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Citation

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 routine sell (buy) predict positive (negative) future return as well as fundamentals. The return predictability of insider silence is stronger among firms with 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"

- Eliot Hearst, *American Scientist, Volume 79*

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 could obtain revealing information about his/her background from the skills or experiences that the person scarcely mentions. The absence of customers in a restaurant with a convenient location perhaps signals that the quality of food is not good. 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), Agostinelli et al. (1986)) suggests that human beings have difficulty using the mere absence of something as a basis for 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 underreaction to 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

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[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 than in a feature-positive one.

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 than others do, and they thus would be expected to have superior access to private information that outsiders do not have.[3]

The previous literature has documented the fact that insiders trade for multiple reasons. When driven by non-information reasons, such as liquidity or diversification, their submitted trades are more likely to be routine-based, i.e., occur in the same month each year, to signal to outsiders that they are not trading on private information about the firm (Cohen et al. (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

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[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 company's stocks.

[3]A large literature examines whether insiders' buying and selling transactions have any cross-sectional as well as a time series forecasting ability for future stock returns (Lorie and Niederhoffer (1968), Jaffe (1974), Seyhun (1986), Seyhun (1988), Rozeff and Zaman (1988), Lin and Howe (1990), Jeng et al. (2003), and Lakonishok and Lee (2001)).

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 two 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 "SSS" (sell-sell-sell) group. If he does not trade on this month, we then put him and his non-trading action in the "SSN" (sell-sell-no trade) group. Similarly, we categorize insiders who purchase in the same months for consecutive two years and purchase (PPP-purchase-purchase-purchase) or do not purchase (PPN-purchase-purchase-no trade) 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 one when at least one insider at the firm-month has SSN (PPN) that equals to one and zero 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

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[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 et al. (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.

signal improving firm fundamentals, which is 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 0.3% improvement in quarterly ROA when insider stops trading after two 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 Fama and 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-months-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-months-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 three months[7] and short stocks with PPN in the previous three months yields an equal-weighted monthly Carhart (1997) 4-factor alpha of 53 basis points (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

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[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 one dollar. We also try other selection criteria, e.g., excluding stocks with prices less than five 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.

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 et al. (1984), Ke et al. (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 to take advantage of their superior information about firms' future cash flow realizations.

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

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

[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.

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 upward.

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 et al. (2012). Finally, our results also remain unchanged when we run panel regressions with firm-year or firm-quarter 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 et al. (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 et al. (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 person'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 of 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

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[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 two years of consecutive same month trading. But 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 in the same month of prior years.

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 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 October 2000, allows an insider to pre-specify 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 pre-dates 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 non-public 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 psychology (Newman et al. (1980)) suggests that increasing the salience or explicitness of

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[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.

something that is absent causes people 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 non-negligible effect on market prices when investors have limited attention and processing power.

The remainder of the paper is organized as follows. Section 2 describes our data and presents summary statistics. Section 3 presents the main empirical results for the predictability of sudden insider silence for firm fundamentals and future returns. In Section 4, we provide some additional analysis aimed at isolating the underlying mechanism driving our results. In Section 5, robustness checks are conducted and several alternative explanations are ruled out. Section 6 concludes the paper.

II.   Data, Variables and Summary Statistics

Our sample is based on all NYSE/Amex/NASDAQ common stocks (share code 10 or 11), covered in CRSP/Compustat merged database from January 1997 to December 2013. The insider trading data are from Thomson Reuters Insider Filing Data Feed, in which only open-market transactions are considered.[13] The 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 August 2002) or within two business days (since August 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 because two years of consecutive same-month trades are needed to define routine insider,

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

and Table 2 shows that silence defined in 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 negative book value of equity. The accounting variables and earnings announcement data are obtained from Compustat. Analyst forecast and recommendation data are from Institutional Brokers Estimate System (I/B/E/S), and data on institutional holdings are from Thompson Reuters. We also utilize hedge fund and mutual fund holdings data from Thompson Reuter's 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 two 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), then we put the insider and his trading action in the SSS (PPP) group. If the insider does not sell (purchase) in this month, then we put him and his non-trading action in the SSN (PPN) group.[18] For example, if insider K sold stock A in January 2000 and in January 2001 but did not trade in January 2002, then insider K and stock A are classified as SSN = 1 for January 2002. Our methodology is different from Cohen et al. (2012) mainly in two ways. First, we condition on the sign of the trade in the definition of two consecutive-year trades, and their definition of routine insider does not. That is, insider K who sells in March 2001 and buys in March 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; Cohen et al.

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[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 with PRC¡5, or market capitalization less than the NYSE 10th percentile breakpoint, the results are similar.

[16]We thank Wenxi Jiang for providing hedge fund holdings data to us. The detailed method to extract hedge fund holdings data can be found in Jiang (2014).

[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.

(2012), 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 one when at least one insider at this firm-month has SSN (PPN) equal to one and zero otherwise.[19]

Overall, 15.38% of total insider transactions are associated with an insider to buy or sell in the same month for two consecutive years. Conditioning on consecutive same-month sell, 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 purchase, 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 could 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 presents 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 shows 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 B/M ratio compared to an average stock in CRSP. They are also past loser stocks but heavily traded. Consistent with their large market capitalization, these stocks are covered by 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 will see in later empirical analysis part, the return predictability of insider silence become stronger after adjusting for the value and

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

[20]Insiders could 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.

momentum factors. Panel D of Table 1 reports the insider-level characteristics, separately for all the insiders in Thomson Reuters database and our sudden silence universe. There are 8,931 and 25,601 unique insiders that become silent following consecutive 2-year buying and selling in our sample, respectively. Insiders in our silence universe conducts more trades on average compared to an average insider in 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 quite similar to the other insiders.

[Table 1 is here]

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

[Figure 1 is here]

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 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 value, and for SSN it is 6.24%. 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 about 0.50% of the U.S stock market.

[Table 2 is here]

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.

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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.

We conduct our test using the following regression specification:

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

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 one if the firm has any insider who sells (purchases) in the same calendar month for two consecutive years, but does not trade in the same month the third year. We aggregate SSN and PPN to firm-quarter level to align with the dependent variable, which is measured at quarterly frequency. The reason we regress current-quarter ROA and cash flow on SSN and PPN is because firm's quarterly fundamental performance is usually announced to the public in the early/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 about current-quarter performance.

Following Fama and French (2006) and Hou et al. (2012), we include lagged profitability from the previous quarter and four quarters ago, the level of accruals in the previous fiscal year (ACCRUAL), ASSET_GROWTH, a dummy indicating negative earnings (NEG_ROE), dividends (scaled by total assets) (DIV) and a non dividend-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

$$NPR = \frac{\#INSIDER\_BUY_{t-1,t-6} - \#INSIDER\_SELL_{t-1,t-6}}{\#TOTAL\_TRANSACTIONS_{t-1,t-6}}.$$

We also control for industry and quarter fixed effects in the regression, in which industry is defined at two digit 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 quarter fixed effect, which means that, firms with insider silence SSN have 0.31% higher ROA in the current quarter compared to other firms without 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 and standard deviation of quarterly ROA in our sample is -0.47% and 5.58%. 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 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 reflect firm's underlying profitability better than ROA.[22] The coefficient on SSN in this case is around 0.008, and it is significant at the 1% level under all specifications.

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

[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.

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The coefficient implies that 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 could 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. The 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 (especially SSN) predicts current and future firm profitability supports our assertion that routine insiders' sudden silence behavior is motivated by private information related to firm fundamentals. If 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.

[Table 3 is here]

B.   Insider Silence and Future Stock Returns

The results in previous Subsection 3.1 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. There are good reasons to believe that investors may fail to unravel this information quickly, however. Citing a great amount of experimental evidence in psychology, Hearst (1991) shows that human beings have difficulty using the mere absence of something as a basis for 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 salient, easily processed form is absorbed more easily than information that

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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.

B.1. Fama–MacBeth Regression

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

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

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[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.

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, so an investor implementing our strategy would have to wait until one month after the expected insider trading month to confirm an insider silence signal. Given this reporting delay, in Internet Appendix Table A5 we re-run 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 our results are not sensitive to the timing convention we employ here. We discuss more on this issue in Section 5.1.4.

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 the 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, Malloy, and Pomorski (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 regression, controlling for the opportunistic buy and opportunistic sell dummy and the insider net purchase ratio (NPR). Column (4), (5) and (6) of Table 4 show that our results remain when controlling for these traditional insider trading variables. SSN predicts 1.13% (t-stat = 3.93) increase and PPN predicts -1.07%

(t-stat $= 2.29$) decrease for the cumulative 3-month returns. Consistent with the literature, opportunistic buy and net purchase ratio 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. But 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 than insider sales.

B.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 January 1997 to December 2013, portfolios are formed based on previous sudden insider silence measure. At the end of each month t, we form two portfolios—SSN and PPN—based on whether the current month is the insider silence month following two consecutive-year sells and purchases, respectively.[24] The portfolios are then held over months $t + 1$ 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 ($k = 1, 3, 6$) months. Panel A of Table 5 presents

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[24]Prior to 2002, insider trades can be reported within ten days following the end of 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 three days. In addition, the deadline was changed to two days in 2002. Our portfolio results are unaffected using the sample starting from 2002.

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 Carhart (1997) four factors:

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

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 high book-to-market ratio over the portfolio of stocks with 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 et al. (1997)). The 5*5*5 benchmark groups are formed at the end of June of each year based on size, book-to-market ratio, and past one-year return.[26]

[Table 5 is here]

Consistent with the Fama-MacBeth regression results, the SSN portfolio earns a significant positive 4-factor alpha of 47.1 (t-stat = 3.18) basis points per month. The statistical significance of 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 (t-stat = 2.62) basis points with a Sharpe ratio of 0.64. The DGTW-adjusted monthly abnormal return for the long-short portfolio is larger at 68.4 (t-stat = 3.14) basis point, with a Sharpe ratio of 0.76. The bottom row shows that on average, SSN portfolio contains 365 stocks and PPN contains 134 stocks, suggesting that

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

[26]The monthly benchmark returns and stock assignments are obtained from Russ Wermer's website: http://alex2.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 basis points per month.

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 worse information environment and are also more costly to arbitrage.

In Figure 2, we plot the cumulative DGTW-adjusted return of the "PPN", "SSN" and "SSN-PPN" portfolios. Panel A shows that the cumulative DGTW-adjusted return increases gradually in our sample period, and reaches over 140% in year 2013. In Panel 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. And for the years that have negative returns, the economic magnitude is small. In subsample analysis, we find that the average monthly DGTW-adjusted return of "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.

[Figure 2 is here]

In Internet Appendix Table A1, we report the calendar-time portfolio alpha for the sudden silence measure defined based on three 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 basis points (t-stat = 2.61) per month, compared with the 53.3 basis points under the two consecutive-year version.

B.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, 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 et al. (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 about 11 bp and 21 bp in large cap and small cap stocks, respectively.

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 et al. (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, insider silence signal can add significant value to a portfolio that trades on multiple signals and spreads transaction costs across these signals.

B.4.   The Dollar Profits to Insider Silence

The result from Fama–MacBeth regression and portfolio sorts shows that sudden insider silence is informative of future stock return, but it doesn't 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 two years prior to 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 the dollar profits insiders make by delaying routine sell (purchases) when future abnormal return is positive (negative).

The result is reported in Internet Appendix Table A2. 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)

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

abnormal dollar profits equal to $301,346 ($1,580) by delaying routine sell and $15,501 ($209) by delaying routine purchase. These numbers are comparable to the estimated dollar profits from insider trading in general, 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 non-trivial 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 earnings announcement is one of the highest-profile corporate events that catch investors' attention. Because 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, 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 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.

$$CAR(-1,+1)_{i,t} = a + bSSN_{i,t-1} + cPPN_{i,t-1} + dX_{i,t-1} + \epsilon_{i,t} \qquad (4)$$

SSN (PPN) is a dummy that equals to one if in the quarter prior to earnings announcement day t, any insider of the firm demonstrates sudden silence following two consecutive years

of selling (purchasing). We include 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 shows the regression results. Columns (1) and (2) use market-adjusted CAR as 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 (t-stat = 2.05) basis points 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 basis points for our sample of stocks. PPN, consistent with our hypothesis, predicts a 10.7 basis points negative abnormal CARs in the earnings announcement window, though it is not significant. Our previous Fama–MacBeth regression results show that SSN predicts 1.13% abnormal positive return over the next three months. This means that about 15% of abnormal return following insider silence after two consecutive years of selling is concentrated on the 3-day window around quarterly earnings announcement, which represents only 5% of all trading days. The fact that 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 et al. (1997)). We find similar results using DGTW-adjusted CAR as dependent variable, as shown in columns (3) and (4).

[Table 6 is here]

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 surprise. 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 announcement.

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.

Panel A of Table 7 shows 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 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 three months to six months.[33]

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

[30]Note here that the summary statistics is based on the individual insider level sudden silence, which is different from the firm level silence measure used in the previous tests. We use insider level sudden silence measure because the length of delay is more straight forward and easy to understand at the individual insider level comparing 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 two 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 have enough shares to sell) as canceling their trades, our estimation of the percentage of cancel is an over-estimation.

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

[Table 7 is here]

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. It shows 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. At the June of each year, we independently construct the NYSE breakpoints for 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 silence month to next trade period, but it is only -0.32% from the next trade to 24 months 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 next trade period, but it is only 0.27% from the next trade to 24 months 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%

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routine trading.

[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 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.

(t-stat = 6.00), and PPNN (purchase-purchase-no trade-no trade) has 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 paper, the results in Table 7 seems 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 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 paper 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 (2012).[35] We split the sample into two groups based on the KS litigation risk measure and

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[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 their Model 3 in Table 7 of Kim and Skinner

compare the return predictability of insider silence across sub-samples. The result is reported in Internet Appendix Table A3. The coefficients on SSN and PPN are always larger in magnitude and more significant for firms with higher litigation risk. For example, SSN predicts 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 the Information in Insider Silence Gets Conveyed into Stock Price?

Our evidence on market underreaction to insider silence raises the question of how the information in insider silence gets conveyed into stock price eventually? We show in Section 3.3 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 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 et al. (2016)), and conduct trades that are more likely to be driven by information (Agarwal et al. (2013)). Thus, 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 holding on insider silence dummies

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(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.

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 presents 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 than PPN.

[Table 8 is here]

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 revision (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 one-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 could 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 10 to 14 basis points more positive 3-day CAR. The coefficient on PPN is also negative but not significant.

[Table 9 is here]

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 intepretation would provide support to our premise in this paper 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 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 analysts (or other sophisticated investors) must 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 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 firm's information environment (Hong et al. (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.

To test the prediction, we run Fama–MacBeth regression on subsamples splitted based on the sample median of analyst coverage, idiosyncratic volatility and market capitalization. Panel A of Table 10 presents 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 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 travel more slowly among less covered firms (Hong et al. (2000)).

[Table 10 is here]

Panel B of Table 10 shows the Fama-MacBeth regression results when we split the sample based on two proxies for limits to arbitrage: firm size and idiosyncratic volatility.

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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% (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 longer time diffusing into 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 to examine the robustness of our results and to rule out some alternative explanations for our main result.

A.   Robustness and Extensions

A.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 three 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 enough to classify whether an insider is routine or not is difficult — insider trading in the same month for two 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 one. 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 three years of consecutive same-month trades: SSSN (sell-sell-sell-no trade) and PPPN (purchase-purchase-purchase-no trade).

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

[Table 11 is here]

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. Because 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 results are driven by the *unconditional* insider silence effect documented in their paper. SILENCE is a dummy variable that equals one if the stock has no insider trading during the previous twelve months. Similarly, dummy variable BUY equals one if the firm has positive net insider trading in the previous twelve months. From the table, we can see that the positive (negative) return predictability of SSN (PPN) is retained; that for PPN even becomes stronger after controlling for the silence measure described by Gao et al. (2015). For

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example, sudden silence following consecutive purchases (PPN) predicts a 3-months-ahead cumulative return of -1.20% (t-stat = 2.61), while sudden silence following consecutive sells (SSN) predicts a 3-months-ahead cumulative return of 0.94% (t-stat = 3.54).

A.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 or 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 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, so they are more likely to stay silent when in possession of private information. Internet Appendix Table A4 presents the Fama–MacBeth 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.

A.3. Multiple Insider Silence within Firm-Month

For our baseline results, we define a firm-month dummy SSN or PPN that equals one when at least one insider within the firm suddenly becomes silent following routine trades. 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 one if a firm has more than one insider becoming silent following routine trades at the same firm. We run a Fama–MacBeth regression of future returns on these two dummies along with SSN and PPN. The result is reported in Internet Appendix Table A5. 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.

A.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, might 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 two business days in 2002. Panel E of Table 1 shows 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 four days for purchase transactions and twp days for sell transactions. 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 re-run 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 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 Internet Appendix Table A6, 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 three 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 Hirshleifer and Ali (2016)).

B. Alternative Explanations

B.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, i.e., 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 paper. For example, insiders who buy consecutively for two years could stop purchasing after the firm experiences abnormal

increases in accruals in the third year. Because 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 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 shows that our results remain after controlling for 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 three to twelve months. PPN predicts negative future stock return, though the statistical significance is weaker. For example, SSN predicts a positive increase of 94.8 basis points and PPN predicts a decrease of 62.4 basis points 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.

[Table 12 is here]

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

VI.   Conclusion

In this paper, 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.

References

Agarwal, V.; W. Jiang; Y. Tang; and B. Yang. "Uncovering Hedge Fund Skill from the Portfolio Holdings They Hide." *Journal of Finance*, 68 (2013), 739–783.

Agostinelli, G.; S. J. Sherman; R. H. Fazio; and E. S. Hearst. "Detecting and Identifying Change: Additions versus Deletions." *Journal of Experimental Psychology: Human Perception and Performance*, 12 (1986), 445.

Alldredge, D. M., and D. C. Cicero. "Attentive Insider Trading." *Journal of Financial Economics*, 115 (2015), 84–101.

Brunnermeier, M. K., and S. Nagel. "Hedge Funds and the Technology Bubble." *Journal of Finance*, (2004), 2013–2040.

Carhart, M. M. "On Persistence in Mutual Fund Performance." *Journal of Finance*, 52 (1997), 57–82.

Chen, D. L.; T. J. Moskowitz; and K. Shue. "Decision Making Under the Gamblers Fallacy: Evidence from Asylum Judges, Loan Officers, and Baseball Umpires." *Quarterly Journal of Economics*, 131 (2016), 1181–1242.

Cohen, L., and A. Frazzini. "Economic Links and Predictable Returns." *Journal of Finance*, 63 (2008), 1977–2011.

Cohen, L.; C. Malloy; and L. Pomorski. "Decoding Inside Information." *Journal of Finance*, 67 (2012), 1009–1043.

Cziraki, P., and J. Gider. "Perks or Peanuts? The Dollar Profits to Insider Trading." (2016).

Daniel, K.; M. Grinblatt; S. Titman; and R. Wermers. "Measuring Mutual Fund Performance with Characteristic-Based Benchmarks." *Journal of Finance*, 52 (1997), 1035–1058.

DellaVigna, S., and J. M. Pollet. "Demographics and Industry Returns." *American Economic Review*, (2007), 1667–1702.

DeMiguel, V.; A. Martin-Utrera; F. J. Nogales; and R. Uppal. "A Portfolio Perspective on

the Multitude of Firm Characteristics." (2017).

Elliott, J.; D. Morse; and G. Richardson. "The Association between Insider Trading and Information Announcements." *Rand Journal of Economics*, (1984), 521–536.

Fama, E. F., and K. R. French. "Common Risk Factors in the Returns on Stocks and Bonds." *Journal of Financial Economics*, 33 (1993), 3–56.

Fama, E. F., and K. R. French. "Profitability, Investment and Average Returns." *Journal of Financial Economics*, 82 (2006), 491–518.

Fama, E. F., and J. D. MacBeth. "Risk, Return, and Equilibrium: Empirical Tests." *Journal of Political Economy*, (1973), 607–636.

Frazzini, A.; R. Israel; and T. J. Moskowitz. "Trading Costs of Asset Pricing Anomalies." (2012).

Gao, G.; Q. Ma; and D. T. Ng. "The Sound of Silence: What Do We Know When Insiders Do Not Trade?" (2015).

Giglio, S., and K. Shue. "No News is News: Do Markets Underreact to Nothing?" *Review of Financial Studies*, 27 (2014), 3389–3440.

Givoly, D., and D. Palmon. "Insider Trading and the Exploitation of Inside Information: Some Empirical Evidence." *Journal of Business*, (1985), 69–87.

Griffin, D., and A. Tversky. "The Weighing of Evidence and the Determinants of Confidence." *Cognitive Psychology*, 24 (1992), 411–435.

Hartzmark, S. M., and K. Shue. "A Tough Act to Follow: Contrast Effects in Financial Markets." Tech. rep., National Bureau of Economic Research (2017).

Hearst, E. "Psychology and Nothing." *American Scientist*, 79 (1991), 432–443.

Hirshleifer, D., and U. Ali. "Opportunism as a Firm and Managerial Trait: Predicting Insider Trading Profits and Misconduct." *Journal of Financial Economics*, (2016).

Hirshleifer, D.; P.-H. Hsu; and D. Li. "Innovative Efficiency and Stock Returns." *Journal of Financial Economics*, 107 (2013), 632–654.

Hirshleifer, D., and S. H. Teoh. "Limited Attention, Information Disclosure, and Financial Reporting." *Journal of Accounting and Economics*, 36 (2003), 337–386.

Hong, H.; T. Lim; and J. C. Stein. "Bad News Travels Slowly: Size, Analyst Coverage, and the Profitability of Momentum Strategies." *Journal of Finance*, 55 (2000), 265–295.

Hou, K.; M. A. Van Dijk; and Y. Zhang. "The implied cost of capital: A new approach." *Journal of Accounting and Economics*, 53 (2012), 504–526.

Jaffe, J. F. "Special Information and Insider Trading." *Journal of Business*, (1974), 410–428.

Jagolinzer, A. D. "SEC Rule 10b5-1 and Insiders' Strategic Trade." *Management Science*, 55 (2009), 224–239.

Jeng, L. A.; A. Metrick; and R. Zeckhauser. "Estimating the Returns to Insider Trading: A Performance-Evaluation Perspective." *Review of Economics and Statistics*, 85 (2003), 453–471.

Jiang, W. "Leveraged Speculators and Asset Prices." *Available at SSRN 2525986*, (2014).

Jiao, Y.; M. Massa; and H. Zhang. "Short Selling Meets Hedge Fund 13F: An Anatomy of Informed Demand." *Journal of Financial Economics*, 122 (2016), 544–567.

Ke, B.; S. Huddart; and K. Petroni. "What Insiders Know about Future Earnings and How They Use It: Evidence from Insider Trades." *Journal of Accounting and Economics*, 35 (2003), 315–346.

Kim, I., and D. J. Skinner. "Measuring Securities Litigation Risk." *Journal of Accounting and Economics*, 53 (2012), 290–310.

La Porta, R.; J. Lakonishok; A. Shleifer; and R. Vishny. "Good News for Value Stocks: Further Evidence on Market Efficiency." *Journal of Finance*, (1997), 859–874.

Lakonishok, J., and I. Lee. "Are Insider Trades Informative?" *Review of Financial Studies*, (2001), 79–111.

Lin, J.-C., and J. S. Howe. "Insider Trading in the OTC Market." *Journal of Finance*, 45 (1990), 1273–1284.

Lorie, J. H., and V. Niederhoffer. "Predictive and Statistical Properties of Insider Trading." *Journal of Law and Economics*, 11 (1968), 35–53.

Lou, D. "A Flow-Based Explanation for Return Predictability." *Review of Financial*

Studies, 25 (2012), 3457–3489.

Mitchell, M. L., and E. Stafford. "Managerial Decisions and Long-Term Stock Price Performance*." *Journal of Business*, 73 (2000), 287–329.

Newman, J. P.; W. T. Wolff; and E. Hearst. "The Feature-Positive Effect in Adult Human Subjects." *Journal of Experimental Psychology: Human Learning and Memory*, 6 (1980), 630.

Noe, C. F. "Voluntary Disclosures and Insider Transactions." *Journal of Accounting and Economics*, 27 (1999), 305–326.

Park, S.; H. J. Jang; and M. P. Loeb. "Insider Trading Activity Surrounding Annual Earnings Announcements." *Journal of Business Finance & Accounting*, 22 (1995), 587–614.

Petersen, M. A. "Estimating standard errors in finance panel data sets: Comparing approaches." *Review of Financial Studies*, 22 (2009), 435–480.

Piotroski, J. D., and D. T. Roulstone. "Do Insider Trades Reflect both Contrarian Beliefs and Superior Knowledge about Future Cash Flow Realizations?" *Journal of Accounting and Economics*, 39 (2005), 55–81.

Pontiff, J. "Costly Arbitrage: Evidence from Closed-End Funds." *Quarterly Journal of Economics*, (1996), 1135–1151.

Rozeff, M. S., and M. A. Zaman. "Market Efficiency and Insider trading: New Evidence." *Journal of Business*, (1988), 25–44.

Sainsbury, R. "The Feature Positive Effect and Simultaneous Discrimination Learning." *Journal of Experimental Child Psychology*, 11 (1971), 347–356.

Seyhun, H. N. "Insiders' Profits, Costs of Trading, and Market Efficiency." *Journal of Financial Economics*, 16 (1986), 189–212.

Seyhun, H. N. "The Information Content of Aggregate Insider Trading." *Journal of Business*, (1988), 1–24.

Seyhun, H. N. "The Effectiveness of the Insider-Trading Sanctions." *Journal of Law and Economics*, 35 (1992), 149–182.

Sias, R. W., and D. A. Whidbee. "Insider Trades and Demand by Institutional and Individual Investors." *Review of Financial Studies*, 23 (2010), 1544–1595.

Sloan, R. G. "Do Stock Prices Fully Reflect Information in Accruals and Cash Flows About Future Earnings?" *Accounting Review*, 71 (1996), 289–315.

Stambaugh, R. F.; J. Yu; and Y. Yuan. "The Short of It: Investor Sentiment and Anomalies." *Journal of Financial Economics*, 104 (2012), 288–302.

Wurgler, J., and E. Zhuravskaya. "Does Arbitrage Flatten Demand Curves for Stocks?*." *Journal of Business*, 75 (2002), 583–608.