JOURNAL OF FINANCIAL AND QUANTITATIVE ANALYSIS Vol. 54, No. 4, Aug. 2019, pp. 1499–1538
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doi:10.1017/S0022109018001059

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

The Information Content of Sudden Insider Silence

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Abstract

We present evidence of investors underreacting to the absence of events in financial markets. Routine-based insiders strategically choose to be silent when they possess private information not yet reflected in stock prices. Consistent with our hypothesis, insider silence following a routine sell (buy) predicts positive (negative) future returns, as well as fundamentals. The return predictability of insider silence is stronger among firms with a poor information environment and facing higher arbitrage costs, and a large fraction of abnormal returns concentrates on future earnings announcements. A long–short strategy that exploits insiders' strategic silence behavior generates abnormal returns of 6% to 10% annually.

> Recognizing and learning from absence, deletion and nonoccurrence are surprisingly difficult. Animals and people, it seems, accentuate the positive (Hearst (1991)).

I. Introduction

The absence or nonoccurrence of events often reveals important information. For example, to decide whether a drug cures a disease, one needs to know how often the drug produces no cures and how often patients recover without the drug. When interviewing a candidate, one may obtain revealing information about his/her background from the skills or experiences that the person scarcely

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https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

mentions. The absence of customers in a restaurant with a convenient location perhaps signals that the quality of food is poor. However, despite the fact that the absence of activity in many settings is often very informative, ample experimental evidence (Sainsbury (1971), Newman, Wolff, and Hearst (1980), and Agostinelli, Sherman, Fazio, and Hearst (1986)) suggests that human beings have difficulty using the mere absence of something as a basis for the efficient and appropriate processing of information.[1] Hearst (1991) surveys a large body of literature in experimental psychology and shows convincingly that humans are less attentive to the absence or nonoccurrence of certain features, and that learning is less effective when the absence of the feature signals a reward. He attributes humans' asymmetric responses to the presence or absence of activity to the fact that the absence of events generally appears less salient and memorable than occurrences.

In the experiments conducted for the above research, inattentiveness led to the underreaction of important information conveyed by the absence of events. However, outside a laboratory setting, there is little evidence from the field. One reason may be that, although absence can be specified quite clearly in a laboratory setting, in the real world, absence is not always easy to conceptualize in a psychologically meaningful way. Countless things are always simultaneously absent. It therefore seems intuitive that the absence of some events or person should exert a strong effect only when there is good reason to expect the presence of that event or person. This paper tests whether underreaction to nonoccurrence operates in the real-world setting of financial markets. The financial-market setting is particularly interesting because we can test whether underreaction to the absence of activity affects equilibrium prices in sophisticated markets, where the price of making mistakes is high and professionals making repeated investment decisions may be less prone to such a bias. Moreover, prices in financial markets are determined through interactions between many investors. Thus, cognitive biases in a subset of investors may not affect market prices given the disciplining role of arbitrageurs.

In this paper, we explore whether the market underreacts to the information embedded in the nonoccurrence of routine insiders' trades. Corporate insiders' trades are among the most widely scrutinized activities in the stock market.[2] Regulators, investment managers, media members, and academics continually parse these trades for signs of illicit behavior, and for signals about a company's future prospects. Corporate insiders, by definition, know more about the internal operations and future prospects of their firms compared to others, and they thus would be expected to have superior access to private information that outsiders do not have.[3]

[1]Typically, in these experiments, subjects are asked to perform a task under feature-positive and feature-negative arrangements. With feature-positive arrangements, the presence of the distinctive feature signals a reward, and with feature-negative arrangements the absence of the feature signals a reward. The same subjects are consistently less able to solve the task in a feature-negative scenario compared to a feature-positive scenario.

[2]Corporate insiders are officers with decision-making authority over the operations of the company, all members of the board directors, and beneficial owners of more than 10% of the company's stocks.

[3]Extensive literature examines whether insiders' buying and selling transactions have any cross-sectional, as well as time series, forecasting ability for future stock returns (Lorie and Niederhoffer

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Previous literature has documented the fact that insiders trade for multiple reasons. When driven by noninformation reasons, such as liquidity or diversification, their submitted trades are more likely to be routine-based, that is, occur in the same month each year, in order to signal to outsiders that they are not trading on private information about the firm (Cohen, Malloy, and Pomorski (2012)). We hypothesize that when an insider who sells routinely in the same calendar month each year suddenly stops doing so, her silence could signal forthcoming good news. An insider who possesses good news about her firm has the incentive to postpone planned selling until the news has been disclosed to the public, and the firm's shares have risen in price. Conversely, sudden silence from an insider who makes routine purchases could convey bad information, as she has the incentive to purchase the firms shares later at a lower cost when the bad news hits the market.[4] Compared with directly buying (selling) the stocks when the insiders possess good (bad) information, being silent offers them the opportunity to take advantage of their private information, and avoid raising suspicion among regulators. While the Securities and Exchange Act of 1934 prohibits agents from trading securities when in possession of material nonpublic information[5], SEC Rule 10b-5 explicitly states that "there can be no liability for insider trading under Rule 10b-5 without an actual securities transaction."

Our empirical strategy for identifying sudden insider silence is simple and intuitive. Following Cohen et al. (2012), we analyze each insider's past trading history and look for consistent patterns in the timing of buying or selling transactions. If the insider sells in the same calendar month for 2 consecutive years, we then check his trades in the same month for the third year. If he continues to sell, then we classify the insider and his trading action in the sell-sell-sell (SSS) group. If he does not trade on this month, we then put him and his nontrading action in the sell-sell-no trade (SSN) group. Similarly, we categorize insiders who purchase in the same month for 2 consecutive years and purchase (purchase-purchase-purchase (PPP)) or do not purchase (purchase-purchase-no trade (PPN)) in the same month of the third year. Finally, we aggregate the insider-level silence measure at the firm level by defining a firm-month dummy SSN (PPN) equal to 1 when at least one insider at the firm-month has SSN (PPN) equal to 1, and 0 otherwise.[6]

After classifying insiders' third-year trades, we examine the information content of the sudden silence measure. As corporate insiders are heavily involved in a firm's daily operations, we hypothesize that sudden silence following an insider's routine selling could signal improving firm fundamentals, which is

(1968), Jaffe (1974), Seyhun (1986), Seyhun (1988), Rozeff and Zaman (1988), Lin and Howe (1990), Jeng, Metrick, and Zeckhauser (2003), and Lakonishok and Lee (2001)).

[4]Routine buys may occur after an insider receives a bonus; since bonuses are often paid out in the same month each year, and since insiders often receive discount plans for their company stock (and hence are more likely to buy the stock), insider buying in the same calendar month is common and often uninformative.

[5]There is some evidence showing that insiders appear to avoid trading before forthcoming news events (Givoly and Palmon (1985)), takeover announcements (Seyhun (1992)), management forecasts of earnings (Noe (1999)), and earnings announcements (Park, Jang, and Loeb (1995)).

[6]In our sample, there are only 414 firm-month observations with both SSN and PPN equal to 1. Setting these firm-months to either 0 or 1 does not affect our results.

reflected in rising earnings and cash flows. Silence following routine purchasing, on the other hand, could indicate deteriorating firm fundamentals.

Using return on assets (ROA) and operating cash flow (scaled by lagged total assets) as proxies for firm profitability, we find evidence supporting this hypothesis. Firms on average experience a 0.3% improvement in quarterly ROA when an insider stops trading after 2 years of consecutive sells (SSN). PPN also predicts decreases in a firm's current and future-quarter ROA and cash flows, although the economic magnitude is smaller.

After establishing that a routine insider's sudden silence is motivated by private information related to firm fundamentals, we then examine whether the market underreacts to the valuable information embedded in insider silence, as predicted by our motivating hypothesis. We use the Fama–MacBeth (1973) regression to show that, consistent with our hypothesis, insider silence following consecutive sells (buys) predicts future positive (negative) abnormal returns for up to 12 months. If the stock falls into the SSN group, the regression predicts that the 3-month-ahead cumulative returns are 1.07% (t-stat. $= 3.67$) higher. The coefficient on SSN increases almost monotonically with forecasting horizons, suggesting that the information contained in insider silence (SSN) is not short-lived and does not get incorporated into stock prices in a timely fashion. The predictability of sudden silence following consecutive purchases (PPN) is weaker than that of SSN. The 3-month-ahead cumulative returns are 0.98% (t-stat. $= -2.03$) lower if the stock falls into the PPN category. A calendar-time portfolio strategy that longs stocks with SSN in the previous 3 months[7] and short stocks with PPN in the previous 3 months yields an equal-weighted monthly Carhart (1997) 4-factor alpha of 53 basis points (bps) (t-stat. $= 2.62$).[8]

Next, we examine the type of firm-specific information that insiders withhold. Because insiders are typically unlikely to trade on a short-term basis due to the "Short Swing" rule,[9] we expect that managers are more likely to be strategically silent for one of the most important news events of the firm (i.e., the earnings announcement). Elliott, Morse, and Richardson (1984), Ke, Huddart, and Petroni (2003), and Piotroski and Roulstone (2005) show that insiders have superior knowledge about future earnings performance. We find that an insider's sudden silence following consecutive sells predicts a 0.19% (t-stat. $= 2.33$) more positive 3-day earnings announcement cumulative abnormal return (CAR) in the following quarter. The sudden silence following an insider's routine purchases predicts a negative earnings announcement CAR of -0.10% (t-stat. $= -1.04$). The results support our hypothesis that routine insiders strategically choose to be silent in order to take advantage of their superior information about firms' future cash flow realizations.

[7] We tried different versions by varying the holding window from 1 month to 12 months, and the results are qualitatively similar.

[8] We focus on common stocks that are listed on NYSE/AMEX/NASDAQ, and exclude those stocks that have prices less than 1 dollar. We also try other selection criteria, for example, excluding stocks with prices less than 5 dollars, or whose market capitalization is less than the NYSE bottom decile, and the results are similar. Hence, our results are not driven by the micro-cap stocks.

[9] The "Short Swing" rule of the Securities Exchange Act of 1934 requires insiders to return any profit that is made from performing round trading within 6 months to the firm.

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

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We also conduct several tests to examine how long insiders delay their routine trades. Our strategic silence hypothesis predicts that insiders, who are trading on a routine basis, could suddenly choose not to trade if they possess some private information about their firms. If this is the case, the direction of their next trade following the sudden silence should be consistent with the direction of previous routine trades, given that insiders do not permanently cancel their previous routine trades. Consistent with the hypothesis, we find that 47.79% (47.05%) of insiders delay their trades in the same direction (cancel their trades).[10] Only 5.16% of insiders move in the opposite direction of their previous routine trades following the sudden silence. Importantly, the abnormal return following insider silence is concentrated in the period between insiders' sudden silence and their next trade, not the period after their next trade.

We also examine the channels through which the information contained in insider silence is conveyed into stock price. We find that the trading activities of sophisticated investors and analysts' forecasts facilitate the incorporation of the information from insider silence into prices. Hedge fund managers, who are among the most sophisticated investors in financial markets, increase their long positions by 0.063% (t-stat. = 3.17) in the quarter after the sudden insider silence following consecutive sells, but mutual fund managers trade in the direction opposite to the information content of insider silence. Security analysts also revise up their earnings forecast for SSN firms with pending good news.

Our finding that insider silence predicts future abnormal returns implies that investors fail to fully incorporate information embedded in the timing and pattern of routine insiders' trades. If the return predictability of insider silence is truly driven by the market underreacting to less salient signals, the return predictability would be expected to be stronger for firms with a more opaque information environment. Consistent with this idea, the return predictability of insider silence is more pronounced for firms with less analyst coverage. We also find that the return predictability is stronger for firms that are more difficult to arbitrage, using firm size and idiosyncratic volatility as proxies for arbitrage costs. This suggests that frictions against arbitrage prevent sophisticated investors from efficiently incorporating the information of insider silence into stock prices.

Our results are robust with respect to different ways of constructing the insider silence measure, holding up regardless of the method used. We also conduct several tests to rule out alternative explanations for our results. First, the informativeness of insider silence could be correlated with confounding insider trading signals. We show that our results persist after controlling for the existing insider-related predictors, such as the opportunistic trades in the work of Cohen et al. (2012), the net insider demand in the work of Lakonishok and Lee (2001), and the unconditional insider silence in the work of Gao, Ma, and Ng (2015). Second, we exclude the possibility that our silence measure is capturing the effect of known public mispricing signals, by controlling for the 11 prominent asset pricing anomalies studied by Stambaugh, Yu, and Yuan (2012). Finally, our results also remain unchanged when we run panel regressions with firm-year or firm-quarter

[10] We define "cancel" as those insiders who do not trade for the subsequent 24 months following their sudden silence. Defining "cancel" using 12 months or 36 months generates similar results.

fixed effects, indicating firm-level compensation change cannot fully explain our results.

One of the main contributions of this paper is to further our understanding of how psychological biases found in the laboratory manifest themselves in real-world settings (Chen, Moskowitz, and Shue (2016), Hartzmark and Shue (2017)). Our finding suggests that underreaction to the absence or nonoccurrence of events persists outside the laboratory in a market setting where prices are determined by interactions between many investors, including sophisticated arbitrageurs. Our findings are related to the growing body of behavioral finance literature showing that prices underreact to low saliency signals (e.g., DellaVigna and Pollet (2007), Cohen and Frazzini (2008), and Hirshleifer, Hsu, and Li (2013)). Most of these papers document the fact that the market underreacts to low saliency news, while we show that the market also underreacts to the absence of news.

In the context of mergers and acquisitions, Giglio and Shue (2014) find that investors underreact to information about deal completion probability contained in the passage of time. This paper focuses on a different, perhaps more significant aspect: we study the information contained in a individual's choice to not take an action, rather than in the passage of time.

Gao et al. (2015) also examine the information content of insider silence, but they focus on the *unconditional* insider silence, defined as a 12-month period of no insider trading activities. They find that unconditional insider silence negatively predicts future stock returns, as insiders will refrain from selling their own-companies' shares when they anticipate bad news to avoid litigation risks. This paper's findings differ from their results in several important ways. Conceptually, we define silence as an insider-level decision *conditional* on the same insider trading in the same month of previous years. By doing so, we are able to identify silence signals containing both positive and negative news. Insider silence in Gao et al. (2015), however, contains only negative information. Empirically, we show that the return predictability of our sudden silence measure is distinct from the silence measure of Gao et al. (2015). These two measures are only weakly correlated by construction.[11] Finally, from a practitioner's point of view, our long–short strategy generates a Carhart (1997) alpha between 0.53% and 0.87% per month, which is much larger than the 0.24% silence minus sell monthly return spread as shown in their paper. Moreover, a large fraction of the alpha in our strategy comes from the long leg. On the other hand, the majority of the abnormal return in the work of Gao et al. (2015) comes from the short leg, which is less exploitable due to short-sale constraints.

Our study also contributes to the insider trading literature by showing the information content of insider silence. The existing literature mostly focuses on the information content of insiders' active trading, and very few papers investigate its absence, namely, insider silence. We show that even routine insiders

[11] The average cross-sectional correlation between their silence measure and SSN is −0.11, and the correlation with PPN is −0.05. This negative correlation is mainly due to two reasons. First, we code a firm-month as silence if one of the insiders at the firm stops trading after 2 years of consecutive same month trading. However, other insiders of the firm could have traded before this month. Clearly, this would not be defined as silence by Gao et al. (2015). Second, their silence definition would not be considered as silence in our paper if the insider did not trade in the same month of prior years.

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

behave strategically. When they expect good news to be on the way, they postpone or cancel their routine sell. When they expect bad news to be approaching, they delay or cancel their routine purchase. On a similar note, Jagolinzer (2009) examines whether insiders trade strategically under SEC Rule 10b5-1. This rule, enacted in Oct. 2000, allows an insider to prespecify the timing and amount of her trades when she does not possess material nonpublic information. Jagolinzer (2009) finds that insiders tend to initiate a sales plan before pending negative disclosures, and terminate a sales plan early when in possession of pending positive news. Unlike Jagolinzer (2009), we identify routine insiders based on actual trading history instead of relying on trading plans. Silence is a less salient and visible event than the initiation or termination of a sales plan. Moreover, our evidence predates the existence of these plans, so the trades in the plans do not drive our results.

Our finding that insiders can profit from private information through silence has important implications for the regulation and disclosure of insider trading. The current law prohibits insiders from trading on material nonpublic information to maintain market fairness and integrity. However, this paper shows that regulators face a tougher situation as they cannot punish insiders for strategic silence based on private information.[12] One possible way to mitigate opportunistic insider silence behavior is to strengthen a firm's information environment through timely disclosure of material information, as disclosure can create a level playing field between insiders and outside investors and reduce insiders' incentive to engage in strategic silence behavior. Moreover, experimental evidence from the field of psychology (Newman et al. (1980)) suggests that increasing the salience or explicitness of something that is absent causes individuals to entertain possibilities they would normally neglect. Our evidence suggests that prices are indeed inefficient with respect to information embedded in the absence of activities, which could potentially distort capital allocation. In this sense, requiring insiders and firms to explicitly announce the suspension of routine insider trades could raise investors' awareness of insider silence and improve price efficiency. This paper thus echoes Hirshleifer and Teoh (2003) by suggesting that alternative ways of presenting information can have a nonnegligible effect on market prices when investors have limited attention and processing power.

The remainder of the paper is organized as follows: Section II describes our data and presents summary statistics. Section III presents the main empirical results for the predictability of sudden insider silence for firm fundamentals and future returns. In Section IV, we provide some additional analysis aimed at isolating the underlying mechanism driving our results. In Section V, robustness checks are conducted and several alternative explanations are ruled out. Section VI concludes the paper.

[12] The loophole in insider trading regulation is similar to "warrant canaries" in firm's transparency reports. Under the Patriot Act, the FBI can send national security letters (NSLs) to firms and request customer data for investigation. Such NSLs with a built-in gag order prohibits firms from revealing the existence of NSL requests. However, firms strategically utilize the disappearance of warrant canaries to signal to the public. See more about "warrant canaries" at http://www.bbc.com/news/technology-35969735. We thank the referee for bringing this case to our attention.

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II. Data, Variables and Summary Statistics

Our sample is based on all NYSE/AMEX/NASDAQ common stocks (share code 10 or 11), covered in the Center for Research in Security Prices (CRSP)/Compustat merged database from Jan. 1997 to Dec. 2013. The insider trading data are taken from the Thomson Reuters Insider Filing Data Feed, in which only open-market transactions are considered.[13] The U.S. Securities and Exchange Commission (SEC) mandates that all officers and directors, large shareholders (those who own 10% or more of the outstanding shares), and affiliated shareholders report their transactions to the SEC by the tenth of the month following the transactions (prior to Aug. 2002), or within 2 business days (since Aug. 2002). The dataset contains the name and position(s) of each insider, the transaction date, the transaction price and quantity, and the date the filing was received by the SEC. We start our sample from 1997 as 2 years of consecutive same-month trades are needed to define routine insider, and Table 2 reports that silence defined using our way is rare in the early years[14]. To make sure that microstructure-related issues do not drive our results, we exclude those stocks whose month-end price is below $1.[15] We also exclude those stocks with a negative book value of equity. The accounting variables and earnings announcement data are obtained from Compustat. Analyst forecast and recommendation data are taken from the Institutional Brokers' Estimate System (IBES), and data on institutional holdings are from Thomson Reuters. We also utilize hedge fund and mutual fund holdings data from Thomson Reuters Institutional Holdings.[16] For each stock in the sample, we compute its quarterly hedge (mutual) fund holdings as the sum of shares held by all hedge (mutual) funds reported at each quarter-end divided by the total number of shares outstanding.

Our empirical strategy for identifying sudden insider silence is simple and intuitive. Building on Cohen et al. (2012), we analyze each insider's past trading history and look for consistent patterns in the timing of buying or selling.[17] If the insider sells (purchases) in the same month for 2 consecutive years, we look for a sell (purchase) in the same month in the third year. If, in this month, the insider continues to sell (purchase), we put the insider and his trading action in the SSS (PPP) group. If the insider does not sell (purchase) in this month, we put him and his nontrading action in the SSN (PPN) group.[18] For example, if insider K sold stock A in both Jan. 2000 and 2001, but did not trade in Jan. 2002, then insider K and stock A are classified as SSN = 1 for Jan. 2002. Our methodology is different from Cohen et al. (2012) mainly in two ways. First, we condition on the sign

[13] We exclude records with a cleanse code of "S" or "A." Open market purchases and sales are those with a trancode of "P" or "S." Following Sias and Whidbee (2010), private transactions with trancode "K" and "J" prior to Apr. 1991 are taken as public transactions.

[14] We also replicate the results for the sample starting from 1988, and all results retain.

[15] We tried various versions of excluding the small stocks, for example, excluding those stocks with share price less than $5, or market capitalization less than the NYSE 10th percentile breakpoint, yielding similar results.

[16] We thank Wenxi Jiang for providing hedge fund holdings data. The detailed method used to extract hedge fund holdings data can be found in Jiang (2018).

[17] We consider all corporate insiders in our main empirical analyses. The result is similar if we only include officers and directors as corporate insiders.

[18] 51% of SSN and 44% of PPN are from officers and directors. CEO comprises 14.8% and 16.3% of SSN and PPN, respectively.

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

of the trade in the definition of 2 consecutive-year trades, and their definition of routine insider does not. That is, insider K who sells in Mar. 2001 and buys in Mar. 2002 has not conducted consecutive trades by our definition, but has according to Cohen et al. (2012). Second, we focus on the no trade month, while Cohen et al. (2012) focus on the trades of insiders after they have been classified as being either routine or opportunistic. After defining the silence measures (SSN and PPN) at the individual insider level, we aggregate the insider-level measure to the firm level by defining a firm-month dummy SSN (PPN) equal to 1 when at least one insider at this firm-month has an SSN (PPN) equal to 1, and 0 otherwise.[19]

Overall, 15.38% of total insider transactions are associated with an insider to buy or sell in the same month for 2 consecutive years. Conditioning on consecutive same-month selling, 66.93% of insiders stopped selling in the same month of the third year, which is 26.95% of total consecutive trades observations. Conditioning on consecutive same-month purchasing, 66.02% of insiders suddenly stopped buying in the same month of the third year, which is 36.05% of total consecutive trades observations. To be clear, we are not arguing that all sudden insider silence is driven by private information, as insiders may stop trading for many reasons. Instead, we contend that part of this sudden silence behavior is motivated by information reasons.[20]

Panel A of Table 1 reports the summary statistics of our variables. PPN and SSN account for 0.96% and 2.77% of the whole universe, respectively. An average firm in our sample has 9 analysts following it, and 44% of its shares is held by institutional investors. Panel C reports the characteristics of firms with insider silence SSN and PPN, and compare them with stocks in the entire CRSP universe. On average, SSN firms have larger market capitalization and lower BM ratio compared to an average stock in CRSP. They are also past loser stocks, but are heavily traded. Consistent with their large market capitalization, these stocks are covered by a greater number of analysts and have higher institutional ownership. In contrast, PPN firms are smaller firms with high past 12-month returns. These stock characteristics indicate that, if anything, SSN stocks should underperform PPN stocks unconditionally. As we show in Section III.B.2, the return predictability of insider silence become stronger after adjusting for the value and momentum factors. Panel D of Table 1 reports the insider-level characteristics, separately for all insiders in the Thomson Reuters database and our sudden silence universe. In our sample, there are 8,931 and 25,601 unique insiders that become silent following consecutive 2-year buying and selling, respectively. Insiders in our silence universe conducts more trades on average compared with an average insider in the Thomson Reuters database, which is not surprising given our identification of routine insiders. In terms of the number and dollar amount of shares per trade, they are similar to the other insiders.

[19]For insider sales, 74.2% of observations have only one insider becoming silent following routine selling within a firm-month. A total of 81.1% of observations have only one insider becoming silent following routine purchasing within a firm-month.

[20]Insiders may stop selling when they no longer have any stock positions in the firm. However, we verified in our sample that the median insiders have 66,865 shares in the firm before their silence month, which is more than 4 times of the median insider trade size.

Figure 1 plots the distribution of insider silence observations by calendar month. The figure shows that insider silence observations are fairly distributed across all calendar months, and are slightly more concentrated in February, May, August, and November.

FIGURE 1
Calendar Month Distribution of Sudden Insider Silence

Figure 1 shows the calendar month distribution of sudden insider silence. SSN (PPN) is a firm-month dummy variable equal to 1 if a firm has any insider who sells (purchases) consecutively in the same calendar month for the previous 2 years, but does not trade in the same month in the third year. The blue/darker (red/lighter) bar represents SSN (PPN).



Table 2 reports the number of SSN and PPN observations each year, as well as the monthly total market capitalization of firms associated with insider silence (PPN or SSN) as a percentage of the entire U.S. stock market capitalization in

TABLE 1
Descriptive Statistics

Table 1 presents the descriptive statistics. Panel A displays the full-sample summary statistics of variables from 1997 to 2013, except for hedge fund holdings for which the sample period is from 1997 to 2012. SSN (PPN) is a firm-month dummy variable equal to 1 if a firm has any insider who sells (purchases) consecutively in the same calendar month for the previous 2 years, but does not trade in the same month this year. Panel B displays the correlation table for silence PPN, SSN, and other firm characteristics. Panel C shows the characteristics of firms associated with sudden insider silence SSN and PPN. Panel D shows the insider-level characteristics. Panel E displays the distribution of the number of days between insiders' trades and their SEC reporting dates.

Panel A. Summary Statistics of Variables

Variable	Definition	Mean	Median	Q1	Q3	Std. Dev.
MOM	Past 1-year return	17.11%	13.72%	−12.34%	40.67%	59.12%
RET1	Past 1-month return	1.52%	0.41%	−6.49%	7.53%	18.32%
ln(SIZE)	Natural log of market capitalization	5.69	5.57	4.19	7.05	2.01
ln(BM)	Natural log of book/market ratio	−0.68	−0.59	−1.16	−0.11	0.85
CAR(−1,+1)	Earnings surprise	0.15%	−0.07%	−4.02%	4.02%	8.76%
ROA	Return on assets	−0.47%	0.44%	−0.50%	1.75%	5.58%
OCF	Operating cash flow	1.90%	2.27%	−0.81%	7.11%	11.98%
IOR	Institutional ownership	43.86%	41.58%	13.91%	71.17%	32.24%
HFH	Hedge fund holding	3.68%	1.32%	0.00%	4.85%	5.63%
MFH	Mutual fund holding	15.83%	12.70%	3.05%	26.41%	14.05%
VOL	Total return volatility	0.68%	0.37%	0.17%	0.82%	0.85%
COV	Analyst coverage	9.37	7.00	3.00	13.00	8.63
PPN	Silence following purchases	0.96%	0.00%	0.00%	0.00%	9.74%
PPP	Consecutive purchases	0.55%	0.00%	0.00%	0.00%	7.38%
SSN	Silence following sells	2.77%	0.00%	0.00%	0.00%	16.41%
SSS	Consecutive sells	1.62%	0.00%	0.00%	0.00%	12.62%

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https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

TABLE 1 (continued)
Descriptive Statistics

Panel B. Correlation Table

	ln(SIZE)	ln(BM)	RET1	MOM	IVOL	TURNOVER	COVERAGE	IOR	ROA	CF	MF%	HF%	OPPBUY	OPPSELL	NPR	SSN	PPN
ln(SIZE)	1.000																
ln(BM)	−0.303	1.000															
RET1	0.024	0.044	1.000														
MOM	0.107	−0.112	0.280	1.000													
IVOL	−0.353	−0.067	0.056	0.190	1.000												
TURNOVER	0.228	−0.197	−0.015	0.010	0.259	1.000											
COVERAGE	0.764	−0.236	−0.016	−0.013	−0.202	0.334	1.000										
IOR	0.656	−0.133	−0.019	−0.004	−0.297	0.308	0.547	1.000									
ROA	0.097	0.039	0.024	0.050	−0.158	−0.036	0.055	0.085	1.000								
CF	0.124	0.018	0.013	0.036	−0.127	−0.002	0.104	0.117	0.336	1.000							
MF%	0.139	−0.028	−0.003	0.005	−0.059	0.069	0.122	0.198	0.017	0.020	1.000						
HF%	0.033	−0.006	−0.002	−0.001	−0.010	0.053	0.028	0.108	−0.005	−0.003	0.945	1.000					
OPPBUY	−0.005	0.027	−0.016	−0.046	−0.020	−0.013	−0.001	−0.008	−0.003	−0.006	−0.004	0.001	1.000				
OPPSELL	0.206	−0.077	0.028	0.071	−0.076	0.072	0.179	0.174	0.036	0.045	0.040	0.009	0.006	1.000			
NPR	−0.349	0.210	0.011	−0.169	0.093	−0.145	−0.277	−0.308	−0.057	−0.079	−0.074	−0.016	0.141	−0.235	1.000		
SSN	0.117	−0.057	−0.010	−0.035	−0.048	0.067	0.116	0.112	0.017	0.023	0.025	0.007	0.004	0.062	−0.092	1.000	
PPN	−0.022	0.032	0.001	0.005	−0.010	−0.031	−0.025	−0.035	0.001	−0.003	−0.008	−0.003	0.022	−0.003	0.056	−0.016	1.000

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https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

TABLE 1 (continued)
Descriptive Statistics

Panel C. Firm-Level Characteristics

Variable	No. of Obs.	Mean	Median	P25	P75
SSN = 1					
MKTCAP ($millions)	27,987	7,022.3	1,300.9	407.1	4,561.9
BOOK_TO_MARKET	27,987	0.45	0.36	0.21	0.58
1_MONTH_RETURN	27,983	0.32%	0.23%	−6.22%	6.54%
12_MONTH_RETURN	27,987	2.85%	0.34%	−24.20%	23.94%
IVOL	27,987	2.33%	1.83%	1.20%	2.85%
TURNOVER	25,837	0.97%	0.74%	0.39%	1.27%
COVERAGE	26,794	10.08	8.00	4.00	15.00
IO	26,795	67.3%	71.9%	51.4%	86.7%
PPN = 1					
MKTCAP ($millions)	10,989	1,621.3	153.8	48.3	619.4
BOOK_TO_MARKET	10,989	0.86	0.70	0.44	1.09
1_MONTH_RETURN	10,988	0.94%	0.46%	−5.39%	6.39%
12_MONTH_RETURN	10,989	13.29%	7.76%	−15.81%	33.19%
IVOL	10,989	2.89%	2.16%	1.34%	3.69%
TURNOVER	10,349	0.39%	0.19%	0.08%	0.45%
COVERAGE	9,953	3.72	2.00	0.00	5.00
IO	9,955	33.9%	27.6%	10.8%	52.5%
CRSP Sample					
MKTCAP ($millions)		1,696.7	224.5	56.5	943.7
BOOK_TO_MARKET		1.63	0.64	0.35	1.06
1_MONTH_RETURN		1.07%	0.22%	−6.32%	7.13%
12_MONTH_RETURN		11.54%	4.29%	−19.75%	30.56%
IVOL		3.23%	2.47%	1.55%	4.03%
TURNOVER		0.48%	0.33%	0.14%	0.62%
COVERAGE		5.13	2.54	0.32	7.28
IO		39.8%	38.5%	14.8%	62.2%

Panel D. Insider-Level Characteristics

	All Insiders Universe		
	All Trades	Purchase	Sell
UNIQUE_INSIDERS(#)	155,838	81,696	113,386
TOTAL_TRADES(#)	1,340,861	392,991	947,870
MEDIAN_TRADES(#)_PER_INSIDER	3	2	3
MEDIAN_SHARES(#)_PER_TRADE	9,600	5,000	10,000
MEDIAN_VALUE_PER_TRADE(US$)	136,800	37,125	228,210

	Insider Silence Universe		
	PPN + SSN	PPN	SSN
UNIQUE_INSIDERS(#)	33,235	8,931	25,601
TOTAL_TRADES(#)	736,099	213,576	593,697
MEDIAN_TRADES(#)_PER_INSIDER	12	9	13
MEDIAN_SHARES(#)_PER_TRADE	10,000	7,000	10,000
MEDIAN_VALUE_PER_TRADE(US$)	190,331	70,400	247,480

Panel E. Number of Days Between Transaction and Reporting Date

Transaction	Mean	Q1	Median	Q3	Std. Dev.
PURCHASE	14.57	1	4	18	32.4389
SELL	9.95	1	2	5	24.7392
ALL	11.96	1	3	12	28.4391

TABLE 2
Distribution of Sudden Insider Silence by Year

Table 2 shows the number of firm-months with sudden insider silence observations by each year. SSN (PPN) is a firm-month dummy variable equal to 1 if a firm has any insider who sells (purchases) consecutively in the same calendar month for the previous 2 years, but does not trade in the same month this year. PPN% (SSN%) represents the monthly total market capitalization of firms associated with insider silence measure PPN (SSN) as a percentage of the entire U.S. stock market capitalization in that month.

Year	PPN	SSN	PPN%	SSN%	PPN% + SSN%
1988	10	0	0.02%	0.00%	0.02%
1989	11	0	0.03%	0.00%	0.03%
1990	17	0	0.04%	0.00%	0.04%
1991	64	0	0.18%	0.00%	0.18%
1992	51	1	0.34%	0.00%	0.34%
1993	0	9	0.00%	0.03%	0.03%
1994	14	24	0.01%	0.08%	0.09%
1995	25	34	0.05%	0.08%	0.12%
1996	34	52	0.14%	0.11%	0.25%
1997	138	179	0.29%	0.52%	0.81%
1998	665	1,296	0.51%	3.39%	3.90%
1999	880	1,404	0.51%	5.87%	6.39%
2000	1,149	1,156	0.54%	7.37%	7.91%
2001	1,089	1,173	0.71%	7.25%	7.95%
2002	784	1,308	0.64%	5.18%	5.82%
2003	840	1,527	0.95%	5.43%	6.38%
2004	617	1,550	0.53%	4.84%	5.37%
2005	541	2,125	0.45%	7.08%	7.53%
2006	651	2,677	0.57%	8.88%	9.45%
2007	631	2,623	0.34%	8.62%	8.96%
2008	646	2,929	0.74%	9.05%	9.79%
2009	995	2,018	0.40%	6.76%	7.17%
2010	931	1,473	0.53%	5.88%	6.41%
2011	506	1,410	0.47%	5.48%	5.95%
2012	503	1,766	0.40%	6.59%	6.98%
2013	661	2,036	0.67%	7.95%	8.63%

that month. The number of observations is quite small in the early years, but it dramatically increases and then stabilizes starting from 1997. Hence, all our subsequent tests use the sample from 1997 to 2013. In addition, the insider silence portfolio is economically important in terms of market capitalizations. On average, the percentage of firm-months associated with PPN is 0.54% of U.S. stock market capitalization, and 6.24% for SSN. For comparison, the "small value" portfolio, which is featured in hundreds of asset pricing papers and which remains one of the most studied anomalies in the literature, is only approximately 0.50% of the U.S. stock market capitalization.

III. Information Content of Insider Silence

In this section we examine the informativeness of insider silence by looking at its predictability for firm fundamentals and stock returns.

A. Insider Silence and Firm Fundamentals

Our paper hypothesizes that routine insiders choose to be silent for information-related reasons. As corporate insiders are involved in the day-to-day operations of their firms, the information they possess is more likely related to firm fundamentals. As such, insider silence following routine sells could signal improving firm fundamentals, which is reflected in a firm's rising earnings and cash flows. Silence following routine purchases could indicate deteriorating firm fundamentals. In this subsection, we test our hypothesis by examining the predictability of insider silence for firm profitability.

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We conduct our test using the following regression specification:

$$\text{PROF}_{i,t} = a + b\text{SSN}_{i,t} + c\text{PPN}_{i,t} + dX_{i,t-1} + \epsilon_{i,t}, \quad (1)$$

where we regress firm i's profitability in quarter t ($\text{PROF}_{i,t}$) on the insider silence dummy SSN and PPN in the same quarter t, controlling for other predictors of profitability. We use both the return on assets and operating cash flow (scaled by lagged total assets) as proxies for profitability. SSN (PPN) is a dummy variable equal to 1 if the firm has any insider who (purchases) in the same calendar month for 2 consecutive years, but does not trade in the same month of the third year, and 0 otherwise. We aggregate SSN and PPN to firm-quarter level to align with the dependent variable, which is measured at quarterly frequency. We regress current-quarter ROA and cash flow on SSN and PPN because a firm's quarterly fundamental performance is usually announced to the public early, or in the middle, of next quarter. Since this information will remain (partially) private until next quarter, insiders could trade (or not trade) strategically on their private information on current-quarter performance.

Following Fama and French (2006) and Hou, Van Dijk, and Zhang (2012), we include lagged profitability from the previous quarter and 4 quarters ago, the level of accruals in the previous fiscal year (ACCRUAL), the growth rate of total assets (ASSET_GROWTH), a dummy indicating negative earnings (NEG_ROE), dividends (scaled by total assets) (DIV), and a nondividend-paying dummy (NEG_DIV). To examine whether our insider silence measure contains distinct information in addition to existing insider trading related predictors, we control for the opportunistic buy (OPPBUY) and opportunistic sell (OPPSELL) dummy of Cohen et al. (2012), and the insider net purchase ratio (NPR) as defined by Lakonishok and Lee (2001). The NPR is calculated as

$$\text{NPR} = \frac{\#\text{INSIDER_BUY}_{t-1,t-6} - \#\text{INSIDER_SELL}_{t-1,t-6}}{\#\text{TOTAL_TRANSACTIONS}_{t-1,t-6}}.$$

We also control for industry and quarter fixed effects in the regression, in which industry is defined at 2-digit Standard Industrial Classification (SIC) code level. Standard errors are double clustered at firm and quarter dimensions, following Petersen (2009).

The results are reported in Panel A of Table 3. Consistent with our hypothesis, sudden insider silence predicts firm profitability. Columns 1 and 2 present the results when the dependent variable is return on assets (ROA). The coefficient on SSN is 0.0031 (t-stat. $=4.04$) in column 1 with year–quarter fixed effects. This means that firms with insider silence SSN have 0.31% higher ROA in the current quarter compared to other firms without an insider silence signal SSN.[21] The coefficient on PPN is negative, but its magnitude is smaller than that of SSN and is not significant. In column 2, we add industry fixed effects along with quarter fixed effects. The positive coefficient on SSN is not affected and is at 0.0033 (t-stat. $=5.75$). The economic magnitude is also quite large. The mean

[21] Our use of year–quarter fixed effects facilitates a cross-sectional interpretation of our results. Essentially we are comparing firms with an insider silence signal with other firms without insider silence in the same quarter.

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

and standard deviation of quarterly ROA in our sample is −0.47% and 5.58%, respectively. A firm experiences 0.33% higher ROA in the quarter of insider silence SSN, which is about 5.9% of the sample standard deviation. Our results cannot be explained by the fact that firms with an insider silence signal have inherently different profitability, since we always control for lagged profitability in the regression. In columns 3 and 4, we replace the ROA with the operating cash flow measure. Cash flow is more difficult to be manipulated by managers, thus could

TABLE 3
Insider Silence and Firm Fundamentals

Table 3 displays the regression results of quarterly ROA and cash flow (scaled by lagged total assets) on the sudden insider silence dummies SSN and PPN. Panel A shows the regression results of return on assets (ROA) and cash flow in quarter t on SSN and PPN measured in the same quarter. Panel B shows the regression results of ROA and cash flow in quarter $t+1$ on SSN and PPN in quarter t. In columns 1 and 2, the dependent variable is ROA, defined as income before extraordinary items over lagged total assets. In columns 3 and 4, the dependent variable is operating cash flow, defined as cash flow from operations scaled by lagged total assets. SSN (PPN) is a firm-month dummy variable equal to 1 if a firm has any insider who sells (purchases) consecutively in the same calendar month for the previous 2 years, but does not trade in the same month this year. We control for lagged profitability from the previous quarter (ROA(−1)) and four quarters ago (ROA(−4)), the level of accruals in the previous fiscal year (ACCRUAL), annual asset growth rate (ASSET_GROWTH), a dummy indicating negative earnings (NEG_ROE), dividends (scaled by total assets) (DIV) and a nondividend-paying dummy (NEG_DIV). We further control for opportunistic buying (OPPBUY) and opportunistic selling (OPPSELL) following Cohen et al. (2012) and for the insider net purchase ratio (NPR) following Lakonishok and Lee (2001). Standard errors are double-clustered at firm and quarter level. Industry and quarter fixed effects are included as indicated. The sample period runs from 1997 to 2013. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. t-statistics are shown in parentheses.

Panel A. Regression of Current-Quarter ROA and Cash Flow on SSN and PPN

	ROA		OPERATING_CASH_FLOW	
	1	2	3	4
SSN	0.0031***	0.0033***	0.0077***	0.0084***
	(4.04)	(5.75)	(5.29)	(5.83)
PPN	−0.0002	−0.0001	−0.0002	−0.0002
	(−0.15)	(−0.14)	(−0.10)	(−0.09)
ROA(−1)	0.0676**	0.0605**		
	(2.51)	(2.42)		
ROA(−4)	0.0343**	0.0320**		
	(2.41)	(2.33)		
CF(−1)			0.1580***	0.1477***
			(2.95)	(2.76)
CF(−4)			0.1121***	0.1029***
			(3.26)	(3.13)
ACCRUAL	−0.0004	−0.0003	0.0032	0.0031
	(−0.35)	(−0.30)	(0.15)	(0.15)
ASSET_GROWTH	−0.0000	−0.0000	0.0002	0.0002
	(−0.41)	(−0.39)	(0.14)	(0.14)
NEG_ROE	−0.0451***	−0.0418***	−0.0643***	−0.0615***
	(−18.26)	(−19.31)	(−6.88)	(−7.19)
DIV	0.0779***	0.0912***	0.1247**	0.1505**
	(3.86)	(3.86)	(2.34)	(2.47)
NEG_DIV	−0.0073***	−0.0070***	−0.0122***	−0.0130***
	(−7.78)	(−6.72)	(−5.64)	(−5.33)
OPPBUY	0.0079***	0.0083***	0.0144***	0.0146***
	(7.02)	(8.46)	(9.08)	(9.22)
OPPSELL	0.0019*	0.0018*	0.0039**	0.0043**
	(1.74)	(1.71)	(2.03)	(2.39)
NPR	−0.0038***	−0.0042***	−0.0089***	−0.0096***
	(−4.39)	(−5.01)	(−6.29)	(−6.79)
Fixed effects	Quarter	Industry/ Quarter	Quarter	Industry/ Quarter
R^2	0.071	0.078	0.296	0.324
No. of obs.	204,552	196,020	199,363	190,883

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https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

TABLE 3 (continued)
Insider Silence and Firm Fundamentals

Panel B. Regression of Next-Quarter ROA and Cash Flow on SSN and PPN

	ROA		OPERATING_CASH_FLOW	
	1	2	4	5
SSN	0.0036***	0.0036***	0.0095***	0.0102***
	(4.12)	(4.03)	(5.90)	(6.09)
PPN	−0.0019	−0.0019	−0.0025	−0.0025
	(−1.34)	(−1.32)	(−1.15)	(−1.12)
ROA(−1)	0.0677**	0.0605**		
	(2.51)	(2.43)		
ROA(−4)	0.0343**	0.0319**		
	(2.40)	(2.33)		
CF(−1)			0.1580***	0.1477***
			(2.95)	(2.76)
CF(−4)			0.1121***	0.1029***
			(3.25)	(3.13)
ACCRUAL	−0.0004	−0.0003	0.0032	0.0031
	(−0.34)	(−0.30)	(0.15)	(0.15)
ASSET_GROWTH	−0.0000	−0.0000	0.0002	0.0002
	(−0.41)	(−0.38)	(0.14)	(0.14)
NEG_ROE	−0.0451***	−0.0418***	−0.0642***	−0.0614***
	(−18.31)	(−19.38)	(−6.88)	(−7.20)
DIV	0.0779***	0.0912***	0.1248**	0.1506**
	(3.85)	(3.86)	(2.34)	(2.48)
NDIV	−0.0073***	−0.0070***	−0.0122***	−0.0129***
	(−7.78)	(−6.74)	(−5.63)	(−5.32)
OPPBUY	0.0079***	0.0083***	0.0144***	0.0146***
	(7.03)	(8.47)	(9.00)	(9.15)
OPPSELL	0.0019*	0.0018*	0.0038**	0.0043**
	(1.75)	(1.71)	(2.02)	(2.39)
NPR	−0.0039***	−0.0043***	−0.0089***	−0.0096***
	(−4.47)	(−5.11)	(−6.24)	(−6.77)
Fixed effects	Quarter	Industry/ Quarter	Quarter	Industry/ Quarter
R^2	0.072	0.079	0.296	0.325
No. of obs.	204,552	196,020	199,363	190,883

reflect firm's underlying profitability better than ROA.[22] The coefficient on SSN in this case is approximately 0.008, and it is significant at the 1% level under all specifications. The coefficient implies that a firm experiences 0.8% higher quarterly operating cash flow following SSN compared to other firms, which is 6.6% of the sample standard deviation. The coefficient on PPN is negative but not significant, suggesting that the information contained in insider silence PPN is much noisier compared to SSN.

In Panel B of Table 3, we further examine whether insider silence can predict firm fundamentals in the next quarter following their silence behavior. The coefficient on SSN is still positive and significant when the dependent variable is next-quarter ROA and cash flow, and the coefficient on PPN is not significant. This result suggests that the private information contained in insider silence extends beyond the current quarter, consistent with Ke et al. (2003).

Overall, the evidence that insider silence, particularly SSN, predicts current and future firm profitability supports our assertion that routine insiders' sudden

[22]Using a cash flow based profitability measure also helps rule out the possibility that our finding is driven by earnings manipulation from managers to inflate the selling price for their subsequent sells.

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

silence behavior is motivated by private information related to firm fundamentals. If the market underreacts to the valuable information embedded in insider silence, abnormal returns should be expected following insider silence. Moreover, the direction of return predictability should be the same as the fundamental predictability.

B. Insider Silence and Future Stock Returns

The results in Section III.A show that the sudden silence of routine insiders contains value-relevant information about firm fundamentals. However, this does not necessarily imply return predictability as long as investors can quickly figure out the information content of sudden insider silence. However, there are good reasons to believe that investors may fail to unravel this information quickly. Citing a great amount of experimental evidence in the field of psychology, Hearst (1991) shows that human beings have difficulty using the mere absence of something as a basis for the efficient and appropriate processing of information. Griffin and Tversky (1992) argue that investors tend to underreact to low salience signals. Hirshleifer and Teoh (2003) argue that information that is presented in a salient, easily processed form is absorbed more easily compared to information that is only implicit in the public information set. Silence is, by definition, a less visible signal and, hence, could well be ignored by investors when making forecasts on firm value.

1. Fama–MacBeth Regression

Our test on return predictability employs Fama and MacBeth (1973) regressions of 3-month-ahead to 12-month-ahead excess stock returns on firm-month dummies SSN and PPN, which indicate sudden insider silence following 2 consecutive-year transactions—sell and purchase, respectively.[23] In these tests, the universe is all CRSP stocks with a price greater than or equal to $1 at the end of the preceding month that have Compustat data available for test variables. By including all the stocks, the regression coefficients on SSN/PPN reflect the difference in future returns between having an insider silence signal versus having no insider trading. The standard errors are Newey–West (1987) adjusted.

$$r^{e}_{i,t+1,t+h} = a + b\mathrm{SSN}_{i,t} + c\mathrm{PPN}_{i,t} + dX_{i,t} + \epsilon_{i,t}. \tag{2}$$

Here, $r^{e}_{i,t+1,t+h}$ is firm i's excess return from month $t+1$ to $t+h$, $\mathrm{SSN}_{i,t}$ ($\mathrm{PPN}_{i,t}$) is a dummy variable equal to 1 if month t is an insider silence month following a consecutive 2 year sell (purchase), and 0 otherwise. X includes well-known determinants of cross-sectional stock returns, including size (the natural log of market capitalization), book-to-market (the natural log of book-to-market ratio), 1-month lagged returns, and momentum (cumulative returns from month $t-12$ to $t-2$). We also estimate the regression controlling for opportunistic buy and opportunistic sell dummies following Cohen et al. (2012) and the insider net purchase ratio (NPR) following Lakonishok and Lee (2001).

Table 4 reports the regression results. For all return horizons, insider silence following consecutive sells (SSN = 1) strongly predicts positive returns in the

[23] All our return predictability results go through if we run pooled regressions with month fixed effects, and standard errors are clustered by month and/or firm.

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TABLE 4

Fama–MacBeth Regression of Future Returns on Sudden Insider Silence

Table 4 displays the Fama–MacBeth (1973) regressions of returns on firm-month dummies SSN (sudden silence following consecutive sell) and PPN (sudden silence following consecutive purchases) in the prior month, over the 1997 to 2013 sample period. The dependent variables are the future cumulative 3-, 6-, and 12-month returns (in %). SSN is a dummy variable that is equal to 1 if a firm has any insider who sells consecutively in the same calendar month for the previous 2 years, but does not trade in the last month. Similarly, PPN is a dummy variable that equals 1 if the firm has any insider who purchases consecutively in the same month for the previous 2 years, but does not trade in the last month. ln(SIZE) and ln(BM) are the natural logarithms of a firm's market capitalization and book-to-market ratio. RET1 (MOM) is the return of a firm over the prior month (year, excluding the prior month $t-1$). PRICE is firm's last month closing price. In columns 4–6, we further control for opportunistic buying (OPPBUY) and opportunistic selling (OPPSELL) following Cohen et al. (2012) and for the insider net purchase ratio (NPR) following Lakonishok and Lee (2001). t-statistics are Newey–West (1987) adjusted and are shown below the estimates in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	CUMULATIVE 3_MONTHS	CUMULATIVE 6_MONTHS	CUMULATIVE 12_MONTHS	CUMULATIVE 3_MONTHS	CUMULATIVE 6_MONTHS	CUMULATIVE 12_MONTHS
	1	2	3	4	5	6
RET1	−2.822***	−2.851**	0.183	−2.860***	−2.866**	0.248
	(−3.21)	(−2.28)	(0.11)	(−3.25)	(−2.30)	(0.14)
MOM	1.119*	1.112	−1.126	1.165*	1.133	−1.206
	(1.80)	(0.90)	(−0.54)	(1.90)	(0.92)	(−0.58)
PRICE	0.000	0.000	0.000	0.000	0.000	0.000
	(0.40)	(0.50)	(0.78)	(0.50)	(0.62)	(0.89)
ln(SIZE)	−0.090	−0.242	−0.551	−0.063	−0.230	−0.584
	(−0.53)	(−0.77)	(−0.99)	(−0.37)	(−0.73)	(−1.06)
ln(BM)	1.070***	1.792**	2.434*	1.041***	1.778**	2.461*
	(2.75)	(2.46)	(1.80)	(2.73)	(2.49)	(1.87)
SSN	1.065***	2.057***	3.190***	1.126***	2.069***	3.043***
	(3.67)	(4.49)	(3.72)	(3.93)	(4.62)	(3.81)
PPN	−0.983**	−1.644*	−2.344	−1.068**	−1.677*	−2.324
	(−2.03)	(−1.81)	(−1.55)	(−2.29)	(−1.94)	(−1.58)
OPPBUY				1.338***	1.633***	2.214***
				(4.67)	(3.17)	(2.78)
OPPSELL				−0.237	0.088	1.198
				(−1.08)	(0.23)	(1.50)
NPR				0.237*	0.106	−0.251
				(1.92)	(0.44)	(−0.52)
INTERCEPT	3.702**	7.757**	15.693**	3.560**	7.693**	15.832***
	(2.24)	(2.41)	(2.58)	(2.15)	(2.39)	(2.64)
R^2	0.04	0.03	0.04	0.04	0.04	0.04
N	921,219	921,246	921,269	921,219	921,246	921,269

future. For example, in the case of 3-month-ahead cumulative returns ($h=3$) as shown in column 1, a stock falling into the SSN group, is predictive of the coming 3-month cumulative return being 1.07% (t-stat. $=3.67$) higher. Columns 2 and 3 show that the coefficient on SSN increases almost monotonically with return horizons, suggesting that the information contained in insider silence (SSN) is not short-lived and does not get reflected into stock prices in a timely fashion. The fact that strong return predictability on SSN is evident beyond the first month following insider silence also alleviates the concern that our strategy is not implementable. Prior to 2002, insider trading reports to SEC could be delayed to the tenth day of the month following the insider trading month. Thus, an investor implementing our strategy would have to wait until 1 month after the expected insider trading month to confirm an insider silence signal. Given this reporting delay, in Table A6 of the Supplementary Material, we rerun the return predictability test by skipping a month between insider silence and return measurement month. The results are virtually identical to those in Table 4, suggesting that our results are not sensitive to the timing convention we employ here. We discuss more on this issue in Section V.A.4.

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The predictability of insider silence following consecutive purchase (PPN = 1) is slightly weaker than that of SSN, and is not significant for the 12-month horizon. The coefficient means that if the stock falls into the PPN group, it predicts that the coming 3-month cumulative return is −0.98% (t-stat. = 2.03) lower.

Our results could be driven by known insider trading signals, such as the opportunistic trades in Cohen et al. (2012) and the insider net purchase ratio (NPR) that have been widely used in the previous literature. Although by construction, our sudden insider silence measure and the traditional insider trading variables are unlikely to overlap, as our identification focuses on the "no trade" activity following consecutive trades, while Cohen et al. (2012) focus on trades submitted by those opportunistic traders. However, for those firm-months with sudden insider silence, opportunistic insiders at the same firm could trade in the direction of our prediction. To exclude such a possibility, we run our Fama–MacBeth (1973) regression, controlling for the opportunistic buy and opportunistic sell dummy, and the insider net purchase ratio (NPR). Columns 4–6 of Table 4 show that our results remain the same when controlling for these traditional insider trading variables. SSN predicts a 1.13% (t-stat. = 3.93) increase and PPN predicts a 1.07% (t-stat. = 2.29) decrease for the cumulative 3-month returns. Consistent with the literature, the opportunistic buy and net purchase ratios predict return positively, while the coefficient on opportunistic sell is negative but insignificant.

The tests on fundamental and return predictability show that SSN has stronger predictive power than PPN. The weak return predictability of PPN compared with SSN is potentially expected. Insiders typically have both human capital and financial wealth concentrated in a single firm. An insider's willingness to purchase or stop selling additional shares would increase risk, and thus should be very informative of coming positive news. Yet the willingness to sell or stop buying is equally likely driven by diversification motives. For example, insiders could stop routine buying if they feel too much risk concentrated in a single firm after consecutive purchases in previous years. In this sense, the asymmetry of return predictability between SSN and PPN is similar to that between insider purchase and sell transactions, with insider purchases being a stronger and more robust predictor of stock return compared to insider sales.

2. Portfolio Returns

We also use the calendar-time portfolio approach (Mitchell and Stafford (2000)) to analyze the returns of portfolios formed according to our firm-level sudden insider silence signal. For each month from Jan. 1997 to Dec. 2013, portfolios are formed based on the previous sudden insider silence measure. At the end of each month t, we form 2 portfolios (SSN and PPN) based on whether the current month is the insider silence month following 2 consecutive-year sells and purchases, respectively.[24] The portfolios are then held over months

[24]Prior to 2002, insider trades can be reported within 10 days following the end of the transaction month. This raises the question of whether our strategy is implementable in real time. Empirically, most of the trades in our sample are actually reported to the SEC within a few days; the median difference between report date and transaction date is only 3 days. In addition, the deadline was changed to 2 days in 2002. Our portfolio results are unaffected using the sample starting from 2002.

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$t+1$ to $t+k$ ($k=1,3,6$). Portfolio returns are equal weighted or value weighted across their constituent stocks. The average portfolio return for month t is the equal-weighted average month t returns of the strategy implemented in the prior month and the strategies formed in the prior k months ($k=1,3,6$). Panel A of Table 5 reports the raw portfolio returns, risk-adjusted portfolio returns, and characteristic-adjusted returns for the equal-weighted portfolios in the case of $k=3$. The Carhart α is obtained by regressing the monthly SSN (or PPN) portfolio excess return on the four factors of Carhart (1997):

$$(3) \qquad R_{i,t} = \alpha_i + b\text{MKTRF}_t + c\text{SMB}_t + d\text{HML}_t + e\text{UMD}_t + \epsilon_t.$$

The variable MKTRF is the excess return of the value-weighted stock market index over the risk-free rate. SMB is the excess return on the portfolio of small stocks over big stocks. HML is the excess return on the portfolio of stocks with a high book-to-market ratio over the portfolio of stocks with a low book-to-market ratio. The variable UMD is the return on high-momentum stocks minus the return on low-momentum stocks, where momentum is measured over months $(-12, -2)$.[25] We also compute the characteristic-adjusted return by subtracting the stock's raw return by the return of the benchmark group to which the stock belongs (see, e.g., Daniel, Grinblatt, Titman, and Wermers (1997)). The $5\times5\times5$ benchmark groups are formed at the end of June of each year based on size, book-to-market ratio, and past 1-year return.[26]

Consistent with the Fama–MacBeth (1973) regression results, the SSN portfolio earns a significant positive 4-factor alpha of 47.1 bps (t-stat. = 3.18) per month. The statistical significance of the PPN portfolio alone is less stable, which is also consistent with our Fama–MacBeth regression results that the predictability of sudden silence following consecutive purchases is in general much weaker.[27] A long–short strategy that longs stocks in the SSN group and shorts stocks in the PPN category yields a monthly Carhart (1997) 4-factor alpha of 53.3 bps (t-stat. = 2.62) with a Sharpe ratio of 0.64. The DGTW-adjusted monthly abnormal return for the long–short portfolio is larger, at 68.4 bps (t-stat. = 3.14), with a Sharpe ratio of 0.76. The bottom row of Table 5 shows that on average, the SSN portfolio contains 365 stocks while the PPN portfolio 134 stocks, suggesting that our portfolios are well diversified. Panel B of Table 5 shows both the value-weighted and equal-weighted monthly alpha of the long–short strategy (SSN − PPN) under different holding periods. The results are robust under different holding horizons for the equal-weighted portfolios. The value-weighted return of the long–short portfolio is much weaker. The difference between equal- and value-weighted portfolios suggests that our results are more pronounced in small stocks, which tend to have a worse information environment and are also more costly to arbitrage.

[25] The Fama–French 3-factor and momentum factor are retrieved from Kenneth R. French's Web site (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/).

[26] The monthly benchmark returns and stock assignments are obtained from Russ Wermer's Web site (http://terpconnect.umd.edu/~wermers/ftpsite/Dgtw/coverpage.htm).

[27] In untabulated results, we compare PPN with PPP portfolios, and we find that the spread is much more negative at −33.8 bps per month.

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TABLE 5

Portfolio Returns Based on Sudden Insider Silence

Table 5 shows the monthly returns and factor-adjusted alphas (in %) for the buy and sell portfolios that follow the sudden insider silence. For each month j from Jan. 1997 to Dec. 2013, portfolios are formed based on preceding insider trading activity and held for 3 months. Stocks in the SSN category in month t (those firms that have insiders sell in month $t-12$ and $t-24$, but do not trade in month t) are held from month $t+1$ to $t+i$ ($i=3$ in Panel A, and $i=1$, 3, 6 in Panel B), and similarly for "PPN." Portfolio returns are equal weighted (EW) or value weighted (VW) across their constituent stocks. We focus on common stocks that are listed on NYSE/AMEX/NASDAQ, and we exclude those stocks whose prices are less than $1. The overall portfolio return for month j is the equal-weighted average month j returns of the strategy implemented in the prior month and strategies formed up to 3 months earlier. The "SSN-PPN" column in Panel A shows the return to a long/short portfolio that is long in stocks with "SSN" and short in stocks with "PPN." Panel B focuses on the return spread of "SSN-PPN" portfolios across different holding windows. The last row of Panel A shows the average number of stocks in each portfolio over time. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. t-statistics are shown in parentheses.

Panel A. Equal-Weighted Portfolio Returns for 3 Months Holding Horizon (1997–2013)

	PPN	SSN	SSN-PPN
RAW_RETURN	0.589*	1.032**	0.443*
	(1.68)	(2.27)	(1.67)
CARHART_ALPHA	−0.063	0.471***	0.533***
	(−0.38)	(3.18)	(2.62)
DGTW_ADJ_RETURN	−0.374**	0.310***	0.684***
	(−2.08)	(2.97)	(3.14)
AVERAGE_STOCKS_NUMBER(MIN)	134 (11)	365 (11)	

Panel B. SSN-PPN Portfolio for Different Holding Horizons (1997–2013)

	EW			VW		
	1 M	3 M	6 M	1 M	3 M	6 M
RAW_RETURN	0.347	0.443*	0.343	−0.180	0.211	−0.165
	(1.04)	(1.67)	(1.42)	(−0.43)	(0.62)	(−0.59)
CARHART_ALPHA	0.466*	0.533***	0.406**	0.112	0.473*	0.044
	(1.70)	(2.62)	(2.28)	(0.31)	(1.89)	(0.22)
DGTW_ADJ_RETURN	0.656**	0.684***	0.559***	−0.060	0.188	−0.085
	(2.26)	(3.14)	(2.80)	(−0.18)	(0.80)	(−0.44)

In Figure 2, we plot the cumulative DGTW-adjusted return of the "PPN," "SSN," and "SSN-PPN" portfolios. Graph A shows that the cumulative DGTW-adjusted return increases gradually in our sample period, and reaches over 140% in year 2013. In Graph B, we plot the average monthly DGTW-adjusted return of the "SSN-PPN" portfolio by calendar year. The DGTW-adjusted returns are positive in 11 out of 17 years. For the years that have negative returns, the economic magnitude is small. In the subsample analysis, we find that the average monthly DGTW-adjusted return of the "SSN-PPN" portfolio is 0.62% (t-stat. = 1.94) from 1997 to 2005, and 0.76% (t-stat. = 2.57) from 2006 to 2013. Overall the result shows that the returns to the strategy are fairly stable across time.

In Table A1 of the Supplementary Material, we report the calendar-time portfolio alpha for the sudden silence measure defined based on 3 consecutive-year trades. The results are stronger when defining silence using a longer trading history. The calendar-time 4-factor alpha for the long–short strategy is larger at 86.6 bps (t-stat. = 2.61) per month, compared with the 53.3 bps under the 2 consecutive-year version.

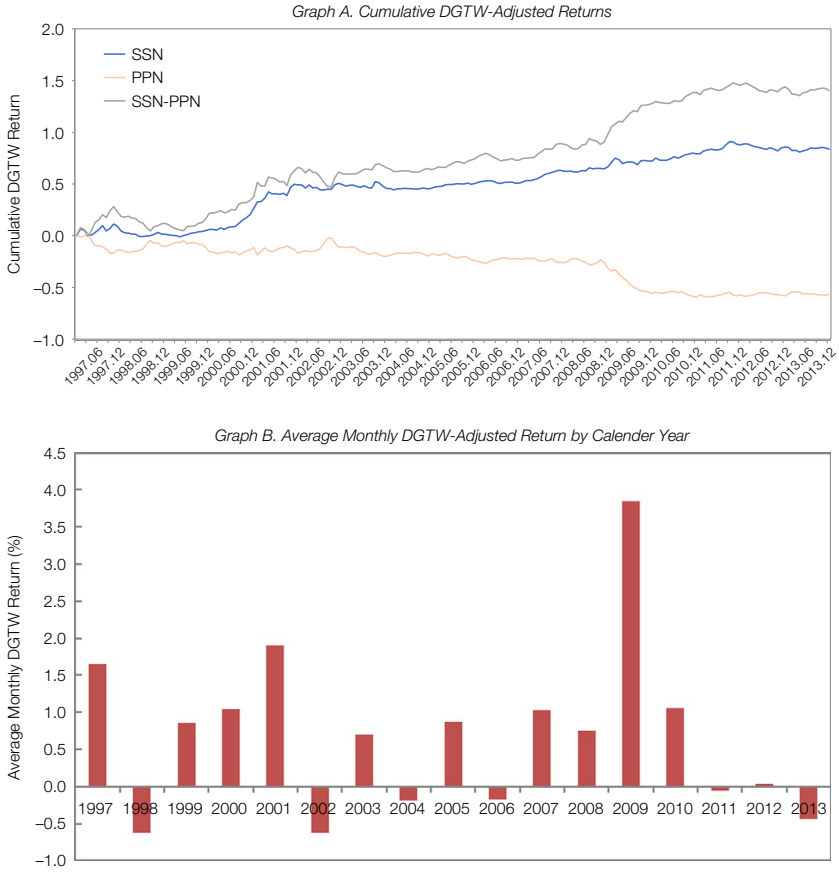
3. The Effect of Transaction Costs

While the return predictability results show that insider silence predicts future stock returns and predictive power is stronger among small stocks, we do not take into account transaction costs. Transaction costs include the bid–ask spread,

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FIGURE 2
Cumulative Returns of Insider Silence Portfolio

Graph A of Figure 2 shows the cumulative DGTW-adjusted returns for the "SSN," "PPN," and "SSN-PPN" portfolios, for the period from Jan. 1997 to Dec. 2013. Graph B shows the average monthly DGTW-adjusted return by calendar year. For each month *j* from Jan. 1997 to Dec. 2013, portfolios are formed based on preceding insider trading activity and held for 3 months. Stocks in the "SSN" category in month t (those firms that have insiders who sell in month $t-12$, $t-24$, but does not trade in month t) are held from month $t+1$ to $t+3$, and similarly for "PPN." "SSN-PPN" denotes the long–short portfolio that longs in stocks with "SSN" and shorts in stocks with "PPN." Portfolio returns are equal-weighted across their constituent stocks.



commissions paid to a broker, and the price impact of the buy or sell order. Broker commissions have been declining over the past 15 years, with many discount brokers offering very low commissions for an unlimited number of shares per trade. The price impact depends on the trade size and can be substantial for large trades of small-cap stocks. However, a recent paper by Frazzini, Israel, and Moskowitz (2012) estimates that the actual trading costs faced by real-world arbitrageurs are an order of magnitude smaller than previous studies suggest. The mean transaction costs are approximately 11 bps and 21 bps in large cap and small cap stocks, respectively.

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In addition, as institutional investors typically incorporate multiple signals in their trading strategies, transaction costs are shared by these multiple signals, further lowering the transaction costs to implement the strategies (DeMiguel, Martin-Utrera, Nogales, and Uppal (2017)). Within this context, we surmise that transaction costs can reduce the profitability of the insider silence strategies if traded alone, and that the strategies are potentially profitable only to institutional investors with low transaction costs and careful execution. However, the insider silence signal can add significant value to a portfolio that trades on multiple signals and spreads transaction costs across these signals.

4. The Dollar Profits to Insider Silence

The result from the Fama–MacBeth (1973) regression and portfolio sorts shows that sudden insider silence is informative of future stock return, but it does not directly speak to how much insiders gain in terms of dollar amount by delaying routine trades. To address this question, we conduct a back-of-the envelope calculation to estimate how much insiders are making from strategic silence behavior.[28] We calculate the dollar value of SSN and PPN by multiplying the cumulative abnormal return by the dollar value of insiders' planned trades, which is proxied by the average value of insiders' actual trades in the 2 years prior to the silence month. The cumulative abnormal return is measured from the month following insider silence to the month when insiders resume their routine trades. The average dollar value calculated using this approach could inform us of the dollar profits insiders make by delaying routine sell (purchases) when future abnormal return is positive (negative).

The result is reported in Table A2 of the Supplementary Material. We use both market-adjusted and DGTW-adjusted abnormal returns to measure abnormal dollar profits. Focusing on DGTW-adjusted dollar profits, the result shows that insiders earn average (median) abnormal dollar profits equal to $301,346 ($1,580) by delaying routine sell, and $15,501 ($209) by delaying routine purchase. These numbers are, in general, comparable to the estimated dollar profits from insider trading, as reported by previous studies. For example, Cziraki and Gider (2016) report that insiders placing round-trip trades realize average (median) abnormal dollar profits equal to $61,000 ($1,000) per trade. Overall, our result suggests that routine insiders could realize a nontrivial amount of profits by exploiting their private information in a subtle way.

C. Insider Silence and Earnings Announcement Returns

The results so far are consistent with our hypothesis that investors underreact to information transmitted by absence of routine insiders' trades. If this is true, investors will be systematically surprised when the relevant information is subsequently disclosed to the market. In this subsection, we test the investor underreaction hypothesis by examining the short-horizon returns around subsequent earnings announcement following sudden insider silence. We focus on earnings announcements instead of other news events because the earnings announcement is one of the highest-profile corporate events that catch investors'

[28] We thank the referee for suggesting this test.

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

attention. As insiders find trading opportunistically on short-term news difficult, given the "Short Swing" rule, they are more likely to remain silent when possessing material earnings-related information. Taken together, the earnings announcement is a good setting to investigate our strategic silence hypothesis.

We extract quarterly earnings announcement dates from Compustat and calculate 3-day announcement period abnormal returns adjusted by the return on CRSP value-weighted market returns or size, book-to-market and past 1-year return matched portfolio. We then regress the earnings announcement CAR$(-1,+1)$ on the dummies SSN and PPN and other control variables.

$$\text{CAR}(-1,+1)_{i,t} = a + b\text{SSN}_{i,t-1} + c\text{PPN}_{i,t-1} + dX_{i,t-1} + \epsilon_{i,t}. \quad (4)$$

SSN (PPN) is a dummy equal to 1 if in the quarter prior to the earnings announcement day t, any insider of the firm demonstrates sudden silence following 2 consecutive years of selling (purchasing), and 0 otherwise. We include the lagged earnings announcement return, size, book-to-market ratio, past 1-month and 1-year return, opportunistic buys and sells, and net purchase ratio as control variables. We also include industry and quarter fixed effects in some specifications. Standard errors are double-clustered at the firm and the quarter level. Table 6 reports the regression results. Columns 1 and 2 use market-adjusted CAR as the dependent variable. The coefficient on SSN is significantly positive under all specifications. With industry and quarter fixed effects in column 2, SSN predicts a 17.2 bps (t-stat. $= 2.05$) abnormal positive return in the 3-day earnings announcement window. The economic magnitude is large given the mean 3-day market-adjusted CAR is 15 bps for our sample of stocks. Consistent with our hypothesis, PPN predicts a 10.7 bps negative abnormal CARs in the earnings announcement window, though it is not significant. Our previous Fama–MacBeth (1973) regression results show that SSN predicts a 1.13% abnormal positive return over the next 3 months. This means that approximately 15% of abnormal return following insider silence after 2 consecutive years of selling is concentrated in the 3-day window around the quarterly earnings announcement, which represents only 5% of all trading days. The fact that the abnormal return following insider silence is concentrated on a few information announcement days makes our findings difficult to square with risk-based explanations (La Porta, Lakonishok, Shleifer, and Vishny (1997)). We find similar results using DGTW-adjusted CAR as the dependent variable, as shown in columns 3 and 4.

Overall, the earnings announcement results are consistent with our hypothesis that insider silence is driven by private information related to firm fundamentals. We find that sudden silence following insider consecutive sells predicts positive earnings news and, to a less extent, that silence following insider consecutive purchases predicts negative earnings surprises. Investors initially fail to unravel the information contained in sudden insider silence, and they are systematically surprised when the relevant information is subsequently disclosed to the market via earnings announcements.

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TABLE 6

Sudden Insider Silence and Earnings Announcement Return

Table 6 shows the regression results of a 3-day cumulative abnormal return CAR (in %) around a quarterly earnings announcement on sudden insider silence dummies SSN and PPN in the previous quarter. SSN (PPN) is a dummy variable that equals 1, if in the quarter prior to the earnings announcement, any insider of a firm has a sudden silence following consecutive 2-year selling (buying) behavior. In columns 1 and 2, abnormal return is calculated as daily stock return minus return on the CRSP value-weighted portfolio. In columns 3 and 4, abnormal return is calculated as daily stock return minus the DGTW matched portfolio return. ln(SIZE) and ln(BM) are the natural logarithms of a firm's market capitalization and book-to-market ratio. PAST_MONTH_RETURN is the return of a firm over the prior month. PAST_YEAR_RETURN is the return of a firm over the prior year, excluding the prior month $t-1$. We further control for opportunistic buying (OPPBUY) and opportunistic selling (OPPSELL) following Cohen et al. (2012) and for the insider net purchase ratio (NPR) following Lakonishok and Lee (2001). Standard errors are double-clustered at firm and quarter level. Industry and quarter fixed effects are included as indicated. The sample period runs from 1997 to 2013. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. t-statistics are shown in parentheses.

	MKT_ADJ_CAR(−1,+1)		DGTW_ADJ_ CAR(−1,+1)	
	1	2	3	4
SSN	0.1942**	0.1721**	0.1451*	0.1369*
	(2.33)	(2.05)	(1.93)	(1.74)
PPN	−0.1012	−0.1071	−0.1161	−0.1134
	(−1.04)	(−1.20)	(−1.22)	(−1.31)
LAGGED_CAR	1.9154***	1.8586***	1.8512***	1.8527***
	(5.99)	(5.54)	(5.89)	(5.44)
ln(SIZE)	0.0331*	0.0484***	0.0224	0.0338**
	(1.83)	(2.79)	(1.49)	(2.32)
ln(BM)	0.2620***	0.2847***	0.2437***	0.2603***
	(6.18)	(7.60)	(7.50)	(8.85)
PAST_MONTH_RETURN	−0.1467	−0.4131*	−0.3975**	−0.5893***
	(−0.56)	(−1.80)	(−2.01)	(−3.09)
PAST_YEAR_RETURN	0.0025	−0.0039	0.0518	0.0158
	(0.04)	(−0.08)	(1.17)	(0.37)
OPPBUY	0.2459***	0.3176***	0.2228***	0.3037***
	(2.84)	(3.85)	(2.68)	(3.73)
OPPSELL	−0.0148	0.0260	−0.0072	0.0222
	(−0.23)	(0.40)	(−0.12)	(0.37)
NPR	0.0548	0.0387	0.0099	0.0187
	(1.20)	(0.99)	(0.25)	(0.51)
Fixed effects	None	Industry/ Quarter	None	Industry/ Quarter
R^2	0.001	0.005	0.001	0.004
No. of obs.	261,305	253,269	261,305	253,269

D. How Long Do Insiders Delay Their Routine Trades?

Our strategic silence hypothesis predicts that an insider, who previously trades on a routine pattern, can suddenly choose not to trade if she possess some private information about the firm. If this is the case, the direction of the insider's next trade following the sudden silence should be consistent with the direction of previous consecutive trades, given that routine trades are not canceled. An insider, on the other hand, could permanently cancel the routine trade based upon a belief that the performance of the firm would be continuously sluggish or outperforming. Despite the delay and permanent cancellation of the trades, one should see few observations of an opposite sign of trades following sudden silence, which is not consistent with our story.[29] This motivates us to examine how long insiders delay their routine trades.

[29] An insider who wants to execute a trade opposite to her previous routine trades does not need to delay the trades.

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Panel A of Table 7 reports the summary statistics of the length of delay for individual insiders[30] displaying sudden silence. We define "cancel" as those insiders who do not trade for the subsequent 24 months following their sudden silence.[31] Consistent with our hypothesis, 47.79% of insiders delay their trades in the same direction, and 47.05% of insiders permanently cancel their trades.[32] Only 5.16% of the insiders execute a trade opposite to the direction of their previous routine trades following sudden silence. Insiders on average delay their previous routine purchases by a mean of 6.03 months (median of 3 months), and delay their previous routine sells by a mean of 6.51 months (median of 5 months) following the sudden silence month. These numbers are consistent with our previous results that the return predictability of insider silence is strongest in the horizon of 3–6 months.[33]

TABLE 7

Conditional Results on the Length of Delay

Table 7 shows the length of delay of sudden insider silence (SSN, PPN) at the individual insider level. For each month from 1997 to 2013, we define insider silence based on consecutive same-month insider trading in the previous 2 years. The sample in this table includes only insiders' monthly firm observations with SSN and PPN, and we look into the number of month gaps and abnormal returns between an insider's sudden-silence month (formation month) and their next trading month (next trade month). PPNP (SSNS) denotes observations for which insiders execute a trade in the same direction as their previous routine trades. PPNS (SSNP) denotes the observations for which insiders trade in the opposite direction of their previous routine trades. PPNN (SSNN) denotes the case when insiders do not trade for the subsequent 24 months following their sudden silence. Panel A shows the mean and median distributions for the number of months delayed for trading. Panel B shows the average monthly excess return adjusted by size and BM from the month following the silence month to the month before the insider's next trading month, insider's next trading month, and from the month following the insider's next trading month to the 24th month after the insider's sudden-silence month. *t*-statistics are shown in parentheses.

Panel A. Number of Months Delayed

Type	No. of Obs.	Mean	Median	Q1	Q3	Std. Dev.
PPNP	8,049	6.03	3	2	9	5.75
PPNS	1,990	8.96	7	3	14	6.77
PPNN	9,051					
SSNS	23,079	6.51	5	2	9	5.64
SSNP	1,373	8.40	7	3	12	6.16
SSNN	21,598					

Panel B. Average Size and BM-Adjusted Monthly Excess Return

Type	Formation to Next Trade	Next Trade	Next Trade to End	Before–After	
PPNP	−0.82%	−0.06%	−0.32%	−0.46%***	(−4.19)
PPNS	1.66%	2.35%	−0.13%	1.79%***	(6.34)
PPNN		−1.32%*** (−13.20)			
SSNS	1.26%	2.55%	0.27%	0.99%***	(17.64)
SSNP	−3.37%	−2.62%	0.62%	−4.08%***	(−15.46)
SSNN		0.28%*** (6.00)			

[30]Note here that the summary statistics are based on the individual insider level sudden silence, which is different from the firm level silence measure used in the previous tests. We use the insider level sudden silence measure because the length of delay is more straightforward and easy to understand at the individual insider level compared to the firm level.

[31]We choose 24 months because we believe that it is less likely that insiders would still follow the same trading pattern after 2 years' silence. However, our results are similar if "cancel" is defined using 12, 36, or 60 months.

[32]Since we also define insiders who do not trade for other reasons (such as leaving the firm or no longer having enough shares to sell) as canceling their trades, our estimation of the percentage of cancel is an overestimation.

[33]In untabulated results, we find that insiders buy or sell a similar amount of shares after resuming their routine trading.

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

Our hypothesis also predicts that, once the insiders resume their routine trades, the information embedded in their previous silence should already be reflected in the stock price. Hence, the abnormal return as predicted by PPN or SSN should come mostly from the period between insiders' sudden silence to their next trade month, not the period after their next trade. Panel B of Table 7 shows that this is indeed the case, reporting the average size and book-to-market adjusted monthly abnormal return for the period from the silence month (exclusive) to insiders' next trade month (exclusive), the next trade month, and the period from the next trade month (exclusive) to the 24 months after the sudden silence month. We follow Fama and French (1993) to construct the size and book-to-market benchmark portfolios. For June of each year, we independently construct the NYSE breakpoints for the size and book-to-market ratios, and we form equal-weighted 10×5 size and book-to-market portfolios that hold for the subsequent 12 months. The monthly adjusted abnormal return is then the return of the stock minus the portfolio return of the size and book-to-market category that it falls into. The average monthly abnormal return is -0.82% from the silence month to the next trade period. However, it is only -0.32% from the next trade to the 24-month end period for the case of PPNP (the insider continues the sudden silence of PPN with a purchase later, purchase-purchase-no trade-purchase). The difference of 0.46% (t-stat. $= 4.19$) is statistically significant. For SSNS (the insider continues the sudden silence of SSN with a sell, sell-sell-no trade-sell), the average monthly abnormal return is 1.26% from the silence month to the next trade period. However, it is only 0.27% from the next trade to 24-month end period. The difference of 0.99% (t-stat. $= 17.64$) is also highly significant.[34]

For permanent cancellation, we calculate the average monthly abnormal return for the subsequent 24 months. Consistent with the predictions of our hypothesis, SSNN (sell-sell-no trade-no trade) has a subsequent average monthly abnormal return of 0.28% (t-stat. $= 6.00$), and PPNN (purchase-purchase-no trade-no trade) has a subsequent average abnormal return of -1.32% (t-stat. $= 13.20$). The much rarer cases of SSNP (sell-sell-no trade-purchase) and PPNS (purchase-purchase-no trade-sell) are not implied by our story. Although SSNP and PPNS are not the focus of this article, the results in Table 7 seem to indicate that those insiders' behaviors are consistent with the previous literature (Lakonishok and Lee (2001), Piotroski and Roulstone (2005)). Insiders in general are contrarian traders who buy (sell) firm stocks when there is large decline (increase) in the stock price and, after their transactions, the return of the firm then increases (declines).

IV. Mechanism

In this section, we provide a series of additional tests aimed at isolating the mechanism driving our main result. In particular, we examine whether variation of

[34]The mean abnormal returns following insider silence conditional on their subsequent trade in the same direction is larger in absolute magnitude than the unconditional abnormal return following insider silence. This is to be expected because our insider silence measure is quite noisy and the insider may become silent for reasons unrelated to private information. However, when we observe insiders resume their routine trades following a period of silence, the silence is more likely to be motivated truly by private information.

litigation risks drives the informativeness of insider silence and also try to pinpoint why the market does not recognize the information in insider silence in a timely manner.

A. Litigation Risks and the Informativeness of Insider Silence

Our article hypothesizes that, when having private information, some routine insiders choose to be silent instead of trading on the information, as doing so reduces litigation risks associated with insider trading. In other words, insiders weigh the benefits of making higher profits by explicitly trading on private information and the potential costs of being prosecuted by regulators. If this is true, increasing litigation risks should lead to more routine insiders being silent when possessing private information and, hence, the information content of insider silence should be stronger. In this section, we test whether the informativeness of insider silence varies predictably in sub-samples with different litigation risks.

Our test uses the firm-level litigation risk measure developed by Kim and Skinner (KS) (2012).[35] We split the sample into two groups based on the KS litigation risk measure and compare the return predictability of insider silence across sub-samples. The result is reported in Table A3 of the Supplementary Material. The coefficients on SSN and PPN are always larger in magnitude and more significant for firms with higher litigation risk. For example, SSN predicts a 1.40% (t-stat. = 3.50) higher future 3-month return in the high litigation risk sample, and 0.38% (t-stat. = 1.57) among firms with low litigation risk. Overall, the variation of the informativeness of insider silence is consistent with our hypothesis that insiders choose to be silent when possessing private information because of litigation risk concerns.

B. How Does the Information in Insider Silence Get Conveyed into Stock Price?

Our evidence on market underreaction to insider silence raises the question of how does the information in insider silence eventually get conveyed into stock price? We show in Section III.C that part of the information contained in insider silence is released during subsequent earnings announcements. In this section, we explore whether the trading activities of sophisticated investors (e.g., hedge funds) and analysts' forecasts also facilitate the information in insider silence being incorporated into stock prices.[36]

We focus on the trading behavior of hedge funds in response to an insider silence signal because hedge funds are among the most sophisticated investors in financial markets. Previous studies find that hedge funds are skilled at stock picking and market timing (Brunnermeier and Nagel (2004)), are able to identify mispriced stocks (Jiao, Massa, and Zhang (2016)), and conduct trades that are more likely to be driven by information (Agarwal, Jiang, Tang, and Yang (2013)). Thus,

[35]The KS litigation risk measure is built upon industry membership, firm size, sales growth, past stock returns, skewness, volatility, and trading volume. We use model 3 in Table 7 of Kim and Skinner (2012).

[36]This prediction would hold even though these sophisticated investors do not realize that insider silence contains information. They could figure out the same information from their own sources, such as independent research.

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

the evidence that hedge funds change their positions in the direction predicted by the information content of insider silence would strengthen our previous return predictability results. To investigate the link between insider silence and hedge fund trading, we regress the change in quarterly hedge fund holdings on insider silence dummies SSN and PPN and a set of control variables in the previous quarter. To make a comparison, we also look at how mutual funds trade in response to insider silence.

Table 8 reports the results of this test. Columns 1 and 2 show the results when the dependent variable is quarterly change in hedge fund holdings. The results suggest that hedge funds trade in the direction consistent with the information in insider silence, especially for the good news contained in SSN. The coefficient on SSN is 0.063 (t-stat. = 3.17) in column 2. Hedge funds significantly increase their long positions on a stock that has pending good news contained in insider silence SSN. The coefficient on PPN is similar in magnitude to that on SSN, with a coefficient of −0.044 (t-stat. = −1.74), but much less significant when both firm and quarter fixed effects are included. This finding is consistent with our return predictability results that SSN is a more accurate signal for future firm value and has stronger predictive power for future stock returns compared to PPN.

TABLE 8

Predicting Quarterly Changes in Hedge Fund and Mutual Fund Holdings

Table 8 shows the regression results of change in quarterly hedge fund and mutual fund holdings (in %) on insider silence dummies SSN and PPN in the previous quarter. Hedge fund (mutual fund) holdings are the total shares held by hedge funds (mutual funds) in each quarter over shares outstanding. SSN (PPN) is a dummy variable equal to 1 if a firm has any insider who sells (purchases) consecutively in the same calendar month for the previous 2 years, but does not trade in the same month this year. ln(SIZE) and ln(BM) are the natural logarithms of a firm's market capitalization and book-to-market ratio. PAST_MONTH_RETURN is the return of a firm over the prior month. PAST_YEAR_RETURN is the return of a firm over the prior year, excluding the prior month $t-1$. We further control for opportunistic buying (OPPBUY) and opportunistic selling (OPPSELL) following Cohen et al. (2012) and for the insider net purchase ratio (NPR) following Lakonishok and Lee (2001). Standard errors are double-clustered at firm and quarter level. The sample runs from 1997 to 2013. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. t-statistics are shown in parentheses.

	CHANGE_IN_HF_HOLDING		CHANGE_IN_MF_HOLDING	
	1	2	3	4
SSN	0.0501***	0.0631***	−0.2161***	−0.1894***
	(5.70)	(3.17)	(−6.31)	(−4.16)
PPN	−0.0252	−0.0438*	0.1260	0.0546
	(−0.80)	(−1.74)	(1.55)	(1.16)
ln(SIZE)	0.0059	−0.0136	−0.0096	−0.0431
	(0.69)	(−0.75)	(−0.47)	(−0.92)
ln(BM)	0.0024	0.0140	−0.0300	−0.0529**
	(0.31)	(1.37)	(−1.38)	(−2.42)
PAST_MONTH_RETURN	0.2304**	0.2191**	0.8429***	0.8270***
	(2.37)	(2.06)	(3.19)	(2.97)
PAST_YEAR_RETURN	−0.0067	−0.0142	0.2650***	0.2421***
	(−0.53)	(−1.09)	(5.66)	(5.27)
OPPBUY	0.0307	0.0215	0.2594	0.2253
	(0.42)	(0.32)	(1.44)	(1.28)
OPPSELL	−0.1074	−0.1063	−0.0028	−0.0248
	(−1.51)	(−1.55)	(−0.02)	(−0.14)
NPR	−0.0791	−0.1055	−0.3102	−0.3778
	(−1.08)	(−1.07)	(−1.40)	(−1.30)
Fixed effects	Quarter	Firm and Quarter	Quarter	Firm and Quarter
R^2	0.013	0.034	0.026	0.049
No. of obs.	293,566	293,276	293,578	293,288

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Columns 3 and 4 of Table 8 report the regression results when the dependent variable is quarterly change in mutual fund holdings. In sharp contrast, we find that mutual funds trade in the opposite direction predicted by the information contained in insider silence. The coefficient on SSN is negative and significant, indicating that mutual funds decrease their position in stocks with pending good news, as predicted by SSN. The coefficient on PPN is positive, but not significant. Our results on mutual fund trades being in the opposite direction of insider silence is consistent with the literature documenting mutual funds being dump money and hedge funds being smart money.

In Table 9, we examine whether security analysts are able to discern the information content of sudden insider silence. Given their strong incentives to generate more accurate earnings forecasts for covered stocks, analysts should revise up (down) their earnings forecast for stocks with SSN (PPN). Moreover, analysts could upgrade (downgrade) their recommendations on these firms when the good (bad) news contained in insider silence deserves such actions. To test this, we regress analyst annual earnings per share (EPS) forecast revisions (scaled by book value per share) on insider silence dummies SSN and PPN in the previous quarter. We control for lagged forecast revisions, size, book-to-market, past 1-year return and industry/quarter fixed effects in some specifications. As reported in columns 1 and 2, the coefficient on SSN is significantly positive under all specifications, suggesting that analysts revise their earnings forecast upward for firms associated with SSN. The coefficient on PPN is also negative, but it is significant only when we control for industry and quarter fixed effects. In columns 3 and 4, we examine whether insider silence can predict announcement returns around future analyst recommendation changes. Consistent with the forecast revision results, SSN predicts significantly more positive cumulative abnormal returns around next quarter's recommendation change. The point estimates suggest that stocks with SSN in the previous quarter experience a 10-bps to 14-bps more positive 3-day CAR. The coefficient on PPN is also negative, but not significant.

In sum, the evidence suggests that either hedge funds and analysts are smart enough to figure out that sudden insider silence contains information, or their own information obtained through other channels is consistent with the latent information embedded in insider silence. Either interpretation would provide support to our premise in this article that insiders' strategic silence behavior is motivated by private information about firm's fundamentals.

C. Heterogeneity in Information Environment and Limits to Arbitrage

In this subsection, we examine the underlying mechanism of why market underreacts to the information in insider silence. If investors are fully rational and have unlimited capacity to analyze all value-relevant information, the information contained in an insider's strategic silence behavior should be reflected in stock prices in a timely fashion. However, our evidence suggests that investors underweight this information in forecasting firm values. If this is true, the return predictability results should be stronger among firms with a more opaque information environment, in which investors are less likely to learn about the information embedded in insider silence through other sources, such as analyst reports and media coverage. Crucially, this cross-sectional prediction does not depend on

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TABLE 9
Insider Silence and Analyst Reactions

Table 9 shows the regression results of the analyst EPS forecast revision (scaled by book value per share) (in %) and recommendation CAR(−1, +1) (in %) on insider silence dummies SSN and PPN in the previous quarter. In columns 1 and 2, the dependent variable is the quarterly change in analysts' consensus forecast in annual EPS scaled by book value per share at the end of the last fiscal year. In columns 3 and 4, the dependent variable is the 3-day CAR around the analyst recommendation change. SSN (PPN) is a dummy variable equal to 1 if a firm has any insider who sells (purchases) consecutively in the same calendar month for the previous 2 years, but does not trade in the same month this year. FREV(−1) is analyst's last quarter EPS forecast revision. ln(SIZE) and ln(BM) are the natural logarithms of a firm's market capitalization and book-to-market ratio. PAST_MONTH_RETURN is the return of a firm over the prior month. PAST_YEAR_RETURN is the return of a firm over the prior year, excluding the prior month $t-1$. We further control for opportunistic buying (OPPBUY) and opportunistic selling (OPPSELL) following Cohen et al. (2012) and for the insider net purchase ratio (NPR) following Lakonishok and Lee (2001). Standard errors are double-clustered at firm and quarter level. The sample runs from 1997 to 2013. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. *t*-statistics are shown in parentheses.

	EPS_FORECAST_REVISION		RECOMMENDATION_ON_CAR	
	1	2	3	4
SSN	0.1377***	0.1000**	0.1431***	0.0981*
	(2.99)	(2.49)	(2.65)	(1.80)
PPN	−0.0708	−0.1525*	−0.0930	−0.0764
	(−0.75)	(−1.67)	(−0.74)	(−0.62)
FREV(−1)	0.0242**	0.0235*		
	(1.99)	(1.89)		
ln(SIZE)	0.2114***	0.2204***	−0.0715***	−0.0767***
	(12.98)	(12.16)	(−3.40)	(−3.79)
ln(BM)	0.6871***	0.6875***	0.1439***	0.1547***
	(11.06)	(11.33)	(3.20)	(3.78)
PAST_MONTH_RETURN	1.5225***	1.6076***	−0.0769	−0.5170*
	(5.43)	(5.17)	(−0.26)	(−1.84)
PAST_YEAR_RETURN	0.1991***	0.2055***	0.2662***	0.2435***
	(4.21)	(3.66)	(4.54)	(4.60)
OPPBUY	0.2611***	0.1946***	−0.0856	−0.0753
	(6.31)	(5.28)	(−1.19)	(−1.04)
OPPSELL	0.0838	−0.0064	−0.0335	−0.0836*
	(1.44)	(−0.14)	(−0.65)	(−1.71)
NPR	−0.1213***	−0.1297***	0.0776**	0.0756***
	(−4.46)	(−4.91)	(2.21)	(2.68)
Fixed effects	None	Industry and Quarter	None	Industry and Quarter
R^2	0.020	0.030	0.002	0.005
No. of obs.	219,217	216,527	212,760	212,730

analysts (or other sophisticated investors) realizing the information contained in insider silence. Given that analysts are specialized in gathering and processing firm's fundamentals, they could well figure out the same information known by insiders from other sources, including independent research.

In addition to the firms' information environment, we consider how the return predictability varies across our sample with different degrees of arbitrage costs. The evidence indicates that sophisticated investors, such as arbitrageurs, also fail to incorporate the information embedded in insider silence and bring stock prices to full-information value. We thus expect that our results are more pronounced among firms subject to greater limits to arbitrage.

We use analyst coverage to proxy for a firm's information environment (Hong, Lim, and Stein (2000)). Analyst coverage is the number of analysts following the firm during the previous fiscal year. Our proxies for arbitrage costs include idiosyncratic volatility (Pontiff (1996), Wurgler and Zhuravskaya (2002)) and firm size. Stocks' idiosyncratic volatility is calculated using weekly return (Wednesday to Wednesday) during the previous year.

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To test the prediction, we run Fama–MacBeth (1973) regression on subsamples split based on the sample median of analyst coverage, idiosyncratic volatility and market capitalization. Panel A of Table 10 reports the subsample results for stocks sorted on analyst coverage. The return predictability of insider silence is stronger among firms with less analyst coverage, particularly for the negative information contained in PPN. For example, PPN in the low analyst coverage sample predicts a 2.36% (t-stat. = 2.17) decrease in the 12-month cumulative return, and only an insignificant 1.40% decrease for the high analyst coverage stocks. The evidence is consistent with the idea that bad news travels more slowly among less covered firms (Hong et al. (2000)).

TABLE 10
Heterogeneity in Firms' Information Environment and Limits to Arbitrage

Table 10 displays the subsample Fama–MacBeth (1973) regressions of returns (in %) on indicators of SSN and PPN in the prior month, over our 1997–2013 sample period. We sort all the firms into two groups each year based on the June market capitalization (MARKET_CAP), idiosyncratic volatility (VOLATILITY), and analyst coverage (ANALYST_COVERAGE). The idiosyncratic volatility is estimated by market model using the weekly stock return (Wed. to Wed.) in the past year. The analyst coverage is the number of analysts covering a firm for the last fiscal year. The dependent variables are the future cumulative 3-, 6-, and 12-month returns (in %). SSN (PPN) is a dummy variable equal to 1 if a firm has any insider who sells (purchases) consecutively in the same month for the previous 2 years but does not trade in the last month. We include control variables ln(SIZE), ln(BM), PAST_MONTH(YEAR)_RETURN, OPPBUY and OPPSELL following Cohen et al. (2012) and the insider net purchase ratio (NPR) following Lakonishok and Lee (2001). t-statistics are Newey–West (1987) adjusted and are shown below the estimates in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

		CUMULATIVE_ 3_MONTHS		CUMULATIVE_ 6_MONTHS		CUMULATIVE_ 12_MONTHS	
		Var. < Median	Var. > Median	Var. < Median	Var. > Median	Var. < Median	Var. > Median
Panel A. Insider Silence and Firms' Information Environment							
ANALYST COVERAGE	SSN	1.304**	1.203***	2.784***	1.752***	3.471***	3.195***
		(2.59)	(3.84)	(4.85)	(4.82)	(4.10)	(5.67)
	PPN	−0.817	0.105	−1.327	0.261	−2.358**	−1.399
		(−1.40)	(0.18)	(−1.70)*	(0.31)	(−2.17)	(−1.17)
Panel B. Insider Silence and Limits to Arbitrage							
MARKET_CAP	SSN	1.401***	0.746***	2.774***	1.131***	3.756***	1.745***
		(4.25)	(2.83)	(6.06)	(3.18)	(5.32)	(3.38)
	PPN	−1.234***	0.060	−1.990***	0.654	−2.808***	0.940
		(−2.92)	(0.11)	(−3.12)	(0.94)	(−3.12)	(0.83)
VOLATILITY	SSN	0.267	1.987***	0.795***	3.002***	0.877**	4.612***
		(1.38)	(4.78)	(2.81)	(5.29)	(2.13)	(5.18)
	PPN	−0.545*	−1.584**	−0.831	−3.201***	−1.731***	−2.941**
		(−1.85)	(−2.28)	(−1.61)	(−3.43)	(−2.63)	(−2.08)

Panel B of Table 10 reports the Fama–MacBeth (1973) regression results when we split the sample based on two proxies for limits to arbitrage: firm size and idiosyncratic volatility. Regarding the firm size results, insider silence contains much stronger return predictability among small firms. For example, insider silence following consecutive sells predicts 2.77% (t-stat. = 6.06) more positive 6-month cumulative returns in small stocks. The corresponding coefficient is 1.31% (t-stat. = 3.18) for big stocks.

The results using idiosyncratic volatility as a proxy for limits–to–arbitrage is more striking. SSN predicts a 3.00% (t-stat. = 5.29) increase in the 6-month-ahead return for the subsample that has high volatility, and only a 0.80% (t-stat. = 2.81) for the low volatility subsample. PPN predicts a decrease of 3.20%

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(t-stat. = 3.43) in the 6-month-ahead return for the high volatility subsample, and only 0.83% (t-stat. = 1.61) for the less volatile subsample.

In sum, the subsample results support our hypothesis that investors underreact to value-relevant information contained in routine insiders' strategic silence behavior. Information in insider silence takes a longer time to diffuse into the price of firms that are smaller, have higher idiosyncratic volatility and have fewer analysts following.

V. Robustness Tests and Alternative Explanations

In this section, we describe several tests conducted in order to examine the robustness of our results and to rule out some alternative explanations for our main result.

A. Robustness and Extensions

1. Alternative Measures of Insider Silence

To guarantee that our results are not driven by the specific methodologies that we use to define insider silence, we consider several variations in the construction of the sudden insider silence measure. First, we try to construct the sudden silence measure using the trading history of the previous 3 years. For our baseline results, we define sudden silence as a no-trade month following two consecutive-year same-month trades. However, determining how many years are needed to classify whether an insider is routine is difficult; insider trading in the same month for 2 consecutive years could be coincidence, with no information content extractable from the following silence. On one hand, if multiple years of trades in the same month in the same direction are required for a definition of routine, the result could be a very small sample with sudden silence equal to 1. On the other hand, if too few years are used to define consecutive trades, the silence measure could have too much noise. Balancing these two considerations, we add another year to the requirement for consecutive trades, looking at the information content of sudden insider silence following 3 years of consecutive same-month trades: SSSN (sell-sell-sell-no trade) and PPPN (purchase-purchase-purchase-no trade).

Panel A of Table 11 reports the Fama–MacBeth (1973) regression for the sudden silence measure defined by 3 consecutive-year trades. Because we require 1 additional year to define routine trades, we restrict our tests to the sample period 1998–2013. The results when defining silence using stricter criteria are stronger. SSSN predicts 1.32% positive abnormal returns for the subsequent 3 months and PPPN predicts 1.51% negative abnormal returns. These numbers are larger than the return predictability of SSN and PPN.

We also consider constructing our silence measure directly at the firm level, by first aggregating all the insider trades at the firm-month level, and then defining SSN and PPN based on the aggregate firm-level insider trades. The results are presented in Panel B of Table 11. As we do not require consecutive trades at the individual insider level, the silence measure is noisier, but the results are still qualitatively similar.

In Panel C of Table 11, we further control for the SILENCE and BUY variables as defined by Gao et al. (2015) to rule out the possibility that our

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TABLE 11
Robustness Tests

Table 11 displays Fama–MacBeth (1973) regression of future stock returns on the insider silence measure under different specifications. The dependent variables are the future cumulative 3-, 6-, and 12-month returns (in %). Panel A shows the results for the sample period 1998–2013, for which insider silence is defined using 3 consecutive years of trades. SSSN (PPPN) is a dummy variable equal to 1 if a firm has any insider who sells (purchases) consecutively in the same calendar month for the previous 3 years, but does not trade in the same month this year. Panel B displays the results for which our silence measure is directly defined at the firm level; we aggregate all the insiders' shares first each month, and then define silence, following the previous construction method, for the sample period 1997–2013. For Panel C, we estimate the Fama–MacBeth regressions controlling for the silence and buy variables defined by Gao et al. (2015). SILENCE is a dummy variable that equals 1 if there is no insider trading activity over the past 12 months, and 0 otherwise. Similarly, BUY is a dummy variable that equals 1 if a firm has positive net insider trading over the past 12 months. *t*-statistics are Newey–West (1987) adjusted and are shown below the estimates in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	1ST_ MONTH	2ND_ MONTH	3RD_ MONTH	CUM_3_ MONTHS	CUM_6_ MONTHS	CUM_12_ MONTHS
Panel A. Insider Silence Defined Using Three Consecutive Years of Trades						
SSSN	0.429**	0.344	0.568**	1.323***	2.459***	4.065***
	(1.97)	(1.32)	(2.20)	(2.79)	(3.00)	(2.93)
PPPN	−0.942***	−0.611	0.067	−1.507*	−1.411	−2.505
	(−2.64)	(−1.55)	(0.18)	(−1.78)	(−1.09)	(−1.07)
Panel B. Insider Silence Constructed at Firm Level						
SSN	0.100	0.180	0.311**	0.585**	1.027***	1.728***
	(0.91)	(1.29)	(2.51)	(2.55)	(2.68)	(2.69)
PPN	−0.391*	−0.218	−0.221	−0.854*	−1.229	−2.073
	(−1.82)	(−1.07)	(−1.05)	(−1.71)	(−1.42)	(−1.43)

Panel C. Sudden Insider Silence vs. Gao et al. (2015)	CUM_3_ MONTHS	CUM_6_ MONTHS	CUM_12_ MONTHS
SSN	0.935***	1.783***	2.671***
	(3.54)	(4.60)	(3.82)
PPN	−1.201***	−2.012**	−2.730*
	(−2.61)	(−2.34)	(−1.97)
SILENCE	−0.290	−0.571	−1.266*
	(−1.54)	(−1.53)	(−1.92)
BUY	0.339*	0.373	−0.047
	(1.86)	(0.98)	(−0.07)

results are driven by the *unconditional* insider silence effect documented in their paper. SILENCE is a dummy variable that equals 1 if the stock has no insider trading during the previous 12 months, and 0 otherwise. Similarly, dummy variable BUY equals 1 if the firm has positive net insider trading in the previous 12 months, and 0 otherwise. From the table, we can see that the positive (negative) return predictability of SSN (PPN) is retained; that PPN even becomes stronger after controlling for the silence measure described by Gao et al. (2015). For example, sudden silence following consecutive purchases (PPN) predicts a 3-month-ahead cumulative return of −1.20% (t-stat. = 2.61), while sudden silence following consecutive sells (SSN) predicts a 3-month-ahead cumulative return of 0.94% (t-stat. = 3.54).

2. Is the Silence of Top Managers More Informative?

We also examine the informativeness of silence from insiders with differential levels of seniority in a firm. Following Thomson Reuters' definition, we define the Chairman of the Board, CEO, Chief Operating Officer, President and General Counsel as the most senior insiders in a firm. We predict that the sudden silence of these top managers should be more informative about future stock

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return than that of the less senior insiders for two reasons. First, senior managers presumably have better access to material private information than others, and could even make strategic decisions to affect the firm's value. Second, the potential litigation risks and reputation losses are larger for these top managers if they trade on insider information and are prosecuted by the SEC, thus they are more likely to stay silent when in possession of private information. Table A4 in the Supplementary Material reports the Fama–MacBeth (1973) results when we decompose insider silence signals into those from top managers (SSN_TOP and PPN_TOP) and those from other insiders (SSN_LOW and PPN_LOW). Consistent with our prior findings, the return predictability of the insider-silence signals is indeed much stronger for top managers, especially at longer horizons of 6 and 12 months. Insider-silence SSN from low-level insiders is followed by a positive return of 2.76% in the subsequent 12 months, while SSN by top-level insiders is followed by a much larger positive return of 4.15%, almost double that of the low-level managers. The negative return predictability of PPN is also larger for top managers.

3. Multiple Insider Silence within Firm-Month

For our baseline results, we define a firm-month dummy SSN or PPN that equals 1 when at least 1 insider within the firm suddenly becomes silent following routine trades, and 0 otherwise. Given the measurement error contained in our silence measure, multiple insider silence in the same firm-month should be a stronger signal than a single case of insider silence, because information should be correlated across insiders within a firm, and noise should not. To test this, we add a dummy MSSN (multiple sell-sell-no trade) and a dummy MPPN (multiple purchase-purchase-no trade) that equal 1 if a firm has more than 1 insider becoming silent following routine trades at the same firm, and 0 otherwise. We run a Fama–MacBeth (1973) regression of future returns on these two dummies along with SSN and PPN. The result is reported in Table A5 of the Supplementary Material. Consistent with our hypothesis, the coefficient of MSSN is positive and that of MPPN is negative, and they become statistically significant for future 12-month returns. For example, the coefficient of MSSN is 2.72% (t-stat. = 2.48) and that of MPPN is −3.08% (t-stat. = −2.50) when the dependent variable is cumulative 12-month returns.

4. Predictability of Insider Silence and Reporting Delay

In our prior analysis, we examine the return predictability of a silence signal starting from the month after the silence month. The implicit assumption of this strategy is that insider silence becomes public information at the beginning of the month after the silence month. In reality, however, insider trades are reported to the SEC after a delay, and a trading strategy based on insider trades or lack of trades, starting from the month after transaction, may not be implementable.

Officially, the SEC requires all insiders to report their trades in a timely manner. Prior to 2002, insider trades could be reported within 10 days following the end of the transaction month. However, this reporting delay was changed to 2 business days in 2002. Panel E of Table 1 reports the summary statistics of the number of days between insiders transaction dates and their reporting dates.

Consistent with the research of Cohen et al. (2012), we find that insider trades in our sample are actually reported to the SEC within a few days of the trade. The median reporting lag is 4 days for purchase transactions, and 2 days for sell transactions. A total of 75% of sell (purchase) transactions are reported to the SEC within 5 (18) days after the transaction date, which makes our long–short strategy that starts from the month following the silence month unlikely to be significantly affected by this reporting lag.

In addition, to be conservative, we rerun the return predictability tests with returns measured from the second month following the insider-silence month. In other words, we skip the month immediately after the insider-silence month to make sure that the strategy is fully implementable by investors. This approach is conservative because we do not capture any return effect in the immediate month following the insider silence. In Table A6 of the Supplementary Material, it can be observed that SSN still significantly and positively predicts future returns and PPN negatively predicts future returns for varying horizons. For example, the first column in Panel A indicates that SSN in month t predicts a 1.14% (t-stat. $= 4.18$) increase in cumulative returns from months $t+2$ to $t+4$. PPN in month t predicts a 0.80% (t-stat. $=-1.77$) decrease in cumulative returns from months $t+2$ to $t+4$. The calendar-time portfolio results are also shown in Panel B of Table A5. Each month, portfolios are formed based on preceding insider trading activity and held for 3 months. Stocks in the SSN category in month t are held from months $t+2$ to $t+4$, and similarly for the PPN portfolio. It can be observed that the portfolio abnormal return is qualitatively similar to that of Table 5. The long–short portfolio yields a 4-factor alpha of 0.46% (t-stat. $= 2.33$) and a DGTW-adjusted excess return of 0.57% (t-stat. $= 2.77$) per month. Overall, the return predictability of sudden insider silence is not sensitive to the timing convention we employ here, which is also used in prior studies (e.g., Cohen et al. (2012), Alldredge and Cicero (2015), and Ali and Hirshleifer (2017)).

B. Alternative Explanations

1. Insider Silence in Response to Mispricing

Our explanation for the return predictability of insider silence is that insiders possess some private information not yet reflected by current stock prices. However, insiders could stop their routine selling (purchasing) if they believe the current stock price is not fair, that is, it is undervalued (overvalued) relative to fundamental value. The return predictability could be driven by mispricing based on public information, which is different from the private information channel proposed in this article. For example, insiders who buy consecutively for 2 years could stop purchasing after the firm experiences abnormal increases in accruals in the third year. As firms with high accruals tend to be overvalued by naive investors (Sloan (1996)), our sudden insider silence measure PPN could simply pick up the effect of accruals in predicting negative returns. To address this concern, we reestimate our baseline Fama–MacBeth (1973) regression, controlling for the 11 prominent asset pricing anomalies as in the work of Stambaugh et al. (2012). If our sudden insider silence measure is capturing these anomaly signals, the predictability of sudden insider silence should disappear after controlling for them. Panel A of Table 12 reports that our results remain the same after controlling for

https://doi.org/10.1017/S0022109018001059 Published online by Cambridge University Press

TABLE 12
Alternative Explanations

Table 12 rules out several alternative explanations. The dependent variables are the future cumulative 3-, 6-, and 12-month returns (in %). The sample period is from 1997 to 2013. Panel A shows the results controlling for the 11 anomalies in the work of Stambaugh et al. (2012): FAILURE_PROBABILITY, OHLSON'S_O (distress), NET_STOCK_ISSUES, COMPOSITE_EQUITY_ISSUES, ACCRUALS, NET_OPERATING_ASSETS, MOMENTUM, GROSS_PROFITABILITY, ASSET_GROWTH, ROA, and INVESTMENT_TO_ASSETS. Panel B shows the results of running the panel regression with firm-year fixed effects. Panel C shows the results of running the panel regression with firm-quarter fixed effects. *t*-statistics are shown in parentheses.

	CUM_3_MONTHS	CUM_6_MONTHS	CUM_12_MONTHS
Panel A. Controlling for 11 Anomalies from Stambaugh et al. (2012)			
SSN	0.948***	1.737***	2.508**
	(3.26)	(3.10)	(2.29)
PPN	−0.624	−0.884	−1.639
	(1.09)	(−1.05)	(−1.24)
Panel B. Panel Regression with Firm-Year Fixed Effects			
SSN	0.748*	1.001*	0.436
	(1.93)	(1.72)	(0.54)
PPN	−1.052**	−1.665**	−1.664**
	(−2.19)	(−2.53)	(−2.07)
Panel C. Panel Regression with Firm-Quarter Fixed Effects			
SSN	1.233***	1.847***	1.825**
	(3.10)	(2.97)	(2.08)
PPN	−0.381	−0.396	0.234
	(−0.81)	(−0.61)	(0.29)

financial distress, net and composite share issuance, gross profitability, momentum, accruals, net operating asset, return on assets, investment, and asset growth. SSN significantly predicts future stock return for the period ranging from 3 to 12 months. PPN predicts negative future stock return, though the statistical significance is weaker. For example, SSN predicts a positive increase of 94.8 bps and PPN predicts a decrease of 62.4 bps for the subsequent 3-month return. Hence, the information embedded in sudden insider silence is distinct from that conveyed by traditional mispricing signals. In the untabulated results, we show that controlling for mutual-fund flow-induced price pressure, as performed by Lou (2012), does not affect our results.

2. Firm-Level Compensation Policy Change

A plausible alternative explanation for why insider silence predicts future stock return is that insiders stop trading due to a change in the firm-level compensation policy, which has information content. For example, an insider could stop purchasing shares in 1 year because the firm he works for did not give him a bonus this year, an indication of trouble within the firm and hence of a negative future return. To rule out this alternative, we run a panel regression of return on insider silence, controlling for the firm-year or firm-quarter fixed effects. The idea is that firms usually set their compensation policies annually or every quarter, while insiders trade in different months within the same year/quarter. Hence we could exploit the within firm-year/firm-quarter variation of insider silence in predicting returns. Panels B and C of Table 12 show that the return predictability of insider silence SSN is not affected by adding firm-year or firm-quarter fixed

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effects, suggesting that our results cannot be fully explained by firm-level compensation policy changes.

VI. Conclusion

In this article, we provide evidence of underreaction to information contained in the absence of activities in sophisticated financial markets. We examine the information content of insiders' strategic silence following their consecutive same-month trades. We hypothesize that, when a routine insider suddenly stops trading, in contrast with the previous trading pattern, this sudden silence can contain value-relevant information about the firm. Consistent with our hypothesis, insider silence following consecutive sells predicts a positive abnormal return and, to a lesser extent, the sudden silence following consecutive purchases predicts a negative return. A long–short strategy exploiting the strategic behavior of insider silence yields a Carhart (1997) 4-factor alpha of between 0.53% and 0.87% per month.

To investigate what specific information is embedded in insiders' sudden silence behavior, we consider the predictability of insider silence for firm fundamentals and earnings announcement day returns. The results indicate that insider silence communicates valuable information about a firm's future operating performance and that investors fail to incorporate the information contained in insider silence in a timely fashion. They are systematically surprised when the information is subsequently disclosed to the market via earnings announcements.

The existing evidence of underreaction to the absence of events mainly comes from laboratory settings and evidence from the field is more limited. Our results show that underreaction to the absence of activities affects equilibrium prices and capital allocation in sophisticated markets. In this setting, professionals make repeated investment decisions based on value-relevant information and market prices are determined by the interactions between many investors. Our finding suggests that underreaction to the absence of events is pervasive and could potentially lead to biased decision in a wide variety of important real-world contexts.

Supplementary Material

Supplementary Material for this article is available at https://doi.org/10.1017/S0022109018001059.

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