) such that the trade does fairly little to narrow down the insider's view on the not-bought stock, as shown in Panel A of Table 1.

Many insider sales are motivated by liquidity or diversification needs (e.g., Cohen et al., 2012), and the relative lack of market reactions to insider sales is consistent with the view that sales are often not motivated by mis-valuation. We observe, for instance, that 83% of trades for the full sample of directors and officers (portfolio insiders and otherwise) are sales and over 46% of these insiders never buy an inside holding during the sample period, such that motives for sales appear to frequently be different from motives for buys. Nonetheless, the sales of portfolio insiders may be particularly informative about not-sold stocks. When an insider is faced with liquidity needs, she may be forced to sell an undervalued stock, and these cases would indicate that the insider believes her not-sold stock is even more undervalued than the sold stock. Because the sold stock could be overvalued, fairly valued, or undervalued, the insider sale has a higher probability of indicating that the not-sold stock is particularly undervalued than would be the case if the sold stock were always overvalued.

Panel B of Table 1 demonstrates the information content of a liquidity-motivated sale. Observing a portfolio insider's decision to sell one stock rather than another does more to narrow down their view on the not-sold stock compared with the not-bought case in Panel A. Conditional on observing a trade for stock *A*, a not-sold signal is more likely to be associated with undervaluation for stock *B* than a not-bought signal is to be associated with overvaluation. We therefore expect that a not-sold signal is stronger compared with a not-bought signal.[7]

[7] Our predictions about the relative performance of traded and not-traded stocks are based on the information about insiders' current expectations that is revealed by their trades. Stocks may experience unanticipated changes in fair values as time elapses after the trades. An unexpected change in valuation can affect the realized performance of a given stock, but our tests are based on the average performance across stocks to reflect expectations at the time of the trade.

Data, Sample, and Methods

Portfolio insider sample. The data for this study come from three sources. First, insider trades are from Securities and Exchange Commission (SEC) Form 3 and Form 4 filings provided by Thomson Reuters. Insiders with decision-making authority over the operations of the firm, board members, and beneficial owners of more than 10% of the company's stock must file these forms. When an individual becomes an insider, they must file a Form 3 reporting the current number of shares held in the firm even if they hold zero. This form serves as a starting point to determine which stocks insiders hold in their portfolios. Insiders report their trades using Form 4. If an insider held no stock when they filed a Form 3, then a Form 4 buy would designate the day of their first position in the stock. 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 NYSE Arca (exchange codes 1, 2, 3, and 4) companies with trading day closing share prices greater than five dollars.[8] Options and derivatives transactions are excluded. Second, returns, prices, and shares outstanding are from the Center for Research in Security Prices (CRSP). Third, book-to-market values are calculated using quarterly Compustat data.[9] We examine insider trades from January 1986 to October 2020. Because the Thomson Reuters sample is poorly populated in early periods, the first identified portfolio insider trade is in November 1992. As such, the effective sample period is November 1992 to October 2020.

Insiders' portfolio holdings are constructed as follows. A stock is first defined as a part of an insider's portfolio on the earliest date they either file a Form 3 holdings report (if they report holding the security) or trade the security (as revealed by a Form 4). That stock is then defined as a part of

[8] Following Sias and Whidbee (2010), we only include observations with Thomson Reuters cleanse codes equal to 'R,' 'H,' or 'L' and transaction codes equal to 'P' or 'S.'

[9] 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 are lagged one quarter (e.g., December 2001 book-to-market values are assigned to securities beginning April 2002).

the insider's portfolio until the last observed day they trade 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 2002, then GM is considered part of the insider's portfolio from February 1998 to January 2002. This methodology is used to construct a conservative estimate of the number of stocks held in the insider's portfolio. Insiders are not required to report their complete holdings (in 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 stock (unless they hold greater than 10% of the company's stock). Therefore, an insider's exact holdings cannot be tracked over the whole sample period. It is not possible to empirically identify whether a lack of trading means that the insider still holds the stock or that she is no longer an insider (or large shareholder) in the firm and therefore is no longer required to report her trades. However, with this methodology, an insider should be required to report her decisions over the entire time series between the two trades. Finally, an insider is defined as a *portfolio insider* during the periods in which we identify inside positions in more than one company.

Types of portfolio insiders. The SEC requires a diverse group of individuals and institutions to file Form 3 and Form 4 reports, necessitating an understanding of the different types of portfolio insiders. We define four possible insider roles for each insider at each of their companies: (1) director, (2) officer, (3) large shareholder or institutional investor, and (4) other insider. We classify insiders primarily based on the reported Thomson Reuters role code. We then hand classify institutional investors into the third category based on insider names (e.g., we reclassify into the third category if the reported insider name is "Bank of America Corp"). As such, each insider in the

director, officer, and other insider categories is an individual. For brevity, we refer to the group of large shareholders and institutional investors as large shareholders throughout the paper.[10]

These classifications create 15 different possible combinations of portfolio insider types. An insider may serve the same role (i.e., director, officer, large shareholder, or other insider) for every stock they hold. Alternatively, an insider can hold any combination of two or more of the roles across companies. For example, an insider could be an officer at one company and a director at another. Table 2 reports the number of insiders of each specific type and the percentage of the total portfolio insider trades these insiders make. Most portfolio insiders either serve as a director at more than one company (42% of portfolio insiders; 28% of portfolio insider trades) or as an officer at one company and a director at another company (32% of portfolio insiders; 26% of trades). Large shareholders make up a small portion of the sample (9% are exclusively large shareholders) but actively trade (accounting for 19% of trades).

Panel B reports the number of trades by insider type. If an insider is both an officer for GM and a director for IBM, she would be defined as a director for an IBM trade in Panel B. This analysis captures what types of insiders trade most heavily, independent of the other position types held. The results reveal that directors and officers account for 68% of trades, followed by large shareholders who account for 28% of trades.

[Insert Table 2 about here]

Much of the existing literature on insider trades excludes the categories of large shareholders and other insiders. Ex ante, insiders that serve as officers or directors may have better access to private information compared with large shareholders and other insiders. To maintain consistency with the

[10] Whereas most institutional investors file as large shareholders, a few institutions file Form 4 under different categories (e.g., Bank of America is listed as a director for several companies in the filings). We reclassify these observations as described. Results are qualitatively and quantitatively similar if we base the insider classification solely on the Thomson Reuters role code.

literature and focus on the insiders most relevant to the hypotheses, our initial tests are restricted to the sample of observations in which the insider trading the security reports being a director or officer at the traded company. We then examine the set of large shareholders and other insiders in a subsequent section.

Table 3 presents summary statistics for the trades included in the sample. Panel A of Table 3 reports that the average portfolio insider holds 2.42 (median of two) 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, which is classified as a large shareholder) is identified as holding 71 stocks at one time. Further, portfolio insiders average 3.56 buys and 8.17 sales. These values are highly skewed, however, as the medians are one buy and two sales. Panel B reports that portfolio insiders make up only 6% of the total insiders in the database (8,580 of 139,684). Collectively, however, they hold a large sample of 6,163 stocks and execute 300 trades per month on average. Given that each portfolio insider trade, by construction, provides information about multiple (traded and not-traded) stocks, these trades generate signals about hundreds of stocks each month. We also find that stocks with traded and not-traded signals make up over 60% of total stock market capitalization in an average year (untabulated).

[Insert Table 3 about here]

Empirical Results

This section provides our empirical results on not-traded securities. We first examine whether portfolio insiders' trades contain information about the not-traded stocks by examining average performance following the trades. We then consider trading strategies that exploit the information in these trades after they are made public.

Not-sold and not-bought security performance. This section tests the primary hypothesis of our study—that portfolio insider trades contain information about not-traded securities—by testing the empirical prediction that not-sold stocks outperform not-bought stocks. We also predict that the performance difference will be largely attributable to good performance by not-sold stocks. We use the insider trade as the event date and compare the subsequent performance of not-bought and not-sold securities.[11] Because insiders often spread their trades out over a few days (e.g., Aboody et al., 2005), we only include an insider's first weekly buy 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 4th and December 5th, 2000, only the trade on December 4th is included. We consider performance over 30-, 90-, and 150-trading-day windows following the identified trade.

We 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 stock's cumulative return less the CRSP value-weighted market return. Size-adjusted returns are analogously computed based on the firm's beginning-of-month size decile using NYSE breakpoints. Finally, DGTW-adjusted returns are calculated as the stock's cumulative return less the return for a portfolio with similar size, value, and momentum characteristics (see Wermers, 2004, for additional details).[12] Firm size, value (i.e., book-to-market), and past returns all meaningfully determine the profitability of insider transactions (e.g., Lakonishok and Lee, 2001). As such, size- and DGTW-adjusted returns are ideal to ensure that insiders' contrarian nature or tax incentives do not drive significant risk-adjusted returns. In addition, these adjustments help control for cross-sectional patterns in mispricing or risk associated with these characteristics.

[11] We note that these initial performance results include market reactions to insider transactions. The trading strategy results reported later in this study, in contrast, are designed to be implementable in real time.
[12] DGTW returns are calculated as in Daniel et al. (1997) and Wermers (2004). The DGTW benchmarks are available via Russ Wermers's website (http://alex2.umd.edu/wermers/ftpsite/Dgtw/coverpage.htm). We use their stock assignments to calculate value-weighted portfolio returns using CRSP daily stock returns. Given the data are only available through the end of 2012 we replicate their methodology to form our own DGTW assignments.

We begin with univariate tests comparing the performance of not-sold securities with not-bought securities. Specifically, for each portfolio insider buy (sell), we compute the average 30-, 90-, and 150-day abnormal returns for the other stocks the insider owns, but did not buy (sell). For instance, if a portfolio insider holds three inside positions and sells shares of stock *A* on day *t*, but does not sell shares of stocks *B* and *C* on day *t*, we compute the abnormal return to the insider's not-sold position over a given horizon as the average abnormal return for stocks *B* and *C*. Thus, each portfolio insider buy (sale) is associated with a single not-bought (not-sold) observation.

[Insert Table 4 about here]

Table 4 compares the performance of not-sold and not-bought stocks based on trades by directors and officers. We report the pooled averages of not-sold and not-bought abnormal returns, their differences, and the associated *p*-values. The results reveal that the not-sold stocks significantly outperform the not-bought stocks. In addition, consistent with our prediction that portfolio insider sales are more informative than buys for not-traded stocks, the difference in abnormal returns between not-sold securities and not-bought securities primarily arises from large positive abnormal returns associated with the stocks that insiders choose not to sell. At a 30-day horizon, not-sold stocks have positive average abnormal returns ranging from 37 to 77 bps, and these performance measures differ from zero at the 1% significance level. In contrast, the 30-day risk-adjusted returns earned by not-bought stocks do not differ significantly from zero in any case.

Table 4 also shows that the strong performance of not-sold stocks relative to not-bought stocks persists and grows over longer horizons. The difference in market-adjusted returns in Panel A, for example, is 64 bps with a 30-day horizon and 107 bps with a 150-day horizon. Thus, while over half of the performance differential in the 150-day window is concentrated in the first 30 days, there continues to be a meaningful difference in performance in the latter part of the longer window. This

finding suggests that market participants do not immediately price in the information about not-traded stocks embedded in portfolio insider trades.

Traded and not-traded security performance. The hypothesis that insider trades contain information about portfolio insiders' 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 stocks sold by portfolio insiders subsequently underperform their not-sold stocks and (2) the stocks bought by portfolio insiders subsequently outperform their not-bought stocks. We test these predictions using a univariate test directly analogous to that in the previous section. For each portfolio insider trade, we calculate the abnormal return to the traded stock, the average abnormal return to the not-traded stocks, and their difference (i.e., for each insider trade, there is one traded return, one not-traded return, and one difference). Because the test directly compares traded and not-traded securities' performance, it naturally controls for time effects, market conditions, and insider effects. We focus on a 30-day horizon for brevity but note that inferences are similar for 90- and 150-day horizons. Table 5 reports the results.

[Insert Table 5 about here]

Table 5 shows that, in all tests, portfolio insiders trade profitably on average within their portfolios of inside holdings. The bought securities outperform the not-bought securities (by between 168 and 195 bps over the subsequent 30 trading days) driven by the large abnormal returns of the bought securities. Further, the sold stocks underperform the not-sold stocks (by between 63 and 67 bps). Insider sales are followed by significantly negative performance based on size- or DGTW-adjusted returns. The performance difference between sold and not-sold stocks is primarily driven by the abnormal returns associated with not-sold securities (36 to 77 bps depending on the

risk-adjustment method, statistically significant at the 1% level in each case).[13] Overall, the results in Table 5 are consistent with portfolio insiders using their private information to profitably trade—in both buying and selling transactions—within their portfolio of inside holdings.[14]

Implementable trading strategies. The results to this point demonstrate that not-sold stocks earn positive risk-adjusted returns following portfolio insiders' sales. Further, Table 4 shows that the abnormal returns grow with horizon, suggesting the information contained in insider sales about the not-sold stocks is not immediately priced in by market participants. The returns in earlier analyses include the days immediately following the transaction, meaning they may include market reactions to the insider trade. In this section, we examine whether the information contained in insider sales is exploitable in real time by trading not-sold stocks. We form trading strategies that use publicly available information about insider sales to identify not-sold stocks. We also consider trading strategies with not-bought stocks for comparison.

We identify not-sold and not-bought stocks at the end of each month based on recent insider trades. Insider trades become publicly available information with the filing of a Form 4. Prior to Sarbanes-Oxley (SOX), the filing deadline was the 10th day of the month following the trade. With the passage of SOX, the reporting deadline was shortened to two business days after the trade. For a given insider trade, we calculate the filing deadline date. We then include the associated not-traded stocks in a portfolio in the first month for which the portfolio formation date comes after the reporting deadline date. Finally, we exclude stocks from the not-sold (not-bought) strategy if they are sold (bought) by other insiders in the same month to avoid stocks with conflicting insider signals. Given the relatively small number of trades early in the sample, the portfolios would be

[13] The sample in Table 5 excludes observations for which the traded security has missing data, such that Table 5 has somewhat fewer observations compared with Table 4.

[14] In the appendix, we examine whether there are significant performance differences between not-sold stocks and not-bought stocks and between traded stocks and not-traded stocks using panel regressions. The panel regressions allow us to account for time-series and cross-sectional correlations across observations by clustering at the stock and month levels. Inferences match those from Tables 4 and 5.

poorly populated in some months. To avoid this issue and study diversified portfolios of not-traded stocks, we use portfolio formation dates ranging from January 1996 to October 2020.

We form trading strategies with four alternative holding periods for the not-traded stocks. The first strategy uses a monthly holding period, such that the entire portfolio turns over each month (unless a given stock is, for example, identified as not-sold by portfolio insiders in consecutive months). The remaining three strategies use quarterly, semiannual, and annual holding periods. We follow Jegadeesh and Titman (1993) to combine the monthly frequency for identifying stocks for portfolio inclusion with longer holding periods. For example, in a given month *t*, the quarterly not-sold strategy combines the returns from the three portfolios that were formed at the end of months *t*-3, *t*-2, and *t*-1 based on trades that were publicly available on the portfolio formation dates. At the end of month *t*, the strategy sells the stocks from the *t*-3 cohort and buys the stocks that are newly identified as not-sold in month *t*. In this same vein, the annual holding period strategy weights across the portfolios formed over the past 12 months. Each portfolio is equally weighted. The sample period for returns is January 1997 to November 2020, where the January 1997 portfolio return start date allows for 12 months of portfolio formation dates from the January 1996 sample start date to form the annual strategy.

We consider trading strategy performance before and after transaction costs. To calibrate the transaction cost levels of an institutional investor, we use information from Frazzini et al. (2018) about the average trading costs realized by AQR Capital Management. AQR measured these costs over the 1998 to 2016 period, which spans most of our sample period for the trading strategies. Frazzini et al. (2018) separately report average implementation shortfalls for large cap (Russell 1000) and small cap stocks. For each month in the sample, we calculate each stock's size rank within the CRSP universe and assign the average large cap trading cost to the largest 1,000 stocks and the

average small cap trading cost to the remaining stocks. We then adjust stock returns for trading costs in the months of the buy and sell transactions to incorporate the round-trip cost.

Given a time series of monthly strategy returns, abnormal performance is based on alphas relative to the CAPM and the Carhart four-factor model. The Carhart model augments the CAPM with factors related to size, book-to-market, and momentum, such that this approach of risk-adjusting returns is similar in spirit to the DGTW approach used in earlier tests. We also calculate the cumulative wealth generated by a given strategy based on a $1.00 investment in January 1997. The cumulative wealth calculation assumes reinvestment of dividends.

Table 6 reports monthly CAPM and Carhart alphas for the not-sold and not-bought portfolios before considering trading costs. The table also reports the alphas for a long-short strategy that buys the not-sold portfolio and sells the not-bought portfolio. These long-short alphas provide an alternative test of the hypothesis that not-sold stocks outperform not-bought stocks, and the design of the portfolio test controls for calendar-time effects in not-traded stocks. The strategies in Table 6 also exclude the stocks that are simultaneously in the not-sold and not-bought portfolios to make a clean comparison of performance. Each of the four panels reports results for a given holding period, and *p*-values are reported in parentheses.

[Insert Table 6 about here]

The not-sold trading strategies generate economically large and statistically significant alphas. With a monthly holding period in Panel A, the CAPM alpha of 47 bps per month and the Carhart alpha of 53 bps are statistically significant at the 1% level. Performance remains relatively stable across the four holding period lengths, with monthly alphas remaining at 44 bps and 42 bps for the CAPM and Carhart model, respectively, with an annual holding period. This finding indicates that the strong performance of not-sold stocks is persistent, as investing a large portion of the portfolio in stocks that were not-sold several months ago does not substantially degrade performance.

Table 6 also indicates that the strategies that hold not-sold stocks outperform those with not-bought stocks. The long-short portfolio earns positive alphas in each design. Each of the long-short alphas for the quarterly, semiannual, and annual holding periods are statistically significant at the 5% level. These positive long-short alphas support our Table 4 findings of significant outperformance by not-sold stocks.

Figure 1 plots the cumulative wealth from investing $1.00 in the not-sold strategy or the stock market portfolio before considering transaction costs. An investment in the not-sold strategy with a monthly holding period generates substantial wealth over this sample period. Cumulative wealth from this strategy at the end of November 2020 is $35.08. In comparison, an investment in the stock market generates $8.26 over this period.

[Insert Figure 1 about here]

We next consider the effect of transaction costs on strategy performance. The not-sold strategy earns significant abnormal returns before trading costs in Table 6. Given that the not-bought strategy generates small positive alphas, strategies that buy the not-sold portfolios and either remain long only or form a long-short portfolio by shorting the market outperform potential strategies that short the not-bought portfolios. Avoiding the trading costs from shorting the not-bought portfolio also leads to improvements in after-cost performance. We note that the alphas from strategies that are long the not-sold portfolio and short the market are equal to the reported alphas for the long not-sold portfolio (given that the market factor is included in the CAPM and the Carhart model).

Table 7 reports not-sold strategy alphas before and after trading costs.[15] With the monthly holding period in Panel A, the CAPM alpha after trading costs is 19 bps per month and not statistically significant. The Carhart alpha is 25 bps and statistically significant at the 5% level. The

[15] The not-sold strategy portfolios in Tables 7 and 8 and Figures 1 to 3 do not exclude stocks that are also not-bought, such that the results differ slightly from those in Table 6.

trading costs realized in the high-turnover monthly strategy thus degrade performance, but some evidence remains of statistically significant abnormal returns after costs.

[Insert Table 7 about here]

As the holding period increases, Table 7 shows that the effective monthly cost from trading declines. This effect occurs because the position in each stock requires only one round-trip transaction and the superior performance of the not-sold stocks accrues over a multi-month holding period. Given that the pre-cost monthly alphas are relatively stable across horizons and the effective trading costs decline with holding period, the after-cost alphas improve with holding period. The quarterly strategy alphas are 32 bps and 36 bps for the CAPM and Carhart model, respectively. Alphas after trading costs from the semiannual and annual holding periods in Panels C and D are similar. The CAPM alphas are 37 and 39 bps per month (statistically significant at the 5% level) and the Carhart alphas are 40 bps and 37 bps (statistically significant at the 1% level). Overall, Table 7 shows that the not-sold strategies earn significant abnormal returns, particularly for the lower-turnover strategies that capitalize on the persistent positive performance of not-sold stocks over extended holding periods.

Figure 2 shows cumulative wealth levels that incorporate trading costs for the not-sold strategy with a monthly holding period, the not-sold strategy with an annual holding period, and the market portfolio (with no assumed trading costs for holding the market portfolio). Trading costs reduce the cumulative wealth from the monthly strategy from $35.08 in Figure 1 to $16.75 in Figure 2, but this strategy continues to outperform the market over this period. The annual strategy outperforms the monthly strategy and grows to $28.11, reflecting the lower effective trading costs for the lower-turnover strategy. Overall, the results in Table 7 and Figure 2 demonstrate that the not-sold strategies generate strong performance even after considering transaction costs.

[Insert Figure 2 about here]

An alternative way to use the information from portfolio insider sales about the not-sold stocks is to use these events to refine or complement other signals about expected stock returns. To illustrate this possibility, we consider the momentum strategy of Jegadeesh and Titman (1993). Chan et al. (1996) attribute the success of the momentum strategy to the market gradually responding to public information. Since our previous results are consistent with insider trades reflecting private information, we expect the information contained in not-sold stocks has little overlap with the information from past returns. Consequently, we speculate that combining the two types of information can yield better results than using each type alone.

We identify stocks in the top tercile of realized buy-and-hold cumulative return over the past 12 months as past winners. We then consider three strategies: (1) buy not-sold stocks, (2) buy past winners, and (3) buy not-sold stocks that are also past winners. If the information about the not-sold stocks revealed by insider trades complements the momentum signal, then the portfolio of not-sold winners should outperform the other two strategies.

Table 8 reports monthly alphas after trading costs for the portfolios of stocks that are not-sold, past winners, and both not-sold and past winners. Beginning with the monthly holding period strategies in Panel A, the results indicate that combining the not-sold signal with the momentum signal is advantageous. The portfolio of not-sold stocks earns a CAPM alpha of 19 bps per month and a Carhart alpha of 25 bps (significant at the 5% level). The past winner portfolio earns alphas of 33 bps and 16 bps relative to the CAPM and Carhart model, respectively.[16] The portfolio of not-sold stocks that are also winners achieves a CAPM alpha of 52 bps and a Carhart alpha of 23 bps even after considering trading costs.

[Insert Table 8 about here]

[16] Carhart alphas for the momentum strategy tend to be substantially attenuated relative to CAPM alphas because the Carhart model controls for exposure to a momentum factor.

As the holding period extends in Table 8, the momentum signal loses its predictive ability for returns. The combination strategy of buying not-sold stocks that are also past winners reaches its best performance with a quarterly holding period. The quarterly strategy reduces effective transaction costs relative to the monthly strategy and uses fresher signals about momentum compared with the semiannual and annual strategies.

Finally, Figure 3 plots cumulative wealth for a $1.00 investment in the stock market or in the strategies formed with not-sold stocks, past winners, and not-sold past winners. The strategies are based on a quarterly holding period and performance includes transaction costs. The strategies for not-sold stocks and past winners generate cumulative wealth of $23.46 and $15.15, respectively, and both outpace the market portfolio at $8.26. The strategy that buys stocks that are both not-sold and past winners outperforms each other strategy and produces $36.73 in cumulative wealth over this sample period.

[Insert Figure 3 about here]

Robustness. In the appendix, we examine two issues that can affect the timing of insider trades to establish that our results are not substantially affected by these events.

First, many firms have blackout periods, during which insiders are restricted from trading the company's stock. Bettis et al. (2000) report that the most common blackout period structure allows insiders to exclusively trade from the 3rd to the 12th day following an earnings announcement. A portfolio insider may not have full discretion on which of her stocks to trade if one or more is in a blackout period, so these windows could affect the relation between traded and not-traded stocks. We study the effect of blackout periods by restricting the sample to observations in which the not-traded stocks are in the 30-trading-day window following an earnings announcement (i.e., a non-blackout period using the metric of Ke et al., 2003). We repeat the analysis in Table 4, and inferences are similar to the base case.

Second, insiders frequently sell stock immediately after an option exercise. This type of sale is included in our sample because it is an open-market transaction (whereas the purchase upon exercising the option is not included in our sample). Thomson Reuters flags these transactions in the database (i.e., the 'optionsell' indicator in the Thomson Reuters database is equal to 'A' or 'P'). Results are very similar to the base case after omitting these transactions.

Large Shareholders and Other Insiders

Our results to this point focus on information contained in insider trades by directors and officers. As previously discussed, large shareholders and other insiders must also file a Form 4 following any trade. In this section, we study whether the trades of portfolio insiders in these categories contain information about the not-traded securities. Ex ante, we expect that directors and insiders likely have more private information about the companies compared with large shareholders and other insiders, but these alternative insider types may have, for example, better access to communicate with management compared with most investors such that their trades may be informative.

Table 9 reports risk-adjusted returns for the not-traded stocks of large shareholders and other insiders. With a 30-day horizon, the not-sold stocks perform quite well on average with returns ranging from 127 to 174 bps. The not-bought stocks earn negative abnormal returns, such that the spread between not-sold and not-bought stock returns are large and statistically significant at the 1% level. This positive abnormal performance is, however, isolated to the short run. Over 90- and 150-day windows, we find little evidence of good performance by not-sold stocks, and the differences in performance between not-sold and not-bought stocks are relatively small.

[Insert Table 9 about here]

The returns in Table 9 begin the day after the trade, such that they may contain a market reaction to the insider trade. In Table 10, we consider implementable trading strategies analogous to those from Table 7. Specifically, we consider strategies that buy not-sold stocks with four potential holding periods, and we measure strategy performance before and after costs.

Table 10 indicates that success of the strategies for large shareholders and other insiders is primarily isolated to the monthly holding period strategy. Before costs, this high-turnover strategy generates a CAPM alpha of 42 bps (insignificant) and a Carhart alpha of 52 bps (significant at the 5% level). The strategy incurs substantial trading costs, such that the alphas after costs are 19 bps and 29 bps for the CAPM and Carhart model, respectively, and statistically insignificant. With longer holding periods, the alphas before trading costs drop substantially, consistent with the pattern in Table 9. The strategies produce insignificant alphas after trading costs. These findings contrast with the long-lived information content for the not-sold stocks of directors and insiders. The differences suggest that directors and officers may have a greater degree of private information about the long-term prospects of their companies.

[Insert Table 10 about here]

Conclusion

We hypothesize that information can be garnered from insider trades, not only about the stocks they trade but also about the stocks they choose not to. Consistent with our hypothesis, stocks that insiders choose not to sell meaningfully outperform the stocks insiders choose not to buy. The return differences between not-sold and not-bought stocks primarily arise from large positive abnormal returns for not-sold stocks. We further find that, following a sale by a portfolio insider, the sold stock subsequently underperforms relative to the not-sold stocks, and this underperformance is driven by the not-sold stocks. A stock that a portfolio insider buys also

outperforms relative to the not-bought stocks on average, mostly due to the stock they bought. As such, portfolio insiders appear to use private information or their superior ability to process information to inform their purchases and sales of insider holdings.

The information content of insider buys is well known to practitioners and academics alike, and the market tends to react quickly to these transactions. In contrast, we find evidence of long-lasting abnormal returns for not-sold stocks, suggesting traders do not quickly incorporate the information from an insider sale about the not-sold stocks. The long-term nature of the positive performance suggests that a trading strategy of buying portfolio insiders' not-sold stocks may be profitable for investors.

We investigate implementable trading strategies that buy portfolio insiders' not-sold stocks with holding periods ranging from one month to one year. The trading strategies generate significantly positive abnormal performance. Given the long-term nature of the abnormal returns to not-sold stocks, strategies with relatively lower turnover perform better after trading costs. We also demonstrate that the signals about not-sold stocks complement other signals, as a combined not-sold and momentum strategy generates large abnormal returns and cumulative wealth after trading costs.

In short, a trade by a portfolio insider also involves an active decision to not trade other stocks. Insiders profitably use their inside information, such that trades are informative about not-traded stocks. Required trade disclosures offer practitioners a publicly available source from which to discern signals about insiders' private knowledge, and insider sales can be informative about the not-sold stocks even when the trade is motivated by liquidity or diversification needs. An implementable trading strategy earns positive alphas after incorporating trading costs, such that practitioners can use portfolio insider sales to inform their trading decisions.

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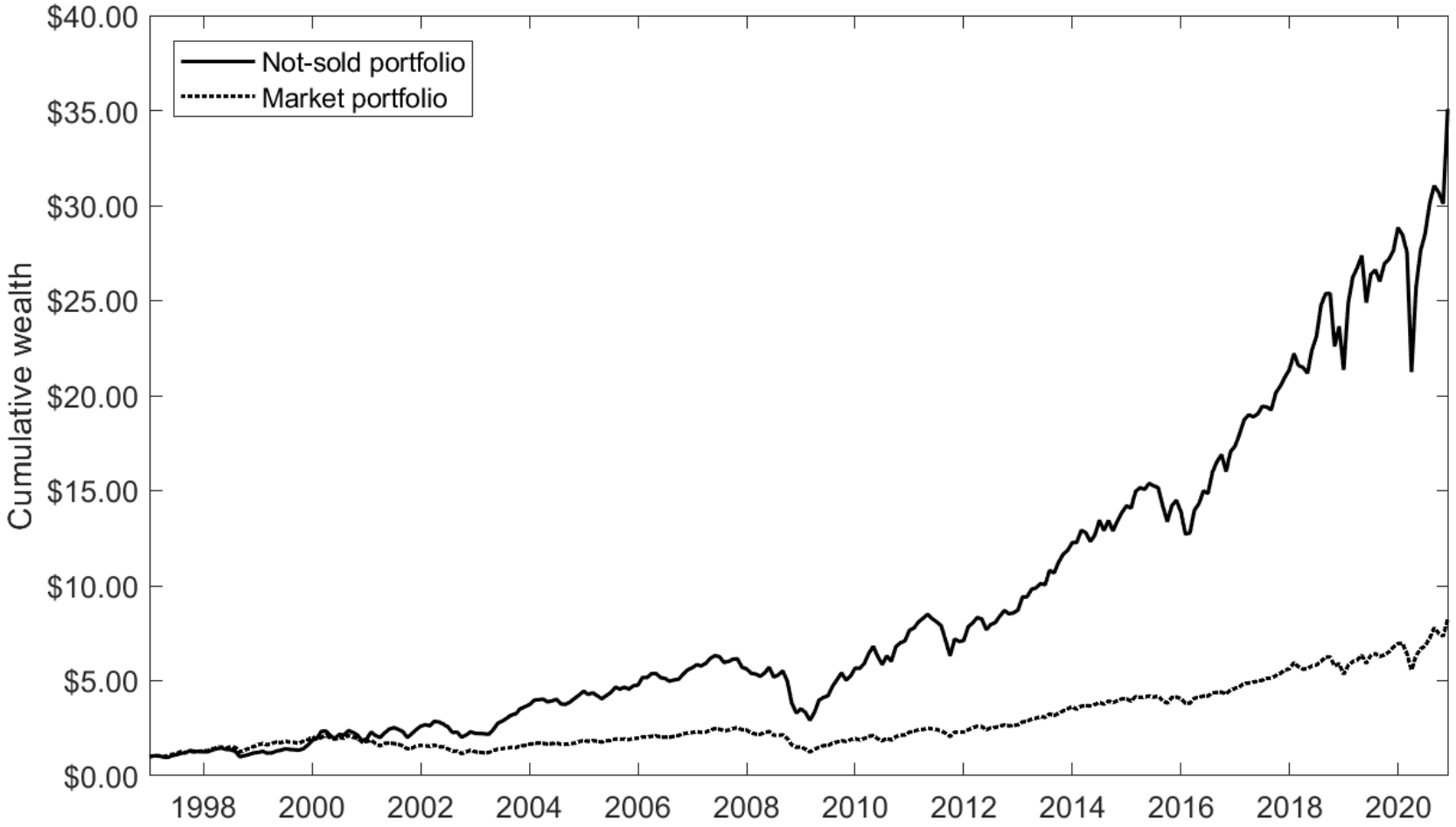

Figure 1. Performance of not-sold trading strategy before trading costs.
Notes: The figure shows the cumulative wealth generated from a $1.00 initial investment in the not-sold portfolio with a monthly holding period or the market portfolio before considering trading costs.

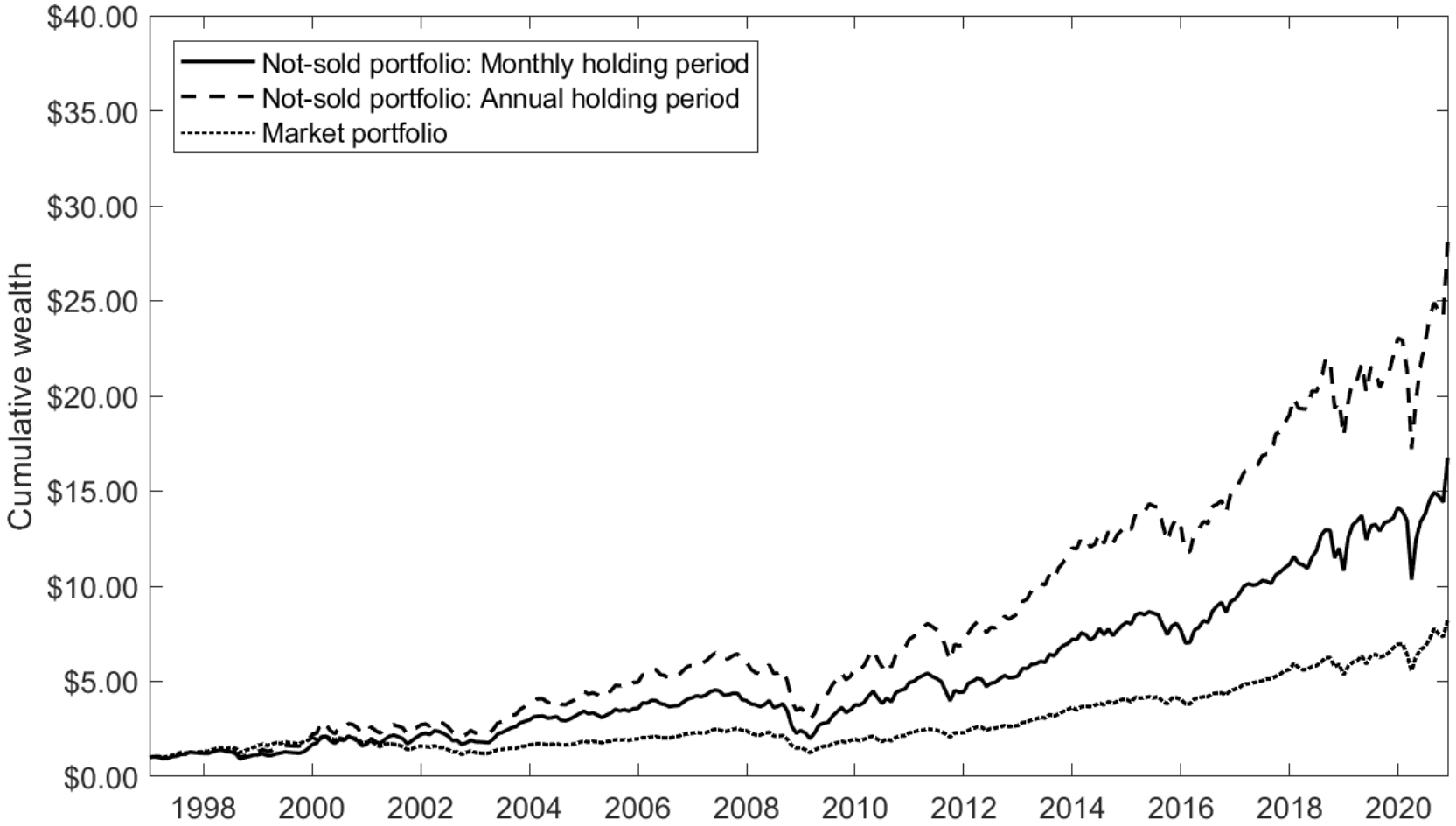

Figure 2. Performance of not-sold trading strategies after trading costs.
Notes: The figure shows the cumulative wealth generated from a $1.00 initial investment in the not-sold portfolio with a monthly or an annual holding period or the market portfolio after considering trading costs.

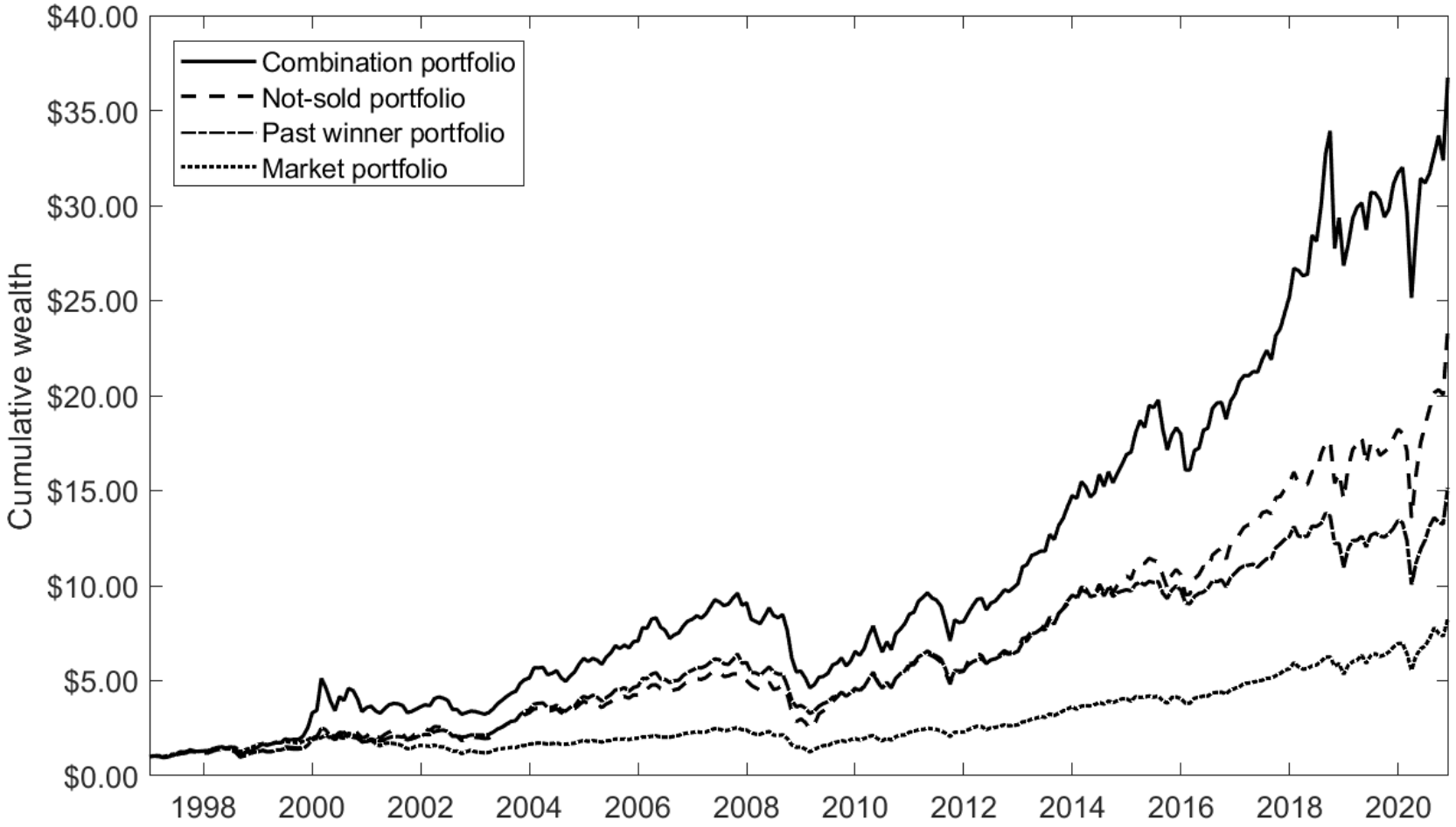

Figure 3. Performance of combination not-sold and momentum trading strategy after trading costs.
Notes: The figure shows the cumulative wealth generated from a $1.00 initial investment in the combination portfolio of not-sold stocks that are past winners, the not-sold portfolio, the past winner portfolio, or the market portfolio after considering trading costs. The strategies have a quarterly holding period.

Table 1.
Illustration of information about not-traded stocks of portfolio insiders.

		Panel A: Portfolio insider valuation-motivated buys		
		Stock *B*		
		Undervalued	Fairly valued	Overvalued
Stock *A*	Undervalued	Buy either	Buy *A*	Buy *A*
	Fairly valued	Buy *B*	No buy	No buy
	Overvalued	Buy *B*	No buy	No buy
		Panel B: Portfolio insider liquidity-motivated sells		
		Stock *B*		
		Undervalued	Fairly valued	Overvalued
Stock *A*	Undervalued	Sell either	Sell *B*	Sell *B*
	Fairly valued	Sell *A*	Sell either	Sell *B*
	Overvalued	Sell *A*	Sell *A*	Sell either

Notes: This table illustrates the relative information content of purchases and sales by portfolio insiders. Buys in Panel A are motivated by the undervaluation of the bought stock. Sells in Panel B are motivated by liquidity needs, such that either stock *A* or stock *B* must be sold. The gray shading indicates the scenarios in which stock *A* is traded, such that stock *B* is the not-traded stock.

Table 2.
Roles of portfolio insiders in inside firms.

Positions held by portfolio insiders	Number of insiders	Percent of total insiders	Number of trades	Percent of total trades
Panel A: All possible position combinations				
Only director	4,022	42.12	40,249	27.65
Only officer	472	4.94	3,460	2.38
Only large shareholder	824	8.63	28,245	19.41
Only other	31	0.32	168	0.12
Director and officer	3,055	31.99	37,763	25.94
Director and large shareholder	282	2.95	7,280	5.00
Officer and large shareholder	28	0.29	438	0.30
Director and other	252	2.64	3,202	2.20
Officer and other	77	0.81	378	0.26
Large shareholder and other	69	0.72	1,785	1.23
Director, officer, and other	189	1.98	5,300	3.64
Director, large shareholder, and other	98	1.03	5,230	3.59
Officer, large shareholder, and other	14	0.15	1,036	0.71
Director, officer, and large shareholder	87	0.91	6,001	4.12
All	50	0.52	5,017	3.45
Total	9,550	100.00	145,552	100.00
Panel B: Insider types by security traded				
Director			75,002	51.53
Officer			24,630	16.92
Large shareholder			41,097	28.24
Other			4,823	3.31
Total			145,552	100.00

Notes: This table outlines the possible roles of portfolio insiders in inside firms. For each firm, a portfolio insider holds one of four roles: director, officer, large shareholder, or other insider. Panel A reports the number and proportion of each role combination of portfolio insiders (first two columns) and the number and proportion of the trades executed by each role combination (last two columns). Panel B reports the number and proportion of the trades executed by insiders with each of the four insider roles. The sample period is November 1992 to October 2020.

Table 3.
Summary statistics.

Panel A: Portfolio insider summary statistics

	Mean	Median	Std	Min	Max
Number of holdings per portfolio insider	2.42	2.00	1.77	2.00	71.00
Number of buys per portfolio insider	3.56	1.00	13.86	0.00	656.00
Number of sells per portfolio insider	8.17	2.00	69.47	0.00	6,166.00

Panel B: Totals

Number of portfolio insiders	Number of all insiders	Number of portfolio insider buys	Number of portfolio insider sells	Stocks held by portfolio insiders	Stocks held by all insiders
8,580	139,684	30,757	70,136	6,163	12,432

Notes: This table shows summary statistics for portfolio insider holdings. Panel A presents the summary statistics of the portfolio insider sample. Panel B presents the number of portfolio insiders, the number of all insiders, the numbers of buys and sells by portfolio insiders, and the numbers of stocks held by portfolio insiders and all insiders. The sample period is November 1992 to October 2020.

Table 4.
Average risk-adjusted returns to portfolio insider not-traded securities.

	Panel A: Market-adjusted return		
	Not-sold	Not-bought	Difference
Subsequent 30-day return	0.77	0.12	0.64
	(.001)	(.240)	(.001)
Subsequent 90-day return	1.67	0.86	0.81
	(.001)	(.001)	(.002)
Subsequent 150-day return	2.84	1.77	1.07
	(.001)	(.003)	(.003)
	Panel B: Size-adjusted return		
	Not-sold	Not-bought	Difference
Subsequent 30-day return	0.40	-0.03	0.43
	(.001)	(.755)	(.001)
Subsequent 90-day return	0.98	0.35	0.63
	(.001)	(.082)	(.012)
Subsequent 150-day return	1.86	1.01	0.85
	(.001)	(.001)	(.016)
	Panel C: DGTW-adjusted return		
	Not-sold	Not-bought	Difference
Subsequent 30-day return	0.37	-0.03	0.40
	(.001)	(.756)	(.001)
Subsequent 90-day return	0.88	0.50	0.37
	(.001)	(.010)	(.119)
Subsequent 150-day return	1.60	1.02	0.59
	(.001)	(.001)	(.075)
Number of buys in Panels A and B (C): 19,176 (17,903)			
Number of sales in Panels A and B (C): 36,713 (34,560)			

Notes: This table presents average risk-adjusted returns following portfolio insider trades in which the insider is a director or an officer of the firm traded. Returns are risk-adjusted using the CRSP value-weighted market index (Panel A), size decile portfolios (Panel B), and matched DGTW portfolios (Panel C). The return to each not-traded observation is calculated by taking the average performance of each insider's not-traded stocks over the 30, 90, or 150 trading days following a trade (e.g., if an insider held stocks *A*, *B*, and *C* on day *t* and sold *A*, the not-sold 30-day return is the average risk-adjusted return of *B* and *C* from days *t*+1 to *t*+30). *P*-values are reported in parentheses. The sample period is November 1992 to October 2020.

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

	Panel A: Market-adjusted return		
	Traded	Not-traded	Difference
Return following buy	2.07	0.12	1.95
	(.001)	(.243)	(.001)
Return following sale	0.10	0.77	-0.67
	(.203)	(.001)	(.001)
	Panel B: Size-adjusted return		
	Traded	Not-traded	Difference
Return following buy	1.77	-0.04	1.81
	(.001)	(.684)	(.001)
Return following sale	-0.22	0.41	-0.63
	(.004)	(.001)	(.001)
	Panel C: DGTW-adjusted return		
	Traded	Not-traded	Difference
Return following buy	1.74	0.06	1.68
	(.001)	(.567)	(.001)
Return following sale	-0.29	0.36	-0.65
	(.001)	(.001)	(.001)
Number of buys in Panels A and B (C): 18,794 (15,372)			
Number of sales in Panels A and B (C): 36,268 (31,587)			

Notes: This table presents the average future 30-trading-day risk-adjusted returns following portfolio insider trades in which the insider is a director or an officer of the firm traded. Returns are risk-adjusted using the CRSP value-weighted market index (Panel A), size decile portfolios (Panel B), and matched DGTW portfolios (Panel C). *P*-values are reported in parentheses. The sample period is November 1992 to October 2020.

Table 6.
Trading strategy performance by horizon before transaction costs.

	Panel A: Monthly holding period		
	Not-sold portfolio	Not-bought portfolio	Long-short portfolio
CAPM alpha	0.47	0.27	0.21
	(.009)	(.114)	(.191)
Carhart alpha	0.53	0.36	0.17
	(.000)	(.005)	(.237)
	Panel B: Quarterly holding period		
	Not-sold portfolio	Not-bought portfolio	Long-short portfolio
CAPM alpha	0.41	0.10	0.32
	(.012)	(.522)	(.010)
Carhart alpha	0.46	0.17	0.29
	(.000)	(.091)	(.007)
	Panel C: Semiannual holding period		
	Not-sold portfolio	Not-bought portfolio	Long-short portfolio
CAPM alpha	0.44	0.18	0.26
	(.009)	(.225)	(.028)
Carhart alpha	0.46	0.23	0.23
	(.000)	(.014)	(.015)
	Panel D: Annual holding period		
	Not-sold portfolio	Not-bought portfolio	Long-short portfolio
CAPM alpha	0.44	0.21	0.22
	(.012)	(.140)	(.041)
Carhart alpha	0.42	0.23	0.19
	(.000)	(.007)	(.028)

Notes: This table presents trading strategy performance before transaction costs for the not-sold and not-bought portfolios as well as a strategy that is long not-sold stocks and short not-bought stocks. The strategies use the not-traded stocks of directors and officers. Holding periods range from monthly to annual across strategies. *P*-values are reported in parentheses. The sample period is January 1997 to November 2020.

Table 7.
Not-sold trading strategy performance by horizon after transaction costs.

	Panel A: Monthly holding period	
	Before costs	After costs
CAPM alpha	0.45	0.19
	(.009)	(.259)
Carhart alpha	0.51	0.25
	(.000)	(.022)
	Panel B: Quarterly holding period	
	Before costs	After costs
CAPM alpha	0.40	0.32
	(.011)	(.045)
Carhart alpha	0.45	0.36
	(.000)	(.000)
	Panel C: Semiannual holding period	
	Before costs	After costs
CAPM alpha	0.42	0.37
	(.009)	(.021)
Carhart alpha	0.44	0.40
	(.000)	(.000)
	Panel D: Annual holding period	
	Before costs	After costs
CAPM alpha	0.42	0.39
	(.014)	(.020)
Carhart alpha	0.40	0.37
	(.000)	(.000)

Notes: This table presents trading strategy performance before and after transaction costs for the not-sold portfolios of directors and officers. Holding periods range from monthly to annual across strategies. Average trading costs are based on Frazzini et al. (2018). *P*-values are reported in parentheses. The sample period is January 1997 to November 2020.

Table 8.
Momentum strategy augmented with not-sold trading strategy after transaction costs.

	Panel A: Monthly holding period		
	Not-sold	Past winner	Not-sold and winner
CAPM alpha	0.19	0.33	0.52
	(.259)	(.059)	(.062)
Carhart alpha	0.25	0.16	0.23
	(.022)	(.063)	(.191)
	Panel B: Quarterly holding period		
	Not-sold	Past winner	Not-sold and winner
CAPM alpha	0.32	0.28	0.55
	(.045)	(.117)	(.037)
Carhart alpha	0.36	0.11	0.28
	(.000)	(.188)	(.050)
	Panel C: Semiannual holding period		
	Not-sold	Past winner	Not-sold and winner
CAPM alpha	0.37	0.20	0.42
	(.021)	(.259)	(.104)
Carhart alpha	0.40	0.05	0.18
	(.000)	(.591)	(.181)
	Panel D: Annual holding period		
	Not-sold	Past winner	Not-sold and winner
CAPM alpha	0.39	0.08	0.25
	(.020)	(.626)	(.292)
Carhart alpha	0.37	-0.04	0.08
	(.000)	(.669)	(.536)

Notes: This table presents trading strategy performance after transaction costs for the not-sold portfolio, the past winner portfolio, and the combination portfolio of not-sold stocks that are past winners. The strategies use the not-traded stocks of directors and officers. Holding periods range from monthly to annual across strategies. *P*-values are reported in parentheses. The sample period is January 1997 to November 2020.

Table 9.
Average risk-adjusted returns to not-traded securities of large shareholders and other insiders.

	Panel A: Market-adjusted return		
	Not-sold	Not-bought	Difference
Subsequent 30-day return	1.74	-0.40	2.14
	(.001)	(.009)	(.001)
Subsequent 90-day return	0.21	-0.53	0.74
	(.540)	(.066)	(.097)
Subsequent 150-day return	0.17	0.10	0.07
	(.695)	(.799)	(.904)
	Panel B: Size-adjusted return		
	Not-sold	Not-bought	Difference
Subsequent 30-day return	1.47	-0.32	1.79
	(.001)	(.032)	(.001)
Subsequent 90-day return	-0.18	-0.55	0.36
	(.585)	(.051)	(.401)
Subsequent 150-day return	-0.45	0.15	-0.60
	(.280)	(.672)	(.274)
	Panel C: DGTW-adjusted return		
	Not-sold	Not-bought	Difference
Subsequent 30-day return	1.27	-0.21	1.48
	(.001)	(.163)	(.001)
Subsequent 90-day return	-0.55	-0.61	0.06
	(.082)	(.016)	(.885)
Subsequent 150-day return	-0.23	-0.57	0.33
	(.557)	(.091)	(.516)
Number of buys in Panels A and B (C): 10,155 (9,355)			
Number of sales in Panels A and B (C): 9,253 (7,847)			

Notes: This table presents average risk-adjusted returns following portfolio insider trades in which the insider is a large shareholder or other insider of the firm traded. Returns are risk-adjusted using the CRSP value-weighted market index (Panel A), size decile portfolios (Panel B), and matched DGTW portfolios (Panel C). The return to each not-traded observation is calculated by taking the average performance of each insider's not-traded stocks over the 30, 90, or 150 trading days following a trade (e.g., if an insider held stocks *A*, *B*, and *C* on day *t* and sold *A*, the not-sold 30-day return is the average risk-adjusted return of *B* and *C* from days *t*+1 to *t*+30). *P*-values are reported in parentheses. The sample period is November 1992 to October 2020.

Table 10.
Not-sold trading strategy performance by horizon after transaction costs for large shareholders and other insiders.

	Panel A: Monthly holding period	
	Before costs	After costs
CAPM alpha	0.42	0.19
	(.149)	(.512)
Carhart alpha	0.52	0.29
	(.031)	(.224)
	Panel B: Quarterly holding period	
	Before costs	After costs
CAPM alpha	0.26	0.17
	(.338)	(.526)
Carhart alpha	0.33	0.24
	(.100)	(.229)
	Panel C: Semiannual holding period	
	Before costs	After costs
CAPM alpha	0.28	0.23
	(.266)	(.356)
Carhart alpha	0.32	0.27
	(.074)	(.129)
	Panel D: Annual holding period	
	Before costs	After costs
CAPM alpha	0.34	0.31
	(.187)	(.223)
Carhart alpha	0.35	0.32
	(.055)	(.075)

Notes: This table presents trading strategy performance before and after transaction costs for the not-sold portfolios of large shareholders and other insiders. Holding periods range from monthly to annual across strategies. Average trading costs are based on Frazzini et al. (2018). *P*-values are reported in parentheses. The sample period is January 1997 to November 2020.

Appendix

This appendix contains supplementary empirical results and robustness tests.

Supplementary empirical results. This section examines the performance of portfolio insiders' traded and not-traded stocks using a panel regression framework. The panel regression methodology is highly similar to that of Cohen et al. (2012).[17] We perform three regressions designed to re-examine the tests in Tables 4 and 5 of the paper in a multivariate framework. Specifically, the dependent variable is the market-adjusted return over the 30-trading-day window following the portfolio insider trade and the independent variables include size, book-to-market ratio, past month return, and past year return to control for the contrarian nature of insider trading (e.g., Piotroski and Roulstone, 2005), tax-loss selling (see Cohen et al., 2012, for additional discussion), and cross-sectional return patterns associated with these firm characteristics. To account for time-series and cross-sectional correlations, standard errors are clustered at the stock and month levels. The regression results are reported in Table A.1.

The sample in the first column of Table A.1 includes all not-bought and not-sold stocks. The Not-sold dummy variable is defined to equal one for not-sold transactions and zero for not-bought transactions. The results reveal that portfolio insiders' not-sold stocks meaningfully outperform their not-bought stocks by about 44 bps over the subsequent 30 trading days after controlling for characteristics related to insider trading profitability (statistically significant at the 5% level). In the second column, the sample includes all sold and not-sold stocks, and the dummy variable, Sell, equals one if the stock was sold and zero if it was held and not sold by the insider. We find that portfolio insiders' sold stocks underperform the not-sold stocks by 69 bps (statistically significant at the 1% level) after controlling for characteristics. The test in the third column covers all bought and

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

not-bought securities. The dummy variable of interest, Buy, equals one if the stock was bought and zero if it was held and not-bought by the insider. We find that insiders' bought securities outperform their not-bought securities by 163 bps over the subsequent 30 trading days. These results are consistent with those reported in Tables 4 and 5 and show that the effects remain statistically significant after accounting for time-series and cross-sectional correlations.

Robustness tests. This section provides additional details on the robustness tests that are described in the paper. Specifically, we consider whether the primary empirical results are affected by blackout periods or option exercises.

We consider the effect of blackout periods, which are periods during which insiders are forbidden from trading, on the univariate results concerning not-sold and not-bought stocks. We first establish that blackout periods affect the timing of portfolio insider trades. Empirical evidence in the literature suggests that insiders prefer to trade in the month after earnings rather than in the month before (Fu et al., 2020). Portfolio insiders have multiple inside holdings that may have different blackout dates. As such, we may observe that these insiders tend to trade the stocks that are more likely to fall outside of blackout windows compared with the not-traded stocks.

To examine whether blackout periods influence the decision to trade or to not trade a security, we compare the fraction of trades and non-trades that occur from the 3rd to the 12th day after an earnings announcement following the findings of Bettis et al. (2000). We find that when a portfolio insider trades, 32.1% of the stocks traded fall within that permitted trading window and 21.2% of not-traded stocks are simultaneously within the window (untabulated; the difference is statistically significant at the 1% level). We also examine the difference if we define the permitted trading window as 30 trading days immediately following the earnings announcement (following Ke et al., 2003). Using this definition, 72.2% of traded securities and 59.4% of not-traded securities fall within

the trading window (untabulated; the difference is statistically significant at the 1% level). Both tests suggest that blackout windows influence when portfolio insiders trade.

To ensure that blackout periods do not drive the results, we restrict the sample by requiring each not-traded stock to be within the 30-trading day window following an earnings announcement (i.e., a non-blackout period using the metric of Ke et al., 2003). We then repeat the analysis from Table 4 in the paper using the 30-trading-day window. The results, reported in Table A.2, are highly comparable to the results using the non-restricted sample. The not-sold securities outperform the not-bought securities by between 43 and 70 bps depending on the risk adjustment method (compared with between 40 and 64 bps in Table 4).

Option exercises are another event type that may affect the timing of portfolio insider sales. That is, an insider may buy a stock via option exercise (which is not included in our sample because we only examine open-market buys and sells) and then immediately liquidate this position (which is included in our sample because it is an open-market sale). We use the Thomson Reuters flags to identify these sales (i.e., sales for which the 'optionsell' indicator in the Thomson Reuters database is equal to 'A' or 'P').[18] To investigate the impact of these trades, we compare the performance of not-sold and sold stocks in the 30-trading-day window following a portfolio insider sale while excluding those sales that are related to an option exercise. The results remain largely unchanged. The abnormal returns to portfolio insiders' sold stocks in the 30-trading-day window following a sale do not differ significantly from zero using market-adjusted returns. The average market-adjusted return for not-sold securities subsequent to a trade is 75 bps, which is statistically significant at the 1% level and similar to the 77-bp average return reported using the full sample (Panel A of Table 4).

[18] 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.

Table A.1.
Panel regressions.

	(1)	(2)	(3)
Intercept	2.73	2.22	3.93
	(.103)	(.189)	(.042)
Not-sold	0.44		
	(.030)		
Sell		-0.69	
		(.000)	
Buy			1.63
			(.000)
Size	-0.10	-0.06	-0.16
	(.223)	(.479)	(.078)
Ln(bm)	0.34	0.42	0.05
	(.199)	(.108)	(.844)
Past month return	0.07	0.12	0.11
	(.259)	(.001)	(.000)
Past year return	0.30	0.58	-0.32
	(.497)	(.181)	(.358)
Number of observations	76,374	86,042	52,595

Notes: This table reports pooled regression estimates of 30-trading-day market-adjusted returns on indicator variables identifying the type of insider trade and firm characteristics. Each column represents a different sample of securities and includes a different indicator. Column 1 includes all not-bought and not-sold stocks and includes the indicator variable "Not-sold" which equals one if the stock was not-sold at the time of a sale by a portfolio insider and zero if the stock was not-bought at the time of a buy by a portfolio insider. In column 2 (3), the sample includes for each insider the stocks the insider sold (bought), as well as the stocks the insider held at the time but did not sell (did not buy). Column 2 (3) includes the indicator variable "Sell" ("Buy") which equals one if the insider sold (bought) the stock and zero otherwise. Each sample only includes the first trade of each type (buy or sell) for each stock each week and for each insider. Size is the natural log of the stock's market capitalization on the day of the trade. Ln(bm) is the natural log of the stock's book to market ratio. 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 month return. Standard errors are clustered by stock and month, and *p*-values are reported in parentheses. The sample period is November 1992 to October 2020. All numbers are expressed in percent (i.e., 1 is 1%).

Table A.2.
Univariate 30-day risk-adjusted returns to portfolio insider not-traded securities: excluding blackout periods.

	Panel A: Market-adjusted return		
	Not-sold	Not-bought	Difference
Subsequent 30-day return	0.89 (.001)	0.19 (.112)	0.70 (.001)
	Panel B: Size-adjusted return		
	Not-sold	Not-bought	Difference
Subsequent 30-day return	0.47 (.001)	-0.01 (.966)	0.47 (.002)
	Panel C: DGTW-adjusted return		
	Not-sold	Not-bought	Difference
Subsequent 30-day return	0.45 (.001)	0.02 (.838)	0.43 (.003)
Number of buys in Panels A and B (C): 13,593 (12,798)			
Number of sales in Panels A and B (C): 27,918 (26,270)			

Notes: This table presents average risk-adjusted returns following portfolio insider trades in which the insider is a director or an officer of the firm traded. Each not-traded security in this analysis is within a non-blackout period as defined by Ke et al. (2003). Returns are risk-adjusted using the CRSP value-weighted market index (Panel A), size decile portfolios (Panel B), and matched DGTW portfolios (Panel C). The return to each not-traded observation is calculated by taking the average performance of each insider's not-traded stocks over the 30 trading days following a trade (e.g., if an insider held stocks *A*, *B*, and *C* on day *t* and sold *A*, the not-sold 30-day return is the average risk-adjusted return of *B* and *C* from days *t*+1 to *t*+30). *P*-values are reported in parentheses. The sample period is November 1992 to October 2020.